Asia-Pacific
Economic Cooperation

APEC Energy Overview 2025

APERC
Asia Pacific Energy Research Centre

Disclaimer

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Foreword

The ***APEC Energy Overview*** (the Overview) is an annual publication that highlights the current energy situation in each of the 21 APEC economies. Since its first publication in January 2001, it has been a flagship publication for APERC, showcasing the latest APEC energy data compiled by the Expert Group on Energy Data and Analysis (EGEDA).

The 2025 edition of the Overview shows unexpected trends between 2021 and 2022, following the strong recovery of economic activity in 2021 due to the waning impact of the COVID-19 pandemic. While most of the economies displayed continuous growth, both in economic output and energy demand, some had decreasing trends observed in 2022 compared with 2021. Additionally, each economy chapter discusses many other trends, issues, policies, initiatives, and notable developments

The Overview monitors progress toward meeting the two APEC energy goals, namely:

1. *Energy intensity improvement of 45% by 2035 (relative to 2005), and*
2. *Doubling the renewable energy share in the APEC energy mix, including in power generation, by 2030 (relative to 2010).*

In 2022, APEC-wide energy intensity had improved by 28%, leaving a 17-percentage point improvement needed to meet the 2035 goal. Progress has also been made in doubling the share of modern renewables. Modern renewables in total final energy consumption in 2022 have increased by 4.6 percentage points or 76% of the way to the 2030 goal. Renewables in the total primary energy supply, albeit more slowly, have increased by more than 60% compared with 2010, while the share of renewables for power generation has increased by more than 70%.

This report is based on the EGEDA data that each member economy submits annually. We thank EGEDA members for their continued support in providing us with these data. We also encourage APEC member economies and other stakeholders to use this publicly available resource to continue to develop, implement, refine, and analyse energy policy and other energy-related issues.

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The ***APEC Energy Overview 2025*** could not have been accomplished without the contributions of many individuals and organisations in APEC. We would like to thank all those whose efforts made this publication possible.

We would also like to thank, in particular, those named below who contributed to the successful completion of this publication.

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Commonly Used Abbreviations

Abbreviation	Term
2021 USD PPP	2021 USD purchasing power parity
APEC	Asia-Pacific Economic Cooperation
APERC	Asia Pacific Energy Research Centre
ASEAN	Association of Southeast Asian Nations
B/D	barrels per day
Bcf	billion cubic feet
bcm	billion cubic metres
Btu	British thermal units
GW	gigawatt
GWh	gigawatt-hour
kL	kilolitre
km	kilometre
km/L	kilometres per litre
ktoe	kilotonne of oil equivalent
kV	kilovolt
kW	kilowatt
kWh	kilowatt-hour
Mbbl/D	thousand barrels per day
ML	million litres (megalitre)
Mloe	million litres of oil equivalent
MMbbl	million barrels
MMbbl/D	million barrels per day
MMBFOE	million barrels of fuel oil equivalent
MMBtu	million British thermal units
MMcf/D	million cubic feet per day
MMscf/D	million standard cubic feet per day
mpg	miles per gallon
Mt	million tonnes
Mtce	million tonnes of coal equivalent
Mtoe	million tonnes of oil equivalent
MW	megawatt
PJ	petajoules
Tbbl/D	trillion barrels per day
tce	tonnes of coal equivalent
Tcf	trillion cubic feet
toe	tonnes of oil equivalent
tU	tonnes of uranium metal
TWh	terawatt-hours
W	watt
Wh	watt-hours

Currency Codes

Code	Currency	Economy
AUD	Australian dollar	Australia
BND	Brunei dollar	Brunei Darussalam
CAD	Canadian dollar	Canada
CLP	Chilean peso	Chile
CNY	yuan renminbi	China
HKD	Hong Kong dollar	Hong Kong, China
IDR	rupiah	Indonesia
JPY	yen	Japan
KRW	won	Korea
MYR	Malaysian ringgit	Malaysia
MXN	Mexican peso	Mexico
NZD	New Zealand dollar	New Zealand
PGK	kina	Papua New Guinea
PEN	nuevo sol	Peru
PHP	Philippine peso	Philippines
RUB	Russian ruble	Russia
SGD	Singapore dollar	Singapore
TWD	New Taiwan dollar	Chinese Taipei
THB	baht	Thailand
USD	US dollar	United States
VND	dong	Viet Nam

Executive Summary

Introduction

The APEC Energy Overview 2025 comprises data up to 2022, covering analyses of the region's economic growth and energy consumption trends post-pandemic. It is interesting to see the unexpected outcomes during this period following the strong recovery of economic activity in 2021 due to the waning impact of the COVID-19 pandemic and improved strategies. However, despite the slower momentum, the year 2022 saw increases in economic output and energy consumption to historic levels.

For instance, APEC's gross domestic product [GDP (PPP[1] at constant 2021 USD)] showed a slower trend (by four percentage points) in 2022 following the significant increase of over 6.0% in 2021. Nevertheless, GDP (PPP constant 2021 USD) in APEC reached a historic level of over USD 87 trillion, resulting in an all-time high GDP per capita in APEC of USD 29 360, on average, in 2022. Similarly, energy production and total final energy consumption, among other things, grew to levels not seen before.

In addition to the energy data for the period 2000 to 2022, each of the APEC member economy chapters provides an up-to-date accounting of energy policies and notable energy developments to 2025.

Energy Supply and Consumption

Total Primary Energy Supply

The total primary energy supply (TPES) in APEC increased by 2.1% to 364 exajoules (EJ) in 2022, equivalent to the same compound annual growth rate (CAGR) between 2000 and 2022. The growth was lower than expected after the significant rebound of the global economy from COVID-19 in 2021; it was only half as fast as the previous year's rate and just 0.6% over its ten-year average *(Figure 1)*.

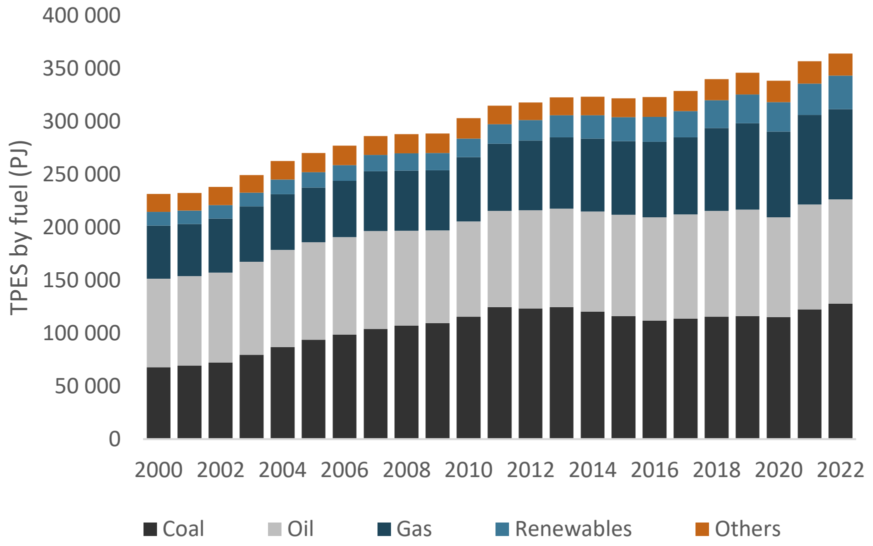
Comprising about 9.0% of TPES, renewable energy (combined solar, wind and biomass) maintained strong growth with a more than 6.0% increase from the 2021 level, driving the overall primary energy supply in 2022. Fossil fuels continued to dominate the energy mix, accounting for 86% of APEC TPES or over 311 EJ in 2022. Coal remained the main fossil fuel, constituting about 35% of TPES, and its contribution grew by more than 4.0% in 2022. Oil and gas maintained their positions as the second and third-largest fuel sources in 2022, contributing 27% and 23% of the primary energy supply, respectively.

By region, Southeast Asia drove the overall expansion of TPES with its over 6.0% increase to a historic level of over 28 EJ in 2022. TPES in Russia[2] (dropping by 6.0%), Oceania and other Northeast Asia (both dropping by 2.4%) all experienced contraction as compared with the 2021 level, which probably explained the slower increase of TPES from 2021 to 2022.

[1] PPPs are both currency conversion factors and spatial price indexes. They convert different currencies to a common currency and, in the process of conversion, equalise their purchasing power by controlling for the differences in price levels between economies.

[2] Unless otherwise specified, China; Russia and the US were considered as regions in the analyses in view of the significant differences in scales with other APEC economies. Other regions include Southeast Asia (Brunei Darussalam; Indonesia; Malaysia; the Philippines; Singapore; Thailand and Viet Nam), Oceania (Australia; New Zealand and Papua New Guinea), other Northeast Asia (Hong Kong, China; Japan and Korea) and other Americas (Canada; Chile; Mexico and Peru).

Figure 1: APEC's energy supply by fuel (PJ), 2000 to 2022

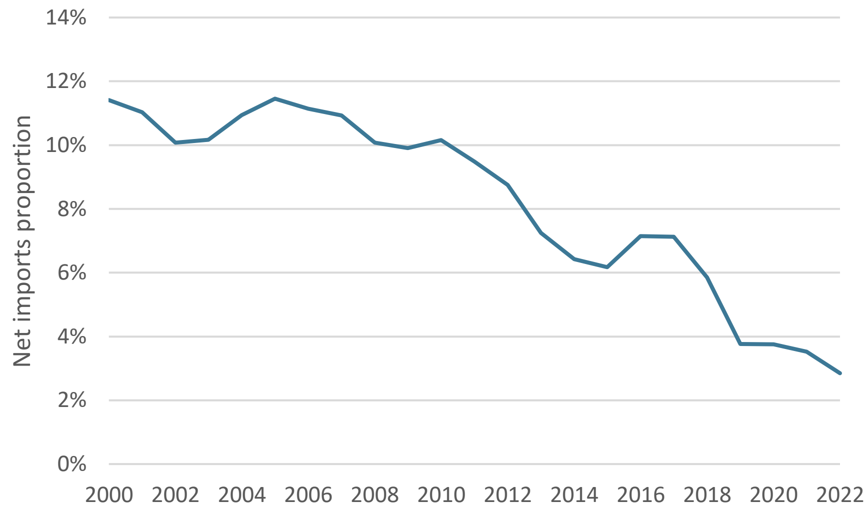


Source: EGEDA (2024)

APEC maintained its status as a net importer in 2022. The net imports (Imports – Exports) declined by more than 17% to just over 10 EJ in 2022 compared to the previous year and were the lowest level in the last two decades. *(Figure 2)*. The import-export structure in 2022 changed slightly. Southeast Asia returned to being a net importer in 2022 after three consecutive years of acting as a net exporter from 2019 to 2021. China and other Northeast Asia regions remained net importers in 2022. The other regions functioned as net exporters, together with the US, which has remained a net exporter since 2019.

While APEC was historically a net importer, the region's production in 2022 grew by 4.0% to an all-time high level of over 364 EJ. Energy production was particularly high in China (9.4%) and the US (4.7%), driving the overall growth of local production within APEC.

Figure 2: APEC's net energy imports as a proportion of supply, 2000 to 2022

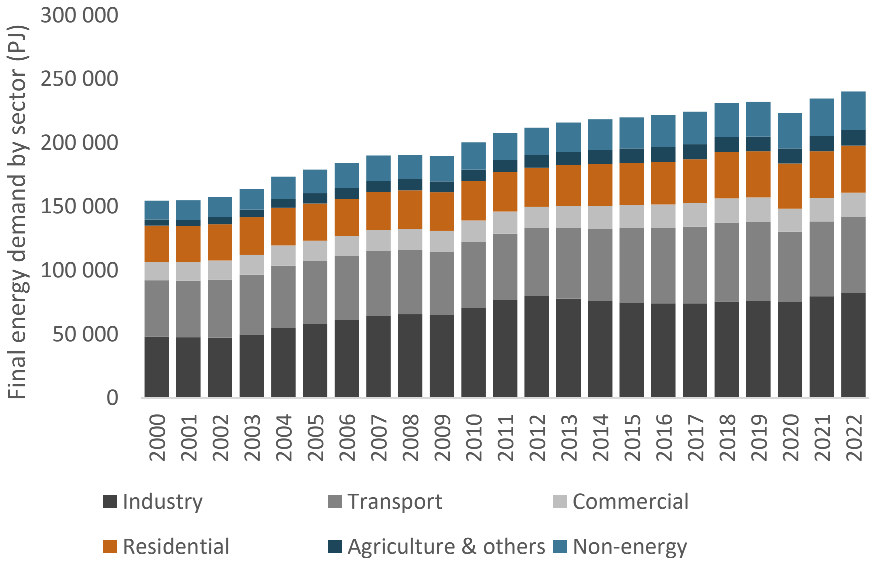


Source: EGEDA (2024)

Total Final Consumption

Total final consumption (TFC) in APEC (including non-energy use) increased by more than 2.0% to over 240 EJ in 2022 after rebounding (5.0%) from the COVID-19 pandemic in 2021 *(Figure 3)*. The industry sector was the main driver of overall growth in APEC TFC, accounting for more than 30% of APEC consumption and experiencing an increase of over 3.0% in 2022. Non-energy consumption grew by almost 3.0% to over 30 EJ, the most significant level by far historically. China was responsible for more than 40% of the growth in non-energy consumption in 2022. Energy consumption in the transport sector, which significantly recovered from the effects of the COVID-19 pandemic in 2021, slightly increased by just over 1.0% in 2022. Energy consumption in the commercial sector increased by 2.4% in 2022, a slower pace than in 2021 and a level lower than the pre-pandemic. Energy consumption in the residential sector in 2022 (1.4%) was likewise slower than in 2021 (2.7%), but rose to a historic level of over 36 EJ. The agriculture sector, historically accounting for the smallest share of the TFC, likewise grew slower (1.0%) but to a historic level of over 12 EJ in 2022.

Figure 3: APEC's final consumption by sector (PJ), 2000 to 2022



Source: EGEDA (2024)

The total final energy consumption [TFEC (excluding non-energy)] also increased more slowly than expected (2.3%) but to a never-before-seen level of almost 2010 EJ in 2022. Oil accounted for more than 30% of the final energy consumption by fuel source, while heat spurred the overall growth with its almost 8.0% expansion in 2022. Electricity retained its position as the second most important fuel in APEC in 2022, accounting for 28% of the total energy consumption by fuel, but likewise grew more slowly by around two percentage points than the previous year. Renewable energy consumption dropped by 2.0% in 2022, offsetting the same rate of increase it posted in 2021. Surprisingly, coal, which has recorded declines since 2013, grew by 2.2% in 2022, but to a level even lower than before the pandemic (just over 24 EJ). On the other hand, gas increased by 1.2% to an all-time high level of almost 36 EJ in 2022.

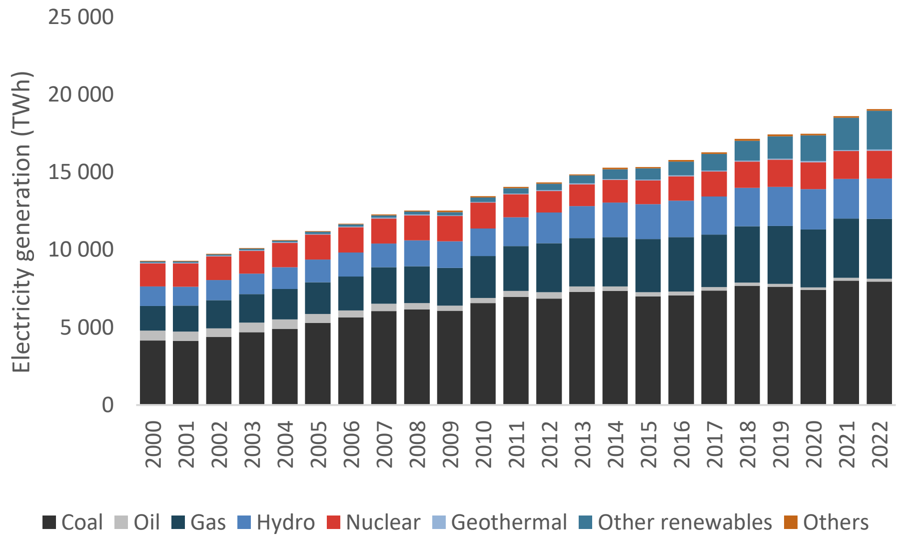
Transformation

Power Sector

Power generation in APEC grew by 2.4% to a historic level of 19 058 TWh in 2022 *(Figure 4).* This is equivalent to a CAGR of 3.3% between 2000 and 2022. The continued upsurges of electricity output from renewable energy (excluding hydropower) bolstered electricity generation. For instance, the combined solar, wind, biomass and ocean jumped by over 19% to a never-before-seen level of 2558 TWh, exceeding the 2021 electricity generation from renewable energy. This was probably because of the record-high increases in electricity generation from renewable energy across the APEC region, an indication of the accelerating race towards the energy transition. In particular, Russia's electricity output from renewables (solar, wind, biomass and tide combined) swelled by almost twice the 2021 level to a historic level of more than 6.0 TWh in 2022.

While comprising a very small part of the total power generation, electricity output from non-renewable wastes grew significantly by over 15%. On the other hand, gas and hydro, accounting for the second and third most significant shares of the total power generation in APEC, respectively, both grew by just 1.6% in 2022. Electricity generation from oil dropped significantly by 6.5% after a considerable increase in the previous year (8.7%). Electricity generated from nuclear power likewise declined, but at a slower pace of 0.2% in 2022.

Figure 4: APEC's electricity generation by fuel, 2000 to 2022



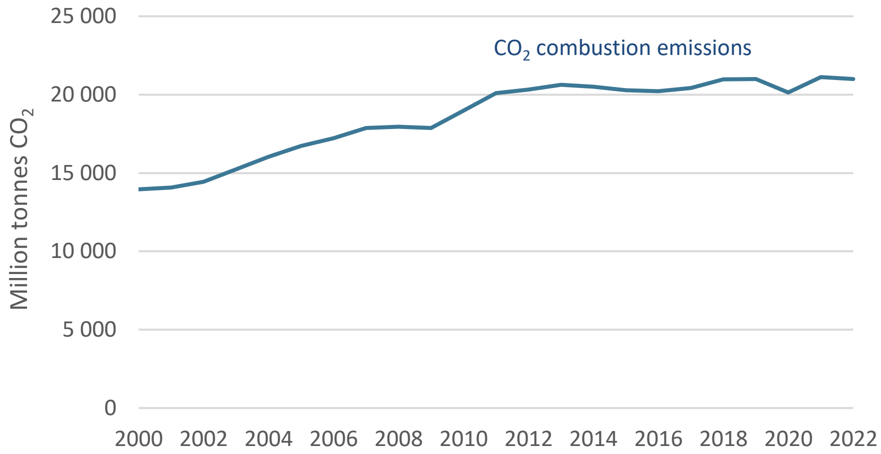
Source: EGEDA (2024)

Energy Transition

Emissions

Albeit very small, CO_2 emissions in 2022 were reduced by 0.6%. The slower pace of fossil demand in 2022 and, consequently, the transport sector, led to lower CO_2 emissions in 2022 *(Figure 5)*. Similarly, the considerable decline in CO_2 emissions in Russia (5.5%), the US (3.9%) and other Northeast Asia (3.4%), three of the top four largest consuming regions in APEC, contributed to lower CO_2 emissions in 2022.

Figure 5: APEC's CO2 combustion emissions (million tonnes), 2000 to 2022



Source: EGEDA (2024)

APEC Energy Goals

APEC member economies have agreed to work together to achieve two energy-related objectives: improving energy intensity and doubling the share of modern renewables.

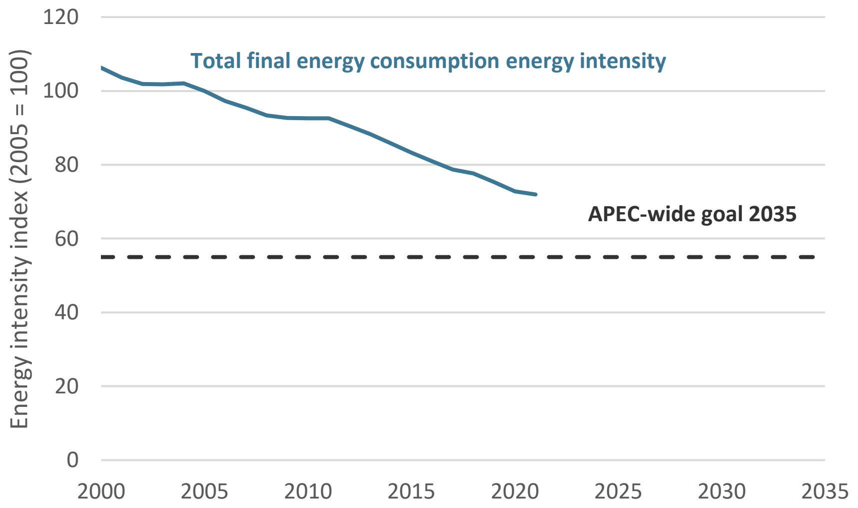
Energy Intensity Goal

In 2011, APEC member economies agreed to increase their ambition to reduce energy intensity by 45% in 2035, relative to a 2005 baseline. The original goal was a 25% improvement by 2030 relative to the 2005 baseline.

The APEC region made progress towards its goal of improving energy intensity by 45% by 2035 (relative to 2005) over the period 2005 to 2022. Both final energy consumption and GDP in APEC in 2022 grew at a slower pace, resulting in the energy intensity falling 28% between 2005 and 2022. Given the intensity improvement from 2005 to 2022, the APEC-wide energy intensity will only need a 1.3% reduction on average each year to meet the 45% goal *(Figure 6)*. However, assuming the current pace of energy intensity continues, the APEC goal of 45% energy intensity reduction will likely be achieved by 2032.

The observed improvement in primary energy supply intensity (26%, not shown here) is very close to the observed improvement in final energy intensity.

Figure 6: APEC's total final energy consumption intensity index, 2000 to 2022 (2005 = 100)



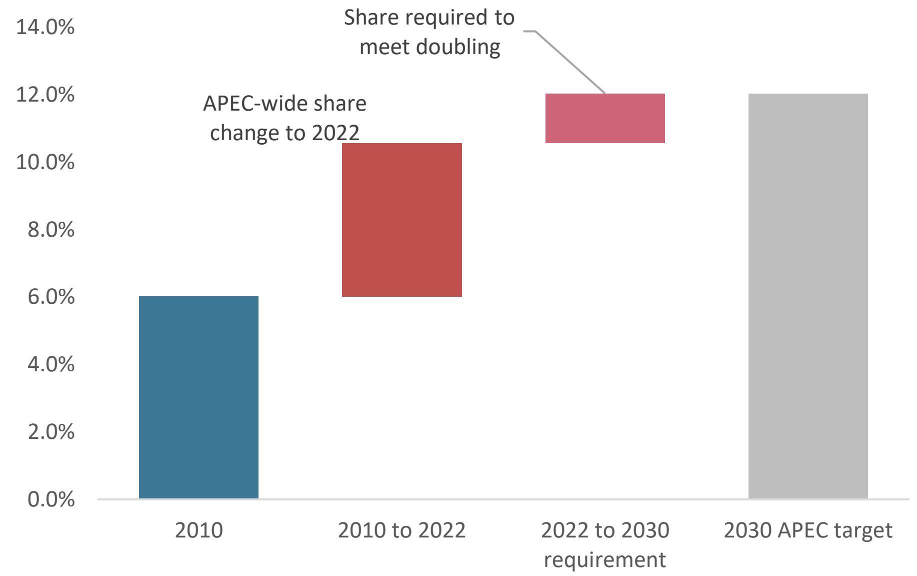
Source: EGEDA (2024)

Renewable Energy Doubling Goal

The second energy goal involves doubling the share of modern renewables in the APEC energy mix from 2010 to 2030.

Modern renewables do not include traditional biomass, which is typically relied on in emerging economies for household energy needs and is associated with negative health outcomes. Many APEC economies are enacting policies to reduce traditional biomass consumption, either through upgrading fuel stoves or by facilitating switching to alternative fuels such as natural gas, liquefied petroleum gas or electricity. With just 40% of the time remaining to reach the goal, the modern renewable share of final energy consumption increased by 76% in 2022 or equivalently, from its 2010 share of 6.0% to 11% in 2022. Given this growth in renewables utilisation, the APEC RE share doubling goal in the final energy demand is expected to be achieved in 2030 *(Figure 7)*.

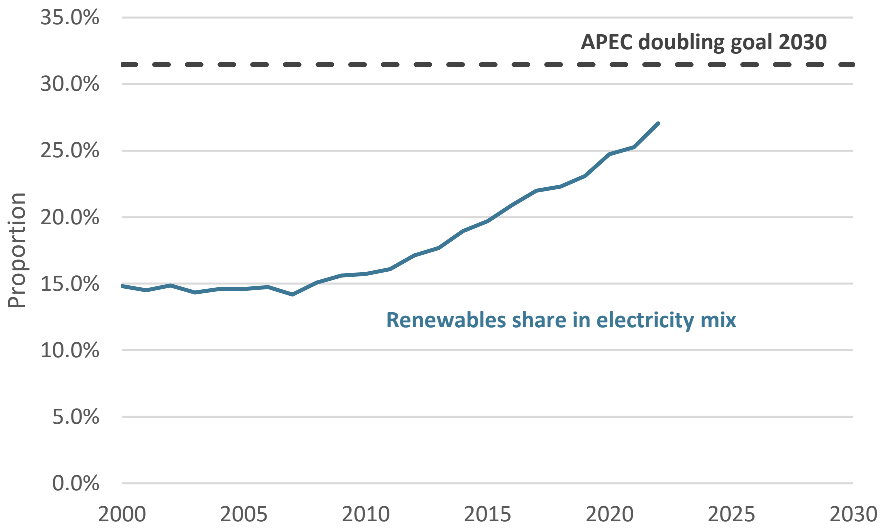
Figure 7: APEC's modern renewable energy share in final energy consumption, 2010 to 2030



Source: EGEDA (2024)

Progress has also been made in doubling the share of modern renewables in the energy mix by 2030 (relative to 2010). In 2022, electricity output from renewable energy was well over 27% or equivalent to a rise of more than 70% compared with 2010 *(Figure 8)*.

Figure 8: APEC's modern renewable energy share in the electricity mix, 2000 to 2030



Source: EGEDA (2024)

In terms of TPES, RE's share increased from 4.8% in 2010 to 8.0% in 2022. As with TFEC, with only 40% of the time remaining until the 2030 deadline, RE's share of TPES is on track to meet the goal of doubling from the 2010 level.

Australia

Introduction

Australia updated its economy-determined contribution (NDC) in June 2022, committing to reduce greenhouse gas emissions to 43% below 2005 levels by 2030. This is a significant expansion of the prior commitment of a 26 to 28% reduction for the same period. Australia has also committed itself to achieving net zero emissions by 2050.

Underpinning the legislated NDC is an Australian Government plan to reach 82% renewable generation by 2030 (Powering Australia, 2024). The share of renewables generation for 2023 in the National Electricity Market (NEM) was 39% (Clean Energy Council, 2024). More than doubling the current renewable generation share will rely on a significant buildout of wind energy, continued growth in rooftop and utility-scale solar PV and for the Snowy 2.0 Pumped Storage Power Station (2.2 GW capacity) to become operational. Other factors such as regulatory approval, integration, distribution, and transmission challenges will need to be overcome as well.

Australia's population is anticipated to reach almost 37 million in 2050 (Intergenerational Report, 2023), an increase of 10 million from the current population of 27 million. This combined with rapid electrification of end-use sectors will be an additional challenge to delivering high levels of renewable generation.

Table 1: Australia's macroeconomic data and energy reserves

Key data [a, b]		Energy reserves [c, d]	
Area (million km^2)	7.7	Oil (billion barrels)	2.4
Population (million)	27	Gas (trillion cubic feet)	84
GDP (2021 USD billion PPP)	1494	Coal (million tonnes)	150 227
GDP per capita (2021 USD PPP)	58 182	Uranium (kilotonnes U < USD 130/kgU)	1236

Source: a ABS (2024); b World Bank (2024); c Energy Institute (2023); d UN (2024)

Note: Reserves are total proved reserves and reasonably assured recoverable resources for uranium.

Export earnings from key commodities such as LNG, thermal and metallurgical coal all declined from 2022-23 to 2023-24 due to reduced prices, market pressures and global decarbonization efforts.

The power sector of Australia is seeing declines in coal generation, while renewable generation is rapidly rising, particularly solar PV with one in three homes now having a solar panel installed.

Australia is making progress towards meeting APEC's dual goals of reducing energy intensity by 45% in 2035 relative to the 2005 baseline and doubling the share of renewables in the energy mix from 2010 to 2030. As of 2022, Australia's energy intensity has improved by more than 29% since 2005. Additionally, the share of renewables in its final energy demand mix increased from 6.3% in 2010 to 12% in 2022.

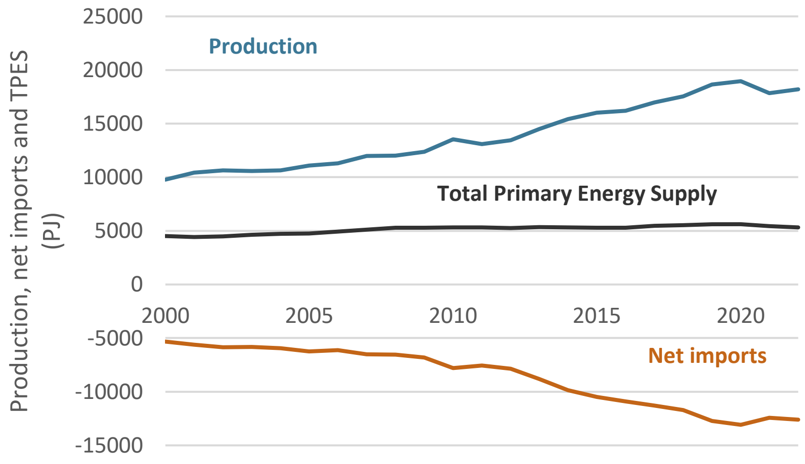
Energy Supply and Consumption

Total Primary Energy Supply

Australia's energy supply (energy that is ultimately consumed domestically) fell slightly, by 2.3%, in 2022 to just over 5326 PJ. Wet weather and labour force disruptions (from the COVID-19 pandemic and labour shortages) reduced production of key energy resources such as coal, contributing to the fall in the energy supply (REQ, 2023).

While the 5.8% fall in energy production in 2021 was large, production recovered in 2022 to near pre-COVID-19 levels (increasing by 331 PJ), with the pullback being a rare blip of the past two decades. Energy production has increased by more than 80% since 2000 with almost all this production destined for export markets, mostly in Asia.

Figure 1: Australia's energy supply, production, and net imports (PJ), 2000 to 2022



Source: EGEDA (2024)

Australia was the fifth-largest global producer of coal and the seventh-largest global producer of natural gas in 2022 (Energy Institute, 2023). Almost 90% of Australia's coal production is exported to meet demand from coal-fired power plants (thermal coal) and blast furnaces for steel production (metallurgical coal) in Asia. Metallurgical coal accounts for less than one-fifth of APEC coal consumption, though it accounts for almost half of Australia's coal exports.

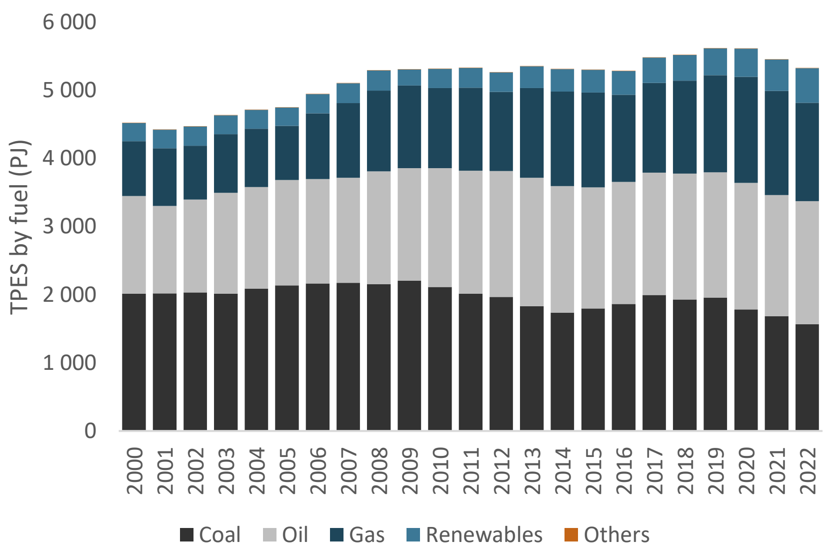
The high prices for energy commodities brought about by the COVID-19 recovery and supply crunches from geopolitical volatility have abated but remain historically high. Nevertheless, with the fall in prices, Australia's thermal coal export revenues decreased by 43% from 2022-23 to 2023-24, dropping to AUD 37 bn (REQ, 2025). Easing market pressures and world governments progressing towards decarbonisation goals and targets (notably China) further contributed to a decline in export revenue despite export volumes being similar to previous years.

Metallurgical coal export earnings were AUD 54 billion in 2023-24, but this represented a decline of 13% from the previous financial year and the very high prices of 2021-22. Volumes are likely to increase in the coming year due to new mines opening up, though earnings are anticipated to remain subdued due to lower prices.

The largest energy commodity earner for Australia for the past few years, LNG, generated export earnings of AUD 69 billion in 2023–24, down by 26% from the previous year. Moreover, an easing of geopolitical pressures and expanded LNG supplies from the US and Qatar have seen prices and subsequently Australian export earnings fall in recent years, with the trend set to continue.

Australia shipped its first LNG cargo from the Northwest Shelf, Western Australia in 1989. Conventional gas resources make up approximately three-quarters of Australia's total gas volume produced, with the north-western regions of Australia accounting for 93% of Australia's identified conventional gas resources, and all of Australia's LNG exports until unconventional coal seam gas resources from the Surat and Bowen basins were developed in Queensland. Most of Australia's unconventional coal seam gas reserves are in Queensland, with a few smaller reserves in New South Wales. The first east coast LNG cargo was shipped from Gladstone, Queensland in 2015, and has since contributed to Australia consistently being a top LNG exporter globally. Australia and Qatar both accounted for a 21% share of global LNG exports in 2022, with both economies being the top two global LNG exporters for that year.

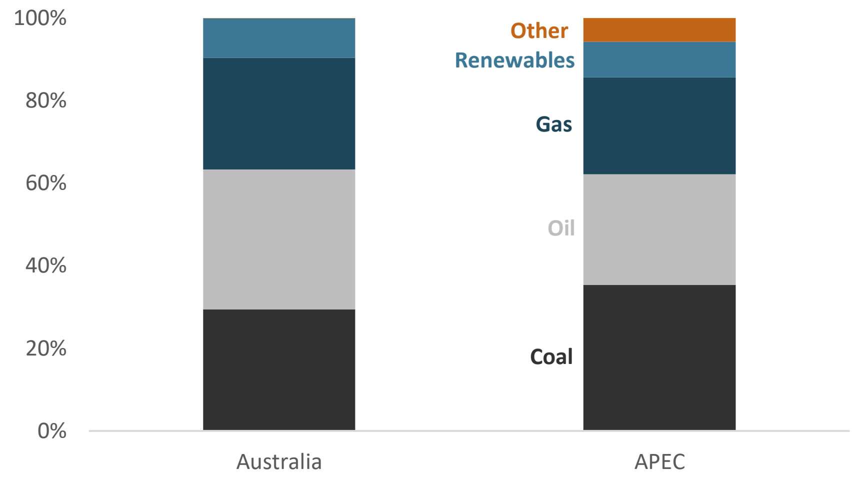
Figure 2: Australia's energy supply by fuel (PJ), 2000 to 2022



Source: EGEDA (2024)

Australia's energy supply was slowly increasing until the global financial crisis in 2008. Energy supply has mostly maintained a high plateau since then, even though the population has increased by a fifth and economic output has increased by more than a quarter. The accumulation of improvements in energy efficiency partially explains why this plateau is observed (Figure 2). Variable renewables such as wind and solar replacing fossil fuels also constrains growth in energy supply, due to their statistical treatment.

Figure 3: Energy supply mix, Australia and APEC, 2022



Source: EGEDA (2024)

Coal supply fell for the fourth year in a row in 2022, representing 29% of Australia's supply mix in 2022. The oil supply (which includes petroleum products imports) also increased in 2022, by 2%, and remained the most prominent absolute source of supply for the third year running. Natural gas supply continued its downward trend by falling 5.8% in 2022. There is a current trend away from using natural gas in many end-use applications, with some states recently banning use in new housing developments, but it is playing an important role in the power sector, via gas-fired peaking turbines to help solve the challenges of variable renewable generation and meeting peak energy demand. There is also a significant consumption of natural gas associated with the liquefaction process required for LNG exports, though that is unlikely to be a future source of growth. The renewables supply increased by 11% in 2022, so that they now account for 9.5% of Australia's energy supply. Australia may have world-beating levels of solar PV (one in three households), but other APEC economies have very significant hydro generation that contributes to APEC having a similar share of renewables (8.6%) to Australia.

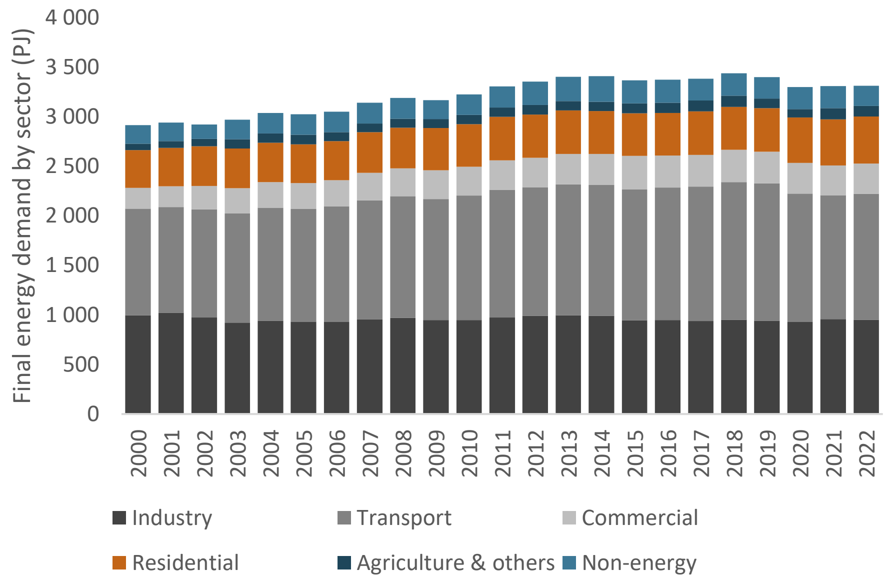
When compared to APEC (Figure 3), oil is more prominent due to Australia's transport sector. Australia has high levels of car ownership, as people and freight move greater distances between population centres than in many other APEC economies. Australian consumers prefer larger sports utility vehicles, which means that recent energy efficiency gains are being offset by energy-hungry vehicles (energy.gov.au, 2024). However, new policies have been implemented such as the New Vehicle Efficiency Standard which will introduce mandatory minimum levels of fuel efficiency for new vehicles, hopefully reducing oil consumption in the transport sector.

Total Final Consumption

Of the 5326 PJ of energy supply in Australia, only 3310 PJ is consumed by end users in the form of end-use demand. This means that almost two-fifths is consumed in the transformation process, which comprises own use and losses.

Total final consumption, which includes the consumption of energy commodities by the non-energy sector, remained relatively stable in 2022, and is almost 4% lower than the peak consumption in 2018. Commercial sector energy consumption rose slightly (2%) in 2022 due to a rebound of activity from COVID-19 restrictions. The increase in residential energy consumption continued, with a 2% growth in 2022. This is partially explained by an increase in the number of individuals working from home following COVID-19 restrictions.

Figure 4: Australia's final consumption by sector (PJ), 2000 to 2022



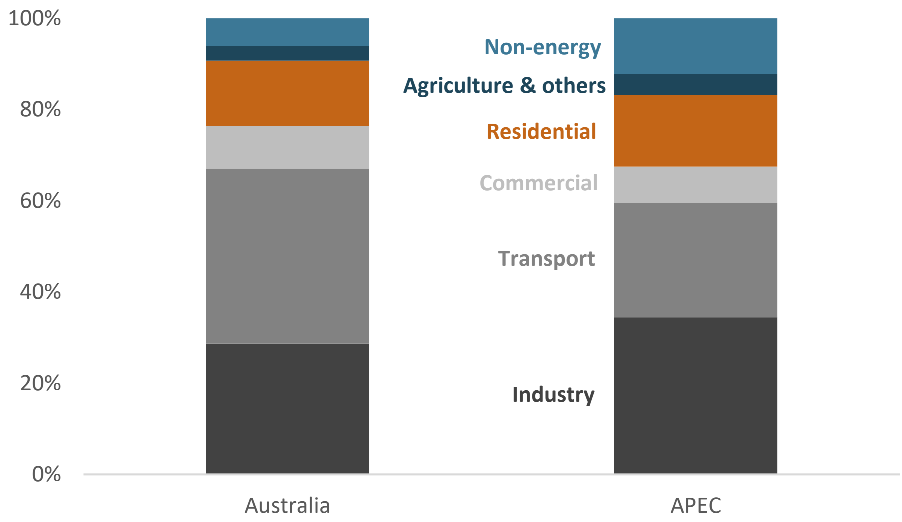
Source: EGEDA (2024)

The transport sector posted a small increase (1.6%) in consumption in 2022. Recovery from lockdowns and COVID-reduced mobility, including interstate travel restrictions, contributed to this increase, and lockdown and state border restrictions ended progressively from late 2021 to early 2022. In contrast, APEC transport energy consumption boomed in 2021, increasing by 7.3%, with many APEC economies rapidly reopening following easing of COVID-19 restrictions.

Australia's industrial energy consumption has maintained a similar level for most of the last two decades (Figure 4). The commodity and resources boom of the 2000s and 2010s saw increased minerals mining activity, leading to increased energy consumption. However, a strong Australian dollar making Australian exports less competitive, and many industrial enterprises being offshored have offset this increase. As a result, industrial energy consumption has declined marginally over time. However, the accelerating global rollout of renewables and batteries will require large quantities of minerals such as lithium and rare earth elements that Australia is well placed to supply.

The Australian Government has developed a *Critical Minerals Strategy* (2023) that not only prioritises greater mining activity but also seeks to expand downstream processing that could contribute to an industrial revival in the coming decades.

Figure 5: Final consumption by sector, Australia and APEC, 2022



Source: EGEDA (2024)

Difficulty exists for Australian manufacturers to secure reliable long-term gas supplies at competitive prices which will incentivise electrification of many industrial pursuits. The rise of renewable-powered industries, such as green steel, requiring large amounts of renewable electricity to produce green hydrogen, will be an opportunity for Australia to pursue due to its vast wind and solar renewable potential.

Recent government announcements such as the Future Made in Australia National Interest Framework have been announced to support this ambition, a scheme which involves a AUD 1.7 bn commitment to foster green metal production. In the interim, the lack of a reliably sourced gas supply will be a disadvantage for Australian manufacturers.

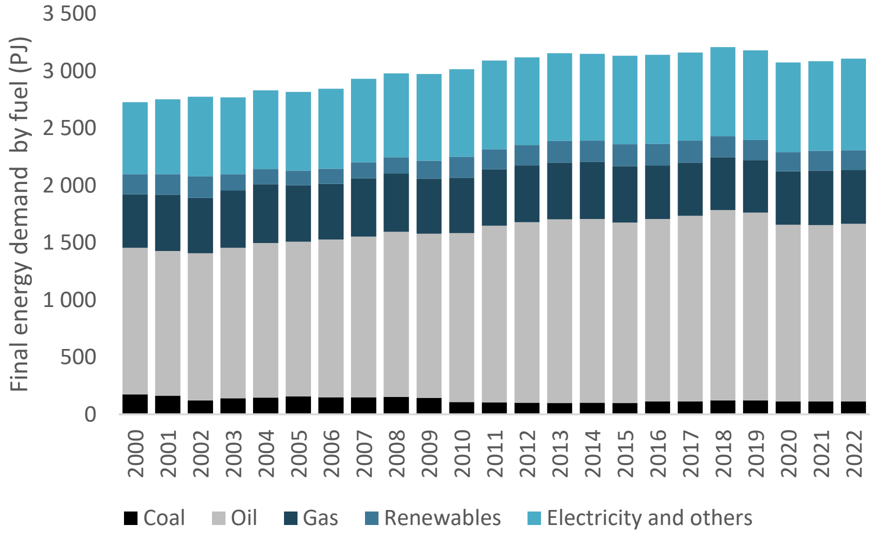
Final Energy Demand

Final energy demand excludes the consumption of energy products by the non-energy sector and is a subset of final consumption.

Transport energy consumption is still mostly tied to oil (refined products) in all APEC economies. For Australia, the transport sector consumes almost four-fifths of refined oil products. Refined products are also used in all other end-use sectors, such as diesel in mineral mining (industry), LPG in residential buildings, and diesel generators in commercial buildings. These use cases combine to mean that oil accounted for half of Australia's final energy demand in 2022, with this share higher than it was in 2000 (47%).

Wide-scale electrification of end-use applications has yet to occur and so electricity has yet to rise in prominence, maintaining a share of roughly a quarter of final energy demand for most of the previous two decades. With the increase in electric vehicles, and a move to electrifying other sectors, electricity is anticipated to undergo significant growth in the next few decades. This is bolstered by recent government initiatives such as the recently announced National Electric Vehicle Strategy which aims to grow the Electric Vehicle (EV) market share. See the 9th edition of the *APEC Energy Demand and Supply Outlook* for an analysis and discussion of these trends.

Figure 6: Australia's final energy demand by fuel (PJ), 2000 to 2022

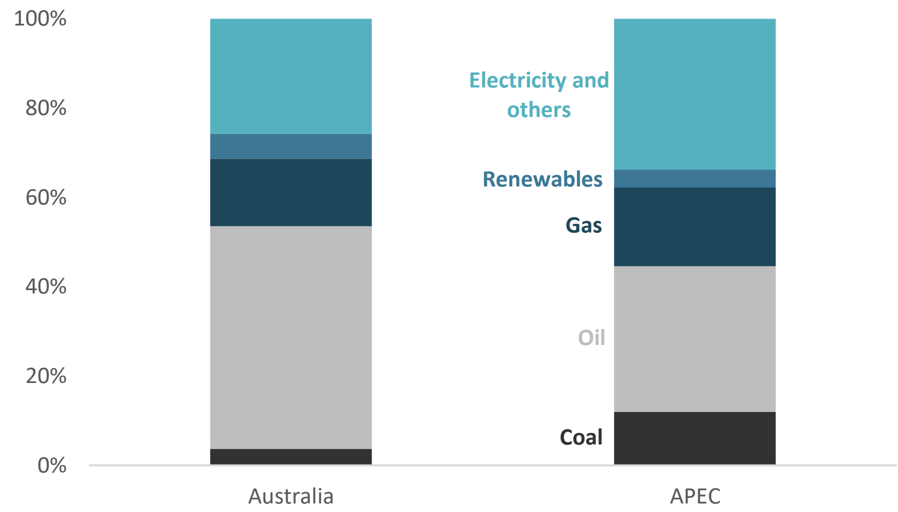


Source: EGEDA (2024)

Note: does not include non-energy sector consumption of energy products

Australia's relatively small heavy industry sector (compared to other APEC economies) means that coal consumption in applications such as steelmaking, cement, and chemicals manufacturing is relatively low. The other end-use sectors use almost no coal in Australia.

Figure 7: Final energy demand fuel share, Australia and APEC, 2022



Source: EGEDA (2024)

Roughly three-quarters of Australia's natural gas production was exported in 2022. A large portion of this production occurs in the north-west and is unavailable to domestic east coast consumers, due to limited domestic pipeline networks and the absence of connecting LNG import terminals. There are currently multiple proposals to build LNG import facilities at locations on the east and south coasts, and one of these projects is nearing completion at Port Kembla in New South Wales (NSW). It is uncertain at this point whether additional import terminals will be built.

Heating and cooking applications within the building sectors have been among the most prominent sources of natural gas demand. Multiple manufacturing applications have also relied on the consistent heating properties of natural gas and its ability to generate high heat. However, higher prices and difficulty in securing long-term contracts on the east coast had been constraining natural gas demand in the lead-up to COVID-19 and afterwards.

In 2022, natural gas consumption fell slightly by 1%, continuing the longer-term decline in domestic natural gas consumption as the share of renewable energy grows. Australia's domestic consumption of gas is likely to stay lower than for the APEC region (Figure 7).

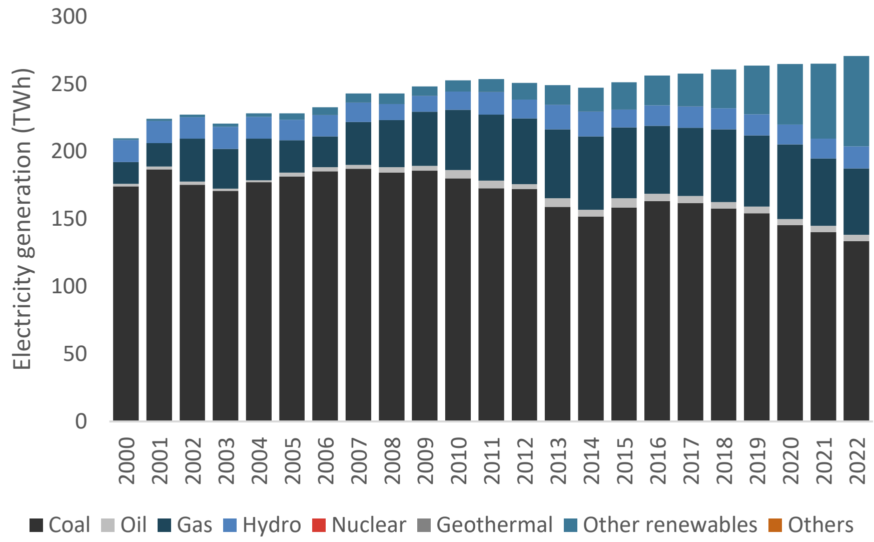
The small size of Australia's heavy industry sector provides a partial explanation for the relatively low consumption of coal by Australian end-use energy consumers. Australia's relatively low consumption of electricity also correlates with the high relative share of the transport sector, which is dependent on refined products (oil).

Transformation

Power Sector

Coal remains the dominant source of electricity generation for Australia. However, coal's share in the generation mix has fallen from well over 80% at its peak to 49% in 2022. The rapid rise in renewable generation, particularly solar PV, has negatively impacted the economics of coal-fired power with intraday profits being heavily impacted by the surge in solar PV flooding the energy market. With continued rapid renewables deployment, coal is likely to be phased out in the 2030s, if the regulatory, integration, distribution, and transmission challenges of integrating a very high share of renewable are met.

Figure 8: Australia's electricity generation by fuel, 2000 to 2022

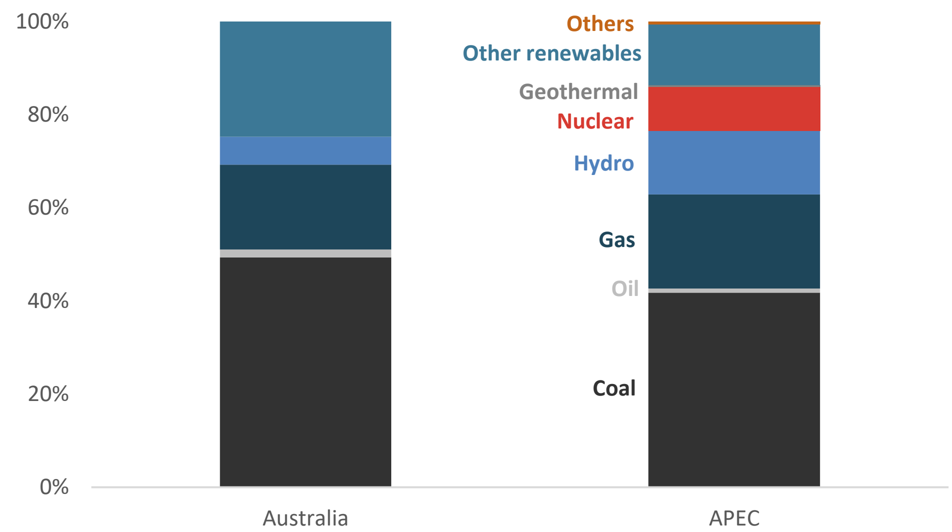


Source: EGEDA (2024)

Natural gas-fired generation had been increasing strongly for a decade but fell by over 10% from 2020 to 2022. Much of this fall accommodated the sustained very large increase in renewable generation, which accounted for a 31% share in 2022.

The very large increase in renewable generation is supported by Australia's world-leading solar rooftop PV rates of installation. The rise of rooftop solar is partly due to very favourable solar radiation conditions, and partially to do with policy support from state and federal governments. One in three Australian homes has a solar panel system installed. The complementary rise of utility-scale solar and wind means that renewable generation is continuing to accelerate (Figure 8).

Figure 9: Electricity generation fuel share, Australia and APEC, 2022



Source: EGEDA (2024)

Refining

The federal government has announced support measures for Australia's remaining two refineries in Geelong, Victoria and Lytton, Queensland to continue to meet some of Australia's demand for refined products until at least 2030. These remaining two refineries have an output that fulfilled just about 10% of Australia's petroleum product consumption in 2024 (Australian Petroleum Statistics, 2024).

Energy Transition

Since a new federal government was elected in May 2022, commitments that support Australia's legislated net zero 2050 commitment have accelerated. A National Net Zero Authority has been established to ensure the opportunities are shared widely, including with workers and communities that are associated with emissions-intensive sectors (Prime Minister of Australia, 2023).

At the end of 2022, Australian federal, state and territory, energy ministers introduced the Commonwealth Capacity Investment Scheme (CIS). The scheme aims to underwrite revenue for a capacity market for clean dispatchable storage and generation to ensure reliability and security while delivering much lower emissions from Australia's electricity grid.

In November 2023, the Australian Government announced an expansion to the scheme to target a total of 32 GW of new capacity by 2030, which is equivalent to around half of the present NEM capacity, made up of:

- 23 GW of renewable capacity representing AUD 52 bn in investment
- 9 GW of clean dispatchable capacity representing AUD 15 billion in investment.

The expanded CIS will be rolled out from 2024 to 2027 with regular competitive tenders held approximately every six months, starting in April/May 2024. Some 14 GW of the CIS will be rolled out through a guaranteed tender, with the remaining 18 GW delivered through Renewable Energy Transformation Agreements. Nearly 6.4 GW worth of capacity for renewable projects was announced under the CIS Tender 1 for the NEM.

New transmission infrastructure to deliver renewable energy and increased generation is being supported by low-cost finance (Rewiring the Nation, 2022). The locations of these new sources of power will be guided by renewable energy zone analysis by the Australian Energy Market Operator (AEMO), which includes offshore wind zones analysis (AEMO, 2022).

The Australian Government has also announced up to AUD 1 bn funding for the Solar Sunshot program in March 2024. The program aims to support facilities along the supply chain of Australia's solar photovoltaic (PV) manufacturing sector (ARENA, 2024).

Australia is also supporting multiple hydrogen initiatives to capitalise on potential demand. Details of these hydrogen initiatives are available in the energy policy section later in the chapter.

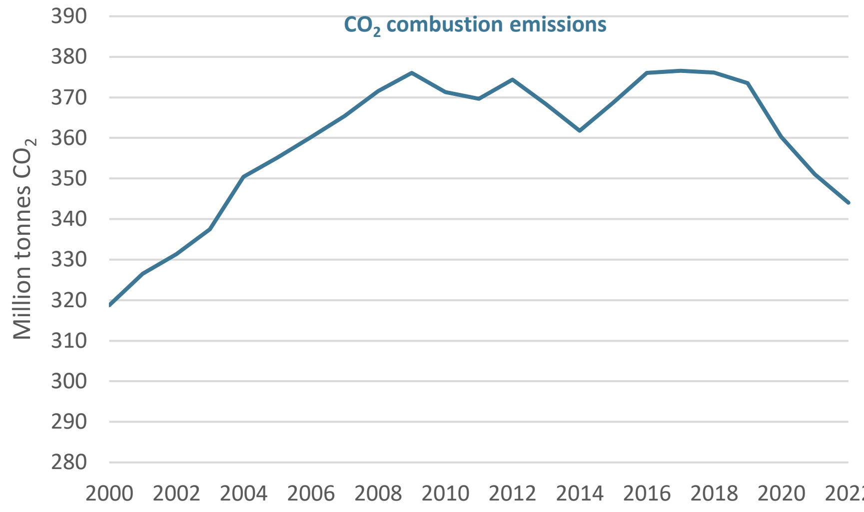
The Department of Climate Change, Energy, the Environment and Water has also ensured that energy policy is more closely aligned with environmental considerations, to support energy transition objectives.

Emissions

The expert group on energy data and analysis (EGEDA) falls under the umbrella of APEC's Energy Working Group In addition to energy data compiled by EGEDA, CO_2 emissions from combustion activities in the energy sector are recorded. These emissions are a subset of total greenhouse gas (GHG) emissions that are considered in the context of climate change, such as under the United Nations Framework Convention on Climate Change.

For Australia, CO_2 combustion emissions have maintained a high plateau for most of the last decade, though they fell in 2020 and 2021 and remained subdued in 2022. This fall was partly due to a decline in economic activity that was brought on by the COVID-19 pandemic and partly due to the rapid rise in renewable generation.

Figure 10: Australia's CO_2 combustion emissions (million tonnes), 2000 to 2022



Source: EGEDA (2024)

Energy Security

Even though Australia produces much more energy than it consumes, energy security has become an increasingly prominent issue in recent years. Geopolitical volatility eventually impacted Australian consumers of natural gas due to the tight market conditions that have been a feature of the Australian east coast natural gas market since LNG exports began in 2015. Despite falling from their 2022 highs, global prices for energy commodities remain higher than pre-2022 levels and have been passed on to many Australian consumers. With the lack of a reservation policy and the market being dominated by LNG exporters selling gas at export parity prices, tension was created between domestic supply and export commitments. This difficulty in securing a natural gas supply, and the much higher prices for that supply, mean that Australian consumers are in a similar predicament to many European and Asian consumers.

The much higher global price for coal and gas has also impacted Australia's electricity markets and was a prominent reason for the increased levels of inflation that Australia has experienced since 2022.

The unprecedented spikes in energy prices sparked significant debate in Australia about energy policy settings. Two-thirds of the respondents of a survey of top economists (Economic Society of Australia, 2022) advocated intervention in response to these challenging market conditions. The proposed interventions included a cap on domestic prices, a tax on excess profits that can then be used to finance subsidies, or domestic reservation.

In December 2022, the Australian Government implemented a wholesale price cap of AUD 12 per gigajoule for natural gas and AUD 125 per tonne of black coal, the latter ending only in 2024 (Energy Price Relief Plan, 2024). The price cap for gas applies to new domestic wholesale gas contracts by east coast producers. However, because 90% of gas supply is controlled by the east coast LNG producer-exporters, east coast consumers have still found it difficult to secure a ready supply (ACCC, 2023). Uncertainty over how the gas market will develop over the next few decades has also hampered investment in pipelines that would more readily transport gas domestically.

The market power of LNG exporters has meant the price cap acts like a price floor and is only applicable for the small proportion of gas consumption that has been newly contracted. These high price gas market conditions are also influential for electricity prices due to gas generation regularly being the marginal price setter for wholesale electricity prices in the NEM. Wholesale gas and electricity prices in Western Australia are lower, in part, due to a policy of domestic gas reservation, but delays in new gas supply and rising demand from domestic consumers are also bringing about price rises (S&P Global, 2023).

To deliver price relief will require an intervention such as domestic reservation, guaranteeing the required supply, or an intervention that encourages a more competitive supply landscape. The Future Gas Strategy, released May 2024, attempts to meet these challenges (Department of Industry, Innovation, Science and Resources, 2024).

Australia has been non-compliant with the International Energy Agency (IEA) 90 days of oil stock requirement since 2012. The federal government signed an agreement with the US in 2020 to lease a portion of the US Strategic Petroleum Reserve (SPR) as part of a commitment to return Australia to compliance by 2026. Economy-owned oil held in the SPR was released to the market in response to the IEA's March collective action in 2022. A collective action is a coordinated release of oil that aims to stabilise the market and put downward pressure on prices. Complementary measures have included the Minimum Stockholding Obligation, requiring refineries to maintain a baseline level of gasoline, jet fuel and diesel oil stocks, and the Boosting Australia's Diesel Storage Program, which allocated AUD 260m to expand diesel storage capacity in Australia.

Most of Australia's relatively small level of oil production is from the remote Northwest Shelf. Distance from Australia's refineries and ill-suited grades mean that most of the oil is exported (Geoscience, 2023).

The closure of two of the remaining four oil refineries in Australia in 2021 means that Australia is now more reliant on sources of imported refined products supply, with 91% of refined petroleum products consumed in Australia being imported (Australian Petroleum Statistics 2024).

APEC Energy Goals

There are two energy-related objectives that APEC member economies have agreed to meet as a collective: to improve energy intensity and to double the share of modern renewables.

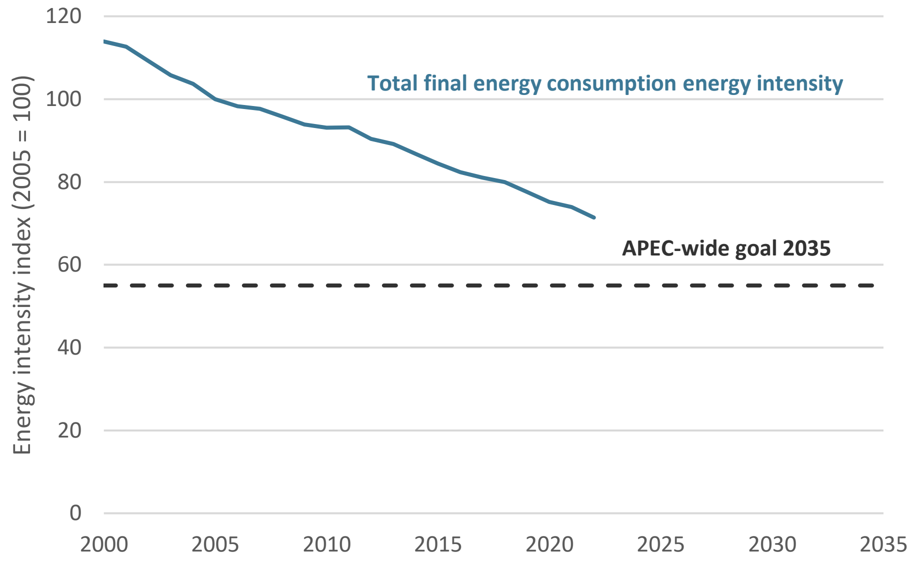
Energy Intensity Goal

In 2011, APEC member economies agreed to increase their ambition to reduce energy intensity by 45% in 2035, relative to a 2005 baseline. The original goal was a 25% improvement by 2030, relative to a 2005 baseline.

APEC is on track to achieve this energy intensity improvement. The goal does not impose individual economy targets, but it is possible to track the progress of individual APEC economies relative to the overarching proportional improvement.

Australia's final energy demand energy intensity has been consistently improving at a rate of between 1.5 and 2% per annum for the two decades to 2022 (Figure 11). This represents more than a 29% improvement since 2005. Energy supply intensity has improved by just under 27% for the same period, with the discrepancy partly due to the large ramp in LNG operations and associated large own-use and energy losses.

Figure 11: Australia's total final energy consumption intensity index, 2000 to 2022 (2005 = 100)

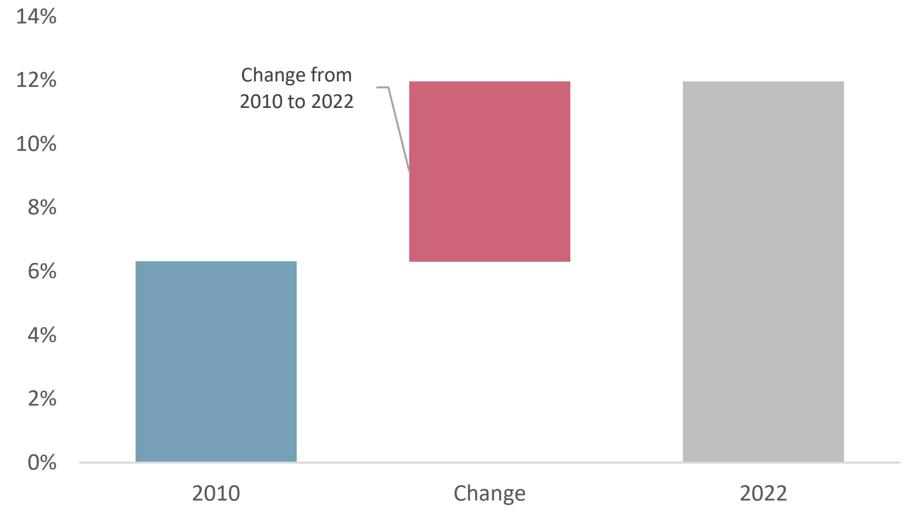


Source: EGEDA (2024)

Doubling of Renewables

The second energy goal involves doubling the share of modern renewables in the APEC energy mix for the period 2010 to 2030. There is no economy-level goal for individual member economies, but improvements by individual economies will contribute to the doubling goal.

Figure 12: Australia's modern renewable energy share, 2010 and 2022

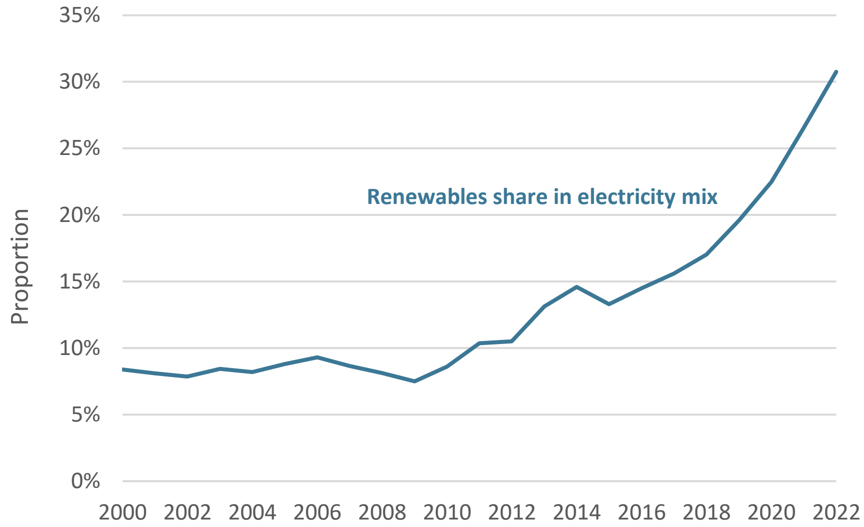


Source: EGEDA (2024)

Note: Biomass used in the residential and commercial sectors is assumed to be traditional biomass and is not included in the definition of modern renewables. All other renewables (biomass used by industry, hydro, geothermal, etc.) are considered modern renewables. Modern renewables also include the share of electricity that is generated from renewable sources.

The share of modern renewables in Australia's final energy demand mix increased from 6.3% in 2010 to 12% in 2022. Australia's large year-on-year increases in renewable generation explain most of this increase. Electricity generation from renewables increased from 22% in 2020 to 31% in 2022, which was more than triple the 2005 level of 8.8% (Figure 13). The large pullback in 2015 coincided with the end of Australia's carbon price in 2014 and a collapse in renewables investment.

Figure 13: Australia's renewable generation share, 2000 to 2022



Source: EGEDA (2024)

The short-lived carbon price, from 2012 to 2014, correlated with an increase in renewable generation but it is difficult to determine how large the impact was from the imposition of this short-lived price. The sustained rise of the late 2010s was largely due to the rise of rooftop solar, though the growth of utility-scale solar and wind generation capacity is also accelerating.

In 2022, the annual increase in renewable generation was more than 18%, which was large considering that hydro generation was flat. Solar and wind capacity continues to accelerate and is supporting increased climate ambitions such as Australia's updated NDC, released in 2022. However, it remains to be seen whether this pace of increase can deliver on the Australian Government's target of 82% renewable generation by 2030. A more recent update shows that renewable generation reached 39% in 2024 (Clean Energy Council, 2024).

Energy Policy

Energy Policy	Details	Reference
Net Zero 2050 Plan	A whole-of-economy plan to achieve net zero emissions by 2050. It will set out government priorities, establish policies and measures to drive down emissions and support ongoing and new investment in low emissions and renewable activities.	Department of Climate Change, Energy, the Environment and Water
Capacity Investment Scheme	A revenue underwriting scheme to accelerate investment in renewable energy generation such as wind and solar and clean dispatchable energy such as battery storage. By 2030 an additional 32 GW of capacity worth of these technologies will be constructed helping the government meet its 82% renewable electricity target.	Department of Climate Change, Energy, the Environment and Water
82% renewable electricity target	Australia's goal to ensure that 82% of electricity generation is derived from renewable sources by 2030.	Climate Change Authority
Safeguard Mechanism	A policy to set legislated limits on the green house gas emissions of Australia's largest industrial facilities. These emissions limits will decline, predictably and gradually, helping Australia meet its emissions reductions targets.	Department of Climate Change, Energy, the Environment and Water
New Vehicle Efficiency Standard	A new fuel efficiency standard to be applied to new cars sold in the Australian market. Each vehicle manufacturer has a set average CO_2 target for the vehicles they produce, which they must meet or beat, with the limit being progressively lowered over time.	Department of Climate Change, Energy, the Environment and Water
The National Electric Vehicle Strategy	Strategy to increase the uptake of electric vehicles to reduce emissions and improve the wellbeing of Australians. The strategy relies on three main principles: 1) to increase the supply of affordable and accessible EVs, 2) to establish the resources, systems and infrastructure to enable rapid EV uptake, and 3) to encourage EV demand.	Department of Climate Change, Energy, the Environment and Water
Future Made in Australia, National Interest Framework	Industries will be prioritised for investment that will make a significant contribution to achieving net zero including renewable hydrogen, critical minerals processing, green metals and clean energy manufacturing.	Australian Treasury Department
National Hydrogen Strategy	A strategy providing a framework to guide Australia's production, use and export of hydrogen, allowing Australia to position itself as a global hydrogen leader. The new strategy focusses on accelerating clean hydrogen industry growth. This will be achieved through increasing global cost competitiveness by supporting industry development at scale.	Department of Climate Change, Energy, the Environment and Water

Notable Energy Developments

Energy development	Details	Reference
Reliable Affordable Clean Energy Cooperative Research Centre	Focused on opportunities from low-cost renewable energy, network integration and smart energy management. The Australian Government has committed AUD 69 million over 10 years, with industry and research partners committing AUD 279 million.	RACE for 2030
Future Battery Industries Cooperative Research Centre	Drives collaboration on research and development across all segments of the battery value chain. The Australian Government has committed AUD 25 million over six years, while industry and research partners have committed AUD 111 million.	Future Battery Industries
Rio Tinto's Renewable Energy Agreement	Rio Tinto, one of the world's largest metal and mining companies, has entered into a 20-year agreement with Edify Energy to purchase 90% of its solar power and battery storage capacity. This initiative is expected to cover 80% of the electricity needs for the Boyne smelter, saving approximately 5.6 million tons of carbon dioxide annually	Guardian
Project EnergyConnect	A 900 km electricity transmission line connecting South Australia and New South Wales. Aimed at enhancing energy security and facilitating renewable energy sharing between the states, the project is expected to be completed by mid-2025	Project EnergyConnect
Snowy 2.0 Pumped Storage Power Station	An expansion of the original Snowy Mountains Scheme, Snowy 2.0 is a pumped-hydro project designed to provide 2.2 GW of capacity and approximately 350,000 MWh of large-scale storage to the national electricity market. Construction began in 2019, with completion anticipated in the coming years.	Snowy Hydro
Hydrogen Hubs	Australia's Regional Hydrogen Hubs Program is investing over AUD 500 million to co-fund infrastructure and establish production, user and export clusters in locations across Australia. The hubs will accelerate Australia's clean-hydrogen industry by scaling up domestic supply and anchor export markets	Growing Australia's Hydrogen industry

Useful Links

Australian Bureau of Statistics – https://www.abs.gov.au/

Australian Competition and Consumer Commission – https://www.accc.gov.au/

Australian Energy Market Commission – https://www.aemc.gov.au/

Australian Energy Market Operator – https://aemo.com.au/

Australian Energy Regulator – https://www.aer.gov.au/

Australian Renewable Energy Agency – https://arena.gov.au/

Clean Energy Finance Corporation – https://www.cefc.com.au/

Clean Energy Regulator – www.cleanenergyregulator.gov.au/

Department of Climate Change, Energy, the Environment and Water – https://www.dcceew.gov.au/

Department of Industry, Science and Resources – https://www.industry.gov.au/

Energy.gov.au – https://www.energy.gov.au/

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Brunei Darussalam

Introduction

Brunei Darussalam, long endowed with an abundance of oil and gas, has pledged to transition to a low-carbon economy and reduce its greenhouse gas (GHG) emissions from business-as-usual levels by 2030 in their Nationally Determined Contributions (NDC). The Brunei National Climate Change Policy (BNCCP) serves as the foundation for achieving the economy's NDC target as well as its net zero emissions goal by 2050, outlining key strategies to reduce emissions across the energy sector in principle, in addition to strengthening carbon sequestration in the forestry sector and enhancing climate adaptation.

Brunei Darussalam is also committed to the Global Renewables and Energy Efficiency Pledge in 2023, which supports the tripling of installed global renewable energy capacity as well as improving energy efficiency at twice the current rate by 2030.

The Brunei Darussalam National Council on Climate Change (BNCCC) launched a directive on the mandatory reporting of GHG emissions in 2023. With this directive, all emitting facilities, including government departments and private sector companies, are required to report their quarterly and annual emissions, in line with the BNCCP objectives.

Brunei Darussalam is a signatory to the Global Coal to Clean Power Transition Statement, which was announced during COP26. The economy is committed to transitioning away from unabated coal-fired power generation, through the rapid deployment of clean power generation and energy efficiency measures, ceasing issuance of new permits for construction of unabated coal-fired power generation projects.

In addition, the Department of Energy, in close collaboration with relevant key stakeholders, is currently formulating an Energy Master Plan to guide Brunei Darussalam's future energy sector development.

Table 1: Brunei Darussalam's macroeconomic data and energy reserves

Key data [a, b]		Energy reserves [c, d]	
Area (km^2)	5765	Oil (billion barrels)	1.1
Population (million)	0.5	Gas (trillion cubic feet)	7.9
GDP (2021 USD billion PPP)	35	Coal (million tonnes)	0
GDP per capita (2021 USD PPP)	77 441	Uranium (kilotonnes U < USD 130/kgU)	0

Source: a Prime Minister's Office (2024); b World Bank (2024); c BP (2024); d UN (2024)

Note: Reserves are total proved reserves and reasonably assured recoverable resources for uranium.

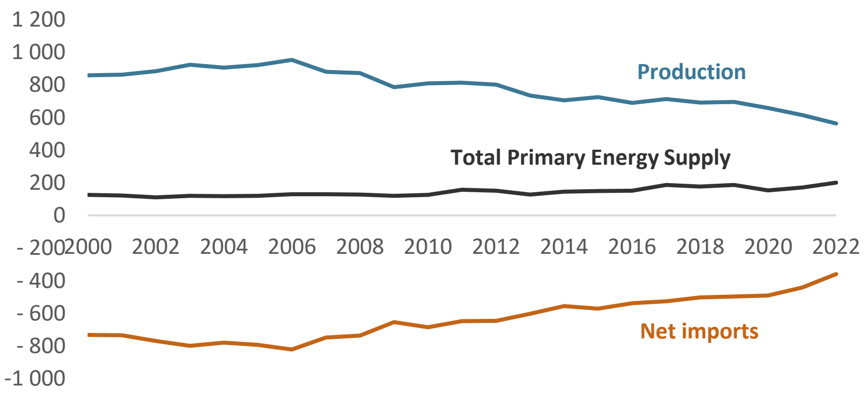
Energy Supply and Consumption

Total Primary Energy Supply

Brunei Darussalam's energy supply increased to 201 PJ in 2022 from 2021 levels of 172 PJ (Figure 1). This was primarily driven by imports of crude oil to meet the domestic refinery requirements. Consequently, net imports grew by almost 19% during the same period. Despite the increase in crude oil imports, coal imports from Indonesia recorded a marginal decline of 2% during the same period.

Unscheduled maintenance and rejuvenation activities drove the decline in Brunei Darussalam's indigenous oil and gas production in 2022. Crude oil and natural gas liquids (NGL) output decreased by 14%, while that of natural gas registered a reduction of 5% between 2021 and 2022.

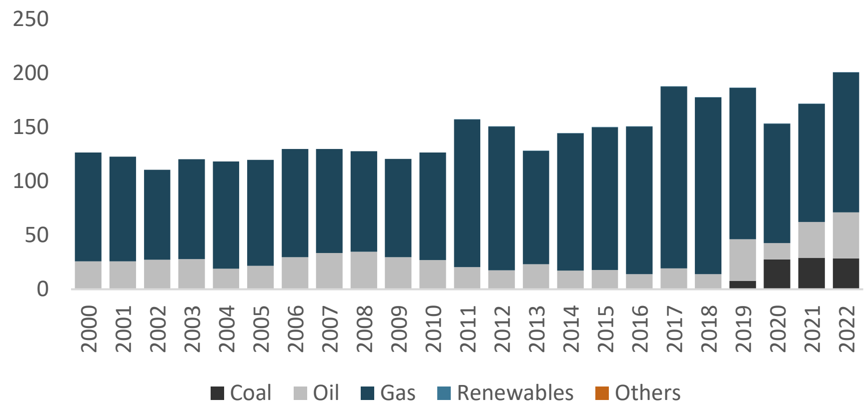
Figure 1: Brunei Darussalam's energy supply, production, and net imports (PJ), 2000 to 2022



Source: EGEDA (2024)

Due to the vast gas reserves in Brunei Darussalam, the fuel has been the cornerstone of the economy's total energy supply, serving as a primary fuel for electricity generation and contributing vastly to its energy exports. Gas accounted for 65% of Brunei Darussalam's energy supply, while coal and oil contributed 21% and 14% respectively (Figure 2).

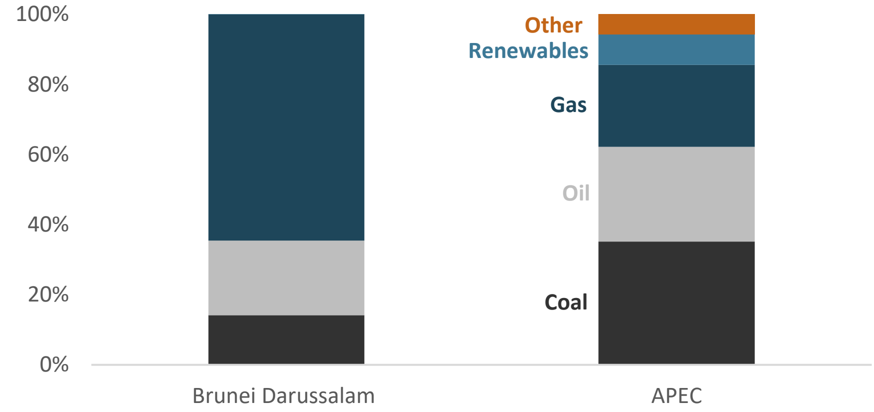
Figure 2: Brunei Darussalam's energy supply by fuel (PJ), 2000 to 2022



Source: EGEDA (2024)

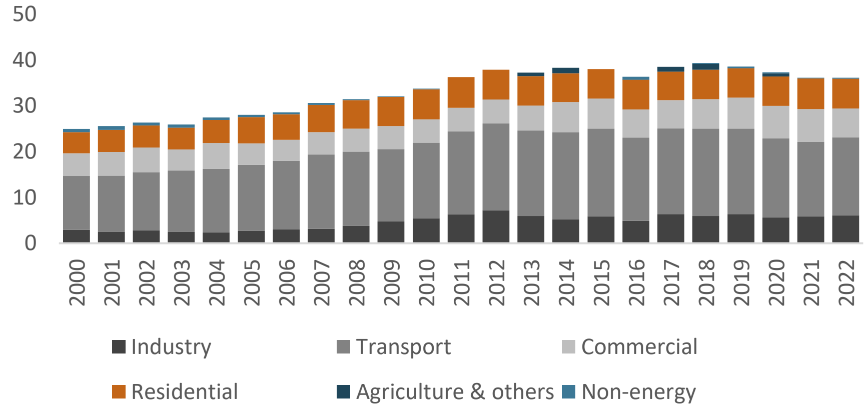
While the APEC energy supply mix was diversified in 2022, heavy reliance on fossil fuels has placed Brunei Darussalam well above the APEC average in terms of fossil fuel share (Figure 3). The share of gas in Brunei Darussalam was almost two times higher than that in APEC, given its monopoly in the economy's power sector. The oil share in APEC was slightly higher than that in Brunei Darussalam, while the coal share in the economy was significantly below that of APEC as coal was only being utilised in the domestic refinery.

Figure 3: Energy supply mix, Brunei Darussalam and APEC, 2022



Source: EGEDA (2024)

Figure 4: Brunei Darussalam's final consumption by sector (PJ), 2000 to 2022



Source: EGEDA (2024)

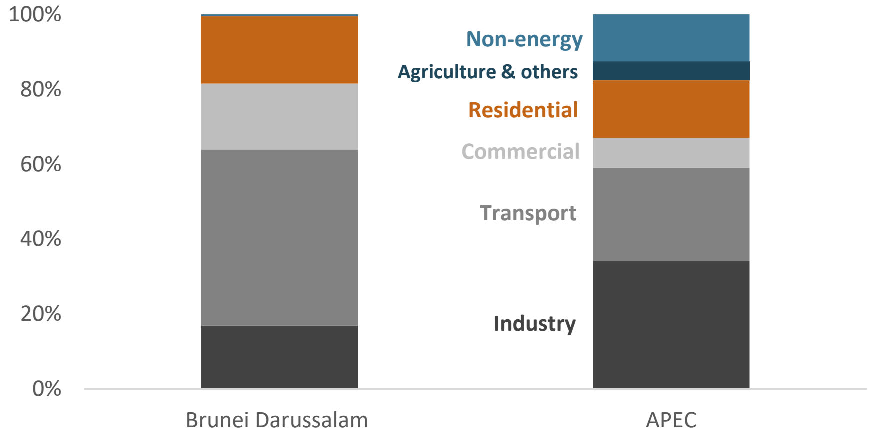
Total Final Consumption

Brunei Darussalam's total final consumption remained stable between 2021 and 2022, despite seeing varied changes in the sectoral consumption (Figure 4). The transport sector registered the largest yearly increase in consumption at 4.7% growth. This was attributed to the increase in the number of registered and licensed vehicles to over 33 400 between 2021 and 2022 (MOFE, 2024). The industry sector's consumption also recorded a substantial increase of 3.7%.

On the other hand, the commercial and residential sectors experienced substantial declines of over 11% and 3%, respectively in 2022. While there are no specific reasons for such declines, they may be due to the enforcement of the Energy Efficiency (Standards and Labelling) Order 2021 which mandates the use of more efficient appliances.

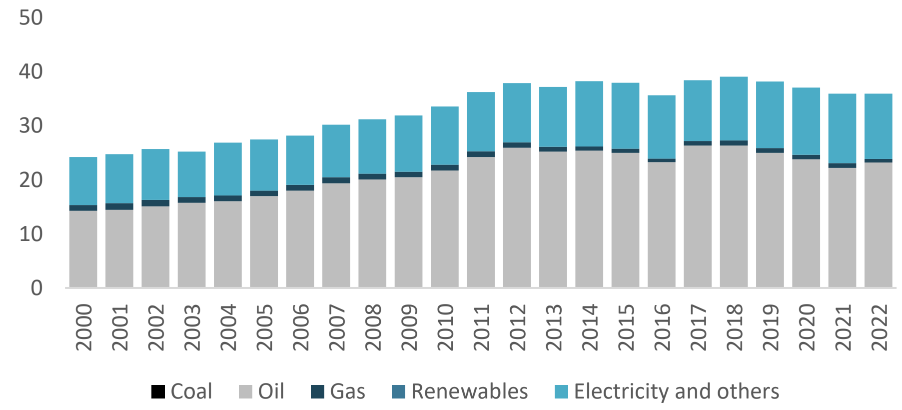
With respect to the APEC region (Figure 5) in 2022, the proportion of the transport sector in Brunei Darussalam was significantly higher than that of APEC, given high ownership of private vehicles coupled with minimal use of public transport. The lower share of the industry sector in Brunei Darussalam compared to that of APEC could be attributed to the economy's heavy reliance on oil and gas exports. The share of the commercial sector in the economy was higher than that in APEC, while the residential sector shares in both Brunei Darussalam and APEC were identical to each other. The shares for 'Agriculture & others', and non-energy sectors in Brunei Darussalam were well below those of APEC, given negligible demands in both sectors.

Figure 5: Final consumption by sector, Brunei Darussalam and APEC, 2022



Source: EGEDA (2024)

Figure 6: Brunei Darussalam's final energy demand by fuel (PJ), 2000 to 2022



Source: EGEDA (2024)

Note: does not include non-energy sector consumption of energy products

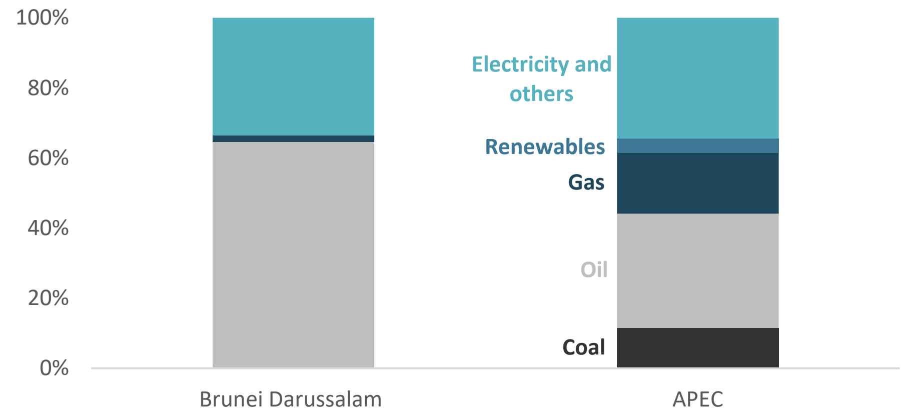
Final Energy Demand

In general, the final energy demand recorded declines across most fuels, excluding oil which increased by over 4% due to increased transport and industrial activities between 2021 and 2022 (Figure 6). The demand for gas decreased the most by almost 17%, possibly due to fuel switching from town gas to liquefied petroleum gas (LPG) for most households in the Belait district, although the use of LPG itself within the residential sector recorded a negative growth of almost 3% in the same period.

Electricity demand registered a decrease of 6.5%, contributed primarily by significant declines in commercial and residential sectors, although the industry sector only recorded a marginal increase in its electricity demand.

The high reliance on oil in demand sectors, particularly in the transport sector, meant that Brunei Darussalam was well above the APEC average in terms of oil share (Figure 7). The share of Brunei Darussalam's electricity was comparable to that of APEC, given a 99% electrification rate in the economy as well as high electricity usage per capita. The direct consumption of natural gas in Brunei Darussalam was very minimal because only a small number of households in Belait District are directly connected to the gas supply via pipelines, as the majority of households use LPG cylinders for cooking.

Figure 7: Final energy demand fuel share, Brunei Darussalam and APEC, 2022



Source: EGEDA (2024)

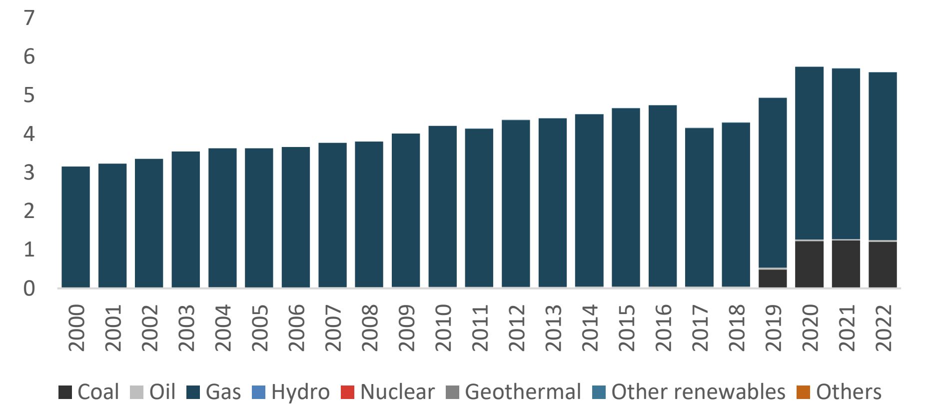
Transformation

Power Sector

The total electricity generation in Brunei Darussalam amounted to 5.6 TWh in 2022, down 1.7% from the previous year (Figure 8). Electricity output from gas, which contributed over 77% of the economy's electricity generation mix, declined by 1.7% to reach 4.3 TWh in 2022. Electricity output from coal, solely for Hengyi Industries' refinery and petrochemical complex, also decreased by 2.8% to reach 1.2 TWh. Coal contributed almost 22% of Brunei Darussalam's electricity generation in 2022.

On the other hand, electricity generation from oil, in the form of diesel, increased substantially by almost 26% in 2022, despite contributing only 0.8% of the total electricity generation mix. The significant increase could be attributed to the increased population and thus activities in Temburong district, to which diesel-fired electricity generation was supplied.

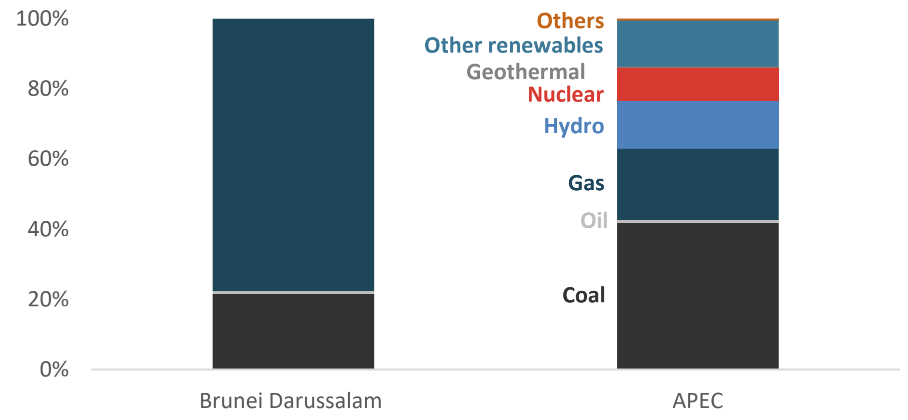
Figure 8: Brunei Darussalam's electricity generation by fuel (TWh), 2000 to 2022



Source: EGEDA (2024)

In comparison with APEC, the dominance of natural gas in Brunei Darussalam's electricity generation mix in 2022 places the economy well above the APEC average (Figure 9). Conversely, coal-fired electricity generation was significantly lower than APEC's share, given that it is supplied only to Hengyi Industries' refinery and petrochemical complex.

Figure 9: Electricity generation fuel share, Brunei Darussalam and APEC, 2022



Source: EGEDA (2024)

Refining

China-based Hengyi Industries Sdn Bhd currently owns and operates the sole refinery and petrochemical complex in Brunei Darussalam. Phase 1 of the complex, with an investment of USD 3.5 billion, has been in operation since November 2019 following over 2.5 years of construction and commissioning activities (Hengyi, 2025). The integrated complex currently refines about 175 000 barrels of crude oil per day, of which more than half is imported from overseas.

Between 2021 and 2022, crude oil throughput increased by 4.5% to reach 387 PJ in 2022, or equivalent to approximately 174 000 barrels per day. Petroleum products comprised mainly diesel, with a share of 35% of the total output, followed by other products (benzene, paraxylene, etc) (27%), motor gasoline (22%), naphtha (9%) and LPG (7%). In terms of yearly changes, only motor gasoline and diesel recorded positive growths while the other products registered declines.

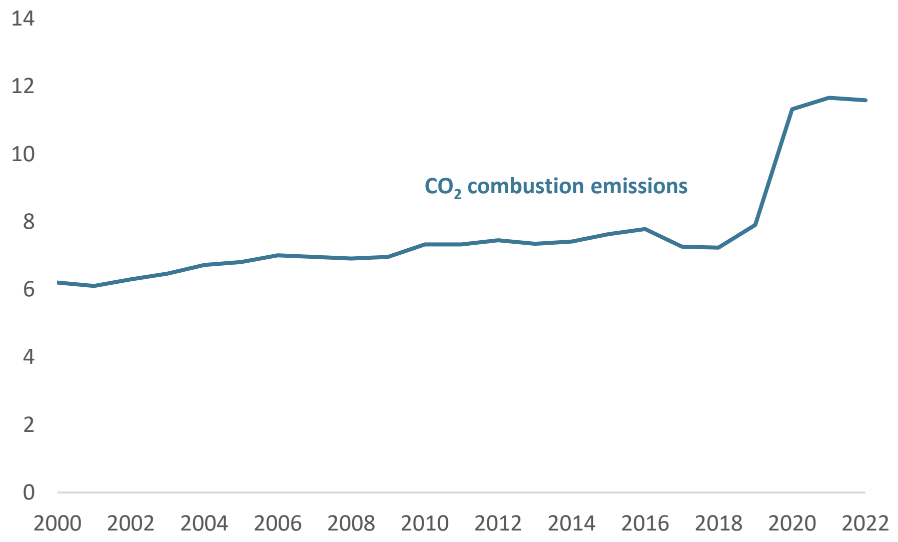
Hengyi Industries has also begun advancing on the development of the Phase 2 complex. The firm will expand the current capacity to further refine 11 million tonnes per annum, equivalent to 260 000 barrels of oil per day, to produce additional refined petroleum products (NS Energy, 2023).

Energy Transition

Emissions

Brunei Darussalam's emissions fell marginally to 11.5 Mt CO_2e in 2022 from 2021 levels of 11.7 Mt CO_2e (Figure 10). Despite the increase in emissions in the demand sectors, the declining coal and gas inputs for electricity generation in 2022 caused a decrease in the overall emissions, since the transformation sector was the main contributor to emissions. The growth in activities in industry and transport sectors contributed to the increase in demand-side emissions between 2021 and 2022.

Figure 10: Brunei Darussalam's CO_2 combustion emissions (million tonnes), 2000 to 2022



Source: EGEDA (2024)

Energy Security

Despite being one of APEC's main net energy exporters, Brunei Darussalam continues to revitalise its upstream oil and gas activities for its long-term energy security and sustainability. Recently Brunei Darussalam announced the first licensing round for its two offshore oil and gas blocks, after more than 10 years. The government is now offering Block A, spanning 1728 km^2, as well as Block D, which covers a total area of 2294 km^2. This move also reinforces the economy's commitment to attracting new upstream investments and enhancing resource development (PABD, 2025).

Brunei Darussalam is also committed to accelerating its renewable energy deployment. The economy is aiming for 30% renewable energy in the total electricity generation mix by 2035, with the deployment of 200 MW of solar photovoltaics (PVs) by 2025. In addition, Brunei Darussalam is also exploring new collaborations with Sarawak on future interconnection projects for renewable energy, which will pave the way for the realisation of the ASEAN Power Grid (Sarawak Energy, 2025).

To ensure adequacy in electricity supply to meet increasing demand, Brunei Darussalam, through the Department of Electrical Services, will develop a new combined-cycle gas turbine (CCGT) power plant in Bukit Panggal. Another utility, Berakas Power Company will also develop a new CCGT power plant. Both facilities, which are expected to commence during 2027-28, will increase the total installed capacity to about 1.2 GW.

APEC Energy Goals

There are two energy-related objectives that APEC member economies have agreed to meet as a collective: to improve energy intensity and double the share of modern renewables.

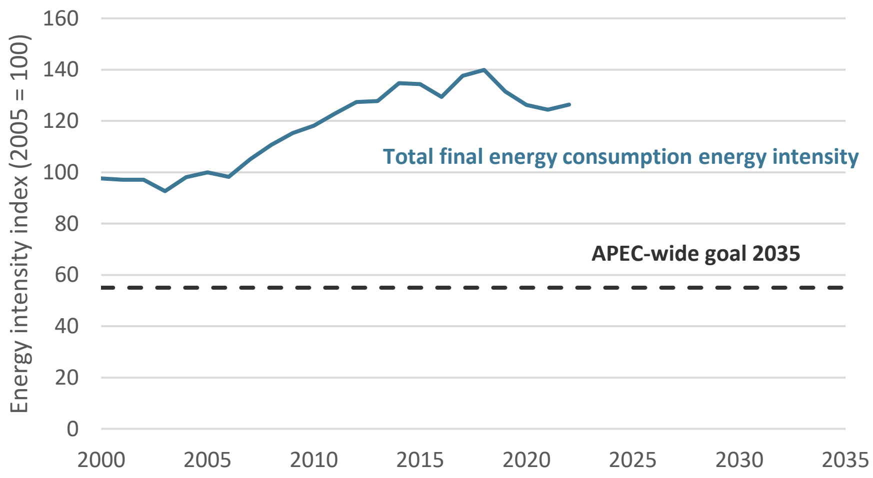
Energy Intensity Goal

In 2011, APEC member economies agreed to increase their ambition to reduce energy intensity by 45% in 2035, relative to a 2005 baseline. The original goal was a 25% improvement by 2030, relative to a 2005 baseline.

APEC is on track to achieve this energy intensity improvement. The goal does not impose individual economy targets, but it is possible to track the progress of individual APEC economies relative to the overarching proportional improvement.

Since 2005, Brunei Darussalam's energy intensity in general has been increasing, since the growth rate of total final energy consumption exceeded the rate of increase of the economy's GDP (Figure 11). Furthermore, the development of energy-intensive downstream industries also contributed to the trend. However, measures like the enforcement of Energy Efficiency (Standards and Labelling) Order 2021 will be key to reducing Brunei Darussalam's energy intensity over time.

Figure 11: Brunei Darussalam's total final energy consumption intensity index, 2000 to 2022 (2005 = 100)

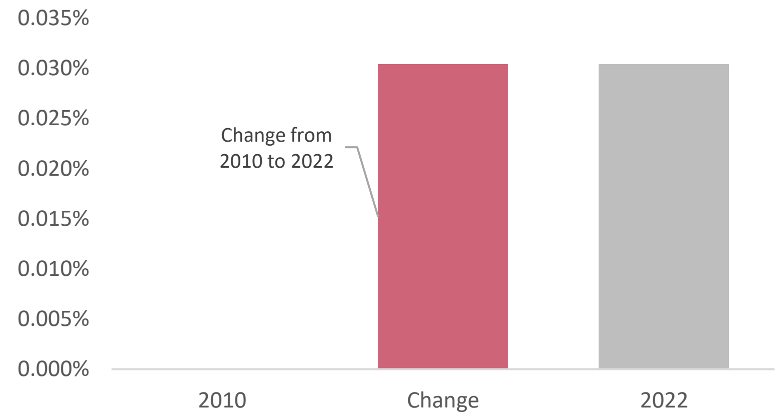


Source: EGEDA (2024)

Doubling of Renewables

The second energy goal involves doubling the share of modern renewables in the APEC energy mix for the period 2010 to 2030. There is no economy-level goal for individual member economies, but improvements by individual economies will contribute to the doubling goal.

Figure 12: Brunei Darussalam's modern renewable energy share, 2010 and 2022

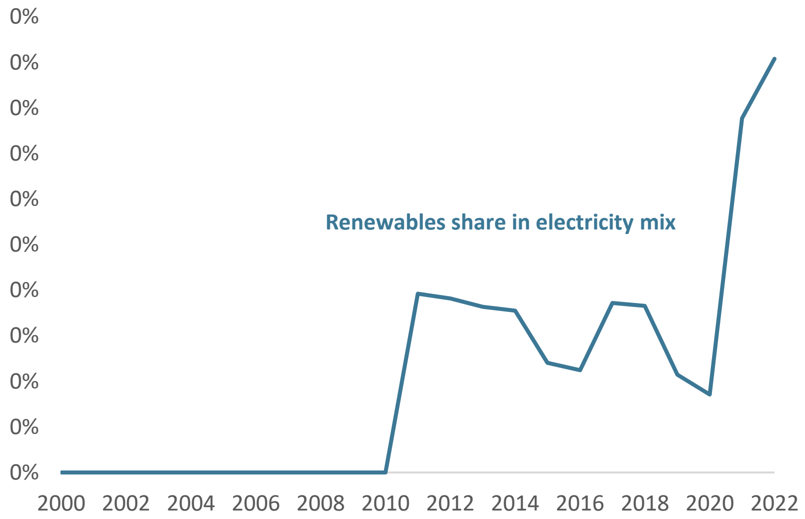


Source: EGEDA (2024)

Note: Biomass used in the residential and commercial sectors is assumed to be traditional biomass and is not included in the definition of modern renewables. All other renewables (biomass used by industry, hydro, geothermal, etc.) are considered modern renewables. Modern renewables also include the share of electricity that is generated from renewable sources.

Given the predominance of natural gas in Brunei Darussalam's electricity generation mix, the share of renewables was still minimal in 2022 (Figure 13). Therefore, the realisation of a 30% renewable energy share in Brunei Darussalam's total electricity generation mix and clean energy trade between the economy and Sarawak would boost Brunei Darussalam's renewables share in the future. This would also reduce the dependence on natural gas in the economy's power sector.

Figure 13: Brunei Darussalam’s renewable generation share, 2000 to 2022



Source: EGEDA (2024)

Energy Policy

Energy Policy	Details	Reference
Nationally Determined Contributions	A 20% reduction of GHG emissions relative to business-as-usual levels by 2030.	UNFCCC (2020)
Brunei Darussalam National Climate Change Policy	The policy was established to pave the way for Brunei Darussalam's low-carbon and climate-resilient pathways for a sustainable economy, through the adoption of 10 key strategies in the following areas: industrial emissions, forest cover, electric vehicles, renewable energy, power management, carbon pricing, waste management, climate resilience and adaptation, carbon inventory, awareness and education.	BNCCC (2020)
Net Zero Emissions	Brunei Darussalam is moving towards net zero emissions by 2050, announced at UNFCCC COP26 in Glasgow, Scotland, United Kingdom.	UNFCCC (2021)
Energy Efficiency (Standards and Labelling) Order, 2021	The Department of Energy at the Prime Minister's Office introduced the order in 2021, in line with its energy efficiency and conservation initiatives. The order requires manufacturers, suppliers, wholesalers and retailers in Brunei to import and sell appliances that meet the minimum energy performance standards.	Department of Energy, Prime Minister's Office (2022)
Directive on the Mandatory Reporting of Greenhouse Gas	Beginning 2023, all facilities that emit GHG emissions are required to report their GHG emissions on a quarterly and annual basis, in line with the objective of Strategy 9 of the BNCCP (Carbon Inventory).	BNCCC (2023)

Notable Energy Developments

Energy development	Details	Reference
Offshore Licensing Round 2025	Brunei Darussalam is offering two offshore oil and gas blocks for competitive bidding. The two offshore blocks are Block A (spanning an area of 1728 km^2) and Block D (with an area of 2294 km^2).	PABD (2025)

Hengyi Industries' Project SINAR	Hengyi Industries launched its Sustainable Integration of Natural and Renewable Energy (Project SINAR), which is set to become the largest in Brunei Darussalam. The aim of reaching a total capacity of 476 MW will be achieved over three phases: • 38 MW in the first phase • 156 MW in the second phase • 272 MW in the third phase	BizBrunei (2024)

Useful Links

Brunei National Council on Climate Change – https://climatechange.gov.bn

Brunei Shell Petroleum – https://www.bsp.com.bn/

Brunei LNG – https://www.bruneilng.com/

Department of Economic Planning and Statistics, Ministry of Finance and Economy – https://deps.mofe.gov.bn

Department of Energy, Prime Minister's Office – https://www.energy.gov.bn/

Hengyi Industries – https://www.hengyi-industries.com/

Canada

Introduction

Several climate policies and regulatory updates have been released in recent years, steering and tracking Canada's progress to reaching its emissions reduction targets of 40-45% below 2005 levels by 2030, and the recently announced target of 45-50% below 2005 levels by 2035, en route to net zero emissions by 2050. Given that approximately 80% of Canada's greenhouse gas (GHG) emissions stem from energy-related activities, climate policies targeting emissions reductions inherently affect Canada's energy system (CER, 2023a).

Notable advancements in Canada's energy policy came with the release of the Canada Green Buildings Strategy and the Clean Electricity Regulations. Given that buildings account for 18% of the economy's emissions, reducing emissions in this sector is a key step towards meeting broader economy-wide reduction targets. The Canada Green Buildings Strategy outlines measures to reduce emissions, such as improving energy efficiency and increasing electrification. With more than 95% of building emissions coming from space and water heating, the government is prioritising the transition away from fossil fuel-based heating systems. In support of this transition, the Clean Electricity Regulations play a critical role in enabling emissions reductions not only in buildings but also in sectors like transportation, as Canada moves towards greater electrification.

Under the Canadian Net-Zero Emissions Accountability Act, the federal government is required to set economy-wide emissions reduction targets every five years, with a 10-year outlook, to guide the economy towards achieving net zero emissions by 2050. Following consultations, Canada has updated its interim target to a 45-50% reduction below 2005 levels by 2035, building on its existing goal of a 40-45% reduction by 2030.

The Canadian government, along with provincial and territorial governments, continues to emphasise the importance of Indigenous participation in energy projects. Canada is home to a diverse energy landscape, influenced by varied geography, climate, and economic drivers. This diversity necessitates a tailored approach to energy generation among its provinces and territories.

Table 1: Canada's macroeconomic data and energy reserves

Key data [a, b]		**Energy reserves** [c, d]	
Area (million km^2)	10	Oil (billion barrels)	163
Population (million)	39	Gas (trillion cubic feet)	87
GDP (2021 USD billion PPP)	2 215	Coal (million tonnes)	6 582
GDP per capita (2021 USD PPP)	56 873	Uranium (kilotonnes U < USD 130/kgU)	493

Source: a StatCan (2024a); b EGEDA (2024); c NRCan (2024); d NEA (2025)

Note: Reserves are total proved reserves and reasonably assured recoverable resources for uranium.

Table 1 provides an overview of key data and energy reserves in Canada for 2022. The economy's economic output continued to grow, reflecting a 3.8% increase from 2021, alongside a 2.0% rise in GDP per capita.

Energy Supply and Consumption

Total Primary Energy Supply

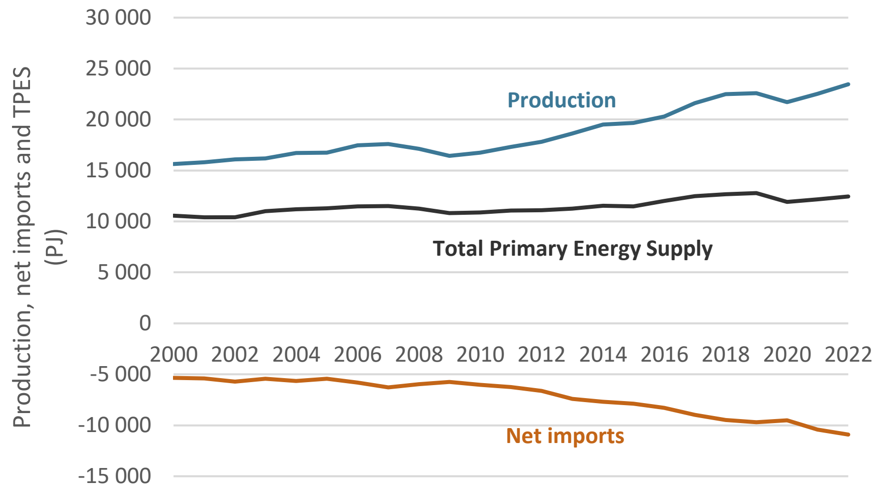
Canada is a self-sufficient and leading producer of energy, with much of its production driven by demand in global markets. Canada is a top-five producer of crude oil, gas, and hydro, a top-six exporter of crude oil, natural gas, and electricity, and the second largest producer and exporter of uranium. As such, the energy sector is an important contributor to Canada's economy, directly and indirectly accounting for approximately 10.3% of GDP. Of that, approximately 6.1% comes directly from petroleum and 1.5% directly from clean energy (NRCan, 2024a).

With 90% of its energy exports by value landing in the US, Canada is trying to diversify its export market. The first phase of the LNG Canada project is set to become its first large-scale liquefied natural gas (LNG) export facility by mid-2025, and the Trans Mountain expansion, which increased oil export capacity by 590 000 barrels per day, began commercial operations in May 2024 (LNG Canada, 2024; Trans Mountain, 2024). Both projects will provide a strategic source of energy supply for APEC members.

Although Canada's crude oil sources vary geographically, oil predominantly comes from Western Canada. Almost two-thirds of the total production comes from the oil sands, while conventional, offshore and tight oil production comprise the remainder (CER, 2024a). Over 99% of natural gas production occurs in Western Canada (CER, 2024b). While the output from conventional resources is declining, advances in hydraulic fracturing have enabled the development of tight gas resources in the Montney Formation and the Alberta Deep Basin. Production from these basins is expected to dominate any future production and LNG exports in the coming decades, dictated largely by domestic energy policy, gas prices and global demand.

Energy production increased by 4.1% from 2021 to 2022, to a record high of 23 464 petajoules (PJ) (EGEDA, 2024). Fossil fuels continue to dominate production with a share of over 75% (NRCan, 2024a). Crude oil production continued to account for the largest share of primary energy production and is currently setting new highs, at around 5 million barrels per day (NRCan, 2024a).

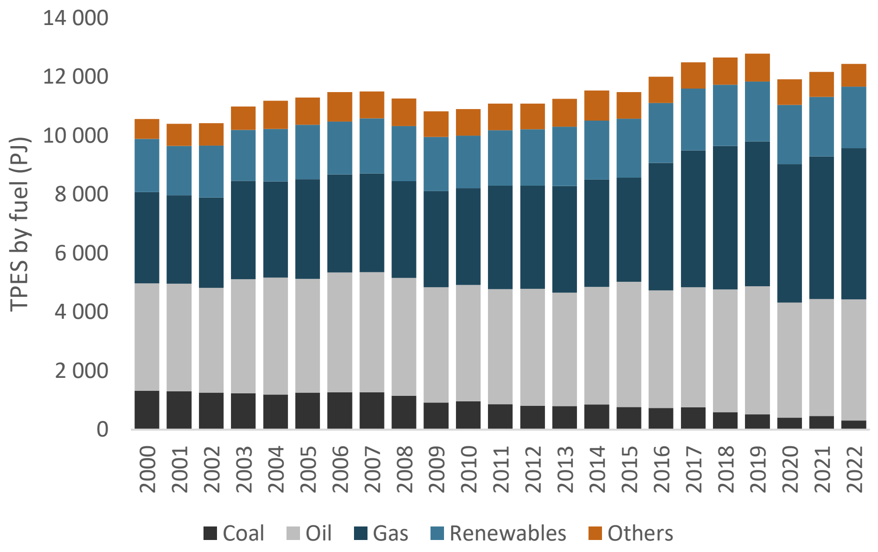
Figure 1: Canada's energy supply, production, and net imports (PJ), 2000 to 2022



Source: EGEDA (2024)

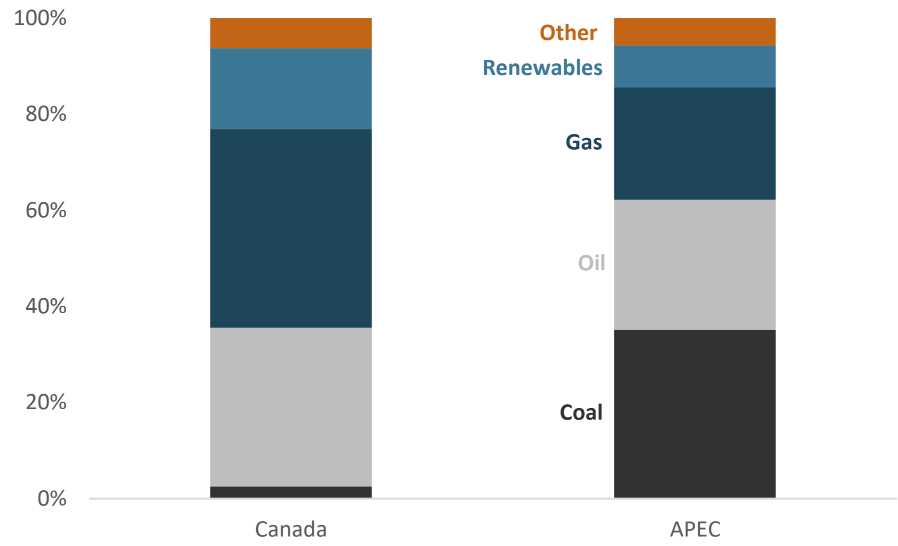
Net imports decreased 4.1% from 2021 to 2022. In 2023, oil and gas domestic exports totalled CAD 177 billion, of which 95% were to the US (NRCan, 2024a).

Figure 2: Canada's energy supply by fuel (PJ), 2000 to 2022



Source: EGEDA (2024)

Figure 3: Energy supply mix – Canada and APEC, 2022



Source: EGEDA (2024)

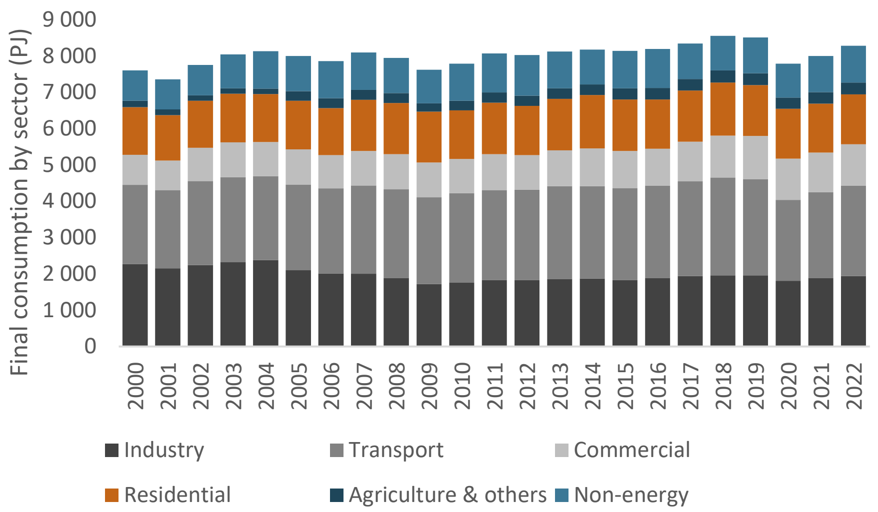
Figures 2 and 3 illustrate how dominant fossil fuels continue to be in Canada's energy mix. While coal has been steadily declining over the past two decades, oil and gas persist as predominant fuel sources in Canada's energy mix. Canada has significant renewable potential and continues to realise more of its potential with the deployment of solar- and wind-generating capacity leading the way across the economy. Hydro is currently the most prominent source of renewable energy in Canada, supplying 62% of Canada's electricity in 2022 (NRCan, 2024a). Hydro is also a key fuel source for Canada's electricity exports, making up more than 90% of electricity generation in three (British Columbia, Manitoba, and Quebec) of the four provinces with the largest exports of electricity to the USA. (NRCan, 2024a).

In the remaining province (Ontario), nuclear is the dominant electricity source at about 53%, while hydro comprises approximately 27% of its total generation. Canada aims to leverage non-emitting electricity capacity to decarbonise its oil, natural gas and LNG operations, driving down own-use emissions to align with its commitment to achieve net zero emissions by 2050. Some oil sands majors have expressed particular interest in the deployment of small modular reactors (SMRs) as a clean electricity source to decarbonise operations through electrification in the coming decade (Pathways Alliance, 2023). Around 13% of Canada's total electricity is provided by nuclear energy, through an installed capacity of more than 14 MW (NRCan, 2024b).

Total Final Consumption

Canada's total final consumption increased 3.4% from 2021 to reach 8274 PJ in 2022 (EGEDA, 2024). This positions Canada as the fifth-largest energy consumer in APEC, after China; the USA; Russia and Japan.

Figure 4: Canada's final consumption by sector (PJ), 2000 to 2022

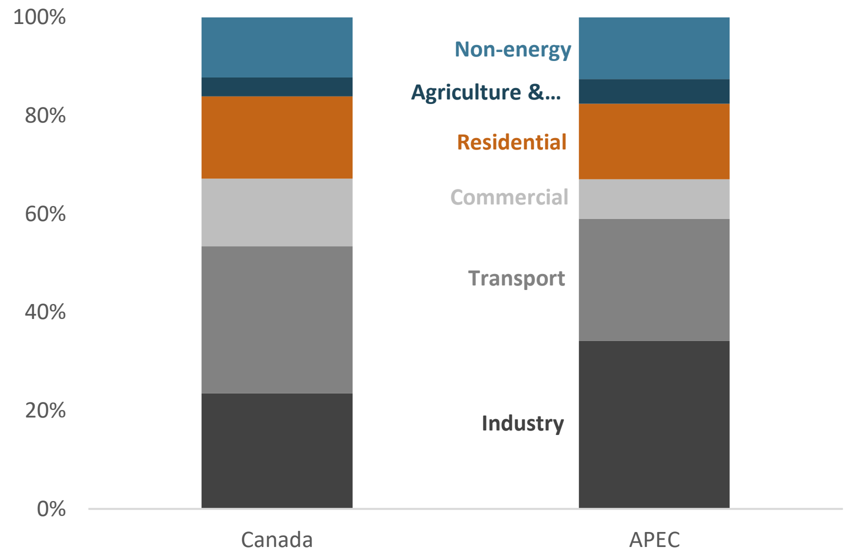


Source: EGEDA (2024)

All sectors experienced increases in total final consumption from 2021 to 2022. The transport sector once again accounted for the largest share of final energy consumption (2479 PJ) and underwent the largest percentage increase from 2021 to 2022 (5.2%), followed by the industrial sector (1944 PJ). Canada's reliance on road transport results in its share of transport energy demand being consistently higher than the APEC average.

Final consumption in the commercial sector increased by 4.2% from 2021 to 1139 PJ in 2022, and final consumption increased by 2.5% in the residential sector up to 1381 PJ in 2022. Non-energy use comprised 1013 PJ, and agriculture and others made up 318 PJ.

Figure 5: Final consumption by sector, Canada and APEC, 2022

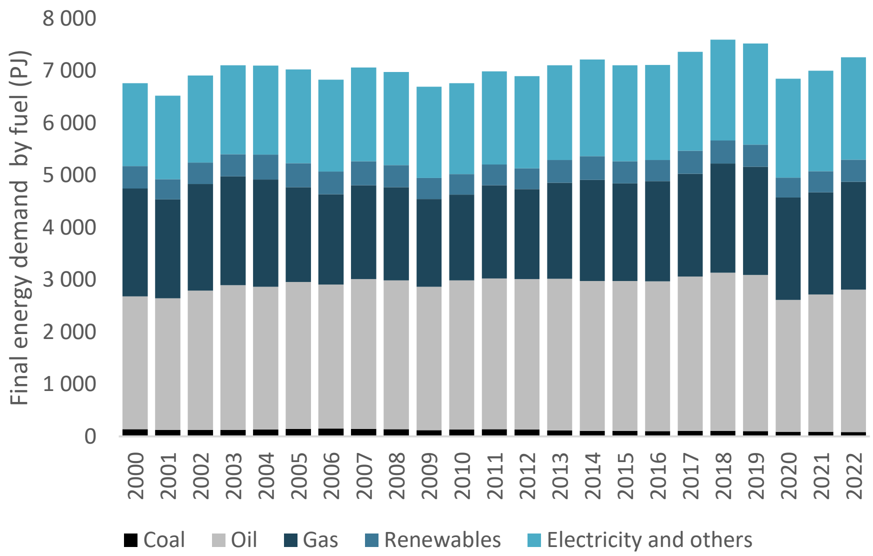


Source: EGEDA (2024)

Final Energy Demand

As the change in non-energy final demand was minimal, Canada's final energy demand paralleled total final consumption, increasing 3.7% to 7261 PJ in 2022 (EGEDA, 2024). A 3.4% increase in oil demand contributed most to this increase, which could be attributed to the increase in road travel leading to a rise in the use of oil products. Natural gas saw the highest year-over-year increase of 5.9%, while renewables experienced a demand increase of 4.2%. Overall, final energy demand remained lower than it was before COVID-19. This was probably influenced by shifts in consumer behaviour, including the widespread adoption of remote and hybrid work that persisted to some degree into 2022.

Figure 6: Canada's final energy demand by fuel (PJ), 2000 to 2022

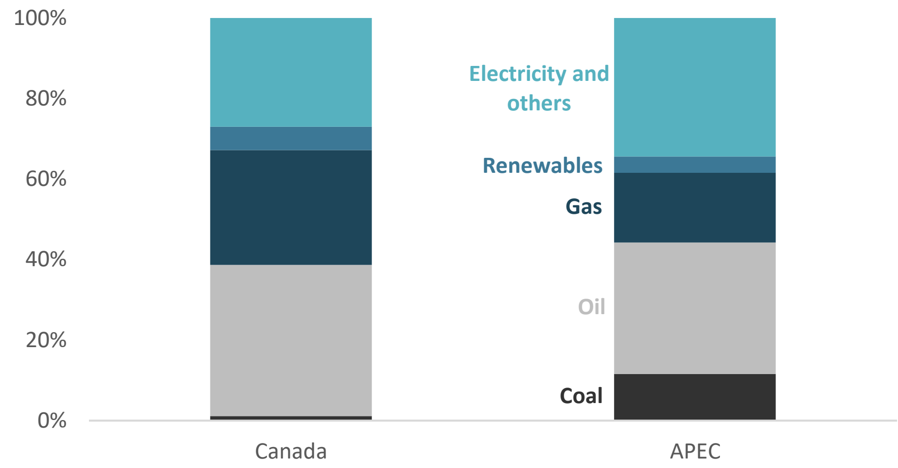


Source: EGEDA (2024)

Note: does not include non-energy sector consumption of energy products

In 2022, fossil fuels accounted for two-thirds of final energy demand[3], comprising oil (2725 PJ, 37%), gas (2071 PJ, 29%), and coal (82 PJ, 1.2%) (EGEDA, 2024). The remainder was formed by the share of renewables (421 PJ, 5.8%) and electricity and others (1962 PJ, 27%), of which the share of renewable electricity and others was 1337 PJ. Although coal makes up less of Canada's fuel mix than the APEC region, Canada has a higher reliance on fossil fuels more broadly.

Figure 7: Final energy demand fuel share, Canada and APEC, 2022



Source: EGEDA (2024)

Transformation

Power Sector

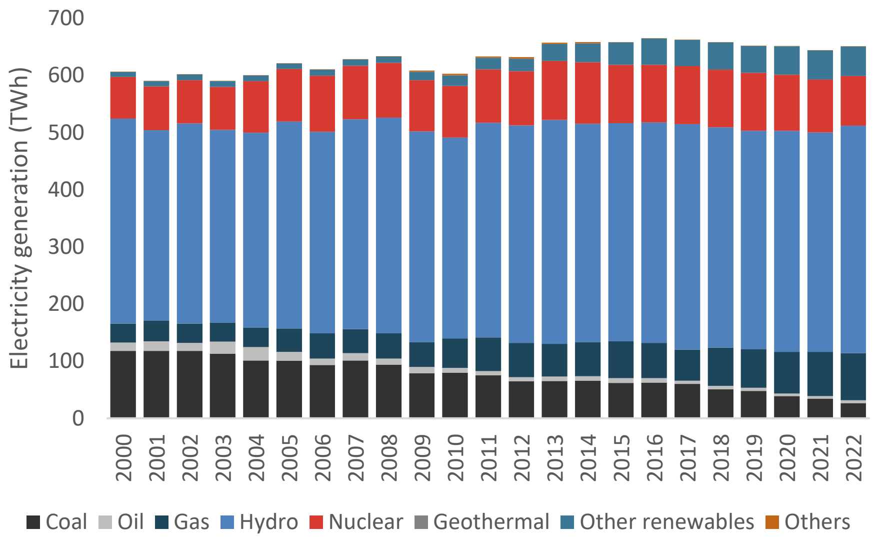
Canada generated 651 terawatt-hours (TWh) of electricity in 2022, an increase of 1.0% from the previous year. Non-emitting electricity generation constituted the largest share of this generation (82%), with hydro as the major contributor at 62% followed by nuclear at 13% and other non-emitting sources at 8.2%. The contribution from hydro increased 3.6% while nuclear decreased 5.8% from 2021 to 2022.

Fossil generation accounted for 18% of total power generation. The proportion of power generated from coal continued its downward

[3] Note that the demands in the EGEDA energy balance differ than those in the Report on Energy Supply and Demand (RESD) energy balances due to differences in energy accounting frameworks (StatCan, 2024b).

trajectory, dropping to 4.0% as Canada advanced in its efforts to phase out coal-fired power plants. Natural gas-fired generation continued as the primary fossil generation source, reaching 13% of total power generation in 2022.

Figure 8: Canada's electricity generation by fuel, 2000 to 2022



Source: EGEDA (2024)

In 2016, the federal government announced its plan to phase out coal-fired electricity generation in Canada by 2030. As of the end of 2024, Saskatchewan, New Brunswick, and Nova Scotia maintained some electricity supply through coal-fired generation. These three provinces are aligned with the federal timeline of the 2030 coal phase-out. Alberta successfully phased out coal-fired electricity in 2024.

Nuclear energy is playing an increasing role to decarbonise electricity systems with plans for both small- and large-scale nuclear expansion being considered across the economy. Ontario is supporting the refurbishment of several nuclear reactor units (Government of Ontario, 2023a; Government of Ontario, 2023b). These refurbishments will add approximately 25-30 years to the operational life of each unit and will allow Ontario to maintain a dependable source of clean electricity. Ontario is also leading the way with new nuclear energy generation plans. The Darlington New Nuclear Project (DNNP) is a project to construct up to four GE Hitachi BWRX-300 small modular reactors (SMRs) at the existing Darlington Nuclear Generating Station owned by Ontario Power Generation (OPG). Together, the four units would add 1,200 MWe of capacity to Ontario's electricity grid. OPG received a licence to construct the first reactor in April 2025 from the Canadian Nuclear Safety Commission – Canda's nuclear lifecycle regulator – and subsequently received final approval from the Ontario government in May 2025. This project will be the first new nuclear build in more than three decades and will be the first commercial SMR deployment in a G7 economy. Ontario is also considering large-scale nuclear energy deployment through Bruce Power's 'Bruce C' Nuclear Project and OPG's Wesleyville Project, which would support the expansion of new nuclear capacity by 4,800 MWe and 10,000 MWe, respectively.

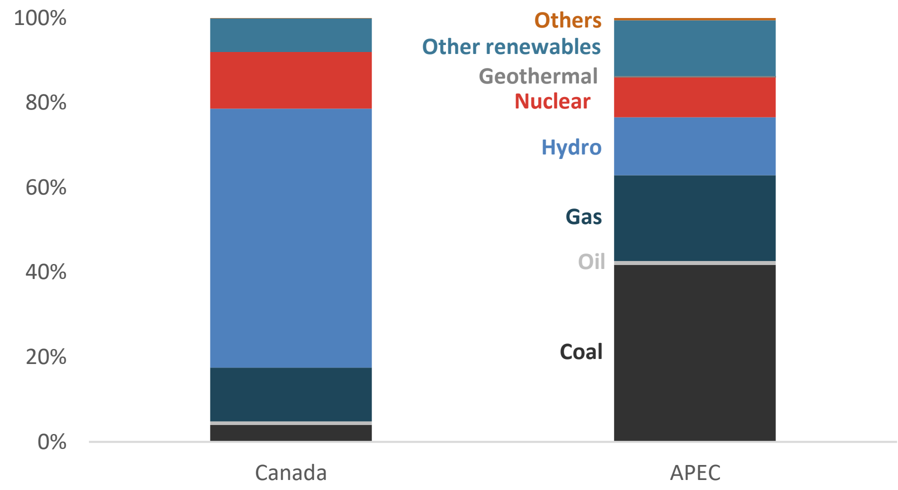
Other nuclear-interested provinces (namely New Brunswick, Saskatchewan, and Alberta) are also exploring both SMR and large-scale nuclear deployment but are at varying stages of nuclear deployment readiness. These provinces are actively working with Ontario to achieve their nuclear objectives.

In December 2024, after more than two years of engagement, Canada released its Clean Electricity Regulations (ECCC, 2024a). Starting in 2035, the regulations will impose limits on carbon dioxide emissions from nearly all fossil fuel-powered electricity generation units. These regulations offer a range of compliance options without mandating specific technologies, allowing provincial, territorial, and municipal authorities to determine the most suitable approaches for their needs. As older units are phased out and replaced by cleaner, more efficient systems, greenhouse gas emissions are expected to decline.

Canada also launched *Powering Canada's Future: A Clean Electricity Strategy* in December 2024. This document identifies the context, key principles, and current and future actions that will support the build out of reliable, affordable, and clean electricity grids across Canada at the pace and scale needed to drive clean growth, strengthen competitiveness, and attract more major investments. The Clean Electricity Strategy drew strongly on the work of the Canada Electricity Advisory Council, an independent, electricity-sector focussed, expert advisory body that provided advice to the Government of Canada to accelerate investment, and promote sustainable, affordable, and reliable electricity systems. Its final report, released May 2024, provided 28 recommendations to advance a reliable, affordable, and speedy transition to a net zero electricity system in ways that facilitated Indigenous participation. The Clean Electricity Strategy also drew on recommendations of the Wah-ila-toos Indigenous Council from their November 2024 report, *Kinship and Prosperity: Clean Energy Soulutions for Future Growth*.

Canada's variable renewable capacity continues to grow in general. In 2023, Canada added 2.3 GW of installed capacity and by the end of 2024, had 24 GW of wind, solar, and energy storage installed capacity (CanREA, 2024). Renewable energy deployment will continue to push higher this decade, supported by policies such as the Clean Electricity Strategy, the Clean Electricity Regulations, the Clean Electricity Investment Tax Credit, among other incentive and regulatory measures.

Figure 9: Electricity generation fuel share, Canada and APEC, 2022



Source: EGEDA (2024)

Refining

Canada has 17 refineries with a total capacity of approximately 1.9 million barrels per day (CER, 2023b). In 2024, Canadian refineries operated on average at 89% capacity.

There are in total seven existing or planned renewable diesel facilities in Canada, with several having been repurposed from existing petroleum refineries (CER, 2024c). The main driver of these facilities is Canada's Clean Fuel Regulations, for which compliance obligation began in July 2023, which require liquid fuel suppliers to gradually decrease carbon intensity. These renewable diesel facilities would add up to 70 thousand barrels per day by 2027, up from zero in 2020.

Energy Transition

In early 2025, Canada published its 2035 greenhouse gas emissions reduction target of 45-50% below 2005 levels (ECCC, 2024b). The target builds on the 2030 target of a reduction of 40-45% below 2005 levels.

To that end, in November 2024 the federal government released a draft version of the proposed Oil and Gas Sector Greenhouse Gas Emissions Cap Regulations (ECCC, 2024c). The draft regulations outline the government's proposal to implement a cap-and-trade system with a declining cap on emissions. If finalized, the sector will be expected to reduce emissions at a pace and scale that meets net zero by 2050.

Canada's efforts in this space will be complemented by its commitment to reduce oil and gas sector methane emissions to 75% below 2012 levels by 2030. Proposed amendments to existing regulations that will help facilitate this increased reduction were released in December 2023 (ECCC, 2023d). Finalised amendments are expected in 2025. Despite fluctuations in total GHG emissions for the sector, emissions have stabilised since 2010. While emissions intensity varies across oil and gas subsectors, the average value has decreased over the decade due to increased efficiencies.

Canada continued investing in zero-emission vehicle (ZEV) charging and refuelling infrastructure and incentives to make it easier and more affordable to own and operate ZEVs. Canada has committed to sales mandates that ensure that ZEVs constitute 20% of light-duty vehicles sales by 2026, 60% by 2030 and 100% by 2035 (Canada Gazette, 2023). For medium- and heavy-duty vehicles, the government is targeting 35% of sales by 2030 and, for those applications where it is feasible, a 100% target by 2040. According to Transport Canada's analysis of data from S&P Global Mobility, ZEVs accounted for 12% of light-duty vehicle sales in Canada in 2023. This marked an increase from 8.9% in 2022, 5.6% in 2021, 3.8% in 2020, and 3.1% in 2019 (TC, 2024). Budget 2024 announced the intention to introduce a new 10% tax credit on the cost of buildings used in key segments of the EV supply chain (Finance Canada, 2024a).

In July 2024, Canada published its Canada Green Buildings Strategy (CGBS) which outlines the federal government's next steps to improve energy efficiency in homes and buildings. The strategy focuses on lowering home energy bills and reducing building emissions by supporting energy-efficient retrofits and the adoption of better building codes to build new homes with net zero in mind, and by promoting home energy labelling. Through the CGBS, Canada has also committed to introduce a regulatory framework to phase out the installation of oil heating systems in new construction as early as 2028, except in those areas with limited access to electricity and where backup heating fuel is necessary.

Financial support includes CAD 800 million towards a new Canada Greener Homes Affordability Program (CGHAP) to support energy-efficient retrofits for low- to median-income households, including renters. The CGHAP will build on the progress of the Canada Greener Homes Grant, which has already helped over 200 000 homeowners install heat pumps as well as energy-efficient windows, doors, and insulation. In addition to the CGHAP, the Oil to Heat Pump Affordability Program and the Canada Greener Homes Loan will continue to provide support to switch to electric heat pumps.

While Canada is working towards policies and regulations targeted at reducing emissions, uncertainty around the future of some policies lingers. Moreover, disagreements between provincial and federal governments regarding the when and how for emissions reductions has introduced additional uncertainty for some projects. Alberta has publicly remarked that it is prepared to take the federal government to court over regulations that the province perceives as a violation of constitutional jurisdiction, such as the proposed oil and gas sector emissions cap (Government of Alberta, 2023).

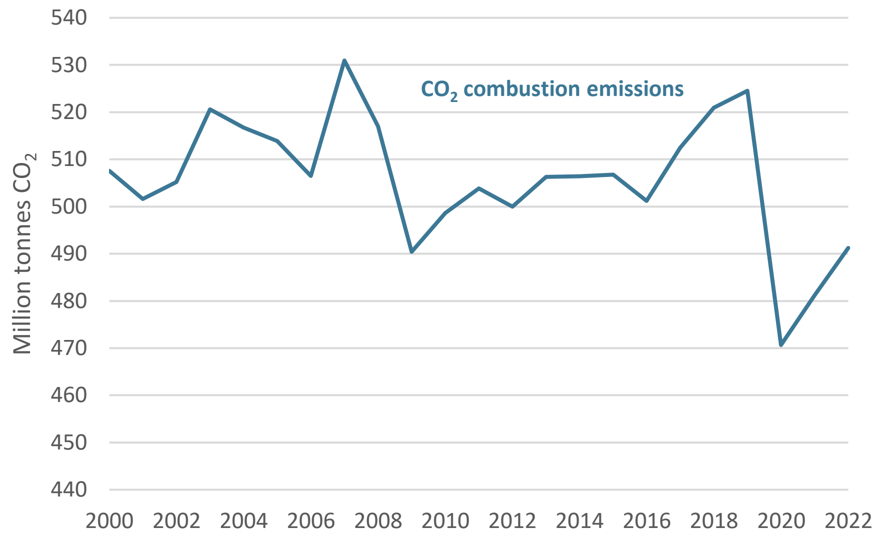
Regarding the Clean Electricity Regulations published in 2024, although the target net zero date was pushed from 2035 to 2050, the Alberta Electricity System Operator indicated in a 2025 report that it will be unable to meet targets and maintain grid reliability (AESO, 2025).

Emissions

The expert group on energy data and analysis (EGEDA) falls under the umbrella of APEC's Energy Working Group (EWG). In addition to energy data compiled by EGEDA, CO_2 emissions from combustion activities in the energy sector are recorded. These emissions are a subset of total GHG emissions that are considered in the context of climate change, such as under the United Nations Framework Convention on Climate Change (UNFCCC).

Canada's CO_2 combustion emissions saw a sharp decrease in 2019 from lower activity during the onset of COVID-19 but have increased each year since 2020. However, emissions remain low compared to the previous two decades. Going forward, Canada's climate policies should provide downward pressure on emissions this decade.

Figure 10: Canada's CO_2 combustion emissions (million tonnes), 2000 to 2022



Source: EGEDA (2024)

Energy Security

Because Canada is a net energy exporter, it generally considers itself to be a driver of energy security solutions, not a victim of energy security disruptions.

However, energy prices in Canada have increased in recent years. In response to concerns about higher energy prices, some provinces across the economy were providing relief via tax cuts, subsidies, and retail price caps on the end-user prices for oil products, natural gas and electricity. Notably, the federal government ended Canada's consumer carbon pricing policy (also known as the federal fuel charge) on April 1, 2025. As of 2025, Canada is aiming to strengthen domestic energy security by supporting targeted infrastructure projects, such as interprovincial interties.

Furthermore, Canada's provincial power system operators are working to address the challenges that integrating high amounts of variable renewables could pose for the reliability and affordability of their electricity systems. However, some analysis has suggested that while electricity rates will rise in the future due to increasing capital investments to enable growth of the electricity system, most households will save on total energy spending because of increases in electrification and energy efficiency (TA, 2024; CCI, 2023). The federal government has introduced several programs to support energy affordability, and given that provinces and territories regulate electricity, it is additionally up to those governments to implement the policy solutions that keep prices low for middle- and low-income households.

As electricity demand is expected to increase in the coming decades through increased demand from data centres, electric vehicles, and electrification of utilities like heating, questions are being raised about how supply will meet demand. Power system operators are beginning to include reliability assessments in their plans to target a net zero electricity system by 2050 while balancing increasing demand. Increasing or enhancing interprovincial (federally regulated) and intraprovincial (provincially regulated) transmission could provide a more flexible and reliable grid for Canada. However, differences in regulatory and market structure across provinces may hinder the speed and depth of interprovincial infrastructure development.

Several new infrastructure developments are connecting Canadian oil and natural gas to new global markets. The 14 million tonnes per annum first phase of the LNG Canada plant in Kitimat, BC is expected to begin operations in mid-2025 (LNG Canada, 2024). The Trans Mountain Pipeline expansion began commercial operations in May 2024 (Trans Mountain, 2024), dramatically increasing Canadian crude exports to APEC member economies. Both LNG Canada and the Trans Mountain Pipeline may provide a strategic source of energy supply for APEC members in the coming decades.

APEC Energy Goals

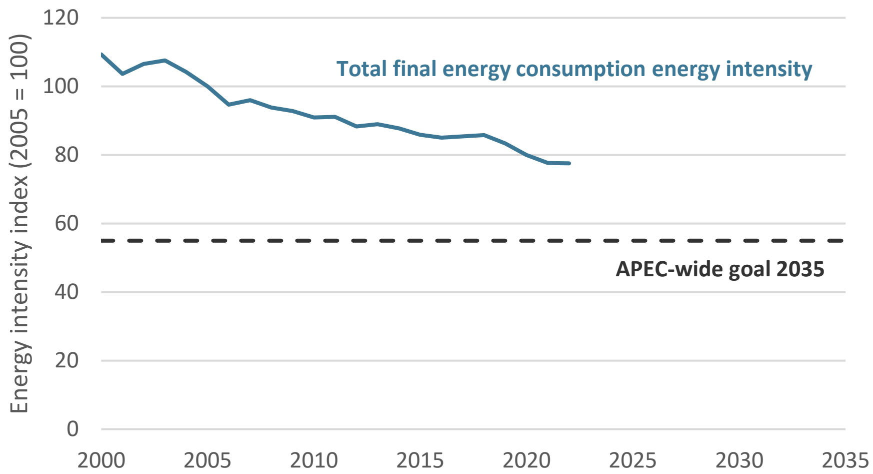
There are two energy-related objectives that APEC member economies have agreed to meet as a collective: to improve energy intensity and to double the share of modern renewables.

Energy Intensity Goal

In 2011, APEC member economies agreed to increase their ambition to reduce energy intensity by 45% in 2035, relative to a 2005 baseline. The original goal was a 25% improvement by 2030, relative to a 2005 baseline.

APEC is on track to achieve this energy intensity improvement. The goal does not impose individual economy targets, but it is possible to track the progress of individual APEC economies relative to the overarching proportional improvement.

Figure 11: Canada's total final energy consumption intensity index, 2000 to 2022 (2005 = 100)



Source: EGEDA (2024)

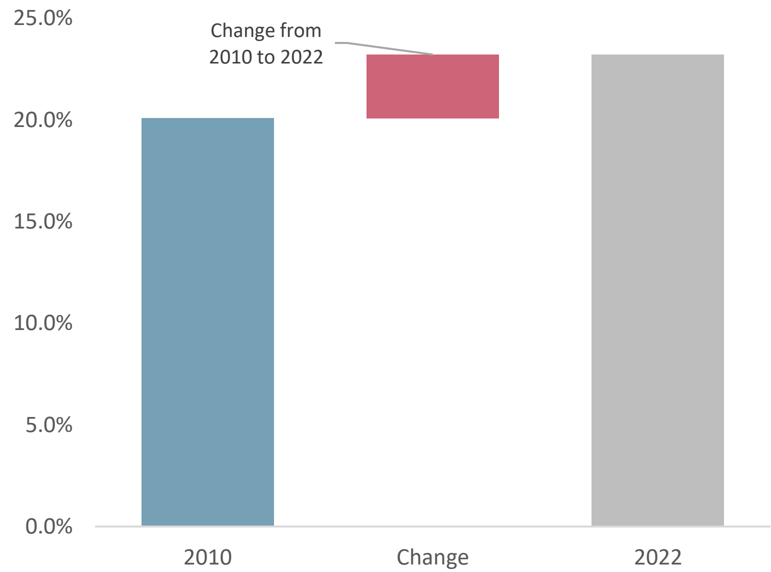
Canada's energy efficiency policies, commitment to reducing GHG emissions, and other targeted regulations have historically reduced energy intensity. Figure 11 illustrates this, showing a 22% reduction in energy intensity since 2005.

After declining steadily since 2005, energy intensity fell sharply for three consecutive years in 2019, 2020, and 2021 before entering a period of no change from 2021 to 2022. Strengthening climate policies and the adoption of energy-efficient technologies could prompt accelerated efficiency improvements towards achieving the 2035 target.

Doubling of Renewables

The second energy goal involves doubling the share of modern renewables (solar, wind, hydro, geothermal, and modern biofuels) in the APEC energy mix for the period 2010 to 2030. There is no economy-level goal for individual member economies, but improvements by individual economies will contribute to the doubling goal.

Figure 12: Canada's modern renewable energy share, 2010 and 2022



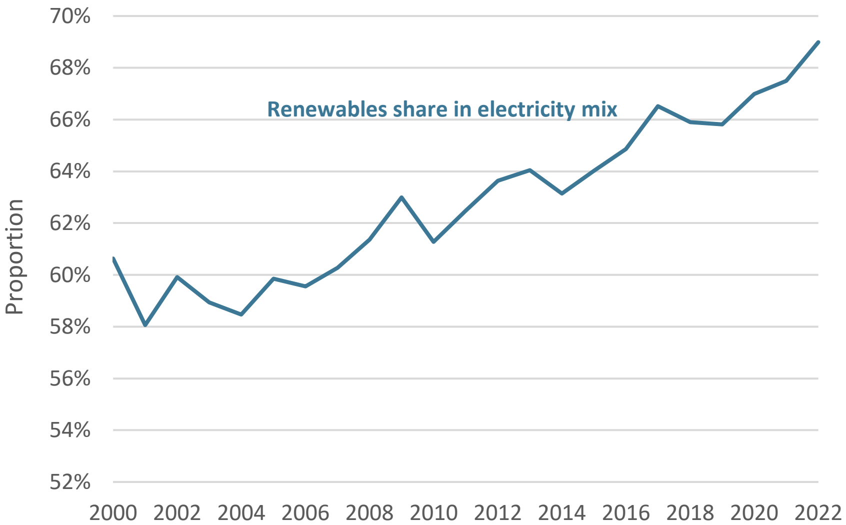
Source: EGEDA (2024)

Note: Biomass used in the residential and commercial sectors is assumed to be traditional biomass and is not included in the definition of modern renewables. All other renewables (biomass used by industry, hydro, geothermal, etc.) are considered modern renewables. Modern renewables also include the share of electricity that is generated from renewable sources.

Canada is hard-pressed to double its share to 40%, particularly considering its already high share of renewable electricity, with more than two-thirds of its generation coming from renewable sources

(Figure 13). However, Canada can still contribute to APEC achieving its aspirational goals. Several of Canada's climate policy announcements, including Clean Electricity Regulations, a 100% net zero power system target by 2050, various investment tax credits, industrial carbon pricing, and grants and contributions programs such as the Smart Renewable and Electrification Pathways program, will continue to increase the share of renewables in the Canadian and APEC fuel mix. Canada's renewables share in the electricity mix increased by two percentage points from 2021 to 2022.

Figure 13: Canada's renewable generation share, 2000 to 2022



Source: EGEDA (2024)

Energy Policy

Key federal energy and climate measures to date include the following:

- The Pan-Canadian Framework on Clean Growth and Climate Change (ECCC, 2016): This was Canada's first-ever economy-wide climate plan that was developed with its provinces and territories and in consultation with Indigenous peoples. It is an important first step for Canada to achieve its Paris Agreement target. It is structured to cut pollution in a more practical and affordable way than any climate plan in Canadian history.
- Canada's Strengthened Climate Plan: A Healthy Environment and a Healthy Economy (ECCC, 2020): Includes more than 60 new and strengthened federal measures and an initial CAD 15 billion in investments, to make life more affordable for Canadians, make communities more liveable and, at every turn, focus on creating jobs, growing the middle class, and supporting workers in a stronger and cleaner economy.
- 2030 Emissions Reduction Plan: Canada's Next Steps for Clean Air and a Strong Economy (ECCC, 2022): A comprehensive roadmap that reflects levels of ambition to guide emissions reduction efforts in each sector.
    - 2023 Progress Report on the 2030 Emissions Reduction Plan (ECCC, 2023): The first progress report released shows interested individuals Canada's progress on the path laid out in the Emissions Reduction Plan. Additional progress reports will be produced in 2025 and 2027 in line with requirements under the *Canada Net Zero Emissions Accountability Act.*
    - In early 2025, Canada released its 2035 emissions reduction target. Additional targets and plans will be developed every five years through to 2050.
- Budget 2024 (Finance Canada, 2024a): Announces new and updated information on the federal toolkit for investing in the clean economy: a set of clear and predictable investment tax credits, low-cost strategic financing, and targeted investments and programming, where necessary, to respond to the unique needs of sectors or projects of economic significance to Canada.

Additionally, provincial and territorial climate policies and plans can be referenced for specific information about what each province and territory is doing to contribute to their respective climate goals and targets, as well as to Canada's as a whole.

This table is not an exhaustive list of energy and climate policies in Canada. However, it is a list of policies that are expected to have a substantial impact on Canada's energy system going forward.

Energy policy	Details	Reference
Canada's 2035 Emissions Reduction Target	Canada released its 2035 emissions reduction target of 45-50% below 2005 levels by 2035. This target builds on Canada's 2030 target. Publishing interim targets is mandated under the Canadian Net Zero Emissions Accountability Act.	Environment and Climate Change Canada
Canada Electricity Advisory Council	In May 2023, Canada launched the Canada Electricity Advisory Council, an independent body of 19 experts to provide the Government of Canada advice on actions to achieve our net-zero goals. Released in June 2024, their final report provided 28 recommendations to promote sustainable, affordable, and reliable electricity systems in Canada, which informed the Clean Electricity Strategy.	Natural Resources Canada
Canada Green Buildings Strategy	The CGBS was finalised in July 2024. It focuses on steps to lower home energy bills and reduce building emissions by supporting energy-efficient retrofits and the adoption of better building, codes, and by promoting home energy labelling.	Natural Resources Canada
Canada Greener Affordable Housing	This program provides forgivable and low-interest loans up to CAD 170 000 per unit to residential owners to help finance building retrofit measures and activities needed to meet climate goals. It also supplies contributions for pre-retrofit activities needed to plan, prepare and apply for retrofit funding. Applicants must meet certain affordability criteria.	Canada Mortgage and Housing Corporation (CMHC)
Canada Greener Homes Initiative	Provides grants of up to CAD 5000 and loans of up to CAD 40 000 to help homeowners undertake home retrofits, and up to CAD 600 towards the costs of pre- and post-retrofit EnerGuide evaluations. The initiative also includes the Oil to Heat Pump Affordability Program and a new Canada Greener Homes Affordability Program.	Natural Resources Canada
Canadian Net Zero Emissions Accountability Act	Legislates on emissions reductions accountability to address climate change, by setting legal requirements on the Government of Canada to plan, report, and course correct on the path to net zero emissions by 2050.	Justice Canada
Canadian Sustainable Jobs Act	The Act received Royal Assent in June 2024. The legislation will foster the creation of sustainable jobs, support industries and communities in every region across Canada, and help the workforce gain the necessary skills, training and tools to fill these new job opportunities.	Natural Resources Canada

Cancellation of the federal fuel charge	Canada's consumer carbon pricing policy (also known as the federal fuel charge) was ended, effective 1 April 2025.	Removal of the fuel charge
Carbon Capture, Utilisation and Storage Investment Tax Credit	An investment tax credit for capital investments in carbon capture, utilisation, and storage of up to 60% for carbon captured from ambient air, up to 50% for carbon captured other than directly from ambient air, and up to 38% for related carbon transportation, use, and storage infrastructure.	Finance Canada
Carbon Management Strategy	The strategy articulates the role of carbon management on the path to net zero and the federal actions that are being taken to accelerate innovation, advance policies, attract investment, scale up projects and build partnerships in developing carbon management solutions.	Natural Resources Canada
Clean Electricity Investment Tax Credit	Proposed investment tax credit of up to 15% for investments pre-2035 in non-emitting electricity generation systems, abated natural gas-fired electricity generation (subject to an emissions intensity threshold), electricity storage, and projects that transmit electricity between provinces and territories.	Finance Canada
Clean Electricity Pre-development Program	The Clean Electricity Pre-Development Program received CAD 250 million in funding to support pre-development activities of clean technologies. Funding has been provided to support pre-development work for various nuclear energy projects in Ontario, New Brunswick, Saskatchewan, and Alberta.	Natural Resources Canada
Clean Electricity Regulations	Canada's Clean Electricity Regulations were finalised in December 2024. The regulations outline a set of rules for transitioning Canada's electricity grid to net zero and will come into force in 2035. They are to set technology-neutral emissions performance standards and include flexibilities so that provinces and utilities can maintain reliable and affordable electricity.	Environment and Climate Change Canada
Clean Electricity Strategy	*Powering Canada's Future* is the Government of Canada's strategy for building more clean electricity. It sets the path forward to build the grids that will serve as the backbone of the economy's low-carbon economy – and to do so at the pace and scale needed to drive clean growth, strengthen competitiveness and attract more major investments.	Natural Resources Canada
Clean Fuel Regulations	Requires liquid fossil fuel (gasoline and diesel) primary suppliers to gradually reduce the carbon intensity from the fuels they produce and sell for use in Canada over time, leading to a decrease of approximately 15% (below 2016 levels) by 2030.	Environment and Climate Change Canada

Clean Hydrogen Investment Tax Credit	Investment tax credit of 15-40% of eligible expenses on equipment for hydrogen projects. The rate of the credit depends on the carbon intensity of the hydrogen, calculated using the Government of Canada's Fuel Life Cycle Assessment model.	Finance Canada
Clean Technology Investment Tax Credit	Investment tax credit of up to 30% to encourage investment in the adoption and operation of clean technology property. Eligible types of equipment include those related to electricity storage, zero-emissions vehicles and clean energy production.	Finance Canada
Clean Technology Manufacturing Investment Tax Credit	An investment tax credit of up to 30% for capital spending related to the manufacturing of specified clean technologies or the processing of critical minerals.	Finance Canada
Climate Aviation Action Plan	The plan presents a vision of net zero by 2050 for the sector and includes key pathways for collaboration between the government and industry to improve efficiency and reduce pollution. A key climate signal delivered through the plan is Canada's goal of 10% for the use of sustainable aviation fuel by 2030 and efficiency improvements.	Transport Canada
Contracts for Difference	The Canada Growth Fund will be the principal federal entity issuing carbon contracts for difference. It will allocate, on a priority basis, up to CAD 7 billion of its current CAD 15 billion in capital to issue all forms of contracts for difference and offtake agreements.	2023 Fall Economic Statement
Critical Mineral Exploration Tax Credit	Tax credit of up to 30% for mineral exploration expenditures renounced under eligible flow-through agreements entered into after 7 April 2022, and on or before 31 March 2027.	Finance Canada
Electric Vehicle Supply Chain Investment Tax Credit	Canada plans to introduce a new 10% tax credit on the cost of buildings used in key segments of the EV supply chain, for businesses that invest in Canada across three supply chain segments: 1) EV assembly, 2) EV battery production, and 3) cathode active material production. A consultation on draft legislative proposals to implement the tax credit ran from February to March 2025.	Finance Canada
Enabling Small Modular Reactors (SMRs) Program	This program will support the conditions and enabling frameworks necessary for SMRs to displace fossil fuels and contribute to climate change mitigation. The program will provide CAD 29.6 million over four years for research and development to address waste generated from SMRs and to develop supply chains for SMR manufacturing and SMR fuel supply.	Natural Resources Canada

Energy Efficiency Regulations	Establishes energy efficiency standards for a wide range of energy-using products, with the objective of eliminating the least energy-efficient products from the Canadian market.	Natural Resources Canada
Energy Innovation Program	The program advances clean and low-carbon energy technologies that will help Canada meet its climate change targets while supporting the transition to a low-carbon economy. It funds research, development and demonstration projects, and other related scientific activities.	Natural Resources Canada
Green Industrial Facilities Manufacturing Program	The program provides financial assistance to support the implementation of energy efficiency and energy management solutions designed to maximise energy performance, reduce GHG emissions, and increase competitiveness for industry in Canada.	Natural Resources Canada
Green Shipping Corridor Program	The Green Shipping Corridor Program provides funding for projects working to establish green shipping corridors and to decarbonise the marine sector in shipping areas along the Great Lakes, the St. Lawrence Seaway, and the east and west coasts.	Transport Canada
Greening Government Strategy	Sets a target to reduce absolute Scope 1 and Scope 2 GHG emissions from federal operations by 40% by 2025 and by at least 90% below 2005 levels by 2050.	Treasury Board of Canada Secretariat
Green Industrial and Manufacturing Program (GIFMP)	Offers cost-shared financial support for a comprehensive suite of energy efficiency measures and is delivered through two separate tracks: energy efficiency solutions and for industrial facilities.	Natural Resources Canada
Hydrogen Strategy for Canada	Published in December 2020, provides a roadmap for Canada to position itself as a world-leading producer, user and exporter of low-carbon hydrogen and associated technologies.	Natural Resources Canada
Low-Carbon Economy Fund	Consists of four funding streams to support projects to reduce Canada's GHG emissions, generate clean growth, build resilient communities, and create good jobs for Canadians.	Environment and Climate Change Canada
Net Zero Accelerator (NZA)	With up to CAD 8 billion in funding to support large-scale investments in key industrial sectors across the economy, the NZA ensures that Canada remains competitive in a net zero economy and reduces GHG emissions.	Innovation, Science and Economic Development Canada

Oil to Heat Pump Affordability Program (OHPA)	Launched in February 2023, and strengthened in October 2023, the Oil to Heat Pump Affordability Program provides upfront grants to help low- to median-income households switch from oil heating to heat pumps by providing funding towards the purchase and installation of a new heat pump. The program offers up to CAD 15 000 for eligible homeowners residing in a co-delivery province.	Natural Resources Canada
Output-Based Pricing System (OBPS)	Implements output-based emissions performance standards that set a price for industrial emissions if a facility's emissions intensity exceeds their sectoral benchmark. Applies in provinces and territories that have not implemented a system of equivalent stringency.	Environment and Climate Change Canada
Proposed Regulations Amending the Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds (Upstream Oil and Gas Sector)	Proposed amendments to the 2018 Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds (Upstream Oil and Gas Sector) intended to further reduce methane emissions from the oil and gas sector by 75% below 2012 levels by 2030 were published at the end of 2023. Finalised amendments are expected in 2025.	Environment and Climate Change Canada
Public Transit Fund	The Government of Canada is investing CAD 14.9 billion over the next eight years in reliable, fast, affordable and low-carbon public transit. This funding includes CAD 3 billion per year in permanent, predictable federal public transit funding which will be available to support transit solutions beginning in 2026/27.	Infrastructure Canada
Regulations on the Reduction of Carbon Dioxide Emissions from Coal-fired Generation of Electricity	Phase-out of traditional, unabated coal-fired electricity by 2030, with exceptions for coal power stations equipped with carbon capture and storage (CCS) units.	Justice Canada
Oil and Gas Sector Greenhouse Gas Pollution Cap	Proposed regulations were published in the Canada Gazette I in November 2024. The proposed design features a cap-and-trade mechanism targeted to achieve an emissions reduction of approximately 35% in the early 2030s compared to 2019. When flexible compliance options are considered, actual emissions are targeted to decline by 19% from 2019 levels.	Environment and Climate Change Canada
Smart Renewables and Electrification Pathways Program	The program provides approximately CAD 4.5 billion until 2035 for smart renewable energy and electrical grid modernisation projects.	Natural Resources Canada

Sustainable Jobs Plan	An interim plan for 2023-25 that describes support for Canadians and their communities in realising the net zero economy of the future by equipping them with the skills and training they need to continue to thrive.	Natural Resources Canada
Sales Targets for Medium- and Heavy-Duty Zero-Emission Vehicles	Aim to reach 35% of total new medium- and heavy-duty vehicle sales being ZEV by 2030. In addition, there is a goal to develop a medium- and heavy-duty ZEV regulation to require 100% of new medium- and heavy-duty vehicle sales to be ZEVs by 2040 for a subset of vehicle types based on feasibility, with interim 2030 regulated sales requirements that would vary for different vehicle categories based on feasibility, while exploring interim targets for the mid-2020s.	Transport Canada
Regional Energy and Resource Tables (Regional Tables)	The Regional Tables are partnerships between the federal government and individual provinces and territories, in collaboration with Indigenous partners (and with input from key stakeholders), to identify and advance the most promising economic opportunities in the energy and resource sectors.	Natural Resources Canada
Regulations Amending the Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations	Legislated Canada's Electric Vehicle Availability Standard, which sets regulated light-duty ZEV sales targets (20% by 2026, 60% by 2030, 100% by 2035).	Canada Gazette II
Update to the Pan-Canadian Approach to Carbon Pollution Pricing 2023-2030	The federal government laid out the economy's minimum stringency standards for carbon pricing for the period 2023-30. Any province or territory can design its own pricing system tailored to local needs or can choose the federal pricing system. A provincial or territorial system must meet the federal minimum stringency standards, which started at CAD 65/tonne GHG emissions in 2023 and increases by CAD 15 each year to 2030, or the federal system will be implemented.	Environment and Climate Change Canada
Wah-ila-toos: Clean Energy Initiatives in Indigenous, Rural and Remote Communities	Wah-ila-toos' mission is to provide funding for renewable energy and capacity-building projects and related energy efficiency measures in Indigenous, rural and remote communities across Canada. Wah-ila-toos operates under five funding streams.	Natural Resources Canada

Notable Energy Developments

Energy development	Details	Reference
Atomic Energy Canada Limited	In September 2015, a Government-owned, Contractor-operated model (GoCo) was implemented to manage the day-to-day operations of Canadian Nuclear Laboratories (CNL). A competitive procurement process is underway to continue the model with CNL, and a preferred bidder is expected to be announced in Summer 2025. In March 2025, AECL and CNL issued a Request for Expression of Interest (RFEOI) to understand market interest in licensing AECL's SLOWPOKE and Nuclear Battery reactor commercialisation opportunities.	AECL GoCo Contract Procurement AECL and CNL explore market interest in SLOWPOKE and Nuclear Battery reactor technologies - Canadian Nuclear Laboratories
Canada Growth Fund	A CAD 15 billion arm's length public investment vehicle that will help attract private capital to build Canada's clean economy by using investment instruments that absorb certain risks in order to encourage private investment in low-carbon projects, technologies, businesses and supply chains.	Canada Growth Fund
Canada Infrastructure Bank to fund SMRs	The Canada Infrastructure Bank has committed CAD 970 million to Ontario Power Generation's (OPG) Darlington New Nuclear Project (DNNP), Canada's first nuclear build in more than three decades and the first commercial deployment of an SMR in a G7 economy.	Clean Infrastructure Bank
LNG Canada	By the fall of 2024, construction on the first 14 million tonnes per annum facility was 95% complete with operations and first exports to begin in mid-2025; a possible final investment decision on a second phase would increase this to 28 million tonnes per annum. LNG Canada's operations in Kitimat are projected to produce GHG emissions that are 35% lower than the world's best-performing facilities, and 60% lower than the global weighted average (Government of British Columbia, 2023).	LNG Canada
Methane Centre of Excellence	Spurred by an initial investment of CAD 30 million, work associated with the Methane Centre of Excellence will aim to improve the accuracy, understanding, reporting and mitigation of methane emissions by focusing on key data, measurement techniques and technology development.	Environment and Climate Change Canada
Trans Mountain Pipeline Expansion	Canada's Trans Mountain Pipeline expansion began commercial operations in May 2024, which greatly expanded Canada's crude oil export capacity and opened new markets, including in Asia.	Trans Mountain Corporation

Useful Links

Atomic Energy of Canada Ltd – www.aecl.ca

Canada Gazette – www.gazette.gc.ca/

Canadian Centre for Energy Information – https://energy-information.canada.ca/en

Canada Energy Regulator – https://www.cer-rec.gc.ca/index-eng.html

Canadian Nuclear Laboratories – www.cnl.ca

Canadian Nuclear Safety Commission – http://nuclearsafety.gc.ca

Environment and Climate Change Canada – www.ec.gc.ca

Innovation, Science and Economic Development Canada – https://ised-isde.canada.ca/site/ised/en

Natural Resources Canada – https://natural-resources.canada.ca/home

Statistics Canada – www.statcan.ca

Transport Canada – www.tc.gc.ca

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CanREA (Canadian Renewable Energy Association) (2024), *By the Numbers*, https://renewablesassociation.ca/by-the-numbers/

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Chile

Introduction

Chile continues to advance its efforts to transform the energy sector by reducing reliance on imported fossil fuels and capitalising on its abundant domestic renewable energy resources to increase their share in the energy mix.

As the 16th largest economy in APEC by GDP, the 13th by GDP per capita, and the 15th by population, Chile is playing a pivotal role in the world's energy transition. Its significance is highlighted by being the world's leading producer of copper and lithium.

Chile's dedication to sustainability is demonstrated by its ambitious targets for reducing carbon emissions and expanding the share of renewables in its energy portfolio, especially in the power sector. Despite progress, Chile faced challenges in 2024.

Severe weather conditions led to significant supply disruptions, especially in Santiago during 2024. These outages exposed the vulnerabilities in the power infrastructure amid growing electricity demand. In December 2024, Chile issued Law 21.721 that modified the General Law of Electricity Systems Regarding Electricity Transmission, which aims to provide a legal framework to strengthen the electricity system.

The Oasis de Atacama energy storage project was launched in 2024, representing a significant milestone in Chile's energy strategy. The project is planned to have five phases, with the first two phases delivering a combined energy storage capacity of 1.2 GWh. Upon completion, the total capacity will reach 4.1 GWh, making it the largest battery energy storage project globally. Full operational capacity is expected by the end of 2026.

Table 1: Chile's macroeconomic data and energy reserves

Key data [a]		Energy reserves [b, c]	
Area (million km²)	0.8	Oil (billion barrels)	N/A
Population (million)	20	Gas (trillion cubic feet)	N/A
GDP (constant 2021 international USD billion PPP)	578	Coal (million tonnes)	000
GDP per capita (constant 2021 international USD billion PPP)	29 481	Uranium (Reasonably recoverable tonnes U < USD 130/kgU)	0

Source: a World Bank (2023); b Energy Institute (2023); c Nuclear Energy Agency (2023)

Note: Reserves are total proved reserves and reasonably assured recoverable resources for uranium.

In April 2024, Chile unveiled the Green Hydrogen Action Plan 2023–2030. The Green Hydrogen Action Plan outlines 18 lines of action, 81 specific actions, and 177 milestones, providing a clear pathway for implementing policies to support the sustainable production and adoption of green hydrogen.

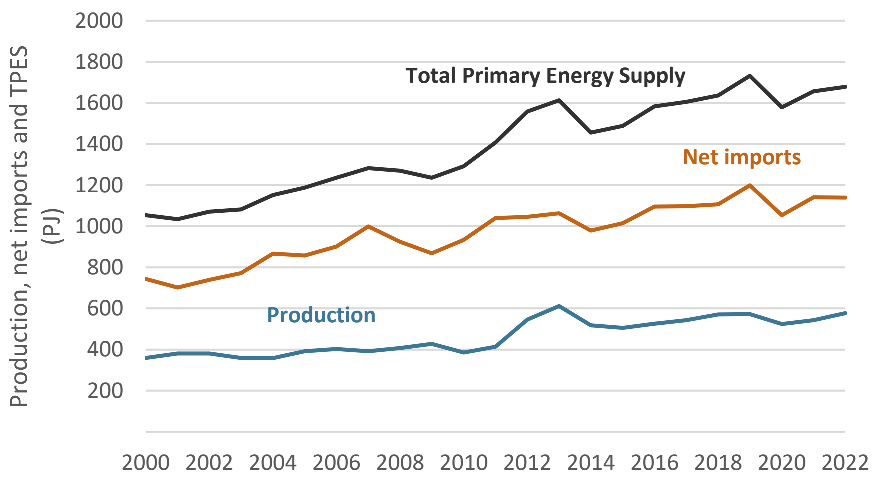
Energy Supply and Consumption

Total Primary Energy Supply

In 2022, global natural gas supply constraints affected its price, complicating efforts to transition away from coal in several economies, including Chile.

Chile's total energy supply reached 1678 PJ in 2022, a 1.4% increase from the previous year. Of this supply, 69% was met through imports, while the remaining 31% was produced domestically. Consequently, Chile remains heavily reliant on imported fuels, predominantly fossil fuels, to meet its energy needs.

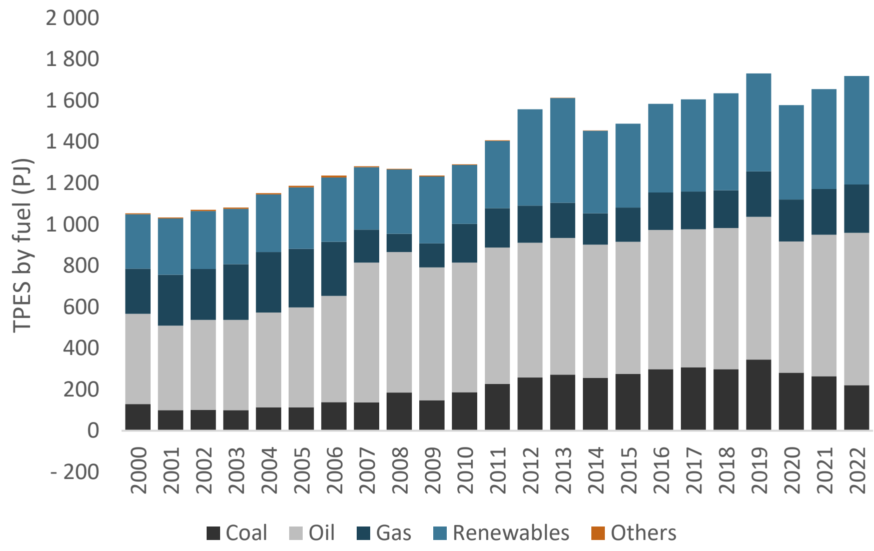
Figure 1: Chile's energy supply, production, and net imports (PJ), 2000 to 2022



Source: EGEDA (2024)

In 2022, total primary energy production increased by 6.2% compared to 2021, reaching 577 PJ. Renewable energy accounted for most of this increase, at 526 PJ, followed by natural gas at 46 PJ. Net imports also rose by 1.9%, reaching 1202 PJ, primarily driven by increased oil and gas imports.

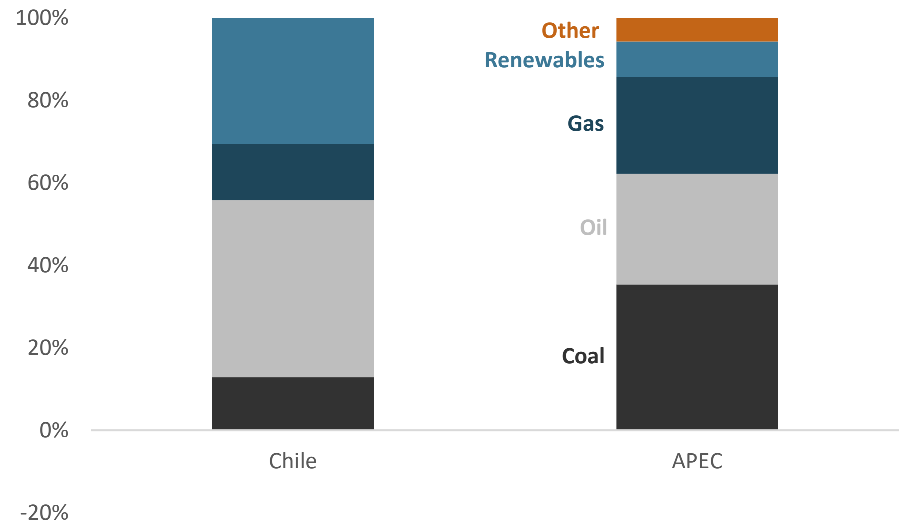
Figure 2: Chile's energy supply by fuel (PJ), 2000 to 2022



Source: EGEDA (2024)

The total energy supply of coal declined by 14% to 227 PJ in 2022, continuing the downward trend since 2019 in alignment with Chile's Coal Phase-Out Plan, which aims to close all coal-fired power plants by 2040. Oil supply rose by 0.8% to 690 PJ, while natural gas supply, domestically produced and imported, increased by 6.3% to 235 PJ. Given the limited domestic production of oil and gas, these increases were largely met through imports. On the other hand, renewable energy supply grew by 8.6% to 527 PJ in 2022.

Figure 3: Energy supply mix, Chile and APEC, 2022



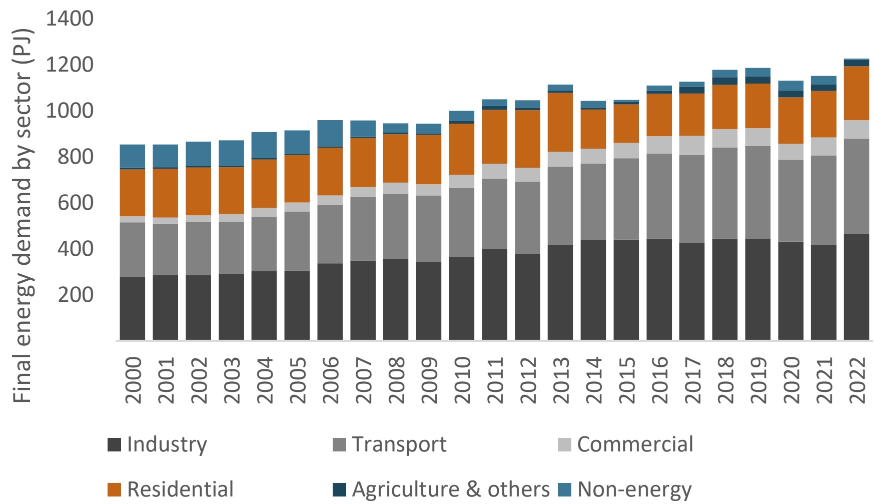
Source: EGEDA (2024)

In 2022, renewables accounted for 31% of Chile's total energy supply, significantly higher than APEC's average of 8.7%. Chile's reliance on oil (41%) also exceeded APEC's average (27%), while coal made up 13% of Chile's energy supply compared to 35% in APEC.

Total Final Consumption

Economic growth in 2022 drove an increase in total energy consumption across key sectors. Industrial energy consumption rose by 12%, from 415 PJ in 2021 to 464 PJ in 2022. The transport sector experienced a 6% increase, reaching 414 PJ in 2022, up from 390 PJ in the previous year. Residential consumption grew by 15%, from 202 PJ to 233 PJ, while the commercial and public sector saw the highest growth at 3.5%, rising from 78 PJ in 2021 to 81 PJ in 2022. In contrast, the non-energy use sector and the agriculture and others sector experienced a 48.5% decline. These trends align with the increase in economic dynamism.

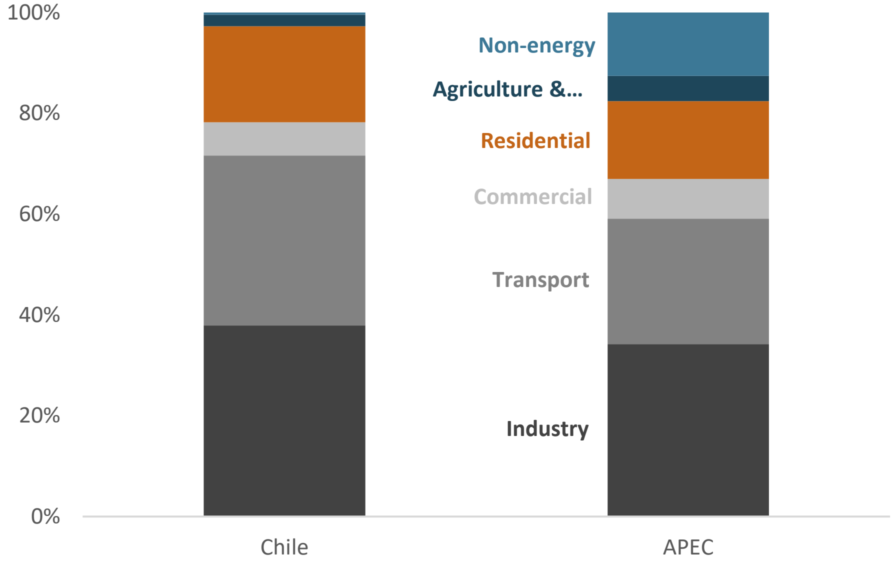
Figure 4: Chile's final consumption by sector (PJ), 2000 to 2022



Source: EGEDA (2024)

The industrial sector was the largest energy consumer (38%), followed by transport (34%) and residential consumption (19%). In comparison, APEC's transport sector accounted for a lower share (25%). Another relevant difference can be observed in the non-energy sector, which uses energy products as raw materials, and which represented only 0.5% of Chile's consumption, compared to 13% in APEC.

Figure 5: Final consumption by sector, Chile and APEC, 2022

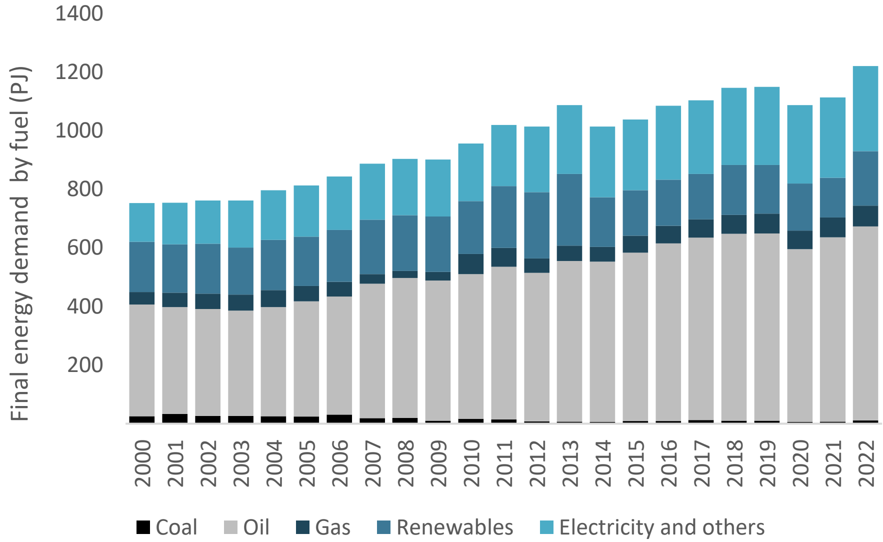


Source: EGEDA (2024)

Final Energy Demand

Chile's final energy demand grew by 10% in 2022, reaching 1220 PJ, surpassing pre-pandemic levels. Oil demand rose by 5%, from 629 PJ in 2021 to 663 PJ in 2022. Renewable energy demand increased by 38%, from 135 PJ to 186 PJ, while electricity demand grew by 5.5%, from 275 PJ to 290 PJ. Notably, coal demand decreased by 2.0%, reaching 19 PJ, and natural gas demand was reduced by 0.8%, reaching 9.7 PJ.

Figure 6: Chile's final energy demand by fuel (PJ), 2000 to 2022



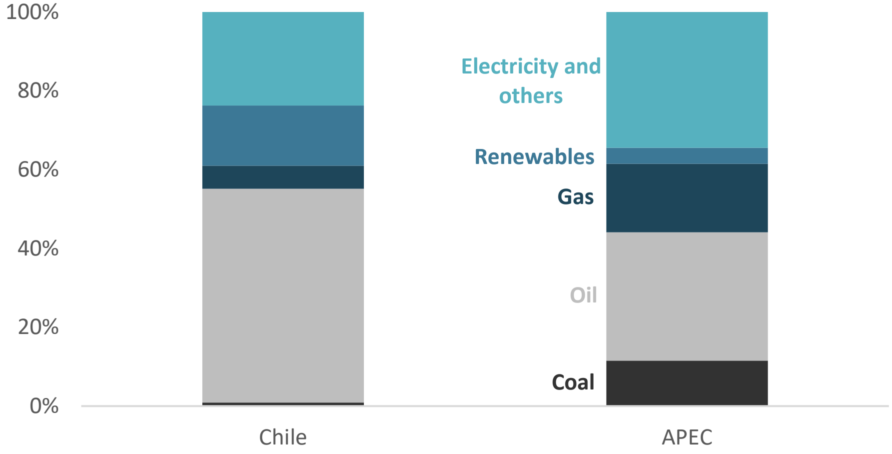
Source: EGEDA (2024)

Note: Does not include non-energy sector consumption of energy products.

In 2022, oil and oil products accounted for 54% of final energy demand, while renewables contributed 15%, natural gas 6%, electricity 24%, and coal 1%.

Additionally, electricity represented 24% of the final energy demand, below the 34% of final energy demand observed in APEC.

Figure 7: Final energy demand fuel share, Chile and APEC, 2022



Source: EGEDA (2024)

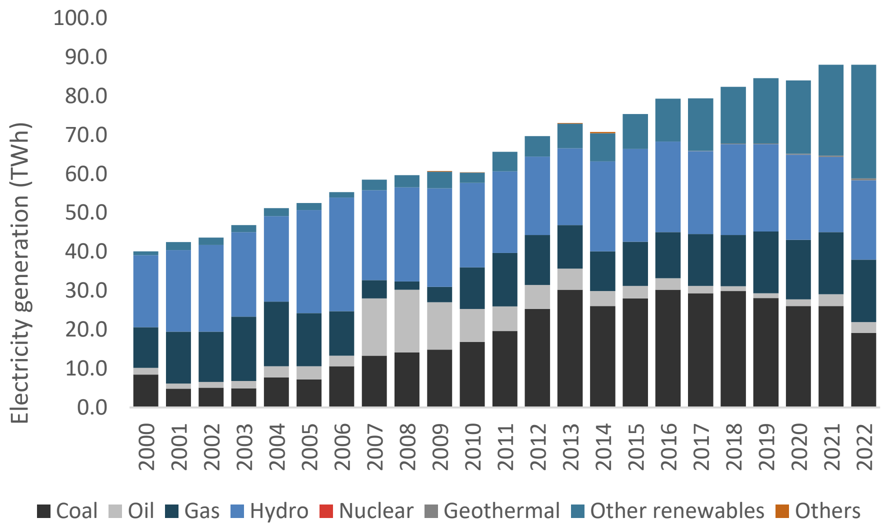
Transformation

Despite the lack of fossil fuel resources, Chile has an enormous potential for renewable energy. Chile had 33 GW of renewable energy installed capacity by 2023; 15 GW corresponded to non-conventional renewable energy[4].

Power Sector

Despite the rise in electricity demand in 2022, thermal power generation declined by 16 %, indicating that the increased demand was met through renewable energy sources. Chile's electricity generation fuel mix consisted of coal (22%), gas (18%), oil (3 %), hydropower (23%), geothermal energy (0.5%), and other renewables (32%). Eleven coal-fired power plants were retired between 2019 and 2024, including the shutdown of Units 1 and U2 (276 MW) of the Norgener coal power plant in April 2024. Chile's goal is to retire or convert all remaining coal-fuelled units while ensuring grid stability by 2040 or earlier if possible.

Figure 8: Chile's electricity generation by fuel, 2000 to 2022



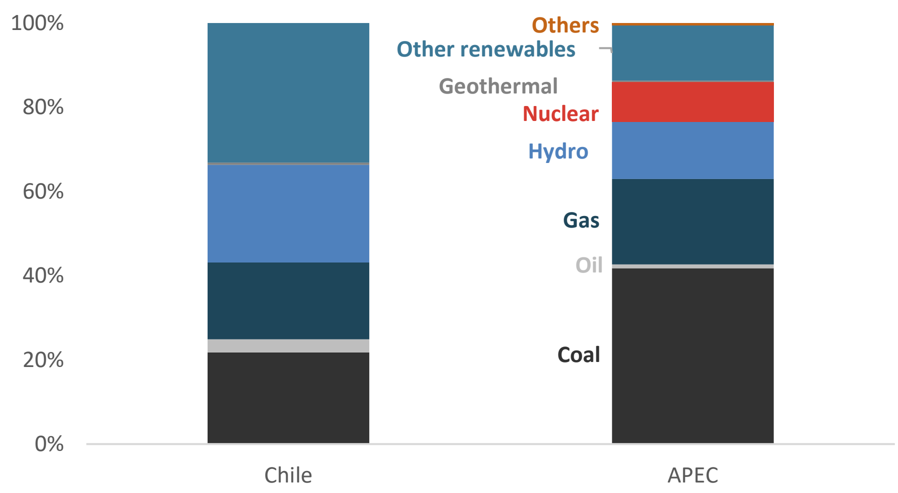
Source: EGEDA (2024)

Electricity generation, which includes power from both main electricity producers and auto producers, remained stable at 88TWh in 2022, similar to the levels seen in 2021. Hydropower generation increased by 5%, rising from 19 TWh in 2021 to 20 TWh in 2022. Oil-fuelled power generation decreased by 11% reaching 2.7 TWh in 2022. Geothermal power generation rose by 44%, from 0.3 TWh in 2021 to 0.5 TWh in 2022. Generation from other renewable sources, including biomass,

[4] Law N°20257 defines non-conventional renewable energy sources such as biogas, hydropower with installed capacity less than 20MW, geothermal energy, solar energy, wave and tidal energy.

solar, wind, and others, grew by 25.2%, increasing from 23 TWh in 2021 to 29 TWh in 2022. Gas-based power generation increased by 1%, reaching 16 TWh in 2022. Lastly, coal-fuelled power generation decreased by 16%, falling from 26 TWh in 2021 to 19 TWh in 2022.

Figure 9: Electricity generation fuel share, Chile and APEC, 2022



Source: EGEDA (2024)

The combined share of hydropower and other renewables accounted for 56% of Chile's electricity generation fuel mix in 2022, with geothermal, biomass, wind, and solar energy representing 32%. In comparison, Chile's electricity generation a lower carbon intensity than the APEC region, where renewables account for just 27% of electricity generation.

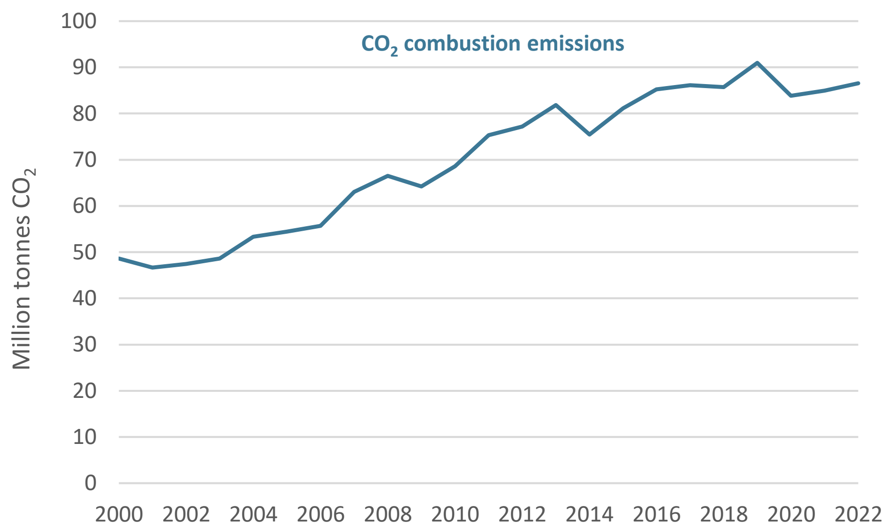
Energy Transition

Emissions

Chile's energy transition efforts include the recently approved Energy Transition Law and the development of a decarbonisation roadmap, aiming for carbon neutrality by 2050 or earlier.

Combustion emissions increased by 1.9% in 2022, reaching 86 569 kt-CO_2, driven by higher energy consumption in the transport and industrial sectors, which predominantly rely on fossil fuels.

Figure 10: Chile's CO_2 combustion emissions (million tonnes), 2000 to 2022



Source: EGEDA (2024)

Energy Security

In 2024, supply disruptions highlighted the vulnerabilities in Chile's transmission and distribution system. The issuance of Law No. 21.721 aims to provide a robust framework to strengthen the electricity system and support Chile's energy transition. The law promotes competition and the development of electricity transmission projects. These initiatives may mitigate the impact of severe weather events by ensuring a more reliable electricity system.

Chile considers natural gas a transition fuel, a role formally recognised in the draft Decarbonization Plan launched in late 2024. Natural gas will support the transition toward a cleaner energy system because, although fossil-based, it emits less CO_2 than other hydrocarbons. It is also versatile, cost-competitive, already in use, available, safe, and complementary to other energy sources (e.g., renewables, CNG vehicles, hydrogen blending, district energy). In parallel, Chile is advancing policies on sustainable fuels such as SAF, HVO, renewable diesel, biofuels, e-fuels, and biogas.

APEC Energy Goals

There are two energy-related objectives that APEC member economies have agreed to meet as a collective: to improve energy intensity and double the share of modern renewables.

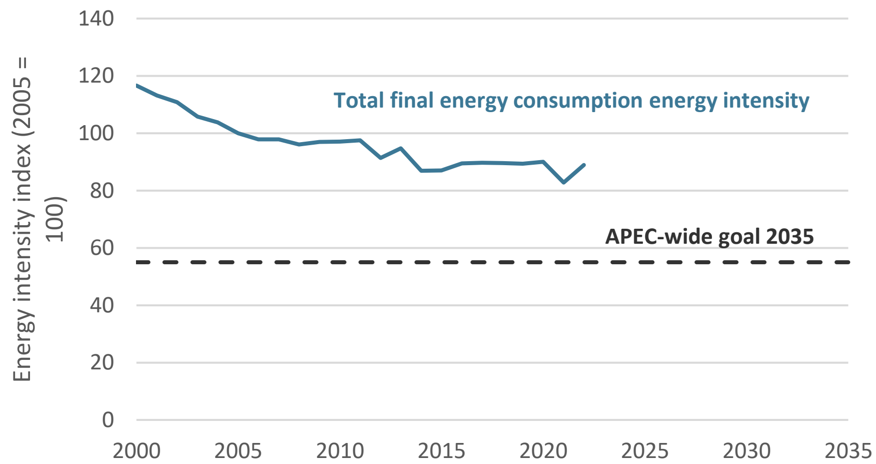
Energy Intensity Goal

In 2011, APEC member economies agreed to increase their energy reduction target to 45% by 2035, relative to a 2005 baseline. The original goal was a 25% improvement by 2030, relative to a 2005 baseline.

APEC is on track to achieve this energy intensity improvement. The goal does not impose individual economy targets, but it is possible to track the progress of individual APEC economies relative to the overarching proportional improvement.

In 2022, Chile ranked 8th among APEC economies in total final energy consumption energy intensity, from 11th place in 2021. The observed increase in energy intensity in 2022 was driven by rising energy demand, particularly in the industrial and transport sectors, coupled with moderate GDP growth.

Figure 11: Chile's total final energy consumption intensity index, 2000 to 2022 (2005 = 100)



Source: EGEDA (2024)

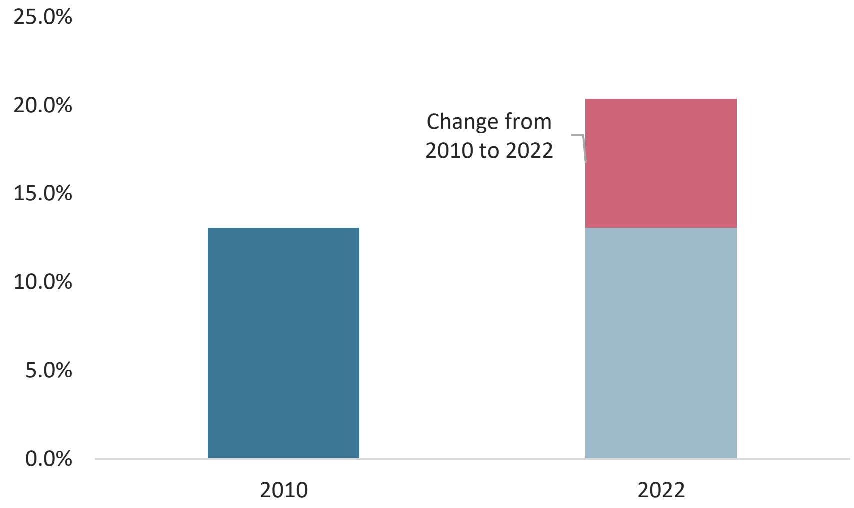
Since 2014, the rate of decline in Chile's energy intensity has slowed, indicating that economic growth has been closely mirrored by energy demand growth. On the one hand, this trend highlights the challenges in reducing energy intensity, as historically around 70% of energy demand stems from the industry and transport sectors, where implementing energy efficiency measures and transitioning to alternative fuels remain complex for many different reasons. For instance, in the copper mining sector, one of the key sectors of the Chilean Economy, the energy consumption per unit per metric ton of fine copper (TMF Cu) has been increasing over time, primarily due to aging mines and lower ore grades (Cochilco, 2024). On the other hand, the growing prevalence and usage of personal electronic devices (like computers and cell phones) across residential, commercial, and public sectors are driving up energy consumption, thereby impacting energy intensity and potentially obscuring the true effects of energy efficiency measures.

Doubling of Renewables

The second energy goal involves doubling the share of modern renewables in the APEC energy mix for the period 2010 to 2030. There is no economy-level goal for individual member economies, but improvements by individual economies will contribute to the doubling goal.

Chile has made significant progress, increasing the share of modern renewables in its total final energy consumption—from 13% in 2010 to 20% in 2022. As a result, Chile now ranks fourth among APEC economies for the share of modern renewables in its energy mix.

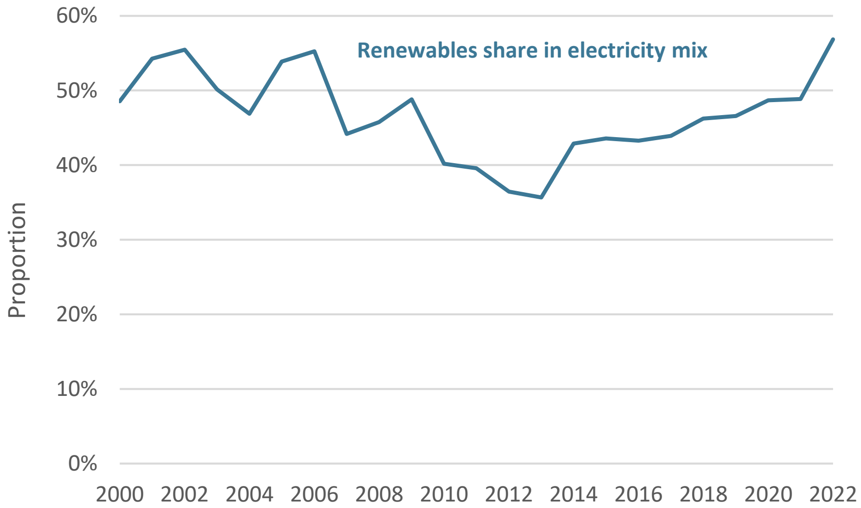
Figure 12: Chile's modern renewable energy share, 2010 and 2022



Source: EGEDA (2024)

Note: Biomass used in the residential and commercial sectors is assumed to be traditional biomass and is not included in the definition of modern renewables. All other renewables (biomass used by industry, hydro, geothermal, etc.) are considered modern renewables. Modern renewables also include the share of electricity that is generated from renewable sources in distributed generation.

Figure 13: Chile's renewable generation share, 2000 to 2022



Source: EGEDA (2024)

Chile has significantly increased the share of renewable energy in its power generation, rising from 49% in 2021 to 56% in 2022, thereby ranking third among APEC economies. The calculation of this indicator includes contributions from auto producers.

In 2022, the decline in thermal power generation was offset by notable increases in hydropower and solar power generation.

Energy Policy

Energy policy	Details	Reference
Hydrogen Strategy for Chile (2020)	The design and implementation of a development policy for hydrogen would allow the displacement of fossil fuels on a large scale in the power generation, transport, and industry sectors.	Ministry of Energy
Energy Efficiency Law (2021)	Law 21.305 outlines a long-term energy efficiency plan, to be updated every five years. The new law regulates the management of energy by large consumers and delivers information to homebuyers regarding housing energy requirements.	Ministry of Energy
Framework Law on Climate Change (2022)	In June 2022, the Chilean Government published Law 21.455, the Framework Law on Climate Change, which establishes the goal of reaching carbon neutrality by 2050.	Ministry of Environment
Agreement on Coal-fired power plant shutdown	A total of 1.679 GW of coal-fired power plants shut down by the end of 2024, which is equivalent to 30% of the total coal electricity capacity in place in 2018. Operation of coal power plants will cease or reconvert by 2040 at the latest.	Ministry of Energy
Electromobility strategy	This strategy outlines actions to be taken in the short and medium terms to meet the government's goal of reaching, by 2035, 100% sales of new zero-emission vehicles in the following types: light and medium, public transportation and mobile machinery.	Ministry of Energy
Long-term energy planning (2023-2027)	The main objectives of this work are to present scenarios to estimate the future energy demand, to be used as input information for electric transmission planning and to function as a tool that helps policymakers develop energy policies. The last report that updated the background information for long-term energy planning was released in 2025.	Ministry of Energy
Energy Agenda 2022-2026	The new government of Chile launched this energy roadmap. The document emphasises equitable access to quality energy and the development of a clean, secure and resilient energy system.	Ministry of Energy
Updated energy policy 2050 (2022)	This update increased the goal of renewable energy in electricity generation to 80% by 2030 and aims to achieve 100% zero-emission energy by 2050. Additionally, there is a goal of 100% access to electricity by 2030, goals for hydrogen and electromobility, and Chile is positioned to be a green hydrogen and derivates exporter by 2030.	Ministry of Energy
Law 21.499 that regulates the production and trade of solid fuels (2022)	This law declares wood fuel, pellets, briquettes, charcoal and agricultural waste as fuels and establishes requirements and standards for commercialisation. This law is intended to improve air quality and protect the health and safety of people who live in areas where these fuels are used.	Ministry of Energy

Law 21.505 to promote electricity storage and electromobility (2022)	This law will expand renewables in the electricity mix by promoting storage technologies, provide greater security to the grid, and help the process of decarbonisation. The law also promotes electric mobility through economic incentives.	Ministry of Energy
Initial Agenda for a Second Phase of the Energy Transition (2023)	In April 2023, the Ministry of Energy launched the Initial Agenda for a Second Phase of the Energy Transition, with the aim of taking actions for an accelerated decarbonisation of the electricity sector.	Ministry of Energy
Green Hydrogen Action Plan (2024)	The Green Hydrogen Action Plan was published by the Ministry of Energy in April 2024, with the aim of defining a roadmap between 2023 and 2030 that will enable the deployment of a sustainable green hydrogen industry and its derivatives, through coordinated actions between different government ministries and related agencies.	Ministry de Energy
Law 21.721 Modification of the General Law on Electric Systems regarding Electricity Transmission	This law introduced energy storage systems as part of the electricity distribution and transmission networks, execution and operation guarantees for transmission projects associated with future electricity generation and energy storage projects, and other changes that affect the electricity transmission grid.	Ley Chile - Ley 21721 - Biblioteca del Congreso Nacional
Decarbonization Plan	Following the agreement to fully retire or convert coal-fired power plants by 2040, this plan builds a roadmap that addresses the enabling conditions that will make it possible to dispense with coal and move rapidly towards a low-carbon electricity system.	Ministry of Energy
Work Plan of Enabling Regulations for the Development of the Hydrogen Industry in Chile 2024 - 2030	This plan presents a chronological planning until 2030 of the regulations under development and planned related to hydrogen and its value chain, considering the competences of both the Ministry of Energy and other State institutions.	Ministry of Energy

Notable Energy Developments

Energy development	Details	Reference
Oasis de Atacama Energy Storage Project inauguration	This project includes an energy storage capacity of 4.1 GWh and a solar power capacity of 1 GW.	Con Pawa inauguran proyecto Oasis de Atacama en Pozo Almonte | Ministerio de Energía
Shutdown of Units 1 and 2 of Norgener thermal power plant	Following the decarbonisation plan, in April 2024, coal-fuelled Units 1 and 2 of the Norgener thermal power plant were retired.	https://www.df.cl/empresas/energia/descabornizacion-este-lunes-se-concreto-retiro-de-centrales-norgener-1

Useful Links

Government Institutions

Chilean National Energy Commission (CNE) – www.cne.cl

Renewable Energy National Register(RENOVA) – https://www.coordinador.cl/renova/

Energía Abierta Beta – www.energiaabierta.cl

Fuel Prices in Refuelling Stations Information System – http://www.bencinaenlinea.cl/web2/

Chilean Energy Sustainability Agency (ASE) – www.agenciaSE.org

National Electric Coordinator – www.coordinador.cl

Government of Chile – www.gobiernodechile.cl

Ministry of Economy, Development and Reconstruction – www.economia.cl

Ministry of Energy – www.energia.gob.cl

Ministry of the Environment – www.mma.gob.cl

Nuclear Energy Chilean Commission (CCHEN) – www.cchen.cl

National Institute of Statistics (INE) – www.ine.cl

National Oil Company (ENAP) – www.enap.cl Superintendence of Electricity and Fuel (SEC) – www.sec.cl

Energy Associations

Chilean Association of Power Generators – www.generadoras.cl

Chilean Association for Renewable Energies and Storage ACERA AG – www.acera.cl

Chilean Association of Electric Companies – www.electricas.cl

Chilean Association of Solar Energy – www.acesol.cl

Chilean Association for Small and Mid-hydro Power Plants (APEMEC) – www.apemec.cl

Chilean Geothermal Energy Association A.G. (ACHEGEO A.G.) – www.achegeo.cl

Chilean Hydrogen Association (H2 Chile) – https://h2chile.cl/

Association of Producers of Green Hydrogen and its Derivatives in Magallanes – www.h2vmagallanes.cl/

Association of Chilean Transmitters – https://transmisoras.cl/

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China

Introduction

China is the largest energy producer and consumer in the world. China is committed to building a clean, low-carbon, safe, and efficient energy system, with a focus on high-quality development featuring innovative, coordinated, green, open, and shared development. On November 8, 2024, China launched its first Energy Law, which came into force on January 1, 2025. It acts as an institutional guarantee to further the energy transition and marks a milestone in China's energy legislation.

In 2024, China's crude coal production reached 4.8 billion tonnes, up 1.3% from the previous year. Crude oil production continued to grow for the sixth year, and oil imports decreased by 1.9%. Gas production has maintained a year-on-year increase of 10 billion cubic metres for the past eight consecutive years (NBS China, 2025).

Electricity generation increased by 4.6% from 2023 to 2024, with renewables generating 3460 TWh of electricity, marking a remarkable 19% increase from 2023. The total installed capacity of wind and solar power surpassed coal for the first time in mid-2024 and reached 1407 GW by the end of that year, with solar and wind power capacity jumping by 45% and 18% from 2023, respectively (NBS China, 2025). China has built the world's largest renewable energy equipment supply chain, becoming the key driver of the global decline in costs for solar PV and onshore wind (IRENA, 2023).

In 2024, 11 new nuclear power units were approved to be constructed. China's total nuclear power generation capacity (including units in operation, under construction, and approved) surpassed the United States, ranked first in the world.

China's new energy vehicle (including electric vehicles, hybrid electric vehicles, fuel cell electric vehicles, etc.) output and sales in 2024 exceeded 12 million, topping global rankings for the 10th consecutive year. Power storage projects amounted to 138 GW, with an increase of 60% from 2023. The hydrogen sector also saw positive progress. With the launch of the Energy Law, hydrogen was officially included in China's legislation as an energy source for the first time.

Table 1: China's macroeconomic data and energy reserves

Key data [a, b]		Energy reserves [c, d]	
Area (million km^2)	9.6	Oil (billion barrels)	26
Population (million)	1 410	Gas (trillion cubic feet)	297
GDP (2021 USD billion PPP)	29 683	Coal (million tonnes)	143 197
GDP per capita (2021 USD PPP)	21 020	Uranium (kilotonnes U < USD 130/kgU)	133

Source: a NBS China (2025); b World Bank (2024); c Energy Institute (2023); d NEA (2025)

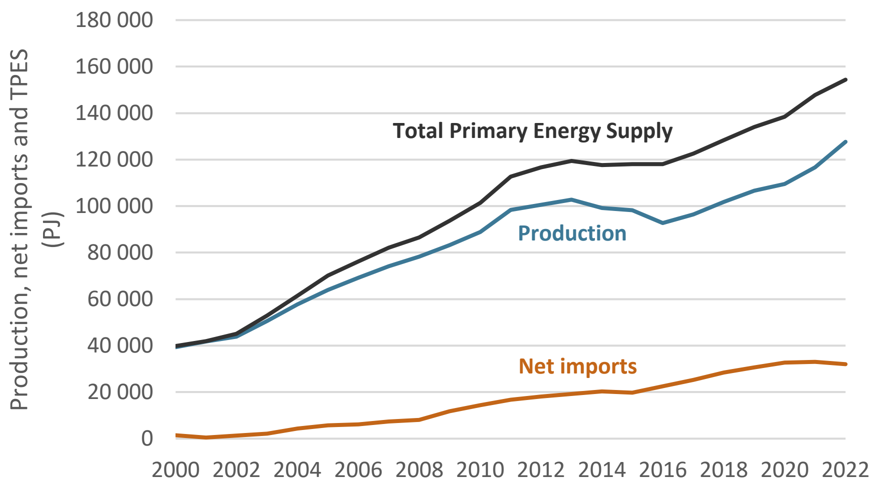
Note: Reserves are total proved reserves and reasonably assured recoverable resources for uranium.

Energy Supply and Consumption

Total Primary Energy Supply

In 2022, China's total primary energy supply (TPES) increased by 4.5%, reaching 154 373 PJ. Energy production increased by almost 10%, while net imports decreased for the first time in seven years by around 3%. This was mainly due to the surging international price of oil, gas, and coal related to geopolitical volatility. The net imports share of energy supply continued to decrease to 21% after peaking at 24% in 2020 (Figure 1).

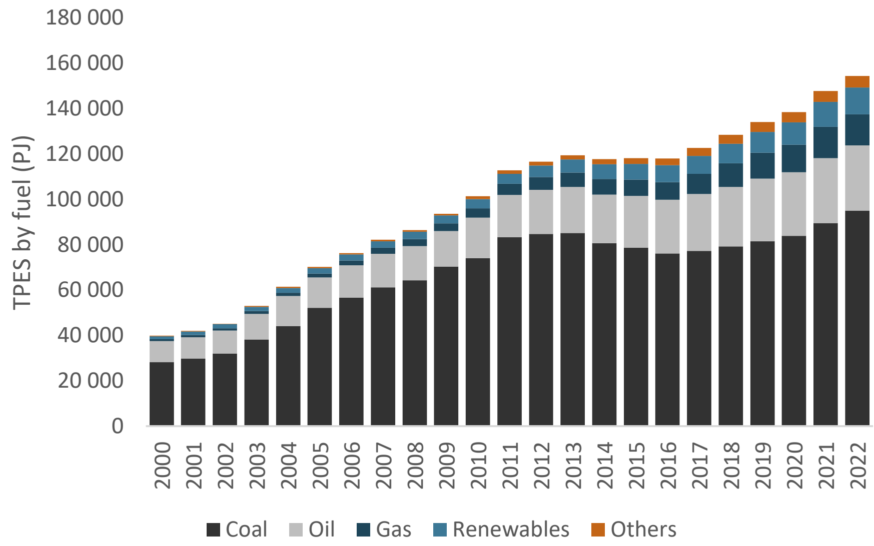
Figure 1: China's energy supply, production, and net imports (PJ), 2000 to 2022



Source: EGEDA (2024)

Coal remains the dominant fuel in China's energy supply. Against the backdrop of international market fluctuations in 2022, the share of oil and gas decreased from 19% and 9.3% to 19% and 8.8%, respectively. To meet energy security needs, the share of coal increased by one percentage point to 62%, reversing the downward trend that has been kept since 2009 before declining again in 2023. Renewables grew rapidly and increased by more than 9%, taking up 7.7% of TPES. Overall, China's energy supply mix is seeing a steady transition from fossil fuels towards cleaner low-carbon alternatives (Figure 2).

Figure 2: China's energy supply by fuel (PJ), 2000 to 2022

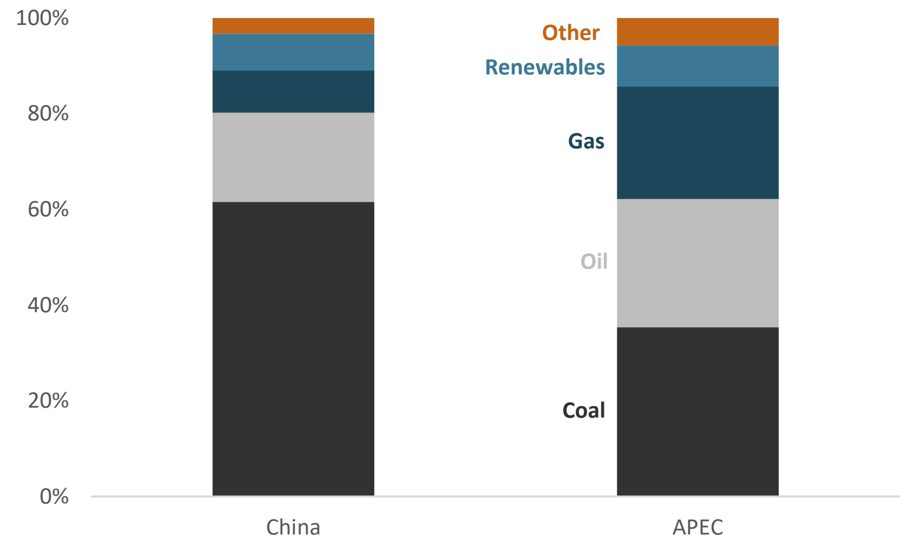


Source: EGEDA (2024)

With the challenges posed by COVID-19, the receding real estate sector, and subdued exports, China's macroeconomic growth took a significant hit in 2022. The GDP growth rate slowed to 3.0% compared with the strong rebound of 8.1% in 2021. Consequently, the energy supply growth rate declined from 6.8% to 4.5% (Figure 1, 2).

China's rich coal reserves, price sensitivity on the demand side, and uncertainties in the oil and gas supply chain contributed to the fact that the share of coal in China's energy supply is much higher than that of other APEC members. Meanwhile, with the government vigorously pushing forward the expansion of renewables, the gap in renewable energy shares between China and APEC is narrowing (Figure 3).

Figure 3: Energy supply mix – China and APEC, 2022



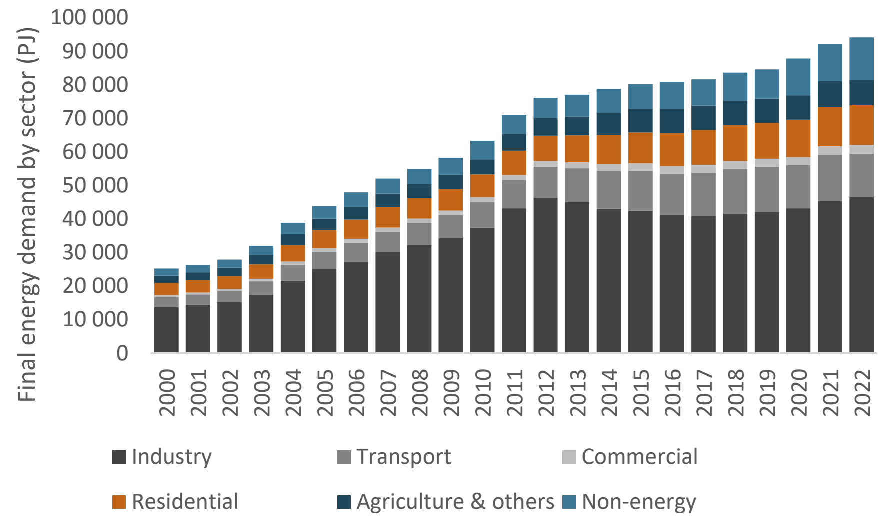
Source: EGEDA (2024)

Total Final Consumption

Following the same logic as the supply end, the growth rate of China's final energy consumption decreased from 4.7% in 2021 to 2.0% in 2022. Since China is the world's largest industrial economy, the industry sector generates around 30% of its GDP and takes up almost half of its energy consumption. The transport sector took a hard hit and consumed almost 6% less energy than the previous year.

Although China's population peaked in 2021 and started to decline, the energy demand of the residential sector increased steadily, and its share has been stable at 13% in recent years (Figure 4). This is backed by the continuous increase in resident income and urbanisation rate, as well as the shift of resident energy consumption structure from coal to electricity and gas.

Figure 4 China's final consumption by sector (PJ), 2000 to 2022



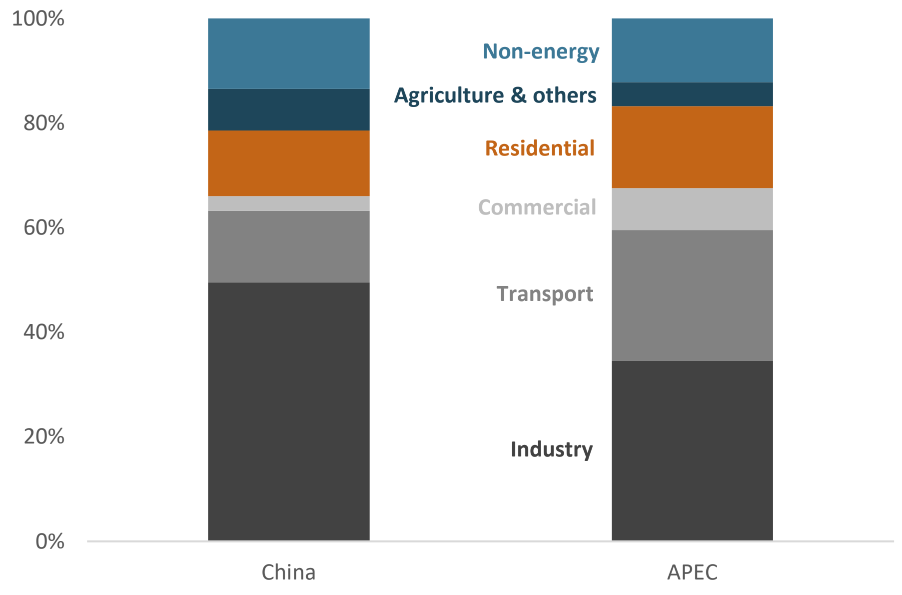
Source: EGEDA (2024)

China's industry has not only been the main driver of domestic economic growth but also played a crucial role in meeting global demand. Its industrial energy consumption accounts for 56% of that of the APEC region and more than 19% of APEC's total final consumption. And that makes the industrial sector the most important sector for energy conservation.

According to the *Action Plan on Boosting Industrial Energy Efficiency*

(The State Council, 2022) released in June 2022, China aims to cut the energy intensity of its large industrial enterprises with annual revenues of more than CNY 20 million (approximately USD 3.0 million) by 14% from the 2020 level by 2025. This will be achieved through various approaches, including improving energy efficiency, optimising the energy consumption structure, and improving the electrification level of end-use energy consumption.

Figure 5: Final consumption by sector, China and APEC, 2022



Source: EGEDA (2024)

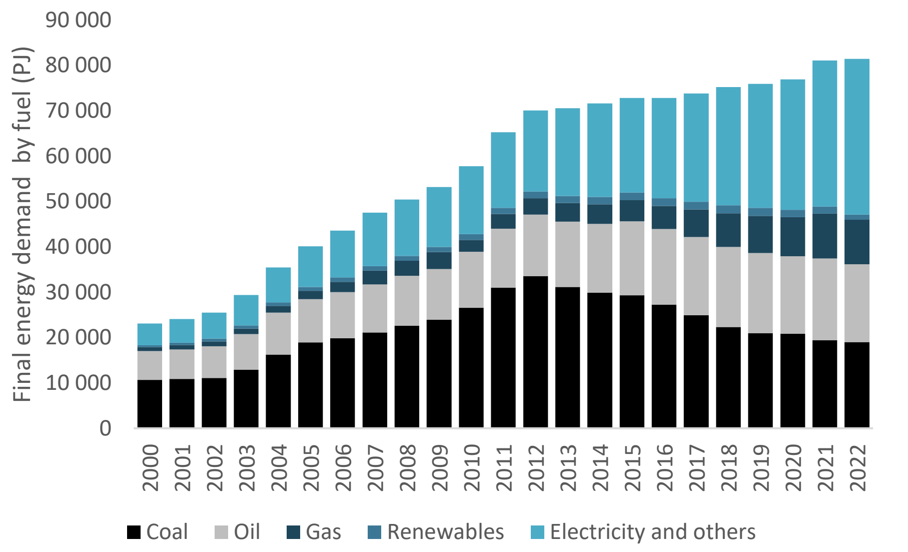
Final Energy Demand

The fuel mix of China's energy demand has seen a dramatic change since 2000. From a proportional point of view, the most noticeable development was the decrease in coal and the increase in electricity and others (Figure 6).

In 2022, coal consumption in final energy demand decreased by around 2% from 2021, taking up 23% of the total, while electricity and others increased from 40% to 42%. The share of total renewable energy demand from primary and secondary sources increased to 11% from 10%.

The top six energy-intensive subsectors (petroleum, chemicals, non-metallic minerals, ferrous metal, non-ferrous metal, electric and heat power) are still heavily dependent on coal-based technologies and are responsible for almost 60% of domestic energy consumption. Thus, shifting away from fossil fuels poses a significant challenge for China.

Figure 6: China's final energy demand by fuel (PJ), 2000 to 2022

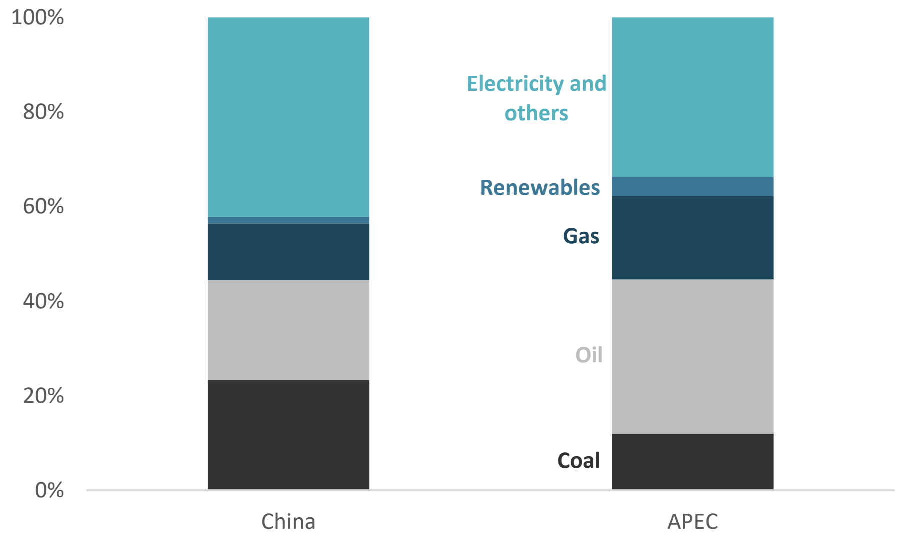


Source: EGEDA (2024)

Note: does not include non-energy sector consumption of energy products

China consumed 38% of APEC's final energy demand and 75% of the APEC region's coal as primary energy. China is vigorously advancing the electrification of final energy consumption. The *Guiding Opinions on Further Promoting Electricity Substitution* (CN Energy News, 2022) issued in 2022, set a target for electricity to account for 30% of final energy consumption by 2025. That number had reached 28% in 2023 (People's Daily, 2024).

Figure 7: Final energy demand fuel share, China and APEC, 2022



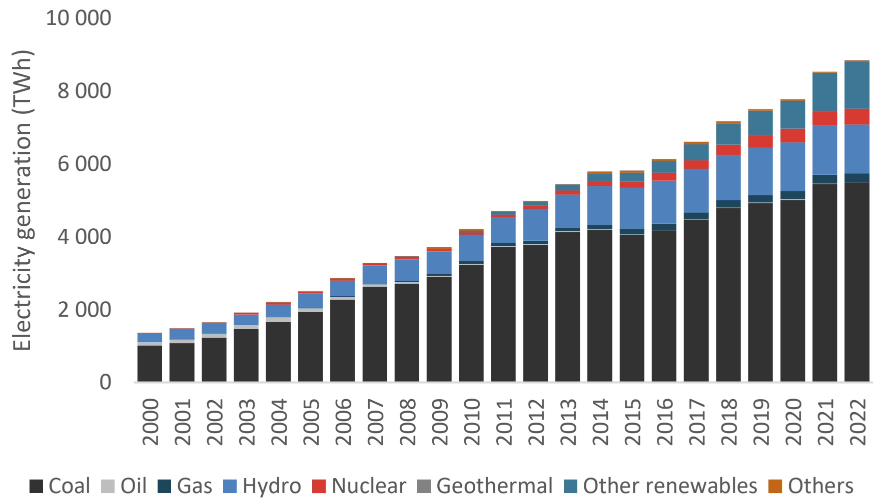
Source: EGEDA (2024)

Transformation

Power Sector

Electricity generation has been constantly expanding, reaching 8 849 TWh in 2022. Coal dominated the power sector (62%) as an abundant, affordable, and stable power source. Although the total installed capacity of thermal power plants increased by 2.7% in 2022 (NDRC, 2023), its share in power generation continued to decline for 11 consecutive years.

Figure 8: China's electricity generation by fuel, 2000 to 2022



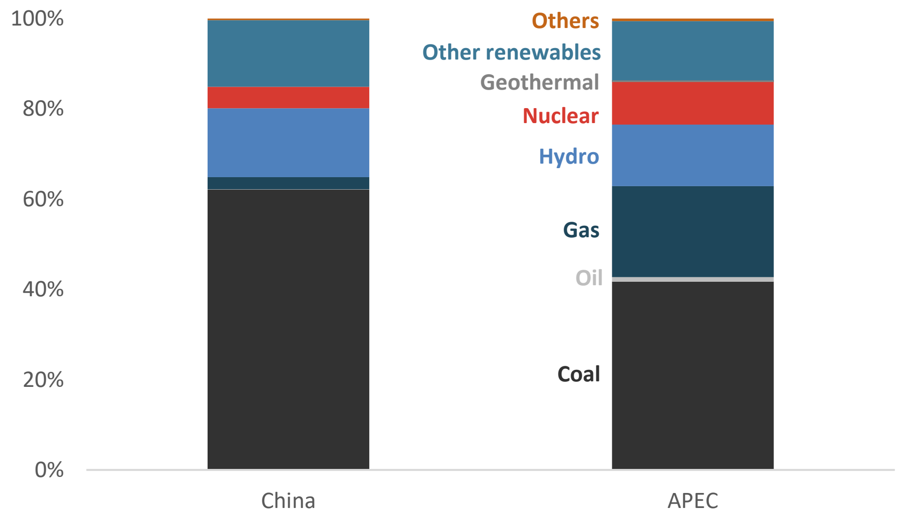
Source: EGEDA (2024)

Hydro is still the largest source of renewable electricity in China. The installed capacity of hydro power increased by 5.8% since 2021 (NDRC, 2023). However, due to the combined effect of continued high temperatures and low precipitation, hydro generation only increased slightly by 1.0%.

Meanwhile, other renewables are rapidly growing. The grid-connected wind and solar power installed capacity increased by 11% and 28% in 2022, respectively (NDRC, 2023). In total, renewables contributed to more than 30% of China's power generation (Figure 13). At the same time, the share of nuclear remained at around 4.7% (Figure 8).

Through determined efforts to improve power diversification, China's thermal generation share has declined to a level (65%) compatible with APEC (63%) (Figure 9). Also, China is leading the world in both renewable and nuclear power capacity expansion. Statistics show that China accounted for nearly half of the net increase in global renewable generation capacity during 2022(IRENA Statistics, 2023). With at least 10 new nuclear power units approved every year since 2022, China accounts for almost half of the nuclear power capacity under construction worldwide (IAEA, 2025).

Figure 9: Electricity generation fuel share, China and APEC, 2022



Source: EGEDA (2024)

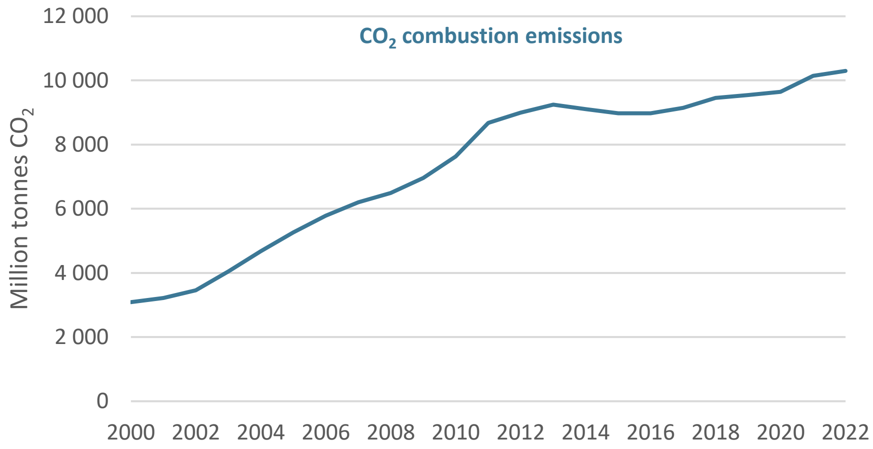
Energy transition

As an economy heavily reliant on coal, China faces a prominent challenge in meeting growing energy demand while working within a tight timeframe to achieve its dual carbon goals: reaching peak carbon emissions by 2030 and achieving carbon neutrality by 2060.

Emissions

For carbon dioxide peaking and carbon neutrality, China has put in place a "1+N" policy framework. "1" refers to the guiding idea and the top-level design for the above goals, outlined in two documents issued in 2021: *Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy* and *The Action Plan for Carbon Dioxide Peaking before 2030*. These documents articulate the schedules, roadmaps, and working procedures. The "N" represents the implementation schemes in key areas and sectors, such as energy, industry, transport, agriculture, and rural areas. Additionally, local governments have also implemented detailed schemes within their respective jurisdictions.

Figure 10: China's CO_2 combustion emissions (million tonnes), 2000 to 2022



Source: EGEDA (2024)

On the supply end, China is striving to accelerate building its non-fossil fuel capacity, advancing thermal power plant modifications to upgrade their efficiency and flexibility, as well as modernising the power system to elevate long-distance transmission capacity and expand energy storage. In 2024, China's combined solar and wind power capacity had met its 1.2 TW target six years ahead of schedule (CN Energy News, 2024).

On the demand side, China is shifting from controlling the volume and intensity of energy use to controlling the volume and intensity of carbon emissions. Energy efficiency benchmarks and standards have been raised in key industrial sectors and buildings. During 2021-2023, the energy consumption per unit of added value in large industrial enterprises decreased by 6.5%. In the transportation sector, China is increasing the share of railways and waterways and promoting new energy vehicles. By mid-2024, the number of registered new energy vehicles reached 25 million, expanding nearly six times from 2020, and more than 10 million charging facilities were in place (NDRC, 2024).

Energy Security

According to the 14th Five-Year Plan (FYP), safeguarding energy security is the prerequisite for building China's modern energy system. In 2014, President Xi Jinping proposed the New Energy Security Strategy aimed at revolutionising consumption, supply, technology, and institutions, while strengthening all-around international cooperation. This has established the fundamental principles for China's energy development.

China is enhancing the stability and security of its energy supply chain in three keyways. The first is to strengthen strategic security, which involves improving the domestic oil and gas supply and advancing coal-to-liquid and coal-to-gas technologies, as well as biofuel technology.

The second is to elevate the operational safety levels of thermal power plants and other energy infrastructure. In the short term, coal will continue to provide the ballast for China's energy security. The policy priorities are to optimise coal production capacity distribution, eliminate obsolete capacity, and accelerate the transformation of coal from the main power supply to a power source that provides basic support and flexibility to the domestic power system.

The third is to enhance emergency response capabilities. The main approaches include improving emergency power supply and accident recovery capabilities, strengthening cybersecurity management and control, and improving forecasting, early warning, and response to hazards.

APEC Energy Goals

There are two energy-related objectives that APEC member economies have agreed to meet as a collective: to improve energy intensity and double the share of modern renewables.

Energy Intensity Goal

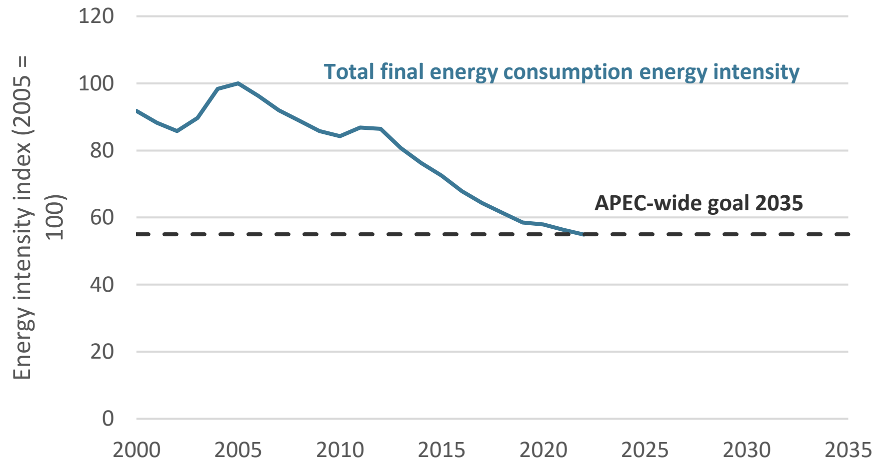
In 2011, APEC member economies agreed to increase their ambition to reduce energy intensity by 45% in 2035, relative to a 2005 baseline. The original goal was a 25% improvement by 2030, relative to a 2005 baseline.

APEC is on track to achieve this energy intensity improvement. The goal does not impose individual economy targets, but it is possible to track the progress of individual APEC economies relative to the overarching proportional improvement.

China has become one of the fastest economies to reduce energy intensity. The 14th FYP aims to reduce its energy intensity by 13.5% below 2020 levels by 2025. China has achieved a 7.3% reduction by 2023 (NDRC, 2024) and a further 3.8% reduction in 2024 (The State Council, 2025).

In 2022, China's total final energy consumption (excluding non-energy sources) energy intensity declined by 45% relative to the peak in 2005, already reaching APEC's set target (Figure 11).

Figure 11: China's total final energy consumption intensity index, 2000 to 2022 (2005 = 100)



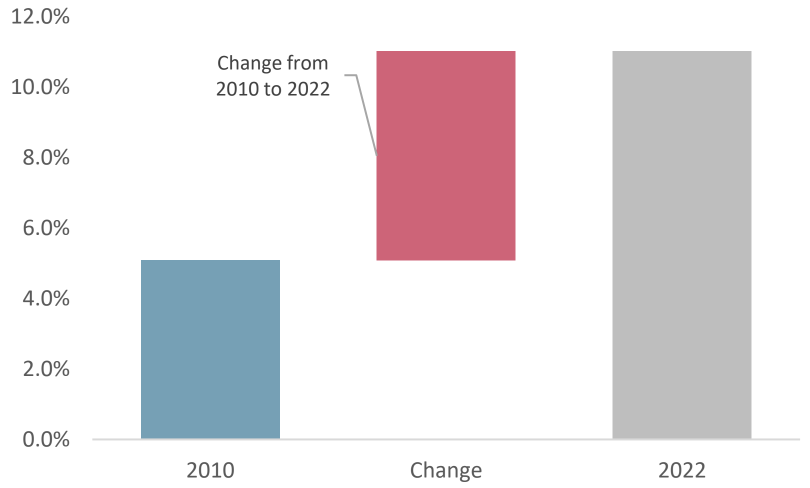
Source: EGEDA (2024)

Doubling of Renewables

The second energy goal involves doubling the share of modern renewables in the APEC energy mix for the period 2010 to 2030. There is no economy-level goal for individual member economies, but improvements by individual economies will contribute to the doubling goal.

China is leading the world in expanding wind and solar power, constructing both inland and offshore large-scale power bases, and promoting distributed power production (Figure 13). Meanwhile, modern renewables' share in final energy consumption in 2022 was 11%, more than double the 5.1% in 2010 (Figure 12).

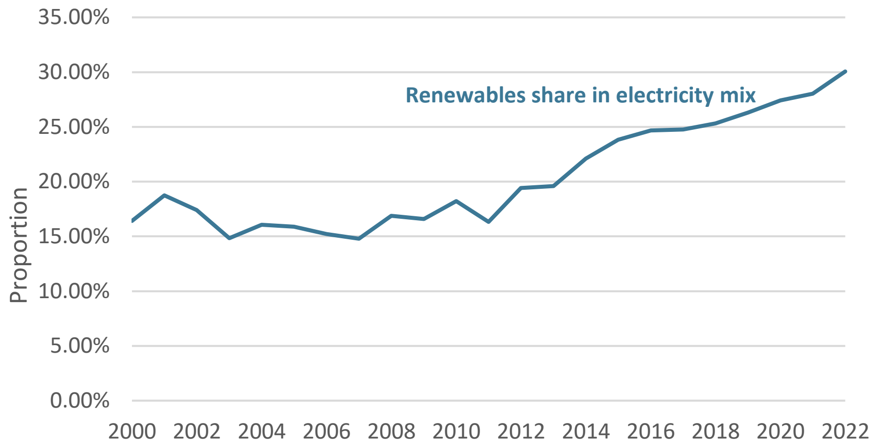
Figure 12: China's modern renewable energy share, 2010 and 2022



Source: EGEDA (2024)

Note: Biomass used in the residential and commercial sectors is assumed to be traditional biomass and is not included in the definition of modern renewables. All other renewables (biomass used by industry, hydro, geothermal, etc.) are considered modern renewables. Modern renewables also include the share of electricity that is generated from renewable sources.

Figure 13: China's renewable generation share, 2000 to 2022



Source: EGEDA (2024)

Energy Policy

Energy Policy	Details	Reference
The Energy Law	Aims to promote high-quality energy development, ensure the economy's energy security, accelerate the green transition, and support China's efforts to achieve carbon peak and carbon neutrality goals. It took effect on 1 January 2025.	The State Council
Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy	The Working Guidance provides guiding principles, guidelines, main objectives and measures to realize carbon dioxide peaking and neutrality.	The Economy Council of the People's Republic of China
Action Plan for Carbon Dioxide Peaking Before 2030	Outline measures for gradually slowing the emission of carbon, transitioning to renewable energy and reducing waste. Offers an overview of China's overall plan for reaching the 2030 goal.	The State Council
14th Five-Year Plan for a Modern Energy System	Clarifies the key tasks for the development of China's energy sector from 2021 to 2025.	NEA of China
14th Five-Year Plan on Renewable Energy Development (2021-2025)	Clarifies the key tasks for the development of China's renewable energy sector from 2021 to 2025.	NDRC
Comprehensive Work Plan for Energy Conservation and Emission Reduction in the 14th Five-Year Plan	Improves and implements the dual control system for energy consumption intensity and total volume and total discharge of major pollutants; organizes the implementation of key projects for energy conservation and emissions reduction.	The State Council
Guiding Opinions on Vigorously Implementing the Renewable Energy Substitution Initiative	Sets out a plan to accelerate renewable energy consumption to reach a goal of 1 billion tons of standard coal equivalent by 2025 and 5 billion tons by 2030.	NDRC
Action Plan for Low-Carbon Transformation Construction of Coal-Fired Power (2024-2027)	Enhances financial support for coal-fired power low-carbon transformation projects and aims to cut the carbon emissions of related projects by 20% by 2025 and 50% by 2027 compared to the average carbon emissions level of similar coal-fired power units in 2023.	NDRC
Action Plan to Accelerate the Construction of a New Power System (2024-2027)	Outlines steps to be taken in nine areas to increase the transmission of clean electricity through the grid, upgrade coal-fired power plants and expand charging infrastructure for electric vehicles.	The State Council
Action Plan for Energy Conservation and Carbon Reduction for 2024-2025	Aims to reduce energy consumption and carbon dioxide emissions per unit of GDP by approximately 2.5% and 3.9%, respectively, in 2024. The proportion of non-fossil energy consumption is expected to reach around 20% in 2025.	The State Council

Notable Energy Developments

Energy development	Details	Reference
Action Plan for Energy Conservation and Carbon Reduction for 2024-2025	Aims to reduce energy consumption and carbon dioxide emissions per unit of GDP by approximately 2.5% and 3.9%, respectively, in 2024. The proportion of non-fossil energy consumption is expected to reach around 20% in 2025.	The State Council
Energy Development Achievements from 2013 to 2023	Press conference held by the State Council Information Office to introduce the energy development achievements in the past ten years since the "New Energy Security Strategy" was adopted.	SCIO
China's Policies and Actions on Carbon Peaking and Carbon Neutrality (2023)	This report reviewed China's practices, progress and results in implementing the carbon peak and carbon neutrality strategy.	PRCEE
Top Ten Landmark Achievements of National Oil and Gas Exploration and Development in 2023	Top Ten Landmark Achievements of National Oil and Gas Exploration and Development in 2023 appraised by the National Energy Administration.	NEA of China
China's total nuclear power generation capacity tops world rankings	By November 2024, China had 58 million kilowatts of nuclear power units in operation, and 55 million kilowatts officially approved or under construction, making its total capacity the highest in the world.	The State Council

Useful links

Central People's Government – https://www.gov.cn/

National Development and Reform Commission – https://www.ndrc.gov.cn/

National Energy Administration – https://www.nea.gov.cn/

National Bureau of Statistics of China – https://www.stats.gov.cn/english/

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Hong Kong, China

Introduction

Hong Kong, China (HKC) is located on the south-eastern tip of China and consists of three main regions: Hong Kong Island, the Kowloon Peninsula, and the New Territories, along with 261 outlying islands. With the geographical constraint, HKC has limited indigenous energy resources, very small-scale biomass, solar and wind power generation. Its energy fuels almost entirely from external supplies, such as oil, gas, and coal products, or transformed secondary energy such as electricity, to meet its energy demand. Currently, electricity accounts for around 60% of HKC's energy demand.

In October 2021, as part of its Climate Action Plan 2050 (CAP2050), HKC announced its goal to halve its carbon emissions by 2035 compared with 2005 level and achieve carbon neutrality before 2050 through four major decarbonisation strategies: "net-zero electricity generation" and "energy saving and green buildings" that jointly reduce emissions from electricity generation, "green transport" and "waste reduction".

In the pursuit of carbon neutrality, the government announced the Strategy of Hydrogen Development in June 2024. Following that, the Chief Executive's 2024 Policy Address announced to promote development of new energy under the new Energy Transport Fund Scheme to subsidise public transport to purchase electric vehicles and for Trial of Hydrogen Fuel Cell Heavy Vehicles, successively. For aviation and maritime, a target will be set for sustainable aviation fuel (SAF) consumption, developing SAF and green maritime fuel supply chains, and promoting green and low-carbon hydrogen energy

Vehicle electrification is a critical initiative for HKC's decarbonisation. The government announced the Hong Kong Roadmap on Popularisation of Electric Vehicles in March 2021, setting the target to cease new registration of fuel-propelled and hybrid private cars in 2035 or earlier. Since public transport represents close to 90% of daily commutes in HKC (TLB, 2024), the government released the Green Transformation Roadmap of Public Buses and Taxis in December 2024 (EEB, 2024) to accelerate e-taxis and e-buses substitution.

Table 1: Hong Kong, China's macroeconomic data and energy reserves

Key data [a, b]		Energy reserves	
Area (km^2)	1 114	Oil (billion barrels)	-
Population (million)	7.3	Gas (trillion cubic feet)	-
GDP (2021 USD billion PPP)	470	Coal (million tonnes)	-
GDP per capita (2021 USD PPP)	64 039	Uranium (kilotonnes U < USD 130/kgU)	-

Source: a World Bank; b C&SD (2024)

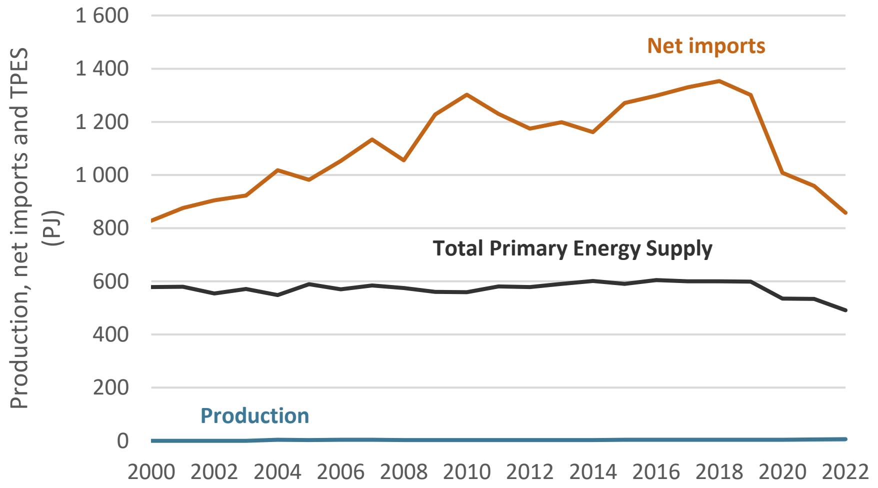
Note: Reserves are total proved reserves and reasonably assured recoverable resources for uranium.

Energy Supply and Consumption

Total Primary Energy Supply

HKC's total primary energy supply (TPES) remained stable at about 600 Petajoules (PJ) after 2000 before dropping to 535 PJ in 2020. In 2022, the TPES further declined to 491 PJ, 8.0% lower than the previous year and net imports dropped by 11%. The energy supply for bunkers dropped by 11% (Figure 1).

Figure 1: Hong Kong, China's energy supply, production, and net imports (PJ), 2000 to 2022

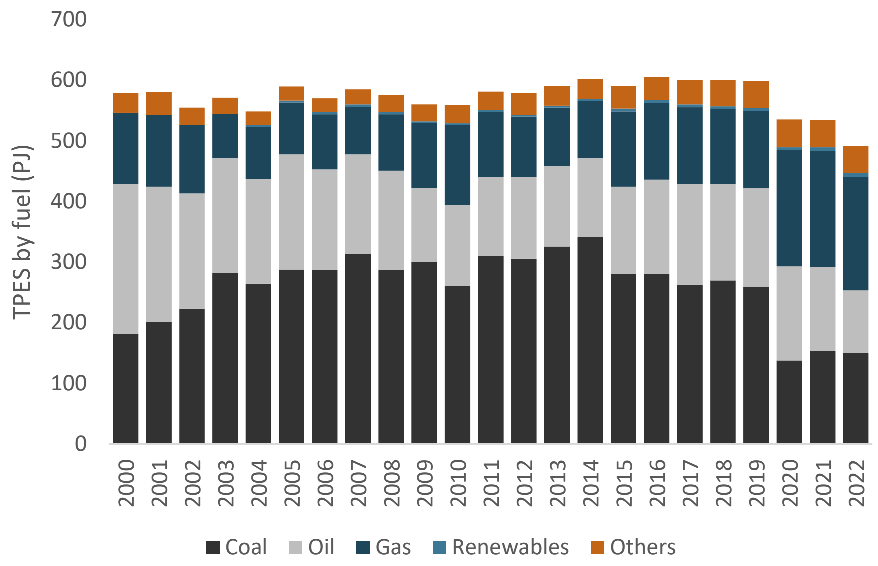


Source: EGEDA (2024)

Fossil fuels continued to dominate HKC's energy supply. Coal and gas supply remained at the same level compared with 2021, accounting for 31% and 38% of the TPES, respectively. In contrast, oil supply decreased by 26%, with its share dropping from 26% to 21%. This was mainly due to decreased energy consumption in the transport sector.

At the same time, renewables continued to expand and went up from 5.5 PJ in 2021 to 6.4 PJ in 2022, contributing to the growth in indigenous energy production (Figure 2).

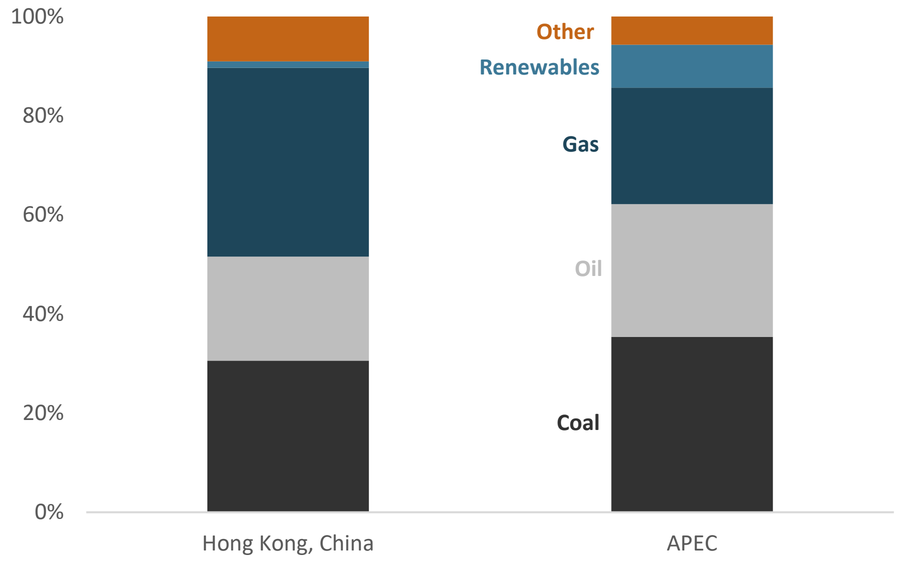
Figure 2: Hong Kong, China's energy supply by fuel (PJ), 2000 to 2022



Source: EGEDA (2024)

HKC's total primary energy supply structure shows a reliance on fossil fuels (90%), about four percentage points, slightly higher than the entire APEC region (86%) in 2022 (Figure 3). Due to its limited terrain, HKC's share of renewables was significantly lower than that of the APEC region.

Figure 3: Energy supply mix – Hong Kong, China's and APEC, 2022



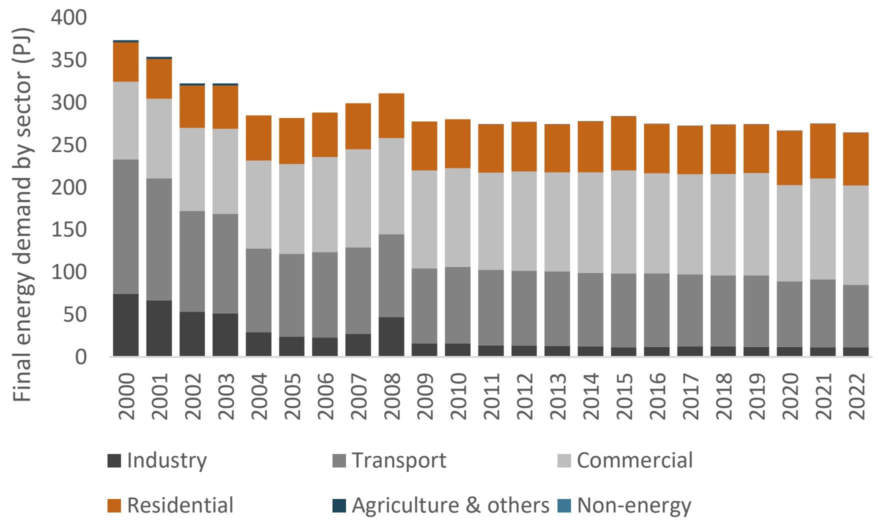
Source: EGEDA (2024)

Total Final Consumption

HKC's total final consumption declined by about a quarter from 374 PJ in 2000 to 282 PJ in 2005, driven by falling demand from the industry sector (Figure 4). Economic growth in HKC led to a steady growth of final consumption until it was disrupted by the financial crisis in 2008. Since then, the final consumption in HKC has stabilised at an average of 275 PJ. HKC's energy consumption dropped by 4% in 2020 after the outbreak of COVID-19 and then recovered in 2021 before dropping again by 4% in 2022.

As a service-based economy, 44% of HKC's 2022 energy consumption was in the commercial sector. Transport is the second largest consumption sector with a share of 28%. In 2004, the former surpassed the latter for the first time, becoming the largest final consumer of energy. The commercial sector has experienced steady growth since 2000, strengthened by HKC's important role in merchandise trade and commercial services. Meanwhile, the transport sector has slowly declined in energy consumption.

Figure 4: Hong Kong, China's final consumption by sector (PJ), 2000 to 2022

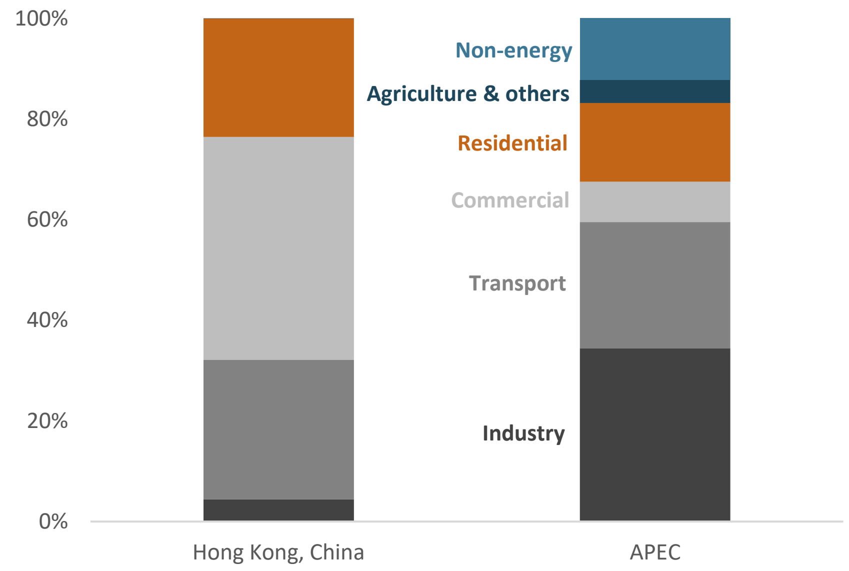


Source: EGEDA (2024)

In 2022, oil products still accounted for around 95% of transport final consumption. As of October 2024, over 16% of private cars were EVs, and the total number of EVs exceeded 100 000 by end the of 2024. It has a significant increase of around seven times that of five years ago (EEB, 2024). Apart from that, HKC is exploring the adoption of hydrogen in the energy sector and green fuels in the maritime industry. As vehicle efficiency increases with the switch of engines, the energy demand of the transport sector is expected to continue the downward trend.

HKC's commercial energy consumption share was around five times larger than the APEC region in 2022, as service activities have been the largest contributor to economic output since the 2000s. The transport sector's share was slightly higher than the APEC region, while industry, agriculture and other sectors' shares were much smaller (Figure 5).

Figure 5: Final consumption by sector, Hong Kong, China's and APEC, 2022



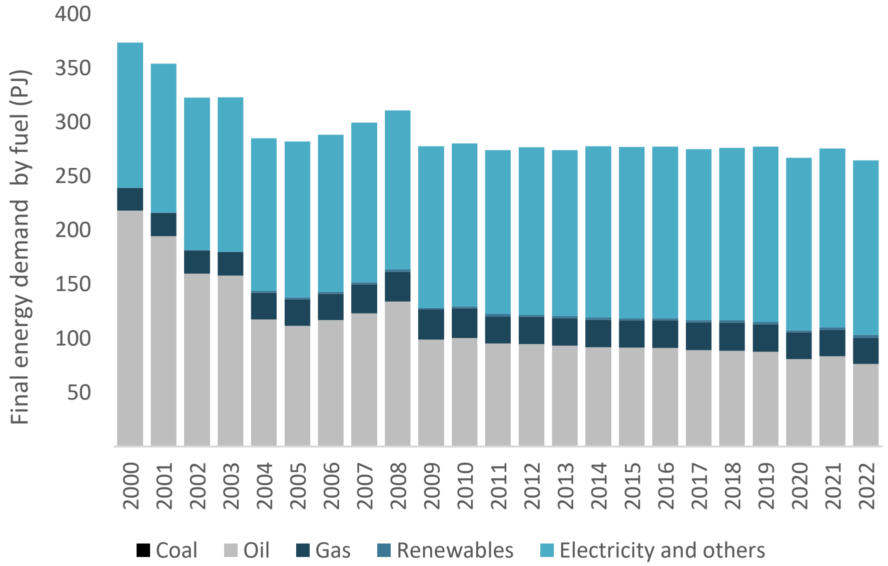
Source: EGEDA (2024)

Final Energy Demand

HKC's final energy demand has been dominated by the electricity and others category since 2004 with its share rising from 50% in 2004 to 61% in 2022. Since 2009, the share of oil gradually decreased from 43% to 29% in 2022. Gas and renewables accounted for 9% and 1%, respectively.

Renewables in the final energy demand hit a new high of 2.4 PJ in 2022 (Figure 6). The largest contribution comes from "biofuels and waste", which is also the largest indigenous renewable energy source in HKC.

Figure 6: Hong Kong, China's final energy demand by fuel (PJ), 2000 to 2022



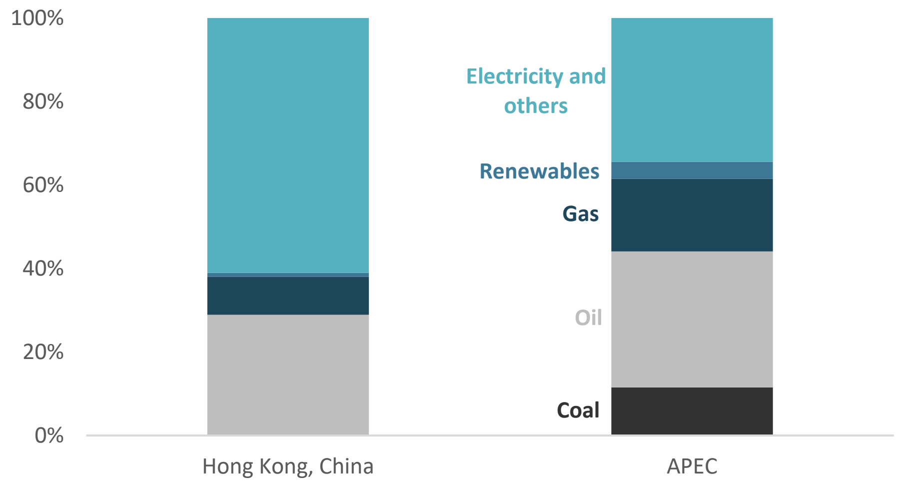
Source: EGEDA (2024)

Note: does not include non-energy sector consumption of energy products

With a relatively high level of electrification, HKC's electricity and others' share was almost double that of the APEC region in 2022

(Figure 7), with the electricity consumed mainly by the commercial and residential sectors. The shares of oil, gas, and renewables were smaller than those in the APEC region, and end-users in HKC did not consume coal in 2022.

Figure 7: Final energy demand fuel share, Hong Kong, China's and APEC, 2022



Source: EGEDA (2024)

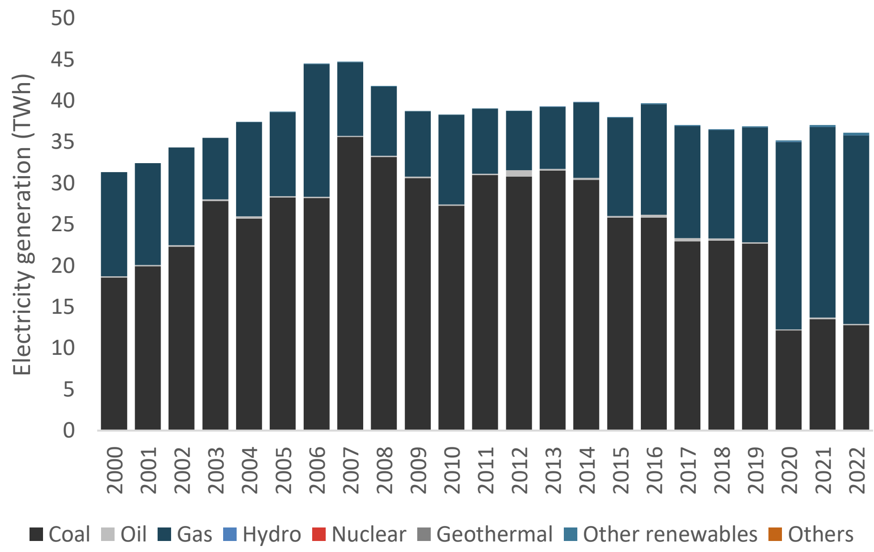
Transformation

Power Sector

HKC's indigenous electricity generation relies heavily on fossil fuels, with coal and gas together accounting for more than 99%. One of the targets to reduce carbon emissions in HKC's CAP2050 is to gradually phase out coal consumption in electricity generation by 2035. For the past decade, the power sector has made significant progress in shifting from coal to gas. The share of coal has gradually decreased from around 80% in 2013 to 35% in 2022 and the share of gas has increased from 20% to 63% (Figure 8) in the same period.

HKC aims to raise the share of zero-carbon energy in its electricity generation fuel mix to 60% to 70%, with a target of reducing total carbon emissions from 2005 levels by 2035. The Clean Energy Transmission System (CETS) enhancement project, scheduled to replace overhead lines by 2025, will provide HKC with greater flexibility to import more clean energy, to about 35% in fuel mix for electricity generation. Additionally, planned electricity facilities in the Tseung Kwan O Area 132 will provide a 30% increase by 2035.

Figure 8: Hong Kong, China's electricity generation by fuel, 2000 to 2022



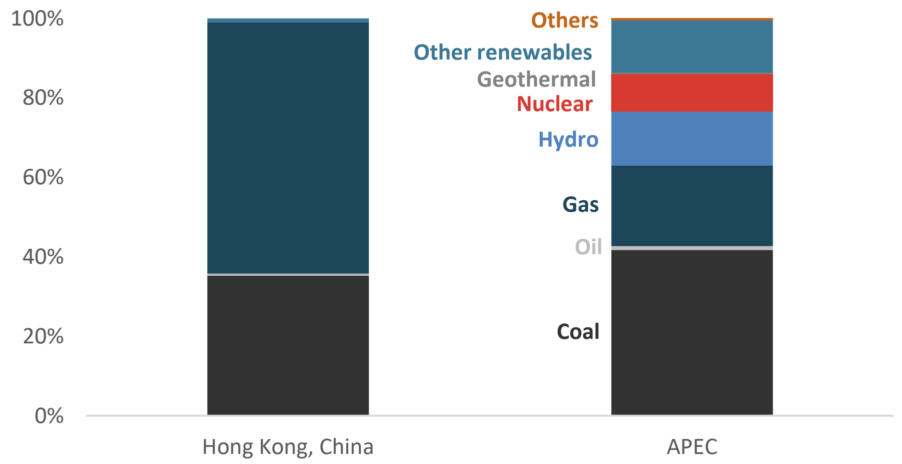
Source: EGEDA (2024)

Renewable power generation is primarily from waste, biofuel, and solar. In 2022, renewables generated 362 GWh of electricity and increased by 37% from 2021.

I•PARK1, located on the island of Shek Kwu Chau, is HKC's first waste-to-energy facility for treating municipal solid waste. With a daily treatment capacity of 3000 tonnes and an annual electricity generation of 480 GWh, it is expected to begin operations in 2025. Additionally, the contract for I•PARK2, which will have a daily treatment capacity of 6000 tonnes and an expected annual electricity generation of 960 GWh, is scheduled to commence in 2030.

HKC relies on imported fossil fuels to generate electricity and meet other energy demands. Most of the imported coal and gas in 2022 was transformed into electricity for final consumption. The dominance of both fuels in the power sector is apparent compared to the APEC region's generation mix in 2022 (Figure 9).

Figure 9: Electricity generation fuel share, Hong Kong, China’s and APEC, 2022



Source: EGEDA (2024)

Energy transition

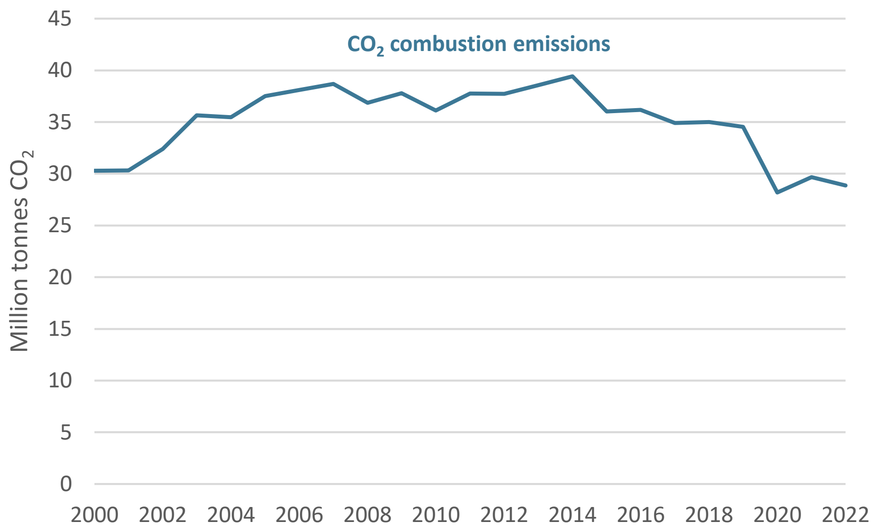
HKC has announced an ambitious plan to boost renewables despite the challenge of limited terrain and high population density. The government strives to increase their share in the fuel mix for electricity generation to 7.5% to 10% by 2035 and further increase this share to 15% subsequently through facilitating local renewable energy projects, regional cooperation, and joint ventures.

In 2018, the HKC government introduced the Feed-in Tariff Scheme to encourage the adoption of renewable energy. This initiative allows private sector entities to sell electricity generated from renewable sources to power companies at rates higher than standard electricity tariffs, thereby assisting in recovering the costs associated with renewable energy investments. By September 2024, approximately 26 000 applications had been approved, amounting to 414 GWh of electricity each year. In addition, the government approved HKD 2.2 billion for more than 250 projects to install renewable energy facilities at government buildings and facilities to generate around 26 GWh of electricity each year.

Emissions

HKC is on course to reduce its carbon emissions by 50% before 2035 as compared to the 2005 level. CO_2 emissions increased by about a third after 2000 and peaked at 40 million tonnes in 2014. Since then, CO_2 emissions have declined to 29 million tonnes in 2022 (Figure 10). This was achieved through various decarbonisation measures from both the supply and demand ends, including promoting EVs and energy-saving measures, constructing innovative waste-to-energy and waste-to-resources facilities, and reducing coal use in electricity generation.

Figure 10: Hong Kong, China's CO_2 combustion emissions (million tonnes), 2000 to 2022



Source: EGEDA (2024)

Energy Security

In securing energy fuel and electricity supply is at the heart of HKC's energy security. HKC started diversifying its gas sources by importing LNG through its first offshore LNG receiving terminal in mid-2023.

HKC keep exploring ways to enhance regional cooperation to increase the supply of zero-carbon electricity. More than a quarter of HKC's electricity demand is secured by imported zero-carbon energy from the nuclear power station located in Guangdong, China via an electrical grid interconnection with the China Southern Power Grid. A pumped storage power station with 600 MW capacity located in Guangdong also supporting the operation and security of HKC's electricity supply system.

APEC Energy Goals

There are two energy-related objectives that APEC member economies have agreed to meet as a collective: to improve energy intensity and double the share of modern renewables.

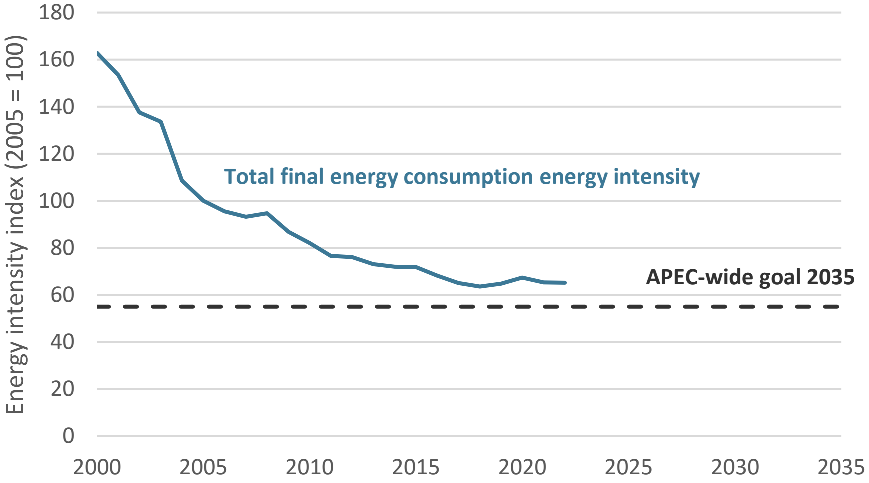
Energy Intensity Goal

In 2011, APEC member economies agreed to increase their ambition to reduce energy intensity by 45% in 2035, relative to a 2005 baseline. The original goal was a 25% improvement by 2030, relative to a 2005 baseline.

APEC is on track to achieve this energy intensity improvement. The goal does not impose individual economy targets, but it is possible to track the progress of individual APEC economies relative to the overarching proportional improvement.

Relative to the 2005 baseline, HKC's final energy consumption intensity declined by 35% from 2005 to 2022, about a 2% annual reduction. The energy intensity reduction in HKC has also contributed to the positive progress towards achieving APEC's energy intensity goal.

Figure 11: Hong Kong, China’s total final energy consumption intensity index, 2000 to 2022 (2005 = 100)

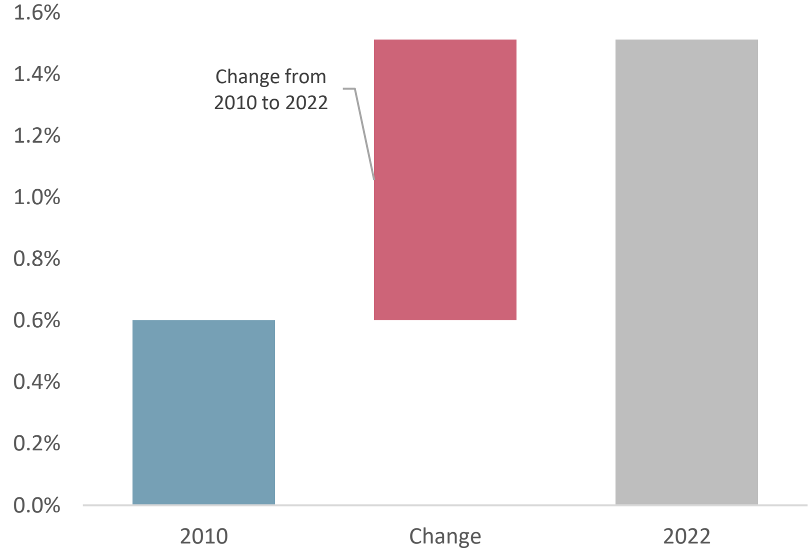


Source: EGEDA (2024)

Doubling of Renewables

The second energy goal involves doubling the share of modern renewables in the APEC energy mix for the period 2010 to 2030. There is no economy-level goal for individual member economies, but improvements by individual economies will contribute to the doubling goal.

Figure 12: Hong Kong, China’s modern renewable energy share, 2010 and 2022

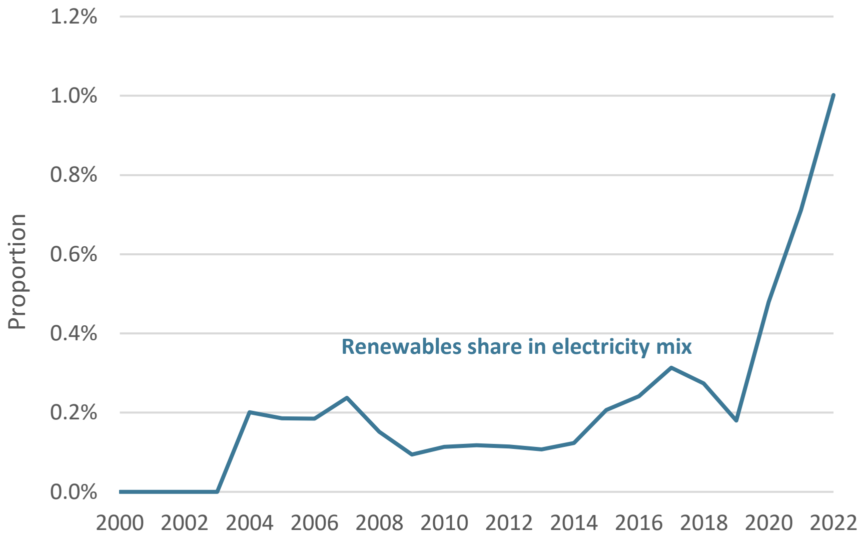


Source: EGEDA (2024)

Note: Biomass used in the residential and commercial sectors is assumed to be traditional biomass and is not included in the definition of modern renewables. All other renewables (biomass used by industry, hydro, geothermal, etc.) are considered modern renewables. Modern renewables also include the share of electricity that is generated from renewable sources.

HKC's share of modern renewables in final energy consumption reached around 1.5% in 2022, increasing by about 133% since 2010 (Figure 12). The renewables share in indigenous electricity generation is relatively low. Despite this, there was a rise from 0.11% to 1.00% over the same period (Figure 13).

Figure 13: Hong Kong, China's renewable generation share, 2000 to 2022



Source: EGEDA (2024)

Energy Policy

Energy Policy	Details	Reference
Green Tech Fund (GTF)	HKD 400 million has been allocated for setting up the GTF to provide better and more focused funding support for environmental protection.	GTF
New Energy Transport Fund (NTF)	The government has put in place a total of HKD 3 billion to subsidise transport trade and charitable/non-profit making organisations to try out innovative green transport technologies and to procure products using these technologies.	Environment and Ecology Bureau
Energy Efficiency Initiatives	Energy efficiency initiatives in HKC include the Mandatory Energy Efficiency Labelling Scheme (MEELS), the Voluntary Energy Efficiency Labelling Scheme (VEELS), the Building Energy Efficiency Ordinance (BEEO), the District Cooling System (DCS), and Retro-Commissioning.	MEELS
Renewable Energy Initiatives	Renewable energy initiatives in HKC include the Feed-in tariff and Renewable Energy Certificate, installing a number of large-scale renewable energy systems at government premises and many other major projects are being planned.	GOVHK
Scheme of Control Agreements (SCAs)	The SCAs promote the development of quality service by power companies and improve energy efficiency and energy conservation.	Environment and Ecology Bureau
A Memorandum of Understanding Between the National Energy Administration and HKC	An MoU where China provides HKC with a stable supply of natural gas and nuclear electricity.	Environment and Ecology Bureau
Energy-Saving Plan for Hong Kong's Built Environment 2015-2025+	This plan comprises energy-saving policy and strategies to achieve an energy intensity reduction of 40% from the 2005 level by 2025.	Environment and Ecology Bureau
Climate Action Plan 2030+ Report	Plans and measures across sectors to reduce carbon intensity by 65% to 70% from the 2005 level by 2030, equivalent to a 26% to 36% absolute reduction and a reduction to 3.3-3.8 tonnes on a per capita basis.	Environment and Ecology Bureau
Climate Action Plan 2050	Comprehensive plans and measures across sectors to achieve carbon neutrality before 2050.	Environment and Ecology Bureau
Hong Kong Roadmap on Popularisation of Electrical Vehicles	Measures related to electric vehicles to achieve zero vehicular emissions before 2050.	Environment and Ecology Bureau
Clean Air Plan for Hong Kong 2035	Comprehensive policies, measures, and long-term decarbonisation strategies to improve air quality.	Environment and Ecology Bureau

Notable Energy Developments

Energy development	Details	Reference
The Chief Executive's 2024 Policy Address	The government plans to further promote the development of new energy by setting a target for SAF consumption, developing SAF and green maritime fuel supply chains, and promoting green and low-carbon hydrogen energy.	Policy Address 2024
The Strategy of Hydrogen Development in Hong Kong	HKC announced this strategy on 17 June 2024. It sets out the four major strategies of improving legislation, establishing standards, aligning with the market, and advancing with prudence to create an environment conducive to the development of hydrogen energy.	CNSD
Funding Scheme to Trial of Hydrogen Fuel Cell (HFC) Heavy Vehicles	This HKD 750 million scheme was introduced under the NTF to subsidise the costs associated with trial projects such as the procurement of HFC vehicles, hydrogen fuel expenses, and refilling facilities. Applications are invited, starting from 19 December 2024.	Environment and Ecology Bureau
GTF	In the fourth application round, the GTF Assessment Committee approved three projects from 125 applications with a total grant of around HKD 14 million. The fifth round of GTF applications closes on 24 March 2025.	Green Tech Fund
Action Plan on Green Maritime Fuel Bunkering	The government has set out several targets, including reaching net zero emissions from international shipping by or around 2050. To achieve these targets, the action plan sets out five green-centric strategies and 10 actions. This document was released on 15 November 2024.	Transport and Logistics Bureau

Useful Links

GovHK of the Hong Kong Special Administrative Region Government – www.gov.hk/en

Electrical and Mechanical Services Department – www.emsd.gov.hk

Environment and Ecology Bureau – www.eeb.gov.hk

Environmental Protection Department – www.epd.gov.hk

Council for Sustainable Development – www.eeb.gov.hk/en/susdev/council/pastreports.htm

Climate Ready – cnsd.gov.hk/en/climate-ready/

Information on New and Renewable Energy (RE) – www.emsd.gov.hk/en/energy_efficiency/new_renewable_energy/index.html

Low Carbon Living Calculator – www.carboncalculator.gov.hk

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Indonesia

Introduction

As the largest economy in Southeast Asia in terms of land area, population, and total Gross Domestic Product, Indonesia's energy policy has a significant influence on the global economy and energy market. Following the inauguration of a new government in 2024, the economy is awaiting clarity on the new government's stance on the energy transition.

The previous administration was known for its strong commitment to environmentally sustainable energy policies, implementing several landmark initiatives, such as setting a Net Zero Emissions target, accelerating electric vehicle adoption, advancing bioenergy development, and relocating the capital from Jakarta to Nusantara, partially as a measure to address worsening air pollution in Greater Jakarta.

Indonesia also took a proactive role on the global stage. During the 2022 G20 Summit in Bali, it successfully secured a USD 20 billion funding commitment under the Just Energy Transition Partnership (JETP) framework, aimed at supporting the economy's shift towards cleaner energy (JETP, 2024). However, the realisation of this funding has been slow, hindered by bureaucratic challenges and global economic uncertainties. Geopolitical tensions coupled with global economic instability have further impeded Indonesia's energy transition. Investor confidence has weakened, delaying the influx of much-needed capital.

At COP29, held in Baku, Azerbaijan, Indonesia reaffirmed its commitment to the energy transition, reiterating ambitious targets for shifting from fossil fuel-based power generation to renewables. Nonetheless, the government struggled to secure substantial new funding, signalling potential stagnation in its transition efforts.

As of 2023, Indonesia remained heavily reliant on fossil fuels to power its economy, sustain its electricity grid, and support the transportation sector. Currently, fossil fuels still account for approximately 85% of the economy's power generation capacity, with only 15% coming from renewables (MEMR, 2024a). One of the most notable policy updates in the energy sector is the continuation and expansion of the biodiesel mandate. The economy increased the blending ratio from 35% (B35) to 40% (B40) in January 2025 (MEMR, 2024b).

While Indonesia's energy policies remain ambitious, implementation will largely depend on political will and global financial support.

Table 1: Indonesia's macroeconomic data and energy reserves

Key data [a, b]		Energy reserves [c, d]	
Area (million km^2)	1.9	Oil (billion barrels)	2.4
Population (million)	280	Gas (trillion cubic feet)	44
GDP (2021 USD billion PPP)	3718	Coal (million tonnes)	34 869
GDP per capita (2021 USD PPP)	13 495	Uranium (kilotonnes U < USD 130/kgU)	5.5

Source: a BPS-Statistics Indonesia (2024); b World Bank (2024); c Energy Institute (2023); d NEA (2023)

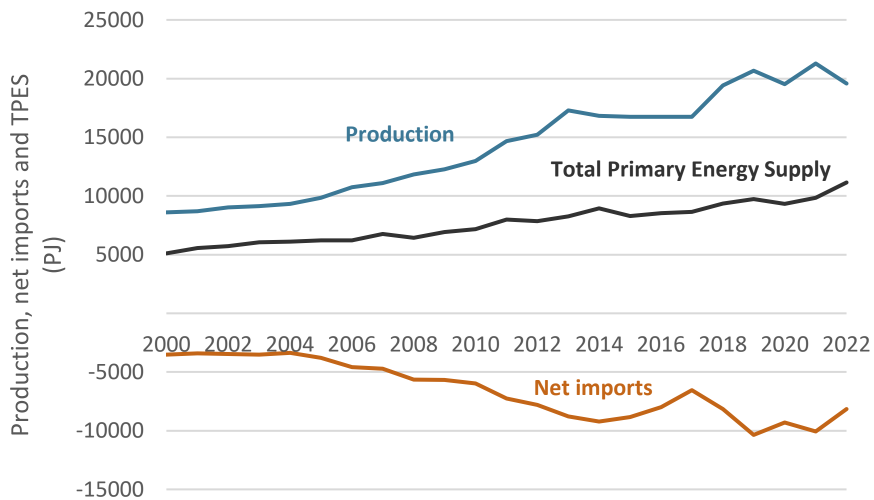
Note: Reserves are total proved reserves and reasonably assured recoverable resources for uranium.

Energy Supply and Consumption

Total Primary Energy Supply

In 2022, Indonesia maintained its status as a net energy exporter, with coal remaining the economy's most abundant energy reserve. Current estimates suggest that Indonesia's coal reserves will last for another 50 to 60 years, depending upon extraction rates and consumption trends. However, there is a growing risk that Indonesia may soon become a net energy importer due to rising domestic consumption, declining reserves, and the lack of major new discoveries of energy resources, particularly oil and gas.

Figure 1: Indonesia's energy supply, production, and net imports (PJ), 2000 to 2022



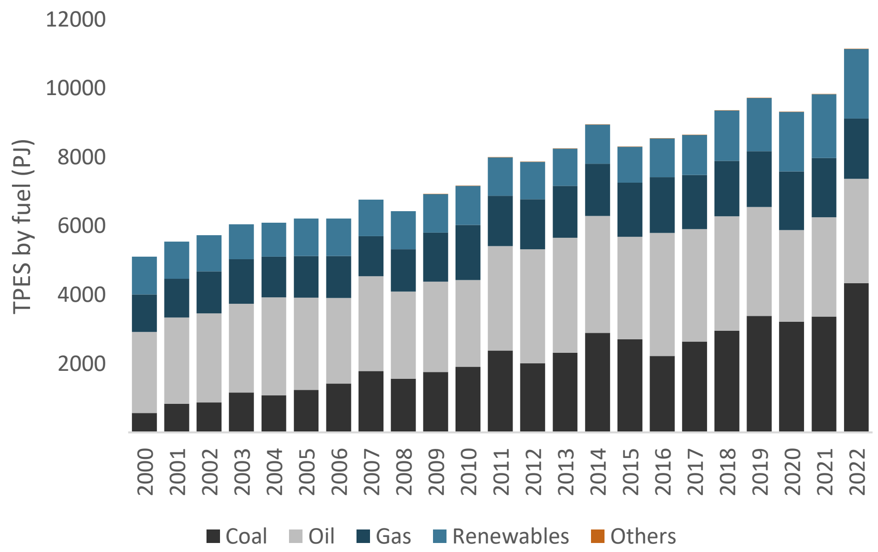
Source: EGEDA (2024)

Total Primary Energy Supply (TPES) in 2022 increased by 1317 PJ (13%) compared to 2021, reflecting higher energy consumption across all major sectors, including industry, transport, power generation, and residential use. This surge in demand highlighted Indonesia's growing reliance on energy to support its economic and industrial growth.

Despite the increase in demand, energy production declined significantly by 8.0% in 2022, primarily due to the declining output of crude oil and natural gas. This trend aligned with Indonesia's ongoing struggle with maturing oil and gas fields and the absence of large-scale discoveries to replenish depleting reserves.

At the same time, net energy imports decreased by 19% from 2021, driven by lower exports of crude oil and natural gas. This decline in exports reflected both reduced production and Indonesia's prioritisation of domestic energy needs over international sales.

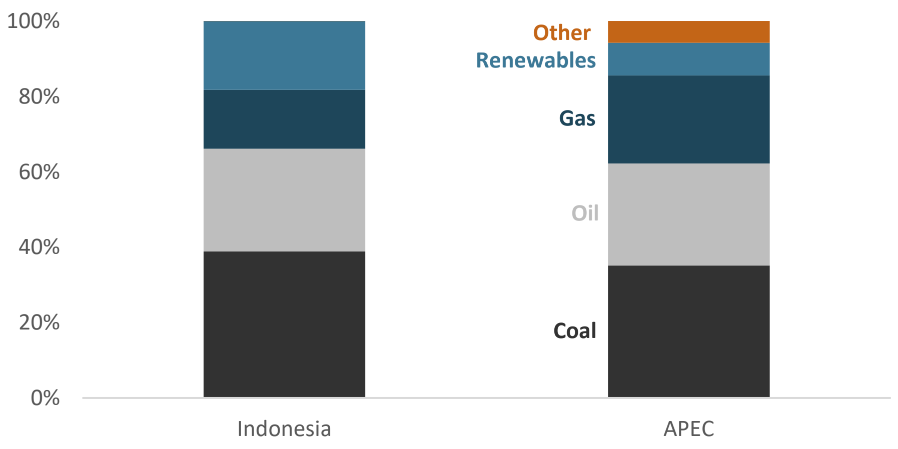
Figure 2: Indonesia's energy supply by fuel (PJ), 2000 to 2022



Source: EGEDA (2024)

Coal remained the dominant energy source, accounting for 39% of TPES in 2022, up from 34% in 2021. Coal also saw the highest growth among all fuel types, increasing by 971 PJ from 3366 PJ in 2021 to 4337 PJ in 2022. This reflected Indonesia’s continued reliance on coal for power generation and industrial processes, as well as due to rising electricity demand and higher coal-fired power plant output. Oil consumption grew by 146 PJ (5.1%), indicating higher demand in the transportation and industrial sectors, which was due to the recovery of economic activity after the COVID-19 slowdown. Natural gas usage remained relatively stable, indicating limited expansion in gas-fired power plants and industrial gas consumption. Continued growth in renewable energy by as much as 9.3% reflected a positive shift towards less carbon-intensive energy sources. This growth aligned with government policies promoting renewable energy, including increased biofuel blending, solar and hydro projects, and electrification initiatives.

Figure 3: Energy supply mix, Indonesia and APEC, 2022



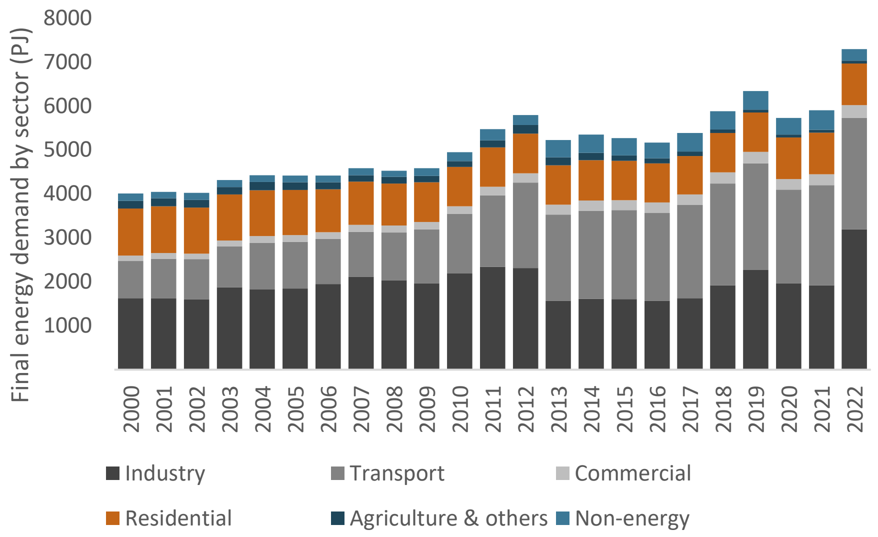
Source: EGEDA (2024)

Indonesia accounted for 5.4% of APEC's total energy production, making it a significant regional producer. While Indonesia's share of APEC's total coal supply was only 3.4%, it remained a major coal exporter, particularly to China; India, and Southeast Asia. Indonesia's oil supply (3030 PJ) and gas supply (1749 PJ) contributed only 3.1% and 2.1% of APEC’s total, respectively. This reflected Indonesia’s declining domestic oil and gas reserves and increased import dependence despite being a historic producer. Indonesia's renewable energy supply accounted for 6.4% of APEC's total, a higher proportion than its share in other fuels. Key sources included hydropower, biofuels, and geothermal energy; however, Indonesia still lagged behind in wind and solar deployment compared to other APEC economies.

Total Final Consumption

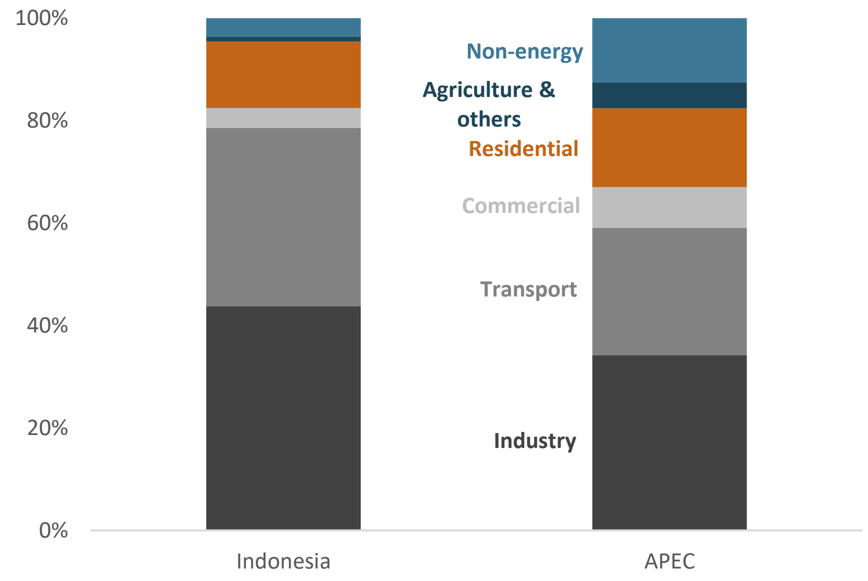
Industry and transport are the major drivers of consumption. The industry sector saw the most dramatic growth, as much as 66%, from 2021. This rise is due to the commencement of some new industrial facilities, such as automotive, iron, and steel. Transport consumption increased steadily, reflecting rising energy use for mobility as the economy developed. Residential consumption remained relatively stable but did see a slight increase over time, though 2022 showed stagnation compared to 2021 due to greater electrification and a decline in the use of biomass for cooking, both of which contributed to improved energy efficiency in households. The declining demand in the agriculture sector was probably due to shifts in energy sources or efficiency improvements.

Figure 4: Indonesia's final consumption by sector (PJ), 2000 to 2022



Source: EGEDA (2024)

Figure 5: Final consumption by sector, Indonesia and APEC, 2022



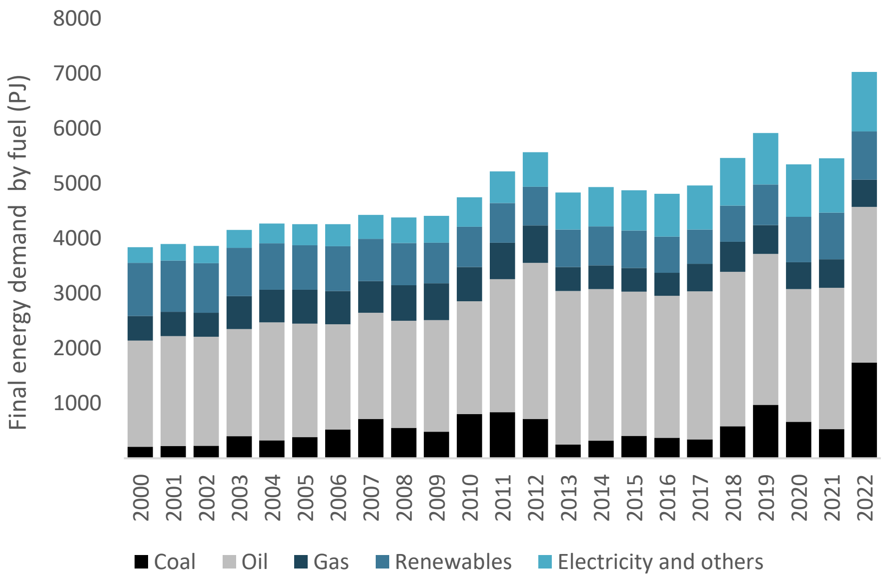
Source: EGEDA (2024)

The industry sector in Indonesia represented a larger share (44%) of total consumption than the APEC average (34%), due to its heavily industrialised economy. Transport was also a significant consumer of energy in Indonesia (35%), which was notably higher than APEC's average (25%), due to increasing mobility needs and road infrastructure development. The residential sector in Indonesia consumed a smaller share (13%) of total energy than APEC's average of 15%, reflecting that households in Indonesia used less energy compared to the broader region. Agriculture represented a smaller share of Indonesia's total energy consumption (0.9%) compared to APEC's share (5.0%), due to the traditional farming that is still very common in the economy.

Final Energy Demand

From 2021 to 2022, Indonesia's final energy demand showed a surge in coal consumption (more than double), indicating that coal is still an affordable and reliable energy source in the economy for electricity generation and industrial processes, especially in sectors such as cement, steel, and other manufacturing. Additionally, global energy prices in 2022 could have driven energy producers to favour coal over more expensive alternatives like natural gas. Oil experienced a moderate rise and was still very dominant, not only for transportation but also for industries like petrochemicals. 2022 saw a decline in gas usage, mainly due to cost competitiveness as volatile gas prices impacted domestic gas utilisation. Additionally, Indonesia's gas distribution and utilisation infrastructure is still developing, so this resource is not as accessible in certain regions of the economy.

Figure 6: Indonesia's final energy demand by fuel (PJ), 2000 to 2022

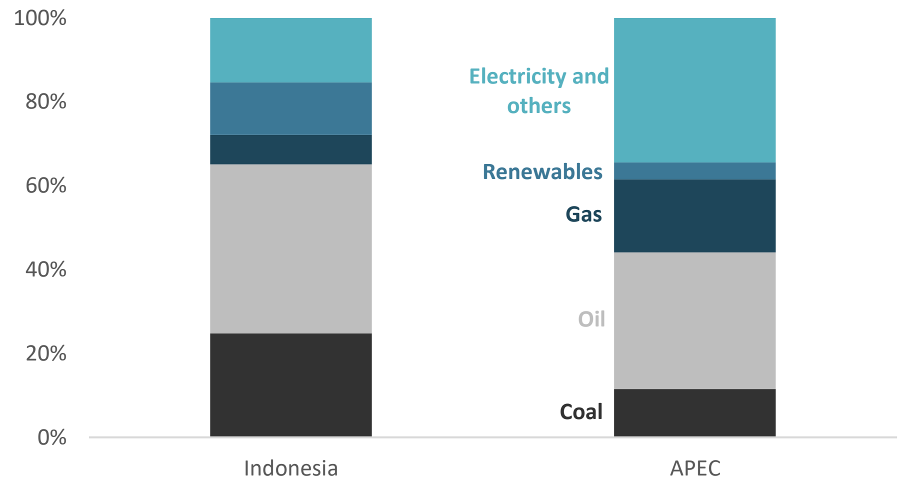


Source: EGEDA (2024)

Note: does not include non-energy sector consumption of energy products

Coal in Indonesia constituted 25% of the final energy demand in 2022, which was relatively high compared to global APEC averages. This was largely a result of Indonesia's heavy reliance on coal, which is abundant and relatively inexpensive. In comparison to Indonesia, the APEC region had a much smaller reliance on coal, at only 12% of final energy consumption.

Figure 7: Final energy demand fuel share, Indonesia and APEC, 2022



Source: EGEDA (2024)

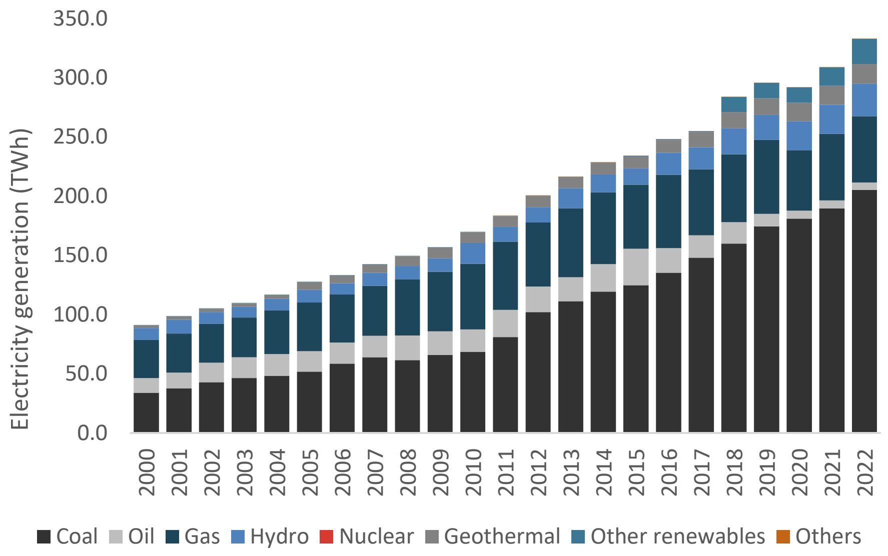
Indonesia's final energy demand consisted of 13% renewable energy, a significantly higher share than APEC's renewable energy mix, which accounted for just 4.0% of final energy demand. While this highlights Indonesia's commitment to the energy transition, it still falls short of the economy's 2025 target of 23% (which is potentially being revised to a lower percentage).

Transformation

Power Sector

Indonesia's total electricity generation reached 332 938 GWh in 2022, marking an 8.0% increase (24 TWh) from 2021, driven largely by economic recovery following the COVID-19 pandemic. Coal accounted for approximately 60% of total generation, supported by the addition of large coal-fired power plants such as Batang, Cirebon Expansion, and Tanjung Jati. Oil's share declined further to 1.8%, continuing its downward trend as Indonesia prioritised more economically viable alternatives.

Figure 8: Indonesia's electricity generation by fuel, 2000 to 2022

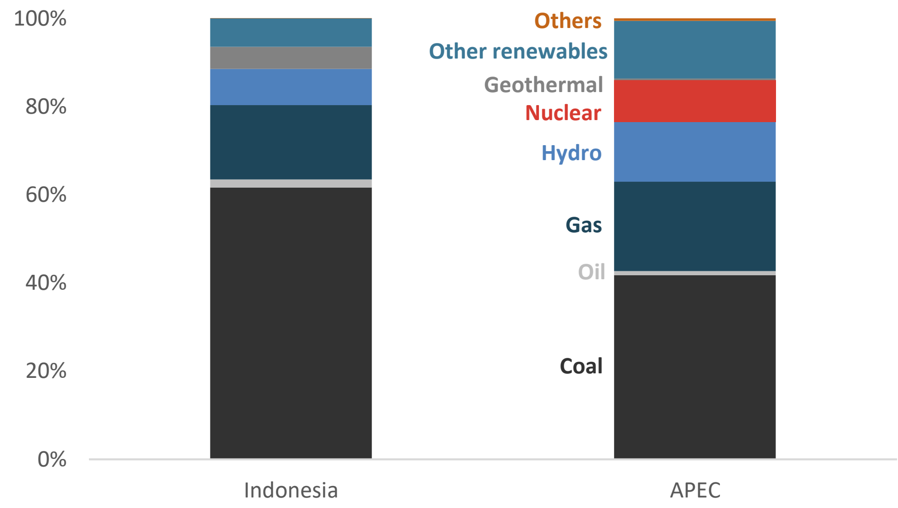


Source: EGEDA (2024)

Indonesia also increased its renewable energy generation, particularly through hydropower and geothermal energy. Indonesia's hydropower generation increased by 10% or 2.6 TWh between 2021 and 2022. Indonesia still has untapped potential in hydropower, but its growth is subject to the development of infrastructure and investment. Indonesia has abundant geothermal resources and has been making steady progress in utilising this potential for clean energy generation, but its expansion requires significant investment. In 2022, Indonesia's geothermal potential was estimated at around 23 gigawatts (GW), while the existing installed capacity stood at approximately 2.3 GW. Notable geothermal projects that began commercial operation in 2022 include Sorik Merapi and Rantau Dedap. By 2060, Indonesia is aiming for geothermal power to contribute around 5.0% of the total economy-wide power capacity, which is projected to reach approximately 23 GW (MEMR, 2024c).

Indonesia's electricity generation accounted for a small share of the APEC total, producing 332 938 GWh, only about 1.7% of APEC's overall electricity output. The share of renewables in APEC stood at 27%, significantly higher than Indonesia's 20%. This comparison highlights that, while Indonesia is making progress in renewable energy development, the APEC region as a whole has advanced further in the transition towards less carbon-intensive energy sources.

Figure 9: Electricity generation fuel share, Indonesia and APEC, 2022



Source: EGEDA (2024)

Refining

Indonesia's Refinery Development Master Plan (RDMP) is a strategic initiative aimed at enhancing economy-wide energy security by increasing domestic refining capacity and reducing reliance on imported refined fuels. The plan consists of two key components: the upgrading of existing refineries and the construction of new grassroots refineries.

As part of the RDMP, significant progress has been made in modernising existing facilities: The Indramayu Refinery's capacity increased from 125 kb/d to 150 kb/d in 2022, and the Balikpapan Refinery will expand from 260 kb/d to 360 kb/d by 2025. These upgrades not only boost capacity but also improve fuel quality to meet Euro IV and V standards. By 2025, Indonesia's total refining capacity is projected to reach approximately 1175 kb/d, marking an important step towards closing the gap between domestic fuel production and consumption.

On the other hand, the development of new grassroots refineries has faced considerable setbacks. Projects such as those in Bontang and Tuban were initially seen as critical to meeting long-term demand; however, key investors have pulled out, Mubadala from the Bontang project and Rosneft from the Tuban project, citing economic and strategic concerns. In the latest government update, the Tuban refinery has officially been discontinued due to economic feasibility issues, despite its potential to add 300 kb/d of capacity.

Indonesia currently meets around 40-50% of its fuel needs through imports, making the success of the RDMP crucial for reducing import dependency and enhancing energy sovereignty. While refinery upgrades have shown measurable progress, the challenges faced in executing grassroots projects underscore the need for stronger investment frameworks and improved regulatory certainty to attract and retain international partners.

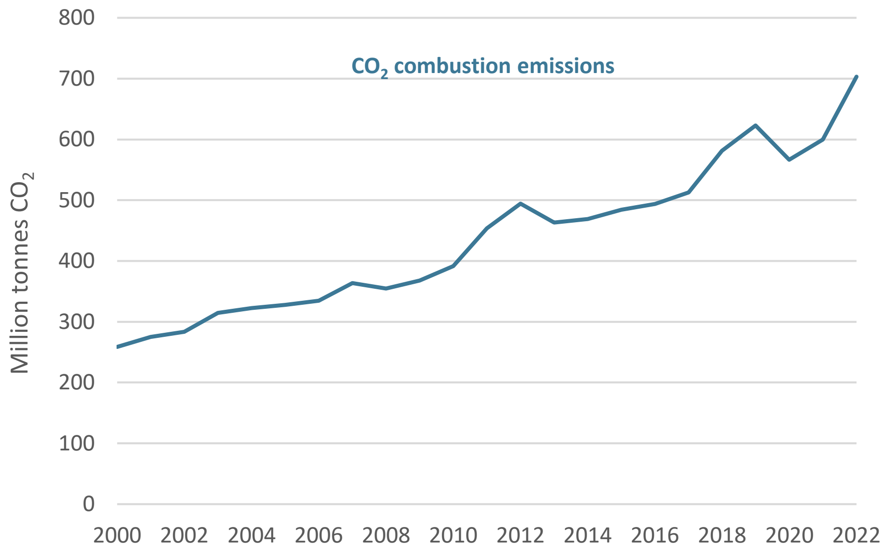
Energy Transition

At the 29th United Nations Climate Change Conference (COP29), Indonesia announced plans to develop 75 GW of renewable energy over the next 15 years. To support this ambitious goal, Indonesia is actively seeking international investment and collaboration. However, this target is seen as challenging, especially after the United States withdrew from the JETP. In February 2025, Germany revealed that it would replace the United States as the leader of JETP, offering new hope for the program. Germany, along with the European Union; Canada; Denmark; France; Italy; Norway and the United Kingdom, remains a part of the International Partnership Group, which continues to support JETP initiatives. Notable ongoing projects under this framework include the early retirement of the Cirebon coal-fired power plant (660 MW) and the development of a 275 kV interconnection in Sulawesi.

Emissions

Indonesia saw a significant increase of 103 Mt in CO_2 emissions from 2021 to 2022, one of the largest annual jumps in the economy's history. Several key factors contributed to this rise. First, Indonesia's GDP grew by 5.3% in 2022, up from 3.7% in 2021, driving higher energy demand. Second, coal production hit a record high of 687 million tonnes in 2022, as Indonesia continued to expand its coal power generation.

Figure 10: Indonesia's CO_2 combustion emissions (million tonnes), 2000 to 2022



Source: EGEDA (2024)

Energy Security

There is growing concern about energy security in Indonesia, particularly regarding the supply of oil and gas. Indonesia has been a net importer of oil since 2004, and the increasing demand for oil and petroleum products has led to greater dependency on imports and exposure to global price fluctuations.

Indonesia is on the brink of becoming an Liquified Natural Gas (LNG) importer by 2025 due to depleting domestic gas reserves and rising electricity demand. Although the economy has historically been a major LNG exporter, the shifting energy landscape and increasing reliance on gas for power generation have created a supply shortfall. The power sector is expected to be among the most affected, as gas becomes increasingly critical for flexible power generation. However, this rising demand is not being matched by supply, due to declining gas reserves, the absence of major new discoveries, and delays in key upstream gas development projects such as Masela and Indonesia Deepwater Development

To address these challenges, the Indonesian government is implementing several strategies, including strengthening the electricity grid, reallocating gas export allocations for domestic use, and accelerating the development of new gas fields. Despite these efforts, the economy faces significant hurdles, including global LNG price volatility, infrastructure constraints, and policy uncertainties. Moreover, Indonesia faces difficulties in securing financing for its LNG-related projects from developed economies. The G7 economies as well as multilateral banks, such as the Asia Development Bank Statement, are reluctant to provide financing for LNG-related projects, due to their commitments under the Glasgow Financial Alliance for Net Zero (GFANZ) (IEEJ, 2025).

APEC Energy Goals

There are two energy-related objectives that APEC member economies have agreed to meet as a collective: to improve energy intensity and double the share of modern renewables.

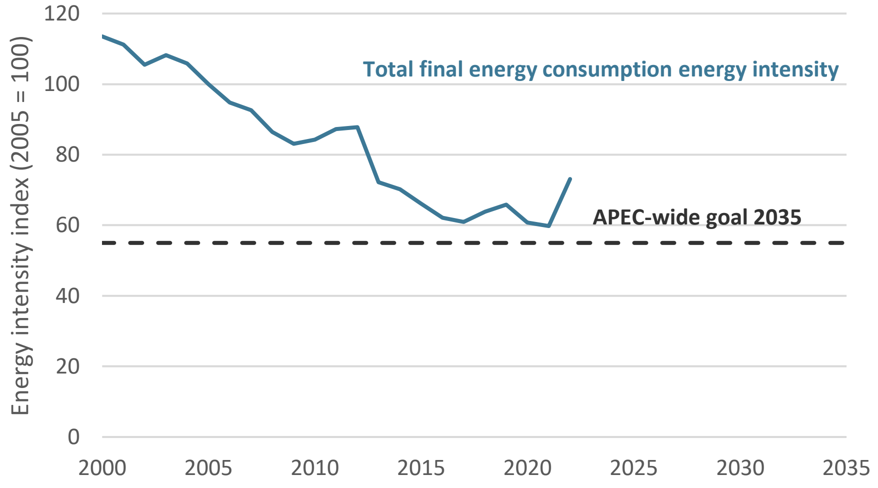
Energy Intensity Goal

In 2011, APEC member economies agreed to increase their ambition to reduce energy intensity by 45% in 2035, relative to a 2005 baseline. The original goal was a 25% improvement by 2030, relative to a 2005 baseline.

APEC is on track to achieve this energy intensity improvement. The goal does not impose individual economy targets, but it is possible to track the progress of individual APEC economies relative to the overarching proportional improvement.

Indonesia's energy intensity index, recorded at 61 in 2020 and 60 in 2022, suggests a consistent reduction trend, and it is likely to meet the APEC target by 2035, given the overall declining trajectory. However, a sudden increase in TPES by 13% in 2022 caused a spike in energy intensity. This surge in TPES can be attributed to the establishment of new industries, such as iron and steel, manufacturing, and automotive, which require significant energy inputs, primarily from coal.

Figure 11: Indonesia's total final energy consumption intensity index, 2000 to 2022 (2005 = 100)



Source: EGEDA (2024)

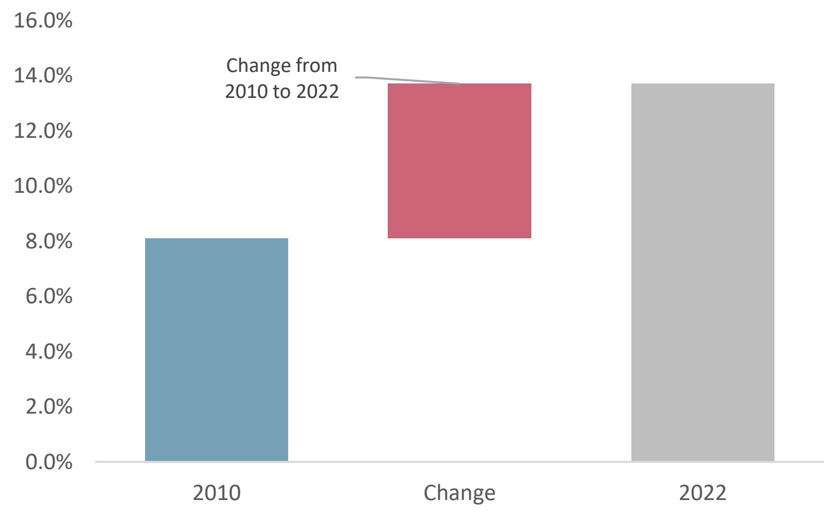
Additionally, while foreign direct investment can contribute to long-term economic growth, its impact on GDP is not immediate and typically requires a payback period, further contributing to the increase in energy intensity in the short term.

Despite these challenges, the overall trend remains positive, indicating improvements in energy efficiency over time. By 2035, Indonesia's energy intensity is expected to align with or fall below the APEC-wide target of 55.

Doubling of Renewables

The second energy goal involves doubling the share of modern renewables in the APEC energy mix for the period 2010 to 2030. There is no economy-level goal for individual member economies, but improvements by individual economies will contribute to the doubling goal.

Figure 12: Indonesia's modern renewable energy share, 2010 and 2022

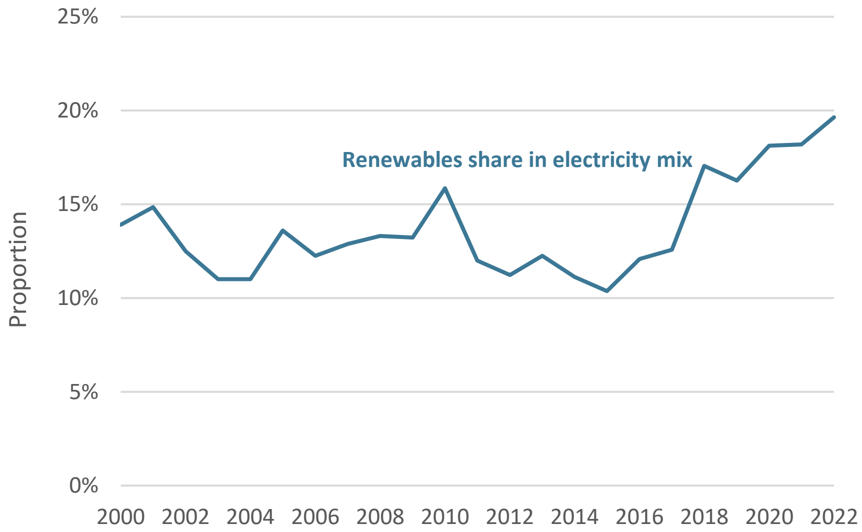


Source: EGEDA (2024)

Note: Biomass used in the residential and commercial sectors is assumed to be traditional biomass and is not included in the definition of modern renewables. All other renewables (biomass used by industry, hydro, geothermal, etc.) are considered modern renewables. Modern renewables also include the share of electricity that is generated from renewable sources.

Indonesia's renewable energy share in the energy mix increased from 8.1% in 2010 to 14% in 2022, marking a 5.6 percentage point growth over 12 years. To meet the APEC Energy Goal of 16% by 2030, Indonesia must achieve an additional 2.5 percentage points over the next eight years. This progress largely depends on structural reforms and infrastructure development, supported by policies and global investment.

Figure 13: Indonesia’s renewable generation share, 2000 to 2022



Source: EGEDA (2024)

From 2021 to 2022, the renewable share in Indonesia’s electricity mix increased from 18% to 20%, driven primarily by a 37% growth in other renewables (such as solar, biomass, wind, etc.) compared to 2021. This growth can be attributed to two key factors: the increasing capacity of other renewables and improved system flexibility.

The expansion of renewable capacity is primarily due to the development of ground-mounted solar photovoltaic (PV) by utilities and rooftop solar PV by the industrial sector, along with the growth of biogas and biomass power plants by Independent Power Producers .

In parallel, enhanced system flexibility has been achieved through grid upgrades and expansion, alongside the integration of more fossil power plants which increases the reserve margin. Better system flexibility enables better integration of Variable Renewable Energy (VRE) into the grid, reducing curtailment and ensuring greater utilisation of renewable energy production.

Energy Policy

Energy Policy	Details	Reference
General Plan of National Energy	Indonesia has renewable energy targets in the economy-wide energy mix of 23% in 2025 and 31% in 2050.	Ministry of Energy and Mineral Resources
General Plan of National Electricity 2025	Energy Mix for electricity production 2060 targets are 74% and for fossil fuel + CCS 26%.	Ministry of Energy and Mineral Resources
Enhanced Nationally Determined Contribution of Indonesia	A reduction target of 32% and a conditional reduction target of up to 43% of the business as usual scenario by 2030, with a reduction target of 13% for the energy sector and conditionally 16%.	UNFCCC
One million barrels of oil production	Program to increase domestic oil production through investment in new oilfields and the use of enhanced oil recovery. Through this approach, oil production is expected to increase from 705 000 bpd currently to 1 million bpd and gas production 12 BSCFD in 2030.	Ministry of Energy and Mineral Resources
Gas pricing policy for industry	The gas price for the industrial sector was reduced to USD 6.5-7.0/MMBTU.	Ministry of Energy and Mineral Resources
Gas pricing policy for electricity generation	The gas price for electricity generation was reduced to USD 7.0/MMBTU.	Ministry of Energy and Mineral Resources
Energy Management regulation	Ministerial Regulation about energy management to implement Presidential Regulation 33/2023 concerning energy conservation.	Ministry of Energy and Mineral Resources
Biodiesel blending rate program increased from 35% to 40%	Mandatory biodiesel blending program starting from a 10% blend rate in 2016, rising to a 20% rate in 2019, a 30% rate in 2020, a 35% rate in 2023, and 40% from January 2025 onward.	Ministry of Energy and Mineral Resources
Coal Domestic Market Obligation	Implementation of the Coal Domestic Market Obligation rate at 25% of each coal mining company's production with a selling price of USD 70 per ton for power production in 2022.	Ministry of Energy and Mineral Resources

Notable Energy Developments

Energy development	Details	Reference
Hyundai Group and LG Group Joint Venture of Electric Vehicle (EV) Battery Factory	Hyundai LG Indonesia Green Industry Co. started operating Battery EV factory in Karawang, West Java.	President Secretariat
Tambak Lorok Combined Cycle Gas Turbine (CCGT) Unit 3 779 MW	Tambak Lorok CCGT Unit 3, owned and operated by PLN, with a capacity of 779 MW, started commercial operations on 30 August 2024. It is a very strategic flexible power plant that will increase Java-Bali system strength and allow better integration of the VRE power plant.	Ministry of Energy and Mineral Resources
Largest Solar PV in Indonesia 100 MWp	Aurna Cahaya Pratama Solar Power Plant 100 MWp in Purwakarta, West Java, started commercial operations on 30 August 2024. It is the largest ground-mounted solar PV currently in Indonesia.	Ministry of Energy and Mineral Resources
Cirebon-Semarang Gas Pipeline Phase II	A gas pipeline project officially started that will connect Cirebon and Semarang and will also connect Java Island from east to west.	Ministry of Energy and Mineral Resources
Strategic Project 3.2 GW Inauguration	As many as 26 power plant development projects in 18 provinces with a total capacity of 3.2 GW were initiated as part of the energy transition program, along with infrastructure development across the economy.	Ministry of Energy and Mineral Resources
Refinery Development Master Program (RDMP) Balikpapan Refinery	The Balikpapan Refinery with an existing capacity of 100 kb/d is being upgraded to 360 kb/d. The upgrade is 92% complete and it will be finished in September 2025.	Ministry of Energy and Mineral Resources
Copper and Gold Smelter	A precious metal refinery (PMR) unit with a total capacity of 1.7 MT per day has started commercial operations in Gresik, East Java Province. This smelter is owned by PT Freeport Indonesia, a gold and copper mining company in Papua.	Ministry of Energy and Mineral Resources

Useful Links

Ministry of Energy and Mineral Resources – https://www.esdm.go.id/

BPH Migas, Downstream Oil and Gas Regulatory Agency – www.bphmigas.go.id

Directorate General of Electricity – www.djk.esdm.go.id

Directorate General of Oil and Gas – www.migas.esdm.go.id

Directorate General of New Renewable Energy and Energy Conservation – www.ebtke.esdm.go.id

Directorate General of Mineral and Coal – www.minerba.esdm.go.id National Energy Council – www.den.go.id

SKKMIGAS, Special Task Force for Upstream Oil and Gas – www.skkmigas-esdm.go.id

Ministry of Transportation – www.dephub.go.id

Ministry of Industry – www.kemenperin.go.id

PT Pertamina – www.pertamina.com

PT Pertamina Gas – www.pertagas.pertamina.com

PT PGN (Persero) – www.pgn.co.id

PT PLN (Persero) – www.pln.co.id

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Japan

Introduction

Japan is an archipelago comprising several thousand islands, with the largest ones being Honshu, Hokkaido, Kyushu and Shikoku. Its terrain is largely mountainous and densely forested. Japan boasts the world's fourth-largest economy after the United States; China; and Germany.

In 2022, Japan's real gross domestic product (GDP) was approximately USD 5.7 trillion (2021 USD purchasing power parity [PPP]) (World Bank, 2024) (Table 1). With a population of 125 million, the economy enjoyed a per capita income of more than USD 45 000, a 1.4% increase from 2021, indicating a modest economic recovery post-pandemic (World Bank, 2024) (Table 1). However, Japan faces long-term challenges, including an ageing population and a shrinking workforce, which may limit future economic growth. Although it boasts significant economic strength, Japan has modest energy resources, relying on imports for most of its fossil fuel needs. The economy's proven reserves include approximately 44 million barrels of oil, 738 billion cubic feet (bcf) of natural gas and 350 million tonnes (Mt) of coal (Xu & Bell-Hammer, 2023; EI, 2024) (Table 1).

The Japanese Government periodically devises a Strategic Energy Plan to steer Japan's energy policy. The latest, the 7th Strategic Energy Plan, was approved in February 2025 (METI, 2024a). It sets ambitious targets for Japan's energy mix by 2040, including increasing the share of renewable energy to 40-50%, nuclear power to 20%, and maintaining fossil fuels at 30-40% (METI, 2024a). Moreover, the updated Nationally Determined Contributions (NDC) under the Paris Agreement reinforce Japan's commitment to reducing greenhouse gas (GHG) emissions. It aims to reduce GHG emissions by 60% by 2035 and 73% by 2040, compared to 2013 levels (METI, 2024a). In parallel, Japan has introduced key policies to support its energy transition, such as the GX2040 Vision, which outlines a transformative roadmap for Japan's Green Transformation (GX) strategy, balancing stable energy supply, economic growth, and decarbonisation efforts.

Table 1: Japan's macroeconomic data and energy reserves

Key data [a, b]		Energy reserves [c, d]	
Area (thousand km^2) [a]	378	Oil (million barrels) [c]	44
Population (million) [b]	125	Gas (billion cubic feet) [c]	738
GDP (2021 USD billion PPP) [b]	5653	Coal (million tonnes) [d]	350
GDP per capita (2021 USD PPP) [b]	45 175	Uranium (kilotonnes U < USD 130/kgU) [e]	6.6

Source: [a] GIS (2022); [b] World Bank (2024); [c] Xu & Bell-Hammer (2023); [d] EI (2024); [e] NEA & IAEA (2023)

Note: Reserves are total proved reserves and reasonably assured recoverable resources for uranium.

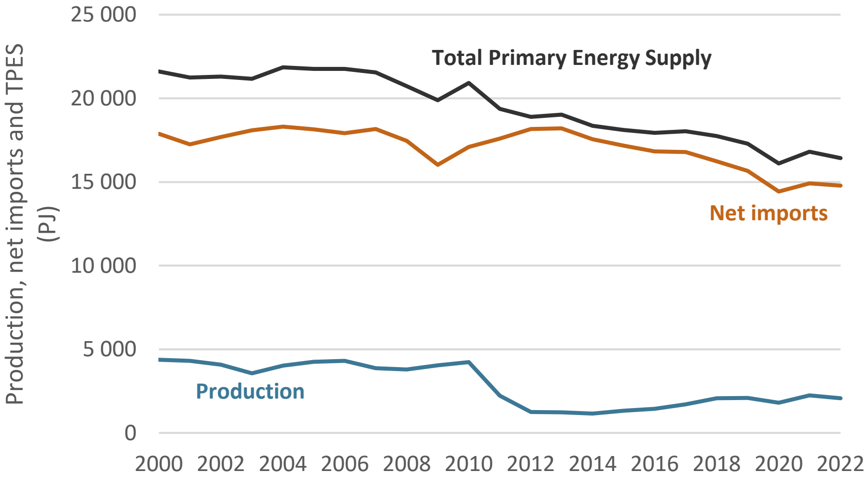
As of December 2024, 1127 local governments, including major cities like Tokyo, Kyoto and Yokohama, had committed to achieving net zero emissions by 2050 (MOE, 2024). This marked a significant increase from the 1013 local governments that made this commitment by December 2023, demonstrating growing momentum at the local level towards advancing decarbonisation goals.

Energy Supply and Consumption

Total Primary Energy Supply

In 2022, Japan's total primary energy supply (TPES) stood at 16 428 petajoules (PJ), reflecting a 2.3% decrease from 2021 (Expert Group on Energy Data Analysis [EGEDA], 2024) (Figure 1). This decrease was part of a broader trend, with TPES falling by 2.0% annually since 2010. The decline was primarily due to reduced demand resulting from various factors, including the post-Fukushima nuclear shutdown, improvements in energy efficiency, slower economic growth, the ageing population, fluctuations in global energy prices, and Japan's ongoing efforts to decarbonise its energy sector.

Figure 1: Japan's energy supply, production, and net imports (PJ), 2000 to 2022

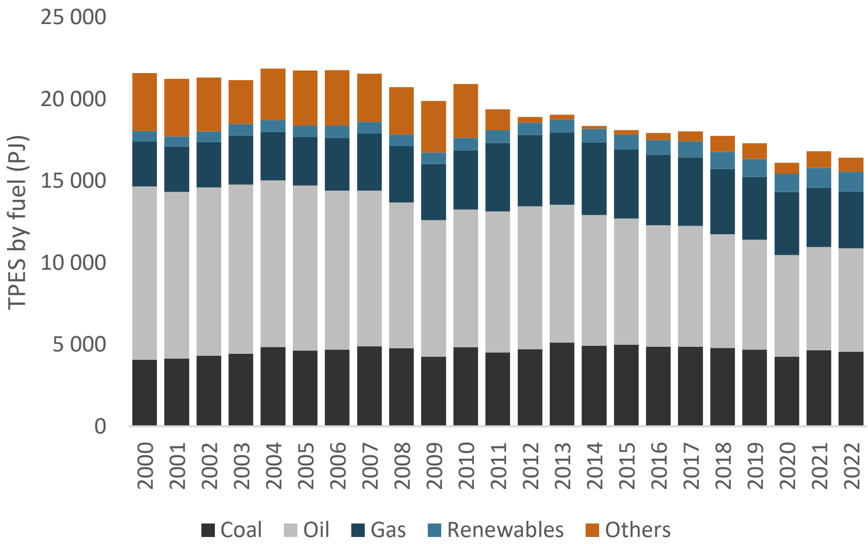


Source: EGEDA (2024)

Despite the overall reduction in TPES, the share of fossil fuels in

Japan's energy mix remained largely consistent between 2021 and 2022. Oil continued to be the dominant energy source, with its supply rising slightly by 0.1%, reaching 6316 PJ in 2022, which increased its share from 37% to 38% (EGEDA, 2024) (Figure 2). Coal supply decreased by 2%, reaching 4560 PJ in 2022, with its share remaining stable at 28% (EGEDA, 2024) (Figure 2). Similarly, the natural gas supply dropped by 4.5%, totalling 3467 PJ in 2022, and its share fell from 22% to 21% (EGEDA, 2024) (Figure 2). Fossil fuels alone constituted 87% of the TPES (EGEDA, 2024).

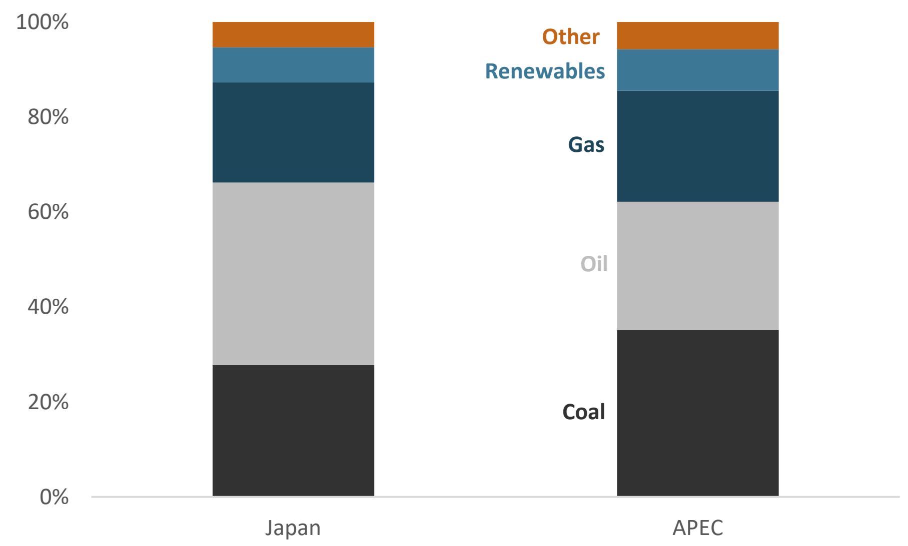
Figure 2: Japan's energy supply by fuel (PJ), 2000 to 2022



Source: EGEDA (2024)

Japan's reliance on energy imports remained high, with net imports decreasing slightly by 0.9% in 2022, totalling 14 777 PJ (EGEDA, 2024) (Figure 1). This continued import dependency highlights Japan's ongoing vulnerability to fluctuations in global energy markets, particularly in the face of rising fossil fuel prices. The Middle East accounted for 94% of Japan's total oil imports in 2022, with Saudi Arabia supplying 39% and the United Arab Emirates providing 38%, making them the two largest contributors (METI, 2024b). For natural gas, Australia remains the largest supplier, providing 43%, followed by Malaysia at 17% (METI, 2024b). Coal imports are dominated by Australia, which accounts for 66%, with Indonesia contributing 14% (METI, 2024b). Despite this ongoing reliance on fossil fuels, Japan is making significant efforts to diversify its energy sources and reduce dependence on imports by increasing its renewable energy supply.

Figure 3: Energy supply mix, Japan and APEC, 2022



Source: EGEDA (2024)

Renewable energy supply continued to rise in 2022, reaching 1215 PJ, a modest increase of 1.0% from the previous year (EGEDA, 2024) (Figure 2). This growth, averaging 3.9% annually since 2010, highlights the increasing role of renewables in Japan's energy transition. As the share of renewables in TPES continues to grow, Japan is making notable progress in diversifying its energy mix and reducing its dependence on fossil fuels.

The comparison between Japan's energy supply mix and the APEC region reveals distinct differences in Japan's energy profile. Japan has a notably higher reliance on oil, with its share 11 percentage points greater than that of the APEC region (EGEDA, 2024) (Figure 3). This highlights Japan's ongoing dependence on oil as a primary energy source, particularly in the transport sector. At the same time, Japan's share of coal is 7.4 percentage points lower than the APEC region, reflecting its efforts to reduce coal consumption, due to environmental concerns and policy shifts aimed at decarbonising the economy.

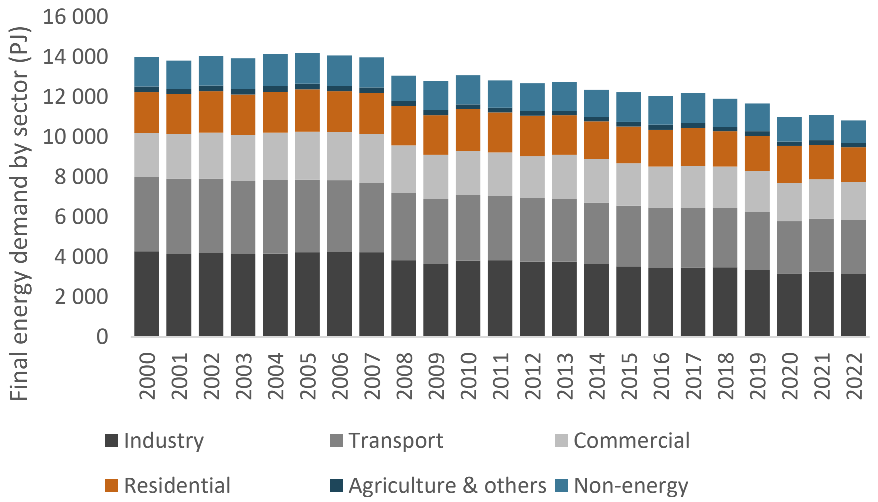
Similarly, Japan's lower reliance on natural gas, with a 2.2 percentage points smaller share than the APEC region, reflects a shift towards cleaner energy alternatives, though natural gas remains a significant part of its energy mix (EGEDA, 2024) (Figure 3). Conversely, Japan's share of renewables is 1.3 percentage points lower than that of the APEC region, but the economy continues to make incremental progress in increasing the share of renewable energy in its overall supply. This shift is in line with Japan's long-term energy transition strategy, though challenges such as land availability and grid integration remain.

Total Final Consumption

In 2022, Japan's total final energy consumption (excluding non-energy uses) decreased by 1.3% from the previous year, totalling 9702 PJ (EGEDA, 2024) (Figure 4). Including non-energy use, total final consumption fell by 2.5% from the previous year, reaching 10 827 PJ (EGEDA, 2024) (Figure 4). This marked a continuation of the long-term trend of a 1.6% annual decrease in total final consumption since 2010

(EGEDA, 2024) (Figure 4). The decline in demand across sectors reflected ongoing economic and demographic shifts, with the energy efficiency measures continuing to take effect, particularly in the industry and residential sectors. However, the transport sector showed a slight increase of 1.8%, signalling a recovery in energy demand as economic activity rebounded after pandemic-related disruptions. This uptick in the transport sector is notable, as it contrasts with the overall decrease in other sectors, indicating a shift in energy usage patterns as the economy resumed activity.

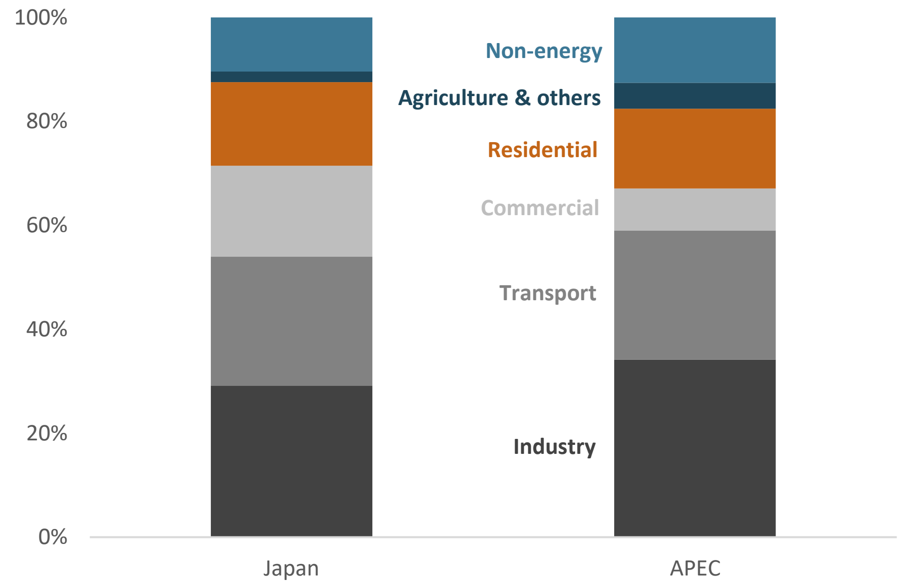
Figure 4: Japan's final consumption by sector (PJ), 2000 to 2022



Source: EGEDA (2024)

In terms of sectoral breakdown, Japan's industrial sector accounted for 29% of total final consumption, 5.1 percentage points lower than the APEC region's share (EGEDA, 2024) (Figure 5). Meanwhile, the transport (25%) and residential (16%) sectors had similar shares to the APEC region, suggesting that Japan's demand patterns in these sectors are largely in line with regional trends (EGEDA, 2024) (Figure 5). The commercial sector, however, consumed 18% of total final consumption in Japan, which was 9.5 percentage points higher than the APEC region's share (EGEDA, 2024) (Figure 5). This higher consumption in the commercial sector reflects Japan's energy use patterns, which may be driven by high energy demands in urban infrastructure and service-oriented industries. Meanwhile, the non-energy sector saw the largest decrease, with consumption dropping by 145 PJ from 2021 (EGEDA, 2024). This decrease reflected the ongoing effort to reduce feedstocks driven by continued energy efficiency measures and changes in industrial practices.

Figure 5: Final consumption by sector, Japan and APEC, 2022

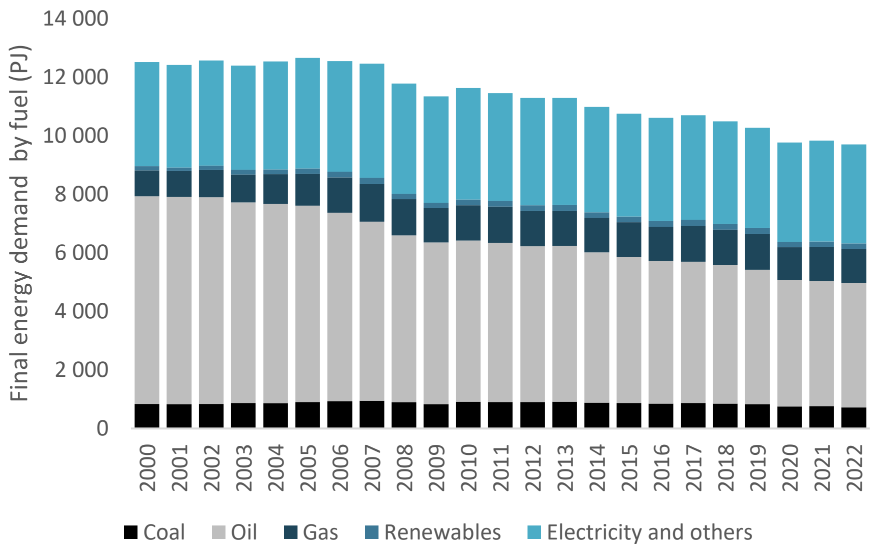


Source: EGEDA (2024)

Final Energy Demand

In 2022, oil consumption remained stable at 4262 PJ, maintaining its dominant share of 44% in Japan's final energy demand (EGEDA, 2024) (Figure 6). This stability contrasts with the decline in other fuels, such as coal, gas and electricity. Coal consumption fell by 6.3%, totalling 1027 PJ, while gas consumption decreased by 1.7%, amounting to 578 PJ (EGEDA, 2024) (Figure 6). Electricity and other energy sources saw a decline of 1.8%, contributing 1898 PJ to the mix (EGEDA, 2024) (Figure 6).

Figure 6: Japan's final energy demand by fuel (PJ), 2000 to 2022

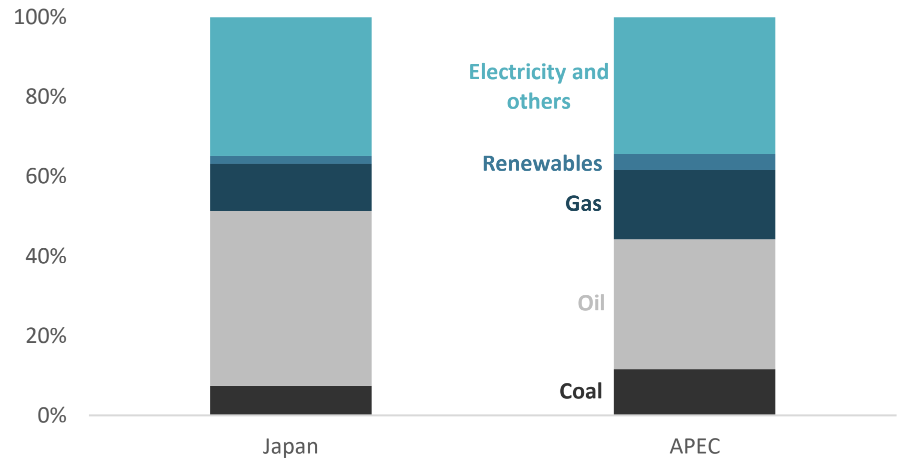


Source: EGEDA (2024)

Note: does not include non-energy sector consumption of energy products

In contrast, renewable energy consumption increased by 3.9%, reaching 1215 PJ, signalling continued efforts towards decarbonising and diversifying Japan's energy supply (EGEDA, 2024). This growth in renewables, though encouraging, remains a small portion of total final energy demand, reflecting the challenges Japan faces in scaling up renewable energy technologies at a faster pace. Looking at long-term trends since 2010, Japan has seen consistent annual reductions in fossil fuel consumption, with coal declining at 2.0% per year, oil at 2.1% and gas at 0.3% (EGEDA, 2024) (Figure 6). Meanwhile, renewables have grown at an annual rate of 4.6%, highlighting Japan's ongoing transition towards cleaner energy sources (EGEDA, 2024).

Figure 7: Final energy demand fuel share, Japan and APEC, 2022



Source: EGEDA (2024)

When comparing Japan's final energy consumption shares by fuel to the APEC region in 2022, oil's share is notably higher in Japan, accounting for 44%, which is 11 percentage points more than the APEC region (EGEDA, 2024) (Figure 7). In contrast, coal consumption in Japan is 4.2 percentage points lower, and gas consumption is 5.5 percentage points lower than in the APEC region, reflecting Japan's efforts to reduce reliance on these fossil fuels (EGEDA, 2024). However, Japan's share of renewables is two percentage points lower than the APEC region, indicating that while progress has been made, there is still room for further growth in integrating renewable energy sources into Japan's overall energy mix. The overall energy demand structure shows Japan's continued reliance on oil while making strides in reducing fossil fuel dependence and increasing the role of renewables.

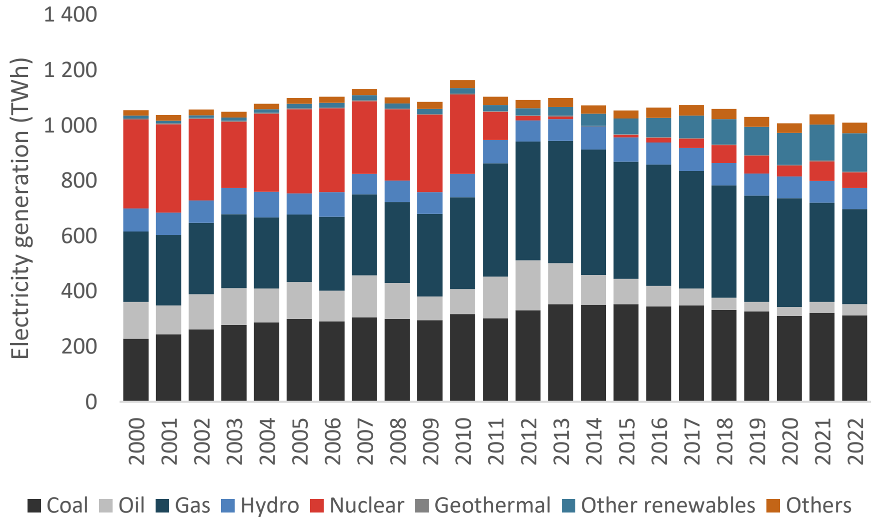
Transformation

Power Sector

As of fiscal year 2022, Japan's total installed generating capacity stood at 319 gigawatts (GW) (JEPIC, 2024), with total electricity generation reaching 1010 terawatt-hours (TWh) in 2022 (EGEDA, 2024) (Figure 8).

In 2022, Japan's electricity generation continued to rely heavily on fossil fuels, which accounted for 69% of the total power mix (EGEDA, 2024) (Figure 9). Natural gas, comprising 34% of the total generation, remains the dominant source of energy in Japan's power sector (EGEDA, 2024) (Figure 9). This highlights Japan's ongoing dependence on natural gas, which plays a central role in the generation mix and has increased significantly in recent years as a cleaner alternative to coal. Although Japan has been making recent efforts to reduce its reliance on coal as part of its decarbonisation strategy, coal still accounted for 31% of total electricity generation, reflecting its earlier expanded use to ensure energy security following the shutdown of nuclear power plants (EGEDA, 2024) (Figure 8). Oil, while contributing a smaller share of 4.1%, continues to play a role in Japan's power sector, though its use has diminished over time in favour of other fossil fuels and renewables (EGEDA, 2024) (Figure 9). The continued dominance of fossil fuels, particularly natural gas and coal, underscores the challenges Japan faces in accelerating its transition to a more sustainable energy mix. While there has been growth in renewable energy, fossil fuel reliance still presents obstacles to meeting carbon reduction goals.

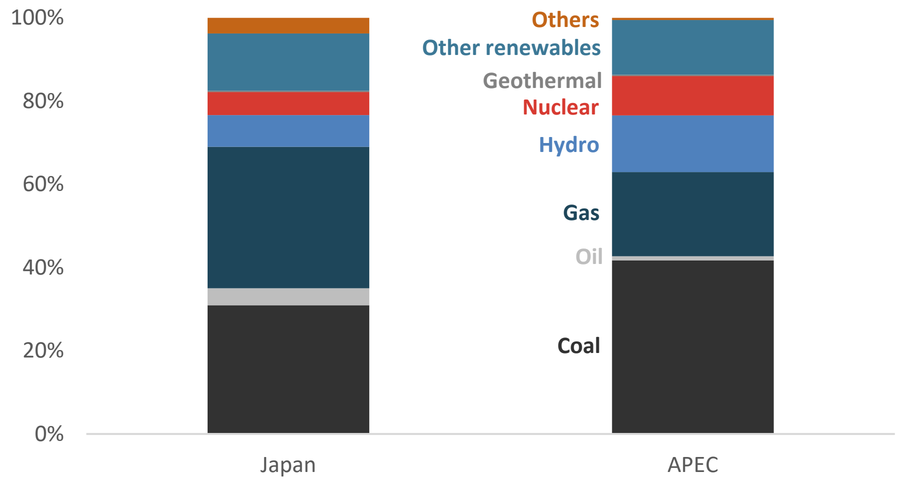
Figure 8: Japan's electricity generation by fuel, 2000 to 2022



Source: EGEDA (2024)

Renewables, which contributed 22% of Japan's electricity generation in 2022, have shown growth, with an increase of 3.5% from the previous year and a 6.2% annual increase since 2010 (EGEDA, 2024) (Figure 8). This reflects Japan's efforts to diversify its energy sources and reduce its dependence on fossil fuels. However, despite this positive trend, Japan still lags behind the APEC region in terms of renewable energy adoption. This suggests that while Japan is making progress, there are still significant challenges to scaling up renewable energy technologies like wind and solar. Limited land availability for large-scale projects and the integration of intermittent renewable energy sources into the existing grid pose ongoing hurdles. As the economy continues to focus on renewables, further investments in grid infrastructure and technology will be crucial for supporting a more sustainable energy future.

Figure 9: Electricity generation fuel share, Japan and APEC, 2022



Source: EGEDA (2024)

In 2022, nuclear energy contributed 5.6% to Japan's electricity generation (EGEDA, 2024) (Figure 9). Japan's nuclear sector is gradually recovering from the 2011 Fukushima Daiichi nuclear disaster, with 14 nuclear power plants now in operation as of January 2025 (JAIF, 2025). Recent restarts, such as Onagawa Unit 2 in December 2024 and Shimane Unit 2 in January 2025, have further strengthened Japan's nuclear capacity (JAIF, 2025). While the recovery of nuclear power is progressing, it remains a slow process, with public sentiment around nuclear energy posing ongoing challenges. Despite this, nuclear power is seen as a crucial component of Japan's energy mix in reducing dependence on fossil fuels and lowering carbon emissions.

When compared to the broader APEC region, Japan's electricity generation mix presents several distinct characteristics, which highlight both its progress and the unique aspects of its energy transition. Japan's share of coal is 11 percentage points lower, which reflects its successful efforts to reduce reliance on the most carbon-intensive fossil fuel, aligning with its sustainable energy goals (EGEDA, 2024) (Figure 9). Japan's share of oil is 3.1 percentage points higher, indicating the continued, though decreasing, role of oil in the power sector (EGEDA, 2024) (Figure 9). Additionally, Japan's share of gas is 14 percentage points higher, reflecting the economy's substantial investment in natural gas as a bridge fuel during its transition to lower-carbon sources (EGEDA, 2024) (Figure 9). Japan's share of nuclear energy is 3.9 percentage points lower, but the steady increase in nuclear capacity, supported by recent reactor restarts, shows Japan's commitment to enhancing this reliable, low-carbon energy source (EGEDA, 2024) (Figure 9). Finally, while Japan's share of renewables remains 5.4 percentage points lower, it is steadily increasing thanks to ongoing efforts to expand renewable energy in the power mix, supporting Japan's transition towards a more diversified and sustainable energy system (EGEDA, 2024).

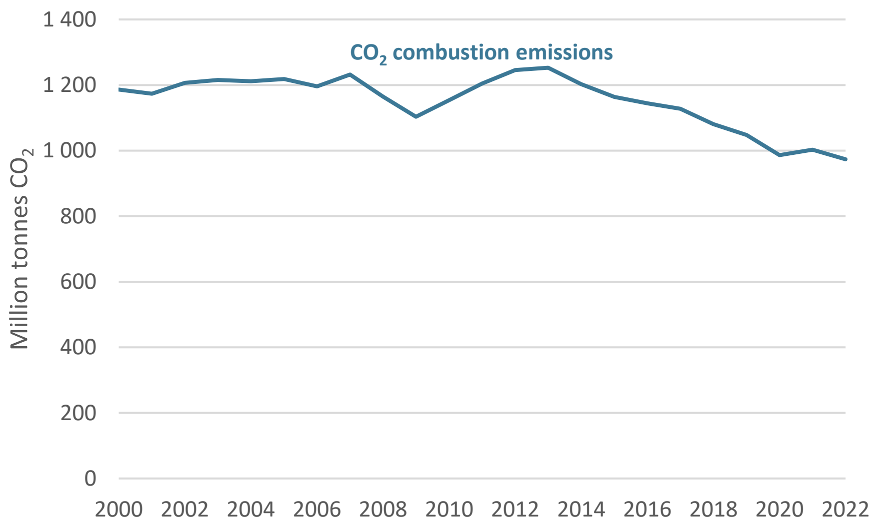
Energy Transition

Japan's energy transition is guided by its commitment to reducing GHG emissions while ensuring stable and secure energy supplies. With its goal of carbon neutrality by 2050, Japan has set ambitious emissions reduction targets, including a 46% reduction by 2030 compared to 2013 levels (MOFA, 2021). In addition, the economy has announced updated targets under the 7th Strategic Energy Plan, aiming for a 60% reduction by 2035 and 73% by 2040 (METI, 2024a).

Emissions

Japan has made steady progress in reducing CO_2 emissions, with a 22% reduction since 2013 and a 2.8% annual decrease from 2013 to 2022 (EGEDA, 2024) (Figure 10). The decrease from 1003 Mt-CO_2 in 2021 to 973 Mt-CO_2 in 2022 reflects positive strides in emissions reductions, showcasing Japan's commitment to its climate goals (EGEDA, 2024). This steady progress marks a significant shift from the relatively flat emissions trend prior to 2013, demonstrating Japan's ongoing success in implementing energy efficiency measures, integrating cleaner energy sources, and phasing out inefficient fossil fuel plants.

Figure 10: Japan's CO_2 combustion emissions (million tonnes), 2000 to 2022



Source: EGEDA (2024)

While these reductions represent important steps, Japan recognises that meeting its ambitious 46% emissions reduction by 2030, as well as the 60% reduction by 2035 and 73% reduction by 2040, will require an acceleration of its current efforts. To stay on track for these targets, Japan is focusing on scaling up renewable energy, enhancing energy efficiency across all sectors, and adopting innovative low-carbon technologies. These actions are crucial for achieving not only the 2030 target but also the 2035 and 2040 targets, ensuring that the momentum in emissions reduction continues on an even faster trajectory. Japan remains committed to strengthening its decarbonisation strategies and is confident that these focused efforts will help it meet its long-term climate goals, including carbon neutrality by 2050.

Energy Security

Ensuring energy security is a central pillar of Japan's energy strategy as it seeks to balance the transition to clean energy while maintaining a stable and reliable energy supply. Japan faces ongoing challenges due to its heavy reliance on energy imports for fossil fuels. As one of the world's largest importers of natural gas, Japan is working to diversify its supply sources and reduce dependency on a limited number of suppliers, with a focus on long-term sustainability.

Japan's 7th Strategic Energy Plan recognises the important role of natural gas, particularly for gas-fired power plants, which are expected to be essential in Japan's energy mix through 2040. As renewable energy sources like solar and wind continue to expand, gas-fired power plants are crucial to provide dispatchable power to manage intermittency and ensure grid stability. To meet expected demand, liquefied natural gas (LNG) imports in 2040 are forecasted to range between 54 Mt and 74 Mt, with plans to diversify supply sources beyond the traditional LNG suppliers in Asia-Oceania, such as Australia and Malaysia (METI, 2024a). These plans include increasing LNG imports from North America, which is seen as a viable source that will secure Japan's future LNG supply and reduce dependency on less flexible sources.

A key element of Japan's strategy for natural gas security involves securing long-term contracts for LNG, which are essential for stability. However, many of Japan's existing long-term contracts are set to expire after 2029, creating a need for new contracts to ensure the economy's future gas supply. To manage this, Japan is focusing on partnerships and investments in North American LNG, particularly from the Gulf of Mexico, Canada and Alaska, each with its own set of opportunities and challenges. The diversification of LNG sources would help Japan reduce its vulnerability to supply disruptions and price volatility, ensuring long-term energy security.

In addition to strengthening domestic energy infrastructure, Japan is pursuing international cooperation to enhance energy security. Collaborating with economies like the United States, Japan is advancing technologies such as clean hydrogen, offshore wind, and advanced nuclear reactors (METI, 2024c). These international partnerships are crucial not only for Japan's energy security but also to contribute to global progress in clean energy solutions.

APEC Energy Goals

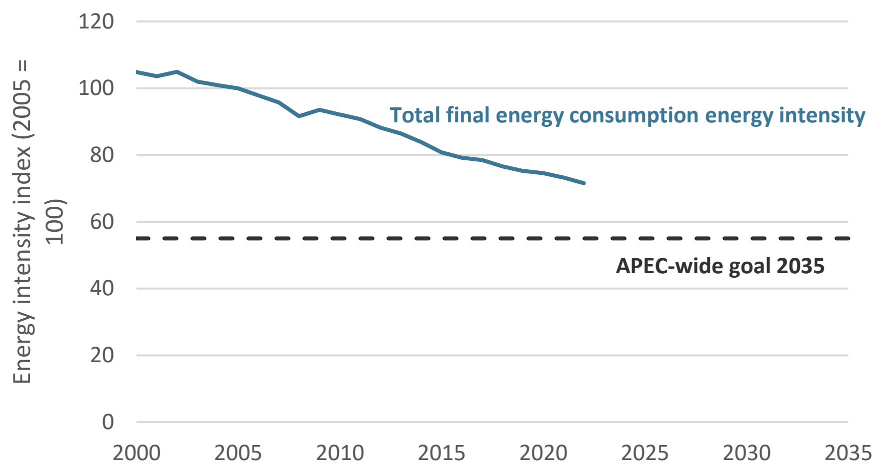
There are two energy-related objectives that APEC member economies have agreed to meet as a collective: to improve energy intensity and double the share of modern renewables.

Energy Intensity Goal

In 2011, APEC member economies agreed to increase their ambition to reduce energy intensity by 45% in 2035, relative to a 2005 baseline. The original goal was a 25% improvement by 2030, relative to a 2005 baseline.

APEC is on track to achieve this energy intensity improvement. The goal does not impose individual economy targets, but it is possible to track the progress of individual APEC economies relative to the overarching proportional improvement.

Figure 11: Japan's total final energy consumption intensity index, 2000 to 2022 (2005 = 100)



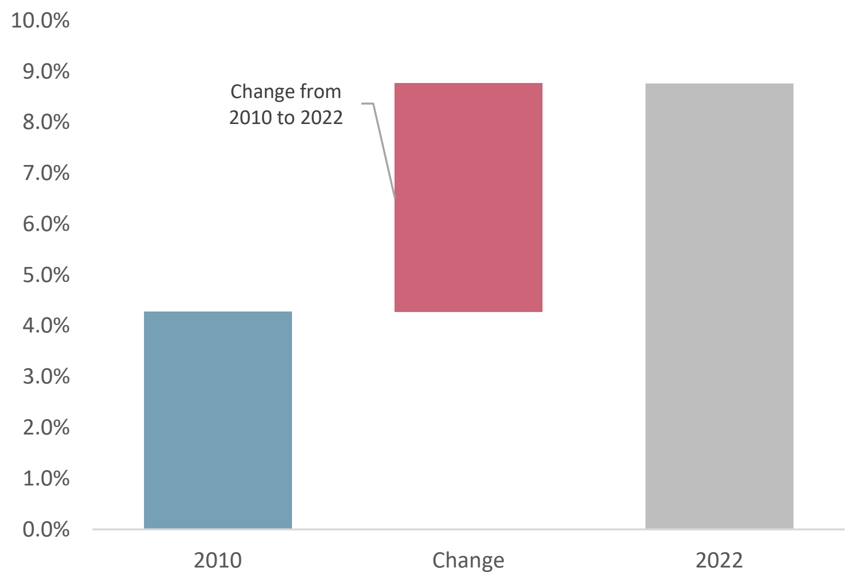
Source: EGEDA (2024)

The energy intensity of Japan's economy has seen notable improvements over the past two decades. In 2022, Japan's energy intensity index was 71, relative to the 2005 baseline of 100 (EGEDA, 2024) (Figure 11). This represents a 29% improvement in energy intensity from 2005 to 2022, with an average annual improvement rate of 2.0% (EGEDA, 2024). The progress reflects Japan's ongoing efforts to improve energy efficiency through technological advancements, sectoral efficiencies and comprehensive policies targeting energy conservation. These efforts align with the broader APEC goal to reduce energy intensity by 45% by 2035 compared to 2005 levels.

Doubling of Renewables

The second energy goal involves doubling the share of modern renewables in the APEC energy mix for the period 2010 to 2030. There is no economy-level goal for individual member economies, but improvements by individual economies will contribute to the doubling goal.

Figure 12: Japan's modern renewable energy share, 2010 and 2022

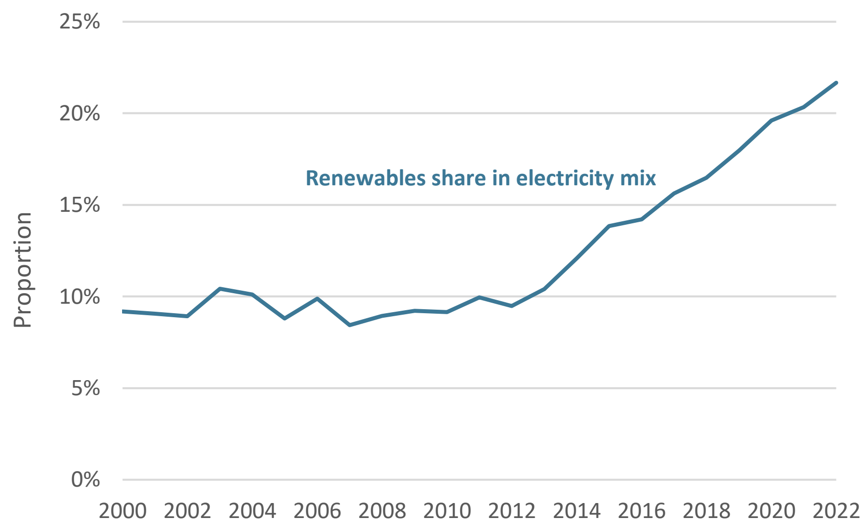


Source: EGEDA (2024)

Note: Biomass used in the residential and commercial sectors is assumed to be traditional biomass and is not included in the definition of modern renewables. All other renewables (biomass used by industry, hydro, geothermal, etc.) are considered modern renewables. Modern renewables also include the share of electricity that is generated from renewable sources.

Japan has made significant strides in increasing the share of modern renewable energy in its energy mix. In 2010, Japan's modern renewable energy share was 4.3%, and by 2022, this figure had risen to 8.8%, effectively doubling the renewable share in just over a decade (EGEDA, 2024) (Figure 12). Furthermore, Japan's renewable generation share in total electricity generation increased from 10% in 2013 to 22% in 2022, reflecting the substantial progress in transitioning to cleaner energy sources (EGEDA, 2024) (Figure 13). This achievement underscores Japan's commitment to APEC's broader energy goals and its transition towards a more sustainable energy future.

Figure 13: Japan's renewable generation share, 2000 to 2022



Source: EGEDA (2024)

Energy Policy

Energy Policy	Details	Reference
The 7th Strategic Energy Plan	Approved in February 2025, it emphasises increasing the share of renewable energy to 50% and maximising the use of nuclear power by 2040 to shape a more balanced and resilient power generation mix.	METI
Updated Nationally Determined Contributions (NDC)	In February 2025, Japan updated its NDC under the Paris Agreement, setting a new target to reduce greenhouse gas emissions by 60% by 2035 and 73% by 2040, compared to 2013 levels.	MOE
GX2040 Vision	Approved in February 2025, this vision sets the foundation for Japan's long-term Green Transformation (GX) strategy, balancing stable energy supply, economic growth, and decarbonisation. It outlines pathways for achieving carbon neutrality beyond 2050, with a strong focus on hydrogen, ammonia, carbon capture, utilisation and storage (CCUS), and next-generation nuclear technologies.	METI (Japanese only)
Plan for Global Warming Countermeasures	Approved in February 2025, this plan provides a comprehensive roadmap to meet Japan's greenhouse gas reduction targets under the Paris Agreement and NDC commitments. It introduces stricter carbon pricing mechanisms, expands CCUS deployment, and promotes low-carbon industrial processes.	MOE
CCS Business Act	Enacted in May 2024, this act establishes a legal framework for businesses engaged in carbon dioxide capture and storage. It includes a licensing system for storage operations and regulations to ensure safe and appropriate carbon capture and storage (CCS) activities.	METI
Hydrogen Society Promotion Act	Enacted in May 2024, this act aims to promote the supply and utilisation of low-carbon hydrogen and its derivatives, facilitating a smooth transition to a decarbonised, growth-oriented economic structure.	METI
2050 Zero Carbon Cities in Japan	As of December 2024, 1127 local governments including Tokyo, Kyoto, and Yokohama announced their commitment to net zero carbon emissions by 2050.	MOE

Green Growth Strategy	As part of Japan's pledge to achieve carbon neutrality by 2050, this strategy outlines action plans for 14 industries. It supports these industries through government funding, tax incentives, regulatory measures, and international collaborations, focusing on sustainable development and green technology.	METI
Top Runner Program	This program sets efficiency benchmarks based on the best-performing products in the market. It aims to continuously improve product efficiency, particularly in household appliances, contributing significantly to energy conservation in Japan.	METI
New Nuclear Law	This law allows nuclear power plants to operate beyond the previous 60-year limit under certain conditions, enhancing the role of nuclear energy in Japan's power mix. Plants operating for more than 30 years are required to obtain safety approval from the Nuclear Regulation Authority every ten years, emphasising safety in the nuclear sector.	AEC
Updated Basic Hydrogen Strategy	In June 2023, Japan updated the Basic Hydrogen Strategy focusing on establishing a hydrogen supply chain based on carbon intensity, rather than hydrogen 'colour'. It sets specific CO_2 emission thresholds for clean hydrogen and ammonia and aims to expand Japan's hydrogen technology in Asia and the Indo-Pacific. It sets goals for increasing supply, reducing costs, and attracting investments in the hydrogen and ammonia sectors.	METI
Basic Policy for the Realisation of GX	In February 2023, the Japanese Cabinet decided on this policy that is focused on achieving enhanced industrial competitiveness and decarbonisation, with the basic premise of securing a stable energy supply. The policy includes promoting energy efficiency and shifting to decarbonised power sources such as renewable energy and nuclear power.	METI
The Revised Act on Rationalising Energy Use	Enacted in April 2023. This act expands the scope of energy rationalisation to include non-fossil fuels, requiring large-scale businesses to adopt equipment and processes that favour non-fossil electricity. This is a significant move towards reducing reliance on fossil fuels and promoting energy efficiency in the industrial sector.	METI
GX Promotion Act	Enacted in May 2023, it supports the Japan's transition to a decarbonised, growth-oriented economy. It includes specific measures such as the GX promotion strategy, GX Economy Transition Bonds, carbon pricing mechanisms, and GX Promotion Organisation to manage emissions trading and support investments related to GX.	METI

J-Credit Scheme	The government certifies CO_2 reduction or absorption volumes as credit. Credit creators can sell their credits, and buyers use purchased credits for various purposes such as corporate social responsibility (CSR) and carbon offset.	METI
Baseload Market	This ensures equal access to cheap power supplies for new power retail companies as part of reforms to foster competition in the market.	METI (Japanese only)
Electricity System Reform	This expands Nationwide Coordination of Transmission Operators, achieves full liberalisation of electricity retail business and generation and secures the neutrality of power transmission and distribution sectors.	METI
Feed-in Tariff (FIT) Law and its revision	This creates a new authorisation system, a revised method of setting purchase prices, a change of the purchaser of renewable energy (from the retail electric power company to the power transmission and distribution company) and a revision of the arrangements for reducing surcharges on electricity rates.	METI (Japanese only)
Feed-in Premium (FIP)	Introduced in April 2022, this complements the existing FIT system for renewable energy. FIP allows renewable energy producers to sell electricity at market prices while receiving a premium to cover the difference between production costs and market prices. This aims to promote renewable energy investment and integrate it more effectively into the electricity market.	METI (Japanese only)
Roadmap for Carbon Recycling Technologies	Considering the concept of carbon recycling technology, CO_2 is considered a source of carbon. In this regard, CO_2 will be recycled into concrete through mineralisation, into chemicals through artificial photosynthesis, and into fuels through methanation to reduce CO_2 emissions into the atmosphere.	METI
Establishing Resilient and Sustainable Electricity Supply Systems	This aims to secure sustainable electricity supply systems by implementing various measures, including requiring electricity transmission/distribution businesses to formulate action plans on their collaboration in disaster responses, establishing a new scheme for supporting businesses in introducing renewable energy, and adding new functions to those provided by JOGMEC.	METI
The Biomass Town Plan	Japanese local governments and private corporations have established biomass towns using agricultural residues, livestock waste, forestry residues, food waste and sewage sludge to convert to electricity, heat, and ethanol etc.	MAFF

Basic Plan for the Promotion of Biomass Utilisation	This promotes the utilisation of biomass as energy or products to contribute to resolving the issues Japan faces, such as the revitalisation of rural areas, the prevention of global warming, and the formulation of a recycling-oriented society.	MAFF

Notable Energy Developments

Energy development	Details	Reference
Shimane Nuclear Reactor Restart	In December 2024, Shimane Unit 2, a boiling water reactor (BWR) with a capacity of 820 MW, resumed power generation after 13 years of hiatus. It began commercial operation in January 2025 and was Japan's 14th nuclear power plant to restart since the new regulatory standards were implemented in 2013.	JAIF
Onagawa Nuclear Reactor Restart	In November 2024, Onagawa Unit 2 officially restarted, becoming the first boiling water reactor (BWR) to resume operation after the 2011 Great East Japan Earthquake. This followed extensive safety upgrades to meet post-Fukushima regulations, including a 29-metre-high seawall for tsunami protection.	JAIF
Ishikari Bay New Port Offshore Wind Farm	In January 2024, Japan's largest commercial offshore wind farm, the 112 MW Ishikari Bay New Port Offshore Wind Farm, began operations. The project developed by JERA, supports Japan's renewable energy expansion and energy security goals.	JERA
Japan-USA Fusion Energy Partnership	In April 2024, Japan and the USA announced a strategic partnership to accelerate the commercialisation of fusion energy. This agreement aims to develop electricity-generating fusion power plants in the 2030s, strengthening global cooperation in next-generation nuclear technology.	WNN
Japan's First 1.1 MW Tidal Turbine Installation	In February 2025, Proteus Marine Renewables successfully installed Japan's first 1.1 MW tidal turbine in the Naru Strait, supplying renewable power to the Goto Islands. This marks a major step forward in Japan's tidal energy initiatives.	Proteus MR
Green Steel Subsidy Program	In January 2025, Japan launched a subsidy program to support the production and adoption of low-emission steel in clean energy vehicles and industrial applications. The program aims to reduce carbon emissions in steel production and accelerate Japan's transition to green manufacturing.	METI
Ultra-Thin Perovskite Solar Cells Commercialisation	In February 2025, Japan invested USD 1.5 billion in commercialising ultra-thin, flexible perovskite solar cells. This initiative aims to diversify energy sources, improve energy security, and make lightweight, highly efficient solar panels available for various applications, including urban environments and transportation sectors.	FT

Useful Links

Agency for Natural Resources and Energy – https://www.enecho.meti.go.jp/en/

Ministry of Economy, Trade and Industry – https://www.meti.go.jp/english/index.html

Ministry of the Environment – https://www.env.go.jp/en/index.html

Ministry of Land, Infrastructure, Transport and Tourism – https://www.mlit.go.jp/en/index.html

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Republic of Korea

Introduction

The Republic of Korea (Korea) is located in north-east Asia, positioned between China and Japan. It covers an area of 100 413 square kilometres (km^2) and had a population of almost 52 million in 2024. Korea has an extremely high population density, averaging about 516 people per km^2. Seoul, Korea's largest city and capital, accounts for around 20% of the total population, with a remarkable population density of 15 550 people per km^2. The landscape of Korea features numerous mountain ranges throughout the economy, including high mountain ranges in the eastern region, along with extensive coastal plains in the western and southern areas. Korea experiences a relatively temperate climate with four distinct seasons. Weather conditions have a huge impact on the economy's energy consumption, with air conditioning being crucial during the hot summers and heating essential during the frigid winters.

Korea has become one of Asia's most dynamic and rapidly growing economies in recent decades. In 2023, its GDP reached USD 2615 billion (2021 USD purchasing power parity (PPP)). The GDP per capita in 2023 stood at USD 50 572 (2021 USD PPP), marking a three-fold increase since 1990.

Korea's key industries include semiconductors, shipbuilding, automobiles, petrochemicals, digital electronics, steel, and machinery parts and materials. According to the World Bank data, manufacturing was estimated to contribute 24% of GDP in 2023, with an export-oriented manufacturing sector driving economic growth.

The Korean Government has recently experienced global energy supply instability due to global geopolitical uncertainty and post-COVID conditions. As it becomes increasingly important to strike a balance between carbon neutrality and energy security, the government continues to monitor global energy supply chain developments in order to establish a feasible and reasonable energy mix.

Korea has limited domestic energy resources, with no significant primary energy reserves aside from a small quantity of coal. As a result, Korea relies heavily on energy imports to support its robust economic growth.

Table 1: Korea's macroeconomic data and energy reserves

Key data [a, b]		Energy reserves [c]	
Area (km^2) [a]	100 413	Oil (billion barrels)	-
Population (million) [a]	52	Gas (trillion cubic feet)	-
GDP (2021 USD billion PPP) [b]	2615	Coal (million tonnes) [c]	307
GDP per capita (2021 USD PPP) [b]	50 572	Uranium (kilotonnes U < USD 130/kgU)	-

Source: a KOSIS (2024); b World Bank (2024); c Korea Public Data Portal (2023)

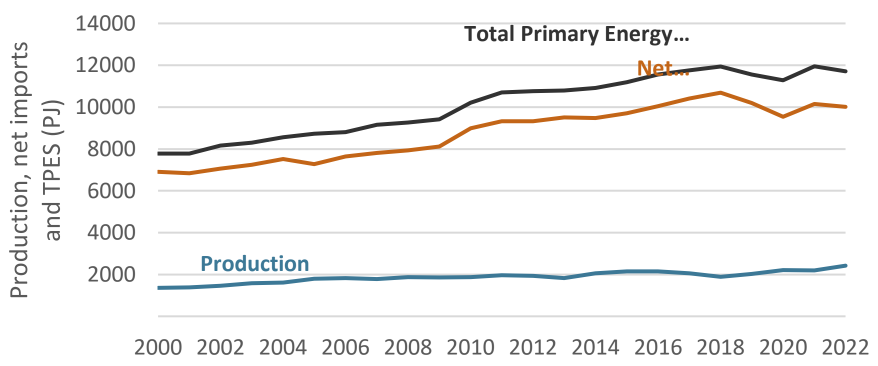
Note: Reserves are total proved reserves and reasonably assured recoverable resources for uranium.

Energy Supply and Consumption

Total Primary Energy Supply

From 1990 to 2022, Korea's total primary energy supply (TPES) nearly tripled, from 3890 PJ to 11 711 PJ. Korea's TPES demonstrated a solid growth trajectory, with an average annual growth rate of 7.3% from 1990 to 2000, surpassing the economy's 7.1% annual growth rate over the same period. After 2000, TPES continued to grow significantly, from 7779 PJ to 11 711 PJ, a 51% percentage increase. However, a 2.1% drop was recorded between 2018 and 2020, largely attributable to the impacts of the COVID-19 pandemic (Figure 1). Notably, the reductions in energy supply in 2020 were mostly caused by lower coal and oil supply compared to 2019. Following three consecutive years of decline, Korea witnessed a substantial 5.9% increase in TPES in 2021, followed by a slight decrease in 2022, both driven primarily by changes in fossil fuel use (EGEDA, 2024).

Figure 1: Korea's energy supply, production, and net imports (PJ), 2000 to 2022

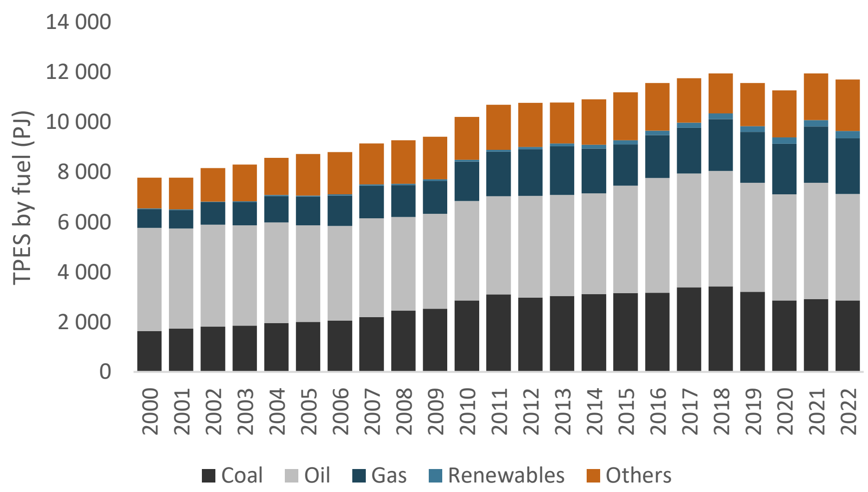


Source: EGEDA (2024)

Due to its limited domestic energy resources, Korea imports a significant amount of its TPES. In 2022, almost 86% of Korea's TPES was reported as net imports. That year, Korea ranked as the world's fourth-largest crude oil importer, third-largest natural gas importer, and fourth-largest coal importer in the world, according to IEA.

From 2000 to 2022, Korea's TPES fuel mix reflected the economy's emphasis on ensuring a stable energy supply (Figure 2). During this period, renewable energy experienced substantial growth from 32 PJ to 290 PJ with its share rising modestly from 0.4% to 2.5%. Notably, the share of natural gas surged from 9.6% in 2000 to 19% in 2022, with its volume steadily increasing from 1656 PJ in 2015 to 2230 PJ in 2022. In contrast, coal and oil reached their peak in 2018 before declining until 2020. Despite cutbacks in coal, oil, and natural gas, renewable energy's contribution to TPES increased in 2022 (EGEDA, 2024).

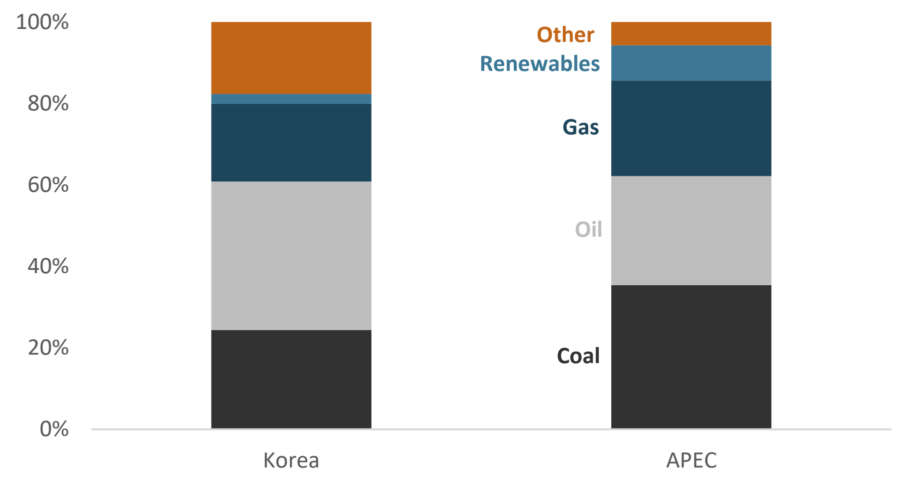
Figure 2: Korea's energy supply by fuel (PJ), 2000 to 2022



Source: EGEDA (2024)

As of 2022, coal, oil, and gas accounted for about 80% of Korea's TPES, a lower share than APEC (Figure 3). Korea's TPES fuel mix showed notable differences from the APEC average in terms of energy source composition. Korea had a higher share of oil and 'other' energy sources, as nuclear energy is classified as 'other' in Korea. Meanwhile, Korea's share of coal, gas, and renewables was lower than that of APEC. Oil was the largest portion of Korea's TPES at 37%, followed by coal (24%), and gas (19%), all below APEC's corresponding shares. Renewables made up only 2.5% of Korea's TPES, while APEC's share was 8.6%, around 3.5 times higher.

Figure 3: Energy supply mix, Korea and APEC, 2022



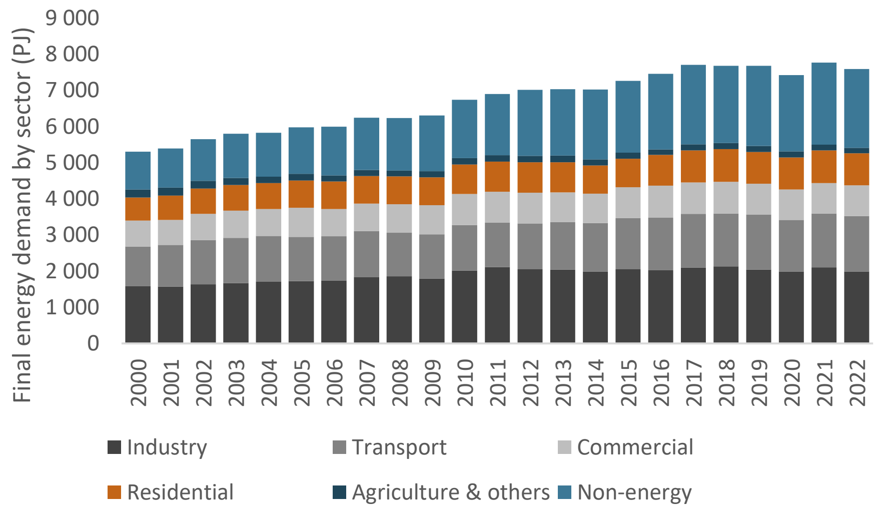
Source: EGEDA (2024)

Total Final Consumption

Total final consumption represents end-use energy, including the non-energy uses of energy products. In 2022, Korea's total final consumption (including non-energy uses) totalled 7585 PJ, marking a 2.3% decrease compared to the previous year. Energy consumption declined steadily between 2018 and 2020, with a notable 3.4% drop in 2020 due to the impact of the COVID-19 pandemic. Although energy consumption rebounded in 2021, it fell again in 2022.

Korea's total final consumption was primarily driven by the non-energy and industrial sectors, which held the largest shares at 26% and 29%, respectively. The transport sector accounted for approximately 20%, while the remaining 25% was distributed among the commercial, residential, and agriculture sectors. Since the late 1990s, the agricultural sector has experienced a steady decline in energy consumption, reaching its lowest level of 150 PJ in 2022. In 2022, all sectors except for transport and commercial showed a decrease in consumption.

Figure 4: Korea's final consumption by sector (PJ), 2000 to 2022

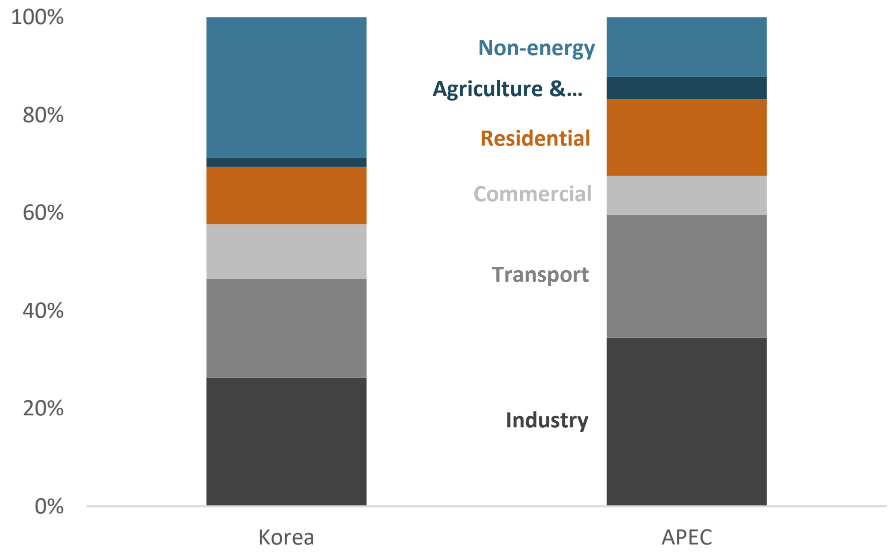


Source: EGEDA (2024)

In comparison to APEC, Korea's industry and transport sectors account for a smaller share of final consumption, while the non-energy sector holds a larger portion (Figure 5). In 2022, the industry and transport sectors represented 35% and 25% of APEC's final consumption, respectively, compared to Korea's lower shares of 26% and 20%.

The non-energy sector generally refers to energy products used as raw materials rather than being consumed as fuel or transformation. These are often oil products used in the chemical and petrochemical industries for producing plastics or lubricants. In 2022, Korea's non-energy sector made up 29% of final consumption, more than double APEC's proportion of 12%.

Figure 5: Final consumption by sector, Korea and APEC, 2022

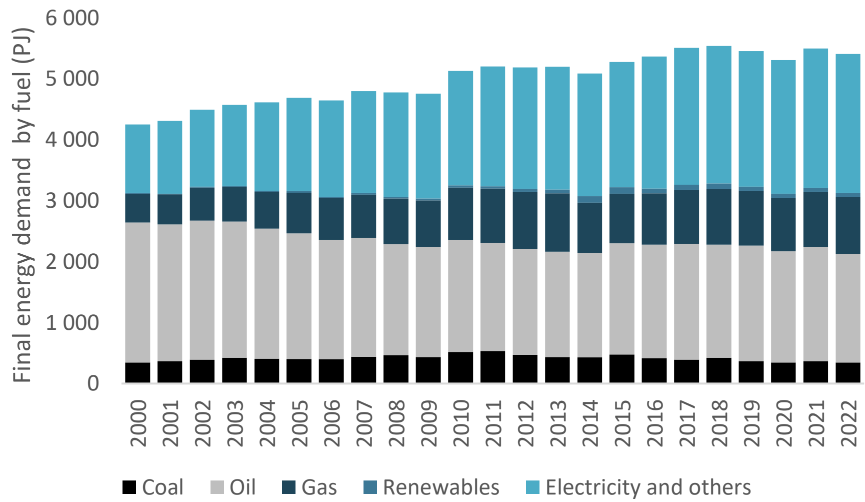


Source: EGEDA (2024)

Final Energy Demand

Korea's final energy demand showed a steady upward trend from 2009 to 2018. However, a decline in final energy demand was observed from 2019 to 2020 due to the impact of the COVID-19 pandemic (Figure 6). By 2021, Korea's final energy demand rebounded to 5499 PJ, followed by 5410 PJ in 2022, reaching levels comparable to those seen before the pandemic. An analysis of fuel demand over the past two decades reveals a decline in the proportion of coal and oil in total energy demand, based on data from 2001 to 2022. Specifically, the combined share of these two fuel sources decreased from 61% in 2001 to 41% in 2022. However, the share of other energy sources, including gas, renewables, electricity, and others, has consistently increased over the same period.

Figure 6: Korea's final energy demand by fuel (PJ), 2000 to 2022

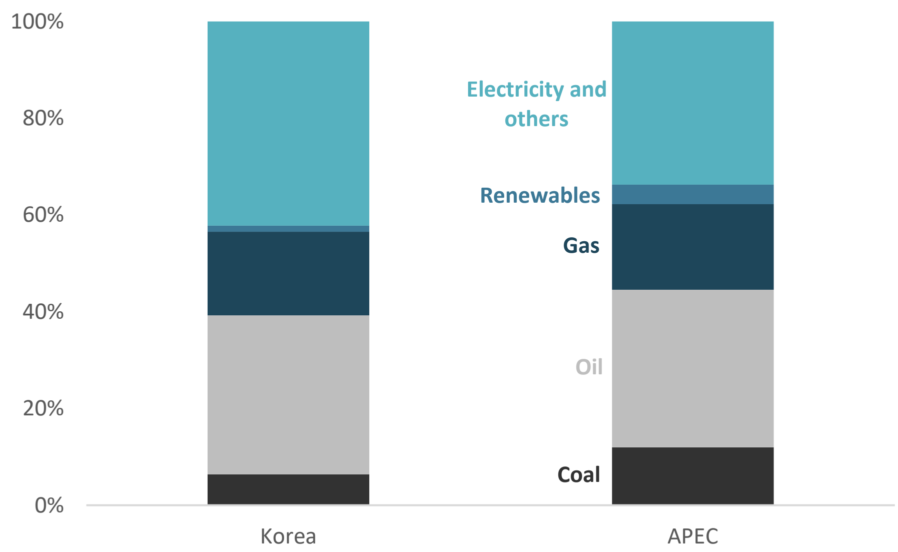


Source: EGEDA (2024)

Note: Does not include non-energy sector consumption of energy products.

Korea's electricity demand is relatively high compared to APEC. In 2022, 'electricity and others' accounted for 42% of Korea's final energy demand, compared to 34% in APEC (Figure 7). Korea's economic growth over recent decades has driven a significant increase in electricity demand. In addition, the continuous rise in power-based equipment usage has further contributed to the growing share of electricity in total final energy demand. According to Korea's 11th Basic Plan for Electricity Demand and Supply (2024-2038), released by the Ministry of Trade, Industry and Energy (MOTIE) in February 2025, Korea's electricity consumption is projected to grow at an average annual rate of 1.8% from 2024 to 2038. Notably, Korea's coal consumption in 2022 remained considerably lower than the APEC average.

Figure 7: Final energy demand fuel share, Korea and APEC, 2022



Source: EGEDA (2024)

Transformation

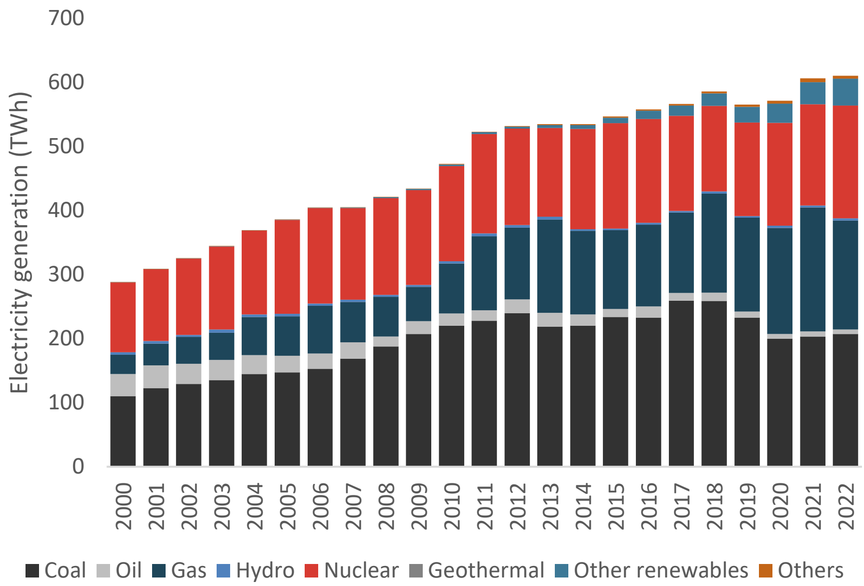
Power Sector

Energy consumption in Korea's transformation sectors has grown significantly since 2000, driven primarily by the expansion of electricity generation capacity. Between 2000 and 2021, overall power generation more than doubled, increasing from 288 TWh in 2000 to 610 TWh in 2022 (Figure 8). Ensuring a stable electricity supply has been a key focus of Korea's energy policy, especially following a power outage in 2011 that led to electricity supply restrictions in certain areas.

Analysing electricity generation by fuel source, coal contributed 34% of Korea's electricity in 2022, down from its peak share of 45% in 2017. With a growing emphasis on carbon neutrality, coal power generation is expected to fall considerably in the long run. In contrast, renewable energy increased its share of the generation mix in 2022 compared to the previous year.

In February 2025, the Korean Government announced the 11th Basic Plan for Electricity Demand and Supply, a 15-year forecast that is updated biennially. The plan includes a projection for rapid growth in electricity demand, which will be driven by innovative industries such as AI and semiconductors. To address this, the government plans to significantly expand nuclear and renewable capacity. Electricity generation from diverse carbon-free sources, including nuclear, renewables, and hydrogen, is expected to increase to meet rising demand, while coal and LNG generation will steadily decline. By 2038, nuclear power and renewable energy are projected to account for 35% and 29% of total electricity generation, respectively. Additionally, all 28 aging coal power plants will be phased out and converted to LNG facilities by 2036.

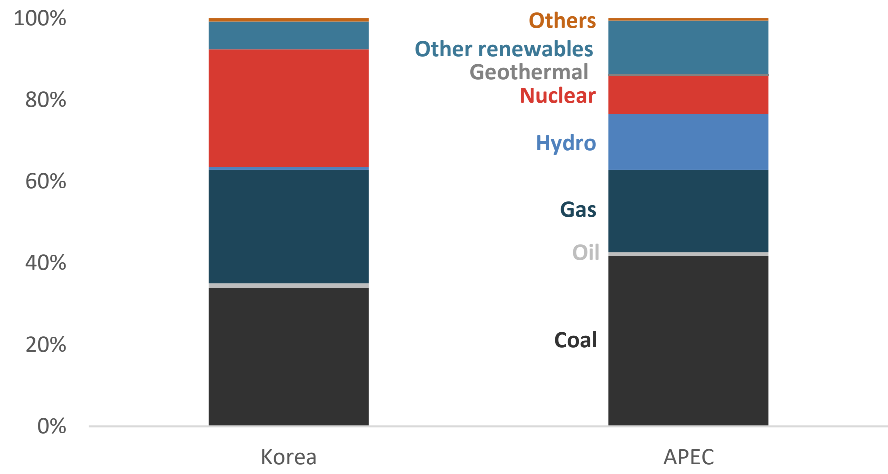
Figure 8: Korea's electricity generation by fuel, 2000 to 2022



Source: EGEDA (2024)

In Korea's electricity generation mix, the proportion of oil in 2022 was similar to that observed for APEC (Figure 9). However, some notable differences exist between Korea and APEC regarding other fuels. In 2022, Korea's coal power generation accounted for 34%, compared to APEC's 42%, despite the two having similar coal shares in 2019. Gas constituted 28% of Korea's power sector, surpassing APEC's share of 20%. Nuclear power contributed 29% to Korea's electricity generation, nearly three times APEC's share of approximately 10%. Conversely, APEC had a larger ratio of renewables (13%) compared to Korea (7%). Additionally, hydro power made up just 0.6% of Korea's generation mix, significantly lower than APEC's 14%.

Figure 9: Electricity generation fuel share, Korea and APEC, 2022



Source: EGEDA (2024)

Refining

Korea has consistently invested in large-scale refineries and facility enhancements to improve product quality. As a result, as of 2023, Korea's oil refining capacity had reached 3363 thousand barrels per day, ranking 5th globally (Energy Institute, 2024). Korea's global share stood at 3.2%, trailing China (18%), the United States (18%), Russia (7%), and India (5%).

Following the end of the COVID-19 pandemic, Korean oil refining businesses reported increased exports of major oil products such as diesel, gasoline, and jet fuel, reaching 494 million barrels in 2023, according to the Korea National Oil Corporation. However, despite this short-term export growth, Korean oil refineries face challenges in reducing long-term oil demand and achieving carbon neutrality, necessitating the diversification of their business portfolios.

Energy Transition

Recognising the climate change concerns and the global commitment embodied in the Paris Agreement, the Korean Government remains steadfast in its pursuit of a clean energy transition. In October 2021, the government announced an updated Nationally Determined Contributions (NDC) to achieve carbon neutrality by 2050. This updated target aims for a 40% reduction in Korea's greenhouse gas (GHG) emissions by 2030 compared to 2018 levels, a substantial increase from the original goal of 26%. To oversee and coordinate domestic carbon-neutral policies, the 2050 Carbon Neutrality Committee was established as a presidential body in May 2021 and renamed the Presidential Commission on Carbon Neutrality and Green Growth in March 2022. However, it is noteworthy that energy security is emerging as a crucial consideration within Korea's energy transition policies.

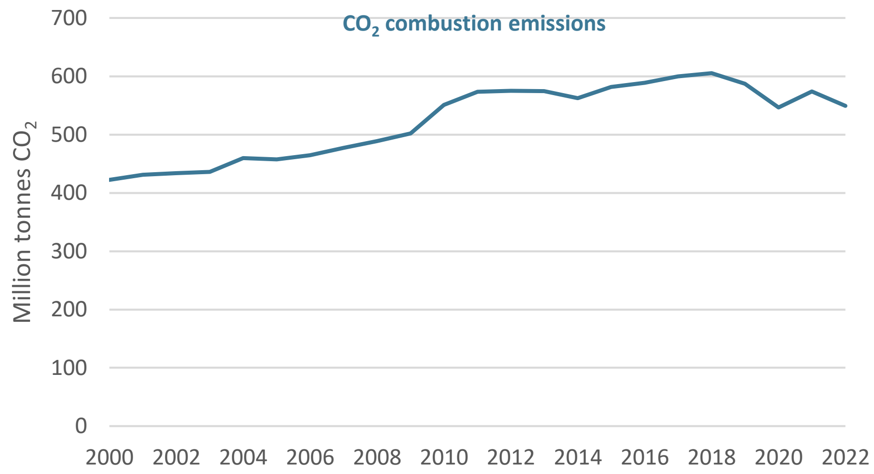
Emissions

EGEDA data indicates that while Korea's CO_2 emissions per GDP have recently shown a declining trend, overall emissions have increased since 2000, peaking in 2018 (Figure 10). This underscores the need for stakeholders to complement sector-specific efforts with effective policy implementation to achieve meaningful emission reductions.

In October 2022, the Presidential Commission on Carbon Neutrality and Green Growth released a vision and promotion strategies for carbon neutrality and green growth. Subsequently, the commission unveiled its 1st Basic Plan for Carbon Neutrality and Green Growth in April 2023. This plan provides policy directions and strategies for achieving carbon neutrality by 2050 through the following key strategies: (1) implementing specific and efficient measures to reduce GHG emissions, including the adoption of carbon-free energy sources; (2) promoting private-sector involvement in carbon neutrality through technology innovation and facilitating investments; (3) improving energy efficiency domestically and fostering collaboration between central and municipal governments, and (4) strengthening international cooperation.

Furthermore, the Korean Government proposed the Carbon-Free Energy (CFE) Initiative to the international community. This initiative emphasises the widespread adoption of nuclear energy, hydrogen, and CCUS (carbon capture, utilisation, and storage), as feasible and sustainable ways to achieve both energy security and carbon neutrality. Korea intends to develop detailed measures under the CFE initiative, such as carbon-free certification requirements that could gain international consensus and facilitate collaborative efforts.

Figure 10: Korea's CO_2 combustion emissions (million tonnes), 2000 to 2022



Source: EGEDA (2024)

Energy Security

Recent geopolitical instability has heightened uncertainty in the energy market, emphasising the critical importance of energy security particularly during the transition to cleaner energy sources. As one of the world's largest importers of oil and gas, Korea has long prioritised energy security to ensure a stable energy supply. In response to these challenges, the Korean Government announced updated energy policy goals and directions in July 2022. These policies aim to mitigate global energy supply chain risks while advancing the economy’s commitment to carbon neutrality.

The updated energy policy directions emphasise a practical and balanced energy mix, including resumption of the construction of the Shin-Hanul No. 3 and No. 4 nuclear reactors. The goal is to enhance the role of nuclear energy as a sustainable energy source, targeting an increase to at least 30% of the total power mix by 2030. This adjustment also necessitates building a robust power grid to accommodate changes in the power supply mix, alongside implementing a power system stability plan to ensure reliable operations.

To further strengthen energy security, both internal and external efforts are underway. In January 2024, the Special Act on National Resource Security Act was enacted to establish a comprehensive framework for addressing energy security through various policy measures. Efforts to diversify energy imports continue through bilateral and multilateral collaborations. For instance, Korea’s participation in the Mineral Security Partnership aims to secure stable supply chains for critical minerals in cooperation with other economies. Additionally, measures are in place to alleviate the financial burden on those vulnerable to energy poverty. Energy vouchers and support for energy efficiency improvements are being provided to ensure access to affordable and sustainable energy for all.

APEC Energy Goals

There are two energy-related objectives that APEC member economies have agreed to meet as a collective: to improve energy intensity and double the share of modern renewables.

Energy Intensity Goal

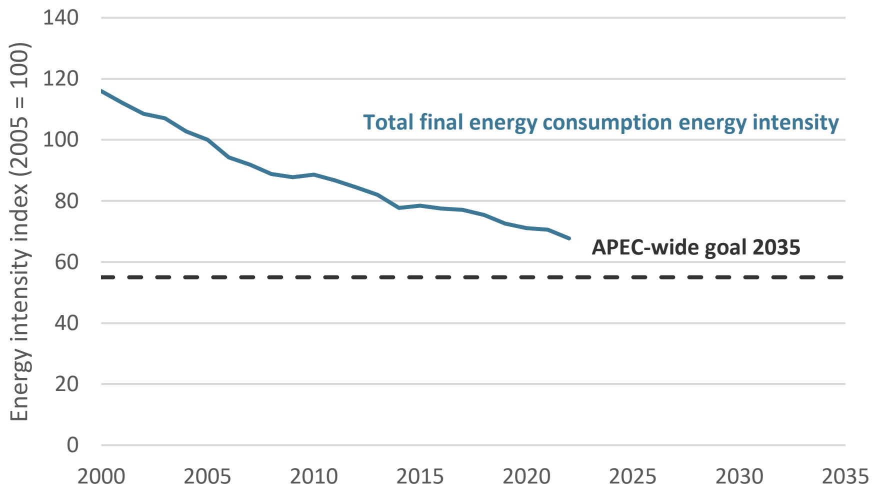
In 2011, APEC member economies agreed to increase their target to reduce energy intensity by 45% in 2035, relative to a 2005 baseline. The original goal was a 25% improvement by 2030, relative to a 2005 baseline.

APEC is on track to achieve this energy intensity improvement. The goal does not impose individual economy targets, but it is possible to track the progress of individual APEC economies relative to the overarching proportional improvement.

Korea’s total final energy consumption intensity, excluding non-energy sectors, has improved steadily since 2005, with only a slight setback in 2010 (Figure 11). By 2022, energy intensity had improved by 32% compared to the 2005 baseline, reflecting a 3% improvement from the previous year and a 9% improvement over the past five years (2017-2022).

The economic conditions and energy usage patterns of APEC economies, including Korea, may change as technology advances and industries evolve. It is therefore essential to closely monitor Korea’s energy intensity in the coming years to ensure that this positive trend continues.

Figure 11: Korea's total final energy consumption intensity index, 2000 to 2022 (2005 = 100)

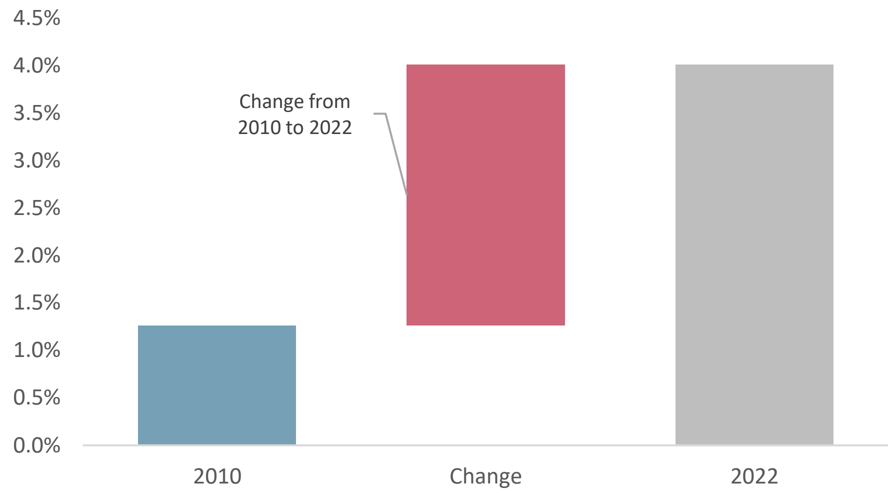


Source: EGEDA (2024)

Doubling of Renewables

The second energy goal aims to double the proportion of modern renewables in the APEC energy mix from 2010 to 2030. While there is no specific economy-level target for each member economy, the progress made by individual economies collectively contributes to achieving the doubling goal.

Figure 12: Korea's modern renewable energy share, 2010 and 2022



Source: EGEDA (2024)

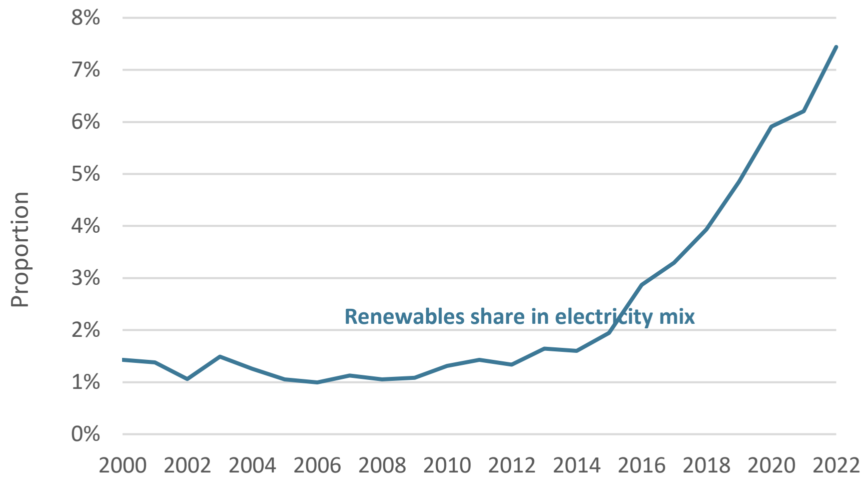
Note: Biomass used in the residential and commercial sectors is assumed to be traditional biomass and is not included in the definition of modern renewables. All other renewables (biomass used by industry, hydro, geothermal, etc.) are considered modern renewables. Modern renewables also include the share of electricity that is generated from renewable sources.

Korea has consistently implemented policies to expand renewable energy, driven by its commitment to addressing climate change and ensuring sustainable long-term growth. Between 2010 and 2022, the share of modern renewables in APEC's energy mix increased from 6.0% to 10%, while Korea's share rose from 1.3% to 4%.

Between 2000 and 2022, Korea's renewable share in electricity generation grew significantly, rising from 1% to 7%, with particularly rapid growth since 2015 (Figure 13). The 11th Basic Plan for Electricity Demand and Supply (2024-38) outlines a phased plan to expand renewable energy, supported by back-up facilities. According to this plan, renewables are expected to account for approximately 33% of total electricity generation by 2038.

To ensure a stable and sustainable renewable energy supply, Korea introduced the Renewable Portfolio Standards (RPS) in 2012, requiring power generation businesses to produce a specified portion of their electricity from renewable sources. While the RPS has been instrumental in fostering the growth of a more mature renewable energy market, MOTIE plans to gradually transition from the RPS system to an auction-based system. This change aims to better align with evolving market conditions and enhance the efficiency of renewable energy development.

Figure 13: Korea’s renewable generation share, 2000 to 2022



Source: EGEDA (2024)

Energy Policy

Energy policy	Details	Reference
2030 NDC (Nationally Determined Contribution)	Korea has committed to reducing greenhouse gas emissions by 40% from 2018 levels by 2030, focusing on expanding renewable energy, increasing energy efficiency, and phasing out coal, alongside international cooperation to achieve its climate goals.	Presidential Commission on Carbon Neutrality and Green Growth
Carbon-Free Energy (CFE) Initiative	The Korean Government proposed the CFE Initiative at the 2023 UN General Assembly and COP 28, highlighting the importance of utilising diverse carbon-free energy sources, including nuclear power, hydrogen, and renewables. This initiative seeks to provide sustainable and pragmatic energy options, particularly for highly industrialised economies such as Korea, as they transition towards a carbon-neutral future.	Korea.net
1st National Basic Plan for Carbon Neutrality and Green Growth	In April 2023, the Korean Government unveiled its 1st Basic Plan under the Framework Act on Carbon Neutrality, covering 2023–2042 with updates every five years. The plan adjusts 2030 NDC targets by sector, focusing on renewable and nuclear energy expansion, K-ETS improvements, eco-friendly transportation, waste reduction, and carbon capture. It also emphasises fostering green industries, enhancing climate adaptation, and boosting international cooperation, providing both opportunities and challenges for businesses in the carbon-neutral transition.	Presidential Commission on Carbon Neutrality and Green Growth
11th Basic Plan for Electricity Demand and Supply	Under the Electricity Business Act, MOTIE is mandated to establish a biennial Basic Plan for Electricity Demand and Supply. The 11th Basic Plan, released in February 2025, outlined mid- to long-term power demand projections and proposed a pragmatic and rational energy mix for the period 2024 - 2038.	Ministry of Trade, Industry and Energy
15th Long-term Natural Gas Demand and Supply Plan	As mandated by the Gas Business Act, MOTIE is developing a biennial long-term plan for natural gas supply and demand. The 15th Plan, published in April 2023, emphasised the importance of ensuring stability in gas supply and demand and provided a detailed forecast for natural gas demand for the period 2023 - 2036.	Ministry of Trade, Industry and Energy
New Energy Policy Goals and Directions	In July 2022, MOTIE announced the New Energy Policy Direction, which included re-establishing the energy mix by increasing the share of nuclear energy to at least 30% by 2030. The policy direction also emphasised strengthening energy security, enhancing energy efficiency, and improving the structure of the electricity market to support stable energy security and a sustainable energy transition.	Ministry of Trade, Industry and Energy

Strategy for Expanding Supply and Strengthening the Supply Chain for Renewable Energy	In May 2024, MOTIE announced the Strategy for Expanding Supply and Strengthening the Supply Chain for Renewable Energy. This strategy focuses on promoting a holistic offshore wind power ecosystem, bolstering the solar power industry through the identification of optimal sites and stabilisation of the relevant supply chain, and maximising market strength through revisions to the RPS/PPA schemes. MOTIE plans to collaborate with relevant ministries to implement these measures effectively.	Ministry of Trade, Industry and Energy
New Hydrogen Economy Policy Directions	The Korean Government announced new hydrogen economy policy directions in November 2022, focusing on three strategies ("3UP"). Scale-Up aims to expand the clean hydrogen ecosystem by developing a global supply chain and driving demand in the power and transport sectors. Build-Up focuses on legal frameworks, infrastructure like the world's largest liquid hydrogen plant, and clean hydrogen certification. Level-Up targets technological innovation. Goals include producing 30 000 hydrogen-powered vehicles and 70 fuelling stations by 2030, increasing clean hydrogen's energy mix share to 7.1% by 2036, and fostering 600 hydrogen-focused companies.	Ministry of Trade, Industry and Energy
Strategy for Securing a Reliable Critical Minerals Supply	In February 2023, MOTIE unveiled a strategy that outlined various measures to secure the supply chain of critical minerals. These measures include identifying specific strategic critical minerals, enhancing international cooperation, mitigating supply risks, and promoting financial assistance and investment.	Ministry of Trade, Industry and Energy
6th Basic Plan for Energy Use Rationalization	In accordance with the Energy Use Rationalization Act, MOTIE has developed a mid- to long-term demand-side energy strategy every five years since 1993. The 6th plan, announced in April 2021, prioritises enhanced demand management, improved energy efficiency, and the advancement of institutional frameworks. Compared to the 2014 plan, the goals reflect a 1.5-fold improvement in energy intensity and a 2.3-fold increase in demand reduction targets. Key strategies include expanding investment and driving energy efficiency at the local government level, strengthening demand management through real-time monitoring and bottom-up participation, and refining efficiency and demand-side policies to accelerate the energy transition.	Ministry of Trade, Industry and Energy
Special Act on National Resource Security	Korea's Special Act on National Resource Security, enacted in January 2024, establishes a comprehensive framework for resource and energy security by identifying critical resources such as oil, natural gas, uranium, and critical minerals, mandating strategic storage requirements, and implementing an early warning system to ensure a stable supply and address potential emergencies.	Ministry of Trade, Industry and Energy

Notable Energy Developments

Energy development	Details	Reference
Revitalising Korea's Nuclear Energy Industry	Korea is committed to strengthening its nuclear energy industry through implementing measures such as the resumption of Shin-Hanul 3 and 4 construction and a significant budget increase to accelerate the development of the Innovative Small Modular Reactor (i-SMR) by 2028. In February 2024, the government announced measures to support the nuclear ecosystem, including expanded funding, tax incentives, and financial assistance for small and medium-sized enterprises (SMEs) and exporters. Strategic plans also focus on fostering Changwon and Gyeongsangnam-do as a global SMR cluster, advancing R&D in next-generation technologies, and enhancing international collaborations.	Korea.net
Korea Explores Oil and Gas Reserves Off the East Coast	In June 2024, the Korean Government announced the discovery of potentially significant oil and gas reserves off the east coast near Yeongilman Bay in Pohang. Preliminary estimates indicate that these deposits might greatly improve Korea's energy security. MOTIE-approved exploration and drilling activities are now underway, with results expected in 2025.	Korea.net
Enacting the Act on the Capture, Transportation, Storage, and Utilization of Carbon Dioxide (the CCUS Act)	In February 2024, the CCUS Act was promulgated to establish a legal basis for the operation of carbon capture, storage, and utilization businesses, addressing regulatory gaps and supporting industry growth through licensing, safety regulations, and financial incentives. It promotes CCUS technology development by introducing cluster support programs, tax benefits, and subsidies while enhancing emissions reduction efforts in line with Korea's 2030 NDC commitment.	Ministry of Trade, Industry and Energy
Advanced Distribution Management System (ADMS)	KEPCO's Advanced Distribution Management System (ADMS) enhances grid adaptability in Korea's evolving distribution system operations by enabling real-time monitoring, optimized operations, and stability amid increasing distributed energy resources (DER) and prosumers. Fully deployed by September 2024, ADMS improves decision-making, reduces costs, and enhances grid reliability through seamless data integration.	Korea Electric Power Corporation

Useful Links

Korea Energy Statistical Information System – https://www.kesis.net/main/main.jsp

Korea Energy Information Culture Agency – https://www.e-policy.or.kr/web/index.do

Korea Electric Power Corporation – https://home.kepco.co.kr/kepco/main.do

Korea Energy Economics Institute – www.keei.re.kr/main.nsf/index.html

Korea Energy Agency – www.energy.or.kr/web/kem_home_new/new_main.asp

Korea Hydro and Nuclear Power – https://www.khnp.co.kr/eng/index.do

Korea Gas Corporation – https://www.kogas.or.kr:9450/portal/index.do

Korea National Oil Corporation – https://www.knoc.co.kr/

Presidential Commission on Carbon Neutrality and Green Growth – https://www.2050cnc.go.kr/base/main/view

Ministry of Trade, Industry and Energy – http://english.motie.go.kr/www/main.do

Ministry of Environment – http://eng.me.go.kr/eng/web/main.do

Statistics Korea – http://kostat.go.kr/portal/eng/index.action

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– (2022), *Vision and Promotion Strategies for Carbon Neutrality and Green Growth*,
https://www.2050cnc.go.kr/base/board/read?boardManagementNo=3&boardNo=1049&searchCategory=&page=2&searchType=&searchWord=&menuLevel=2&menuNo=17

– (2023), *1st Basic Plan for Carbon Neutrality and Green Growth*
https://www.2050cnc.go.kr/base/board/read?boardManagementNo=3&boardNo=1049&searchCategory=&page=2&searchType=&searchWord=&menuLevel=2&menuNo=17

Malaysia

Introduction

Despite contributing only 0.8% to global Green House Gaseous (GHGs), Malaysia is committed to net-zero emissions as early as 2050. By 2050, National Energy Transition Roadmap (NETR) 2023 initiatives are expected to deliver a 32% reduction in GHG emissions for the energy sector compared to the 2019 baseline, reaching 4.3 $MtCO_2eq$ emissions per capita. According to NETR, the projected 32% reduction of GHG emissions for the energy sector is from 261 $MtCO_2eq$ (2019) to 175 $MtCO_2eq$ (2050). This aligns with that target in the Twelfth Malaysia Plan (2021-2025) and the National Energy Policy 2022-2040, laying the groundwork for transitioning to this target.

Malaysia intends to unconditionally reduce its greenhouse gas (GHG) emissions intensity against GDP by 45% by 2030, relative to its 2005 levels. Malaysia has announced a new target for installed renewable energy (**RE**) capacity, aiming for 70% by 2050, in line with the government target of net-zero by 2050.

Malaysia's energy policy landscape in 2024 has seen several significant developments, demonstrating its commitment to sustainability and its transition to a greener economy. Malaysia launched Energy Exchange Malaysia (ENEGEM) in April 2024 to enable cross-border RE trading, particularly within Association of Southeast Asian Nations (ASEAN) economies. The initiative supports the ASEAN Power Grid Initiative and aims to enhance regional energy cooperation. The first pilot auction supplied 100 megawatts of green electricity from Peninsular Malaysia to Singapore. In December 2024, Proton, Malaysia's leading automaker, launched its first electric vehicle, the e.MAS 7, while Malaysia’s second car manufacturer, Perodua, unveiled the eMO-11 electric vehicle concept. It is anticipated that this vehicle will be launched in 2025. This marks a significant step in the economy's efforts to expand the electric vehicle (EV) market and aligns with Malaysia's broader strategy to promote EV adoption and integrate into the global EV supply chain.

Table 1: Malaysia’s macroeconomic data and energy reserves

Key data [a, b]		Energy reserves [c, d]	
Area (million km^2)	0.33	Oil (billion barrels)	4.5
Population (million)	34	Gas (trillion cubic feet)	76
GDP (2021 USD billion PPP)	1111	Coal (million tonnes)	275
GDP per capita (2021 USD PPP)	32 735	Uranium (kilotonnes U < USD 130/kgU)	-

Source: a DOSM, EPU (2024); b World Bank (2024); c EC (2024).

Note: Reserves are total proved reserves and reasonably assured recoverable resources for uranium.

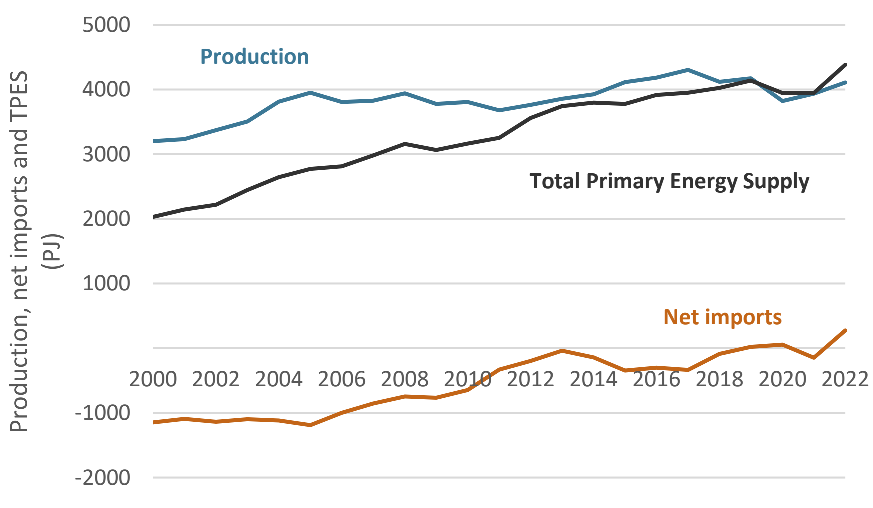
Fossil fuels, such as coal, oil, and natural gas have historically dominated Malaysia's energy sector. Although the sector is a key contributor to the economy, it has experienced challenges due to fluctuating global oil prices and pandemic-related disruptions. In 2024, Malaysia’s crude oil reserve stood at 4.5 billion barrels, while total natural gas reserves stood at 76 Tscf.

Energy Supply and Consumption

Total Primary Energy Supply

Malaysia's total energy supply steadily increased from 2000 to 2012 before levelling off and experiencing minor fluctuations. It aligned closely with energy production in earlier years but diverged later, reaching 4370 PJ in 2022 (Figure 1), indicating growing reliance on imports. In 2021, Malaysia slowly recovered from the pandemic as businesses were allowed to operate and COVID-19 vaccinations were rolled out in stages.

Figure 1: Malaysia's energy supply, production, and net imports (PJ), 2000 to 2022

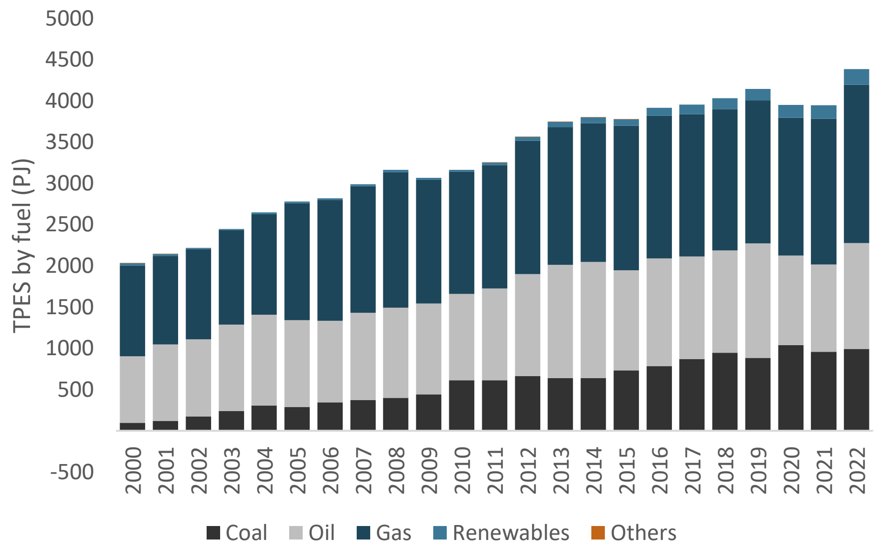


Source: EGEDA (2024)

Total primary energy supply (TPES) increased by 125% compared to 2000, and this trend was to be expected as Malaysia experienced significant industrialisation and economic growth during this period, leading to a rise in energy demand. Coal use has significantly increased, contributing to much of the growth, particularly after 2010. Oil supply has remained relatively stable with moderate increases over time. The gas supply grew steadily but has plateaued in recent years.

The Malaysia Renewable Energy Roadmap (MyRER) outlines strategies to achieve a 31% RE share in the economy's installed capacity mix by 2025, and 40% by 2035. Despite these plans, as of 2022, the contribution of renewables to Malaysia's TPES) remained limited. The government's prioritisation of energy security and affordability has, understandably, resulted in a continued reliance on coal and gas for power generation as part of the current energy mix.

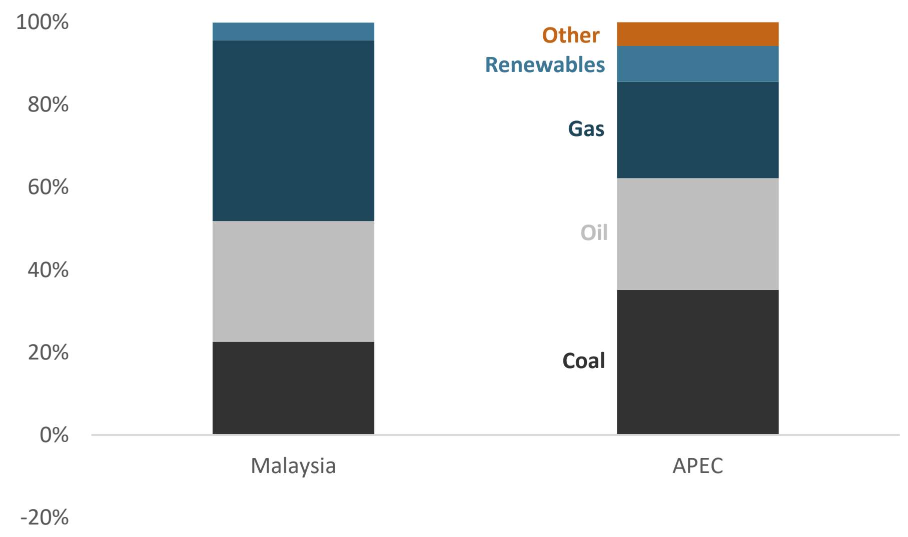
Figure 2: Malaysia's energy supply by fuel (PJ), 2000 to 2022



Source: EGEDA (2024)

Malaysia's significant natural gas resources have increased the economy's reliance on gas for energy needs (Figure 3). Malaysia's reliance is 75% higher than APEC's. Similarly, Malaysia's oil share is about 3% higher than APEC's. This is due to the transportation sector's heavy dependence on oil, contributing to its substantial TPES share. Meanwhile, Malaysia's share of renewable energy is 50% lower than APEC's. While Malaysia's share of renewable energy is currently lower than the APEC average, the government is actively working to address the barriers to adoption.

Figure 3: Energy supply mix, Malaysia and APEC, 2022



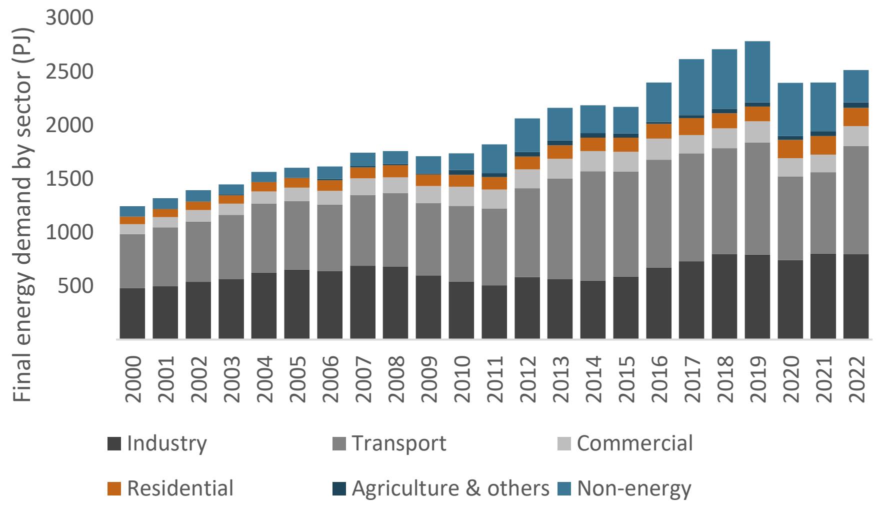
Source: EGEDA (2024)

Total Final Consumption

The transport sector had the largest share of TFC in Malaysia, 40% in 2022. The industry sector followed at 32%, non-energy at 12%, commercial and residential at 7% respectively, and agriculture at 2%.

As shown in Figure 4, in 2022, total final energy consumption experienced an upward trend of 3% from 2020. This was due to increasing energy consumption, especially in the transport and industry sectors. However, energy consumption in the transport sector remained below pre-COVID levels in Malaysia, due to a combination of lingering pandemic effects.

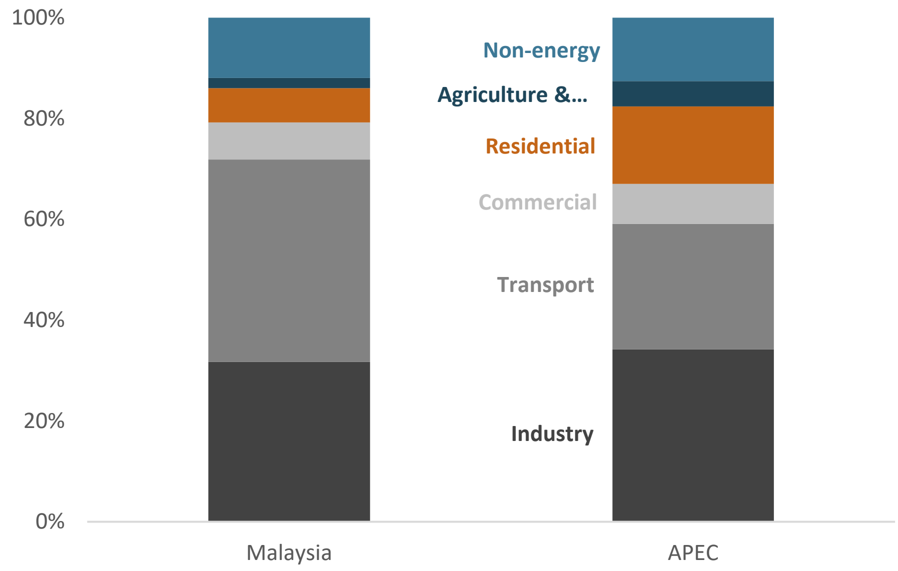
Figure 4: Malaysia's final consumption by sector (PJ), 2000 to 2022



Source: EGEDA (2024)

Like the APEC region, the transport and industry sectors represented the most significant portion of Malaysia's final consumption, more than 70% in 2022 (Figure 5). The significant rebound in the transport and industry sectors' energy consumption in 2022 reflects Malaysia's economic recovery from the COVID-19 pandemic, increased mobility, and a surge in industrial activities to meet global and domestic demand. These factors combined to elevate the energy consumption in these sectors beyond the levels seen in 2020 and 2021.

Figure 5: Final consumption by sector, Malaysia and APEC, 2022



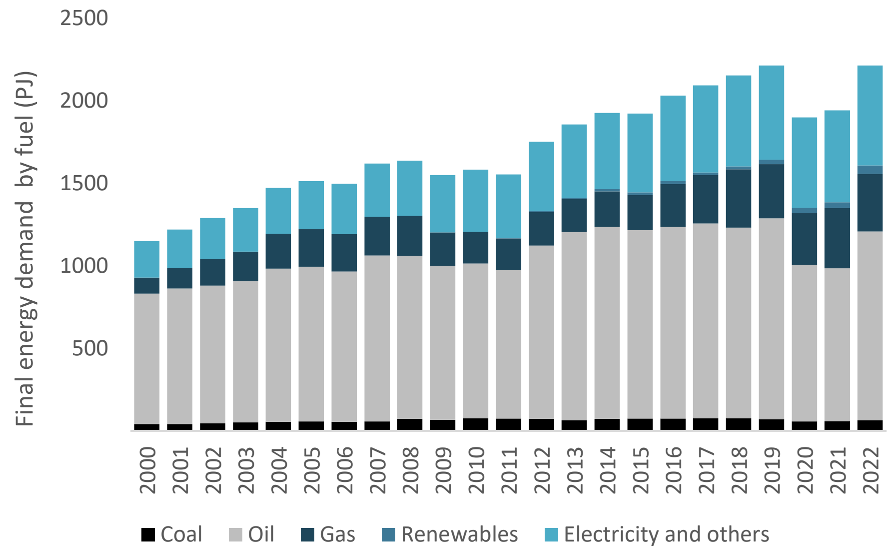
Source: EGEDA (2024)

Final Energy Demand

Malaysia experienced a 92.5% growth in final energy demand, rising from 1149 PJ in 2000 to 2212 PJ in 2022. Fossil fuels constituted nearly 70% of the fuel share utilised by end-users in 2022. Petroleum products, primarily oil and gas, comprised slightly over half of the end-user fuel share in 2022.

Electricity emerged as the second most prominent fuel. After the COVID-19 pandemic, electricity demand in 2022 increased in volume due to a slight increase in the industrial, commercial, and residential sectors.

Figure 6: Malaysia's final energy demand by fuel (PJ), 2000 to 2022



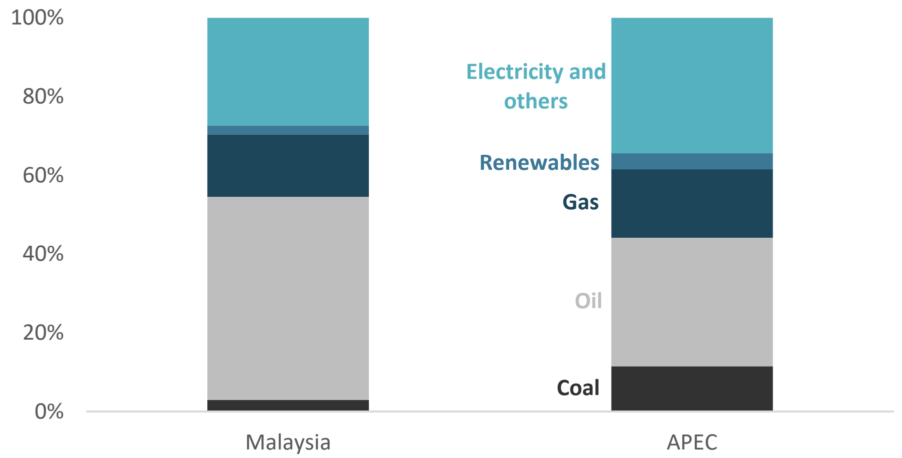
Source: EGEDA (2024)

Note: does not include non-energy sector consumption of energy products

Unlike some APEC economies that rely on coal in industrial processes or for heating, Malaysia has a significantly lower reliance on coal in its energy demand mix, as it uses coal mainly for electricity generation rather than direct end-use consumption. Oil dominates the largest share of final energy demand at 50% because Malaysia's transport sector relies heavily on oil due to its high dependence on private vehicles. Based on the 12th Malaysia Plan (2021-2025), public transportation coverage and usage remain limited outside urban areas like Kuala Lumpur. Similarly, the National Transport Policy 2019-2030 highlights the need to improve public transportation to reduce oil dependency and carbon emissions.

Malaysia lags behind APEC in renewable energy share by 1.7%. Malaysia's renewables primarily consist of solar and biomass (3.2%), and hydro (17%), but their development has been slower than the APEC average. Malaysia has abundant oil and gas resources, which influences its energy demand mix, making it more reliant on these fuels compared to the broader APEC region.

Figure 7: Final energy demand fuel share, Malaysia and APEC, 2022



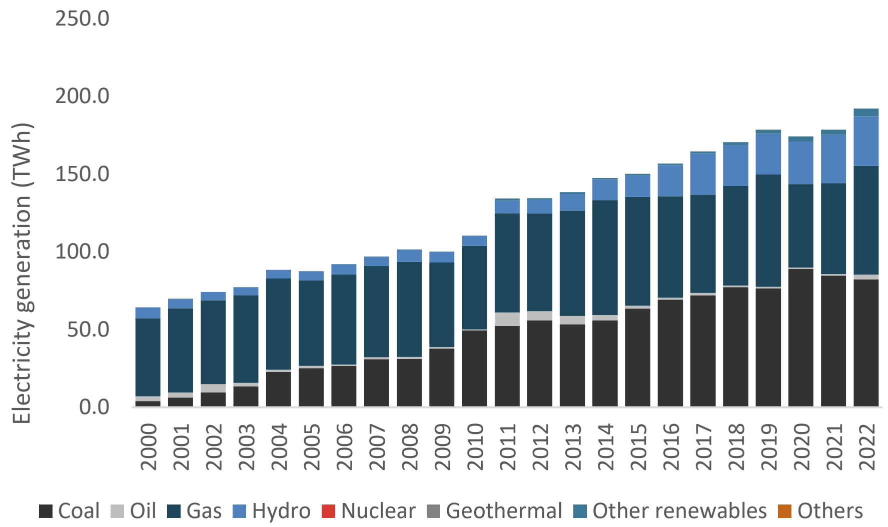
Source: EGEDA (2024)

Transformation

Power Sector

Since 2000 (Figure 8), Malaysia's electricity generation has predominantly relied on fossil fuels, particularly coal and gas, which held a combined share of 89% in 2000. This share steadily increased to 94% in 2010 before gradually declining to 81% in 2022. Coal constitutes almost half of the electricity generation mix. Malaysia's gradual introduction of more shares from gas (36%) and renewables (20%) in 2022 reflects its efforts to transition towards cleaner energy, though progress has been slower than in some APEC economies.

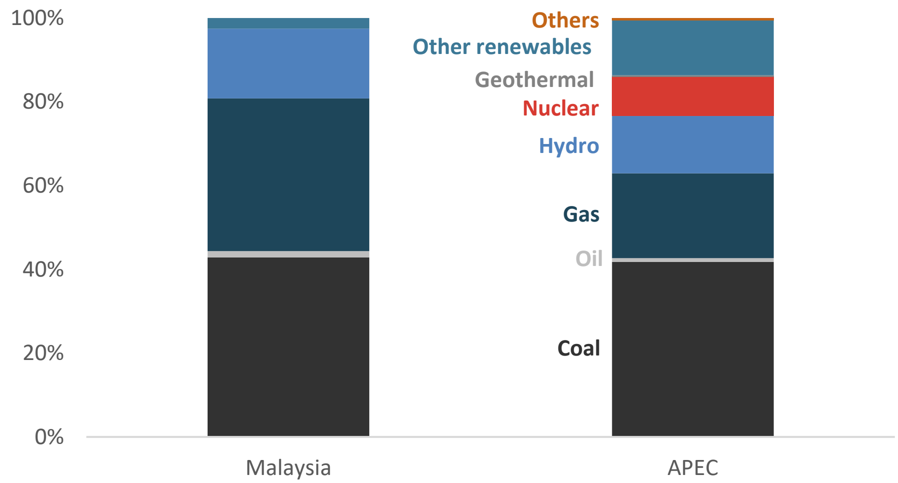
Figure 8: Malaysia’s electricity generation by fuel, 2000 to 2022



Source: EGEDA (2024)

Malaysia's electricity generation in 2022 featured a higher proportion of coal, gas, and hydro compared to the APEC region (Figure 9). Although Malaysia has established a nuclear agency and has periodically reviewed the nuclear option, as of 2022, Malaysia had no nuclear power plants due to policy decisions, public concerns, and the absence of related infrastructure.

Figure 9: Electricity generation fuel share, Malaysia and APEC, 2022



Source: EGEDA (2024)

Refining

Malaysia's refinery sector is a vital component of its energy industry, with a total refining capacity of approximately 955 000 barrels per day, an increase from 625 000 barrels daily in 2021 due to the expansion of existing refinery (Pengerang Integrated Complex). The sector supports Malaysia's industrial growth and economic development, with the latest target of producing sustainable aviation fuel and renewable products by 2028, using approximately 650 000 tons of raw materials annually.

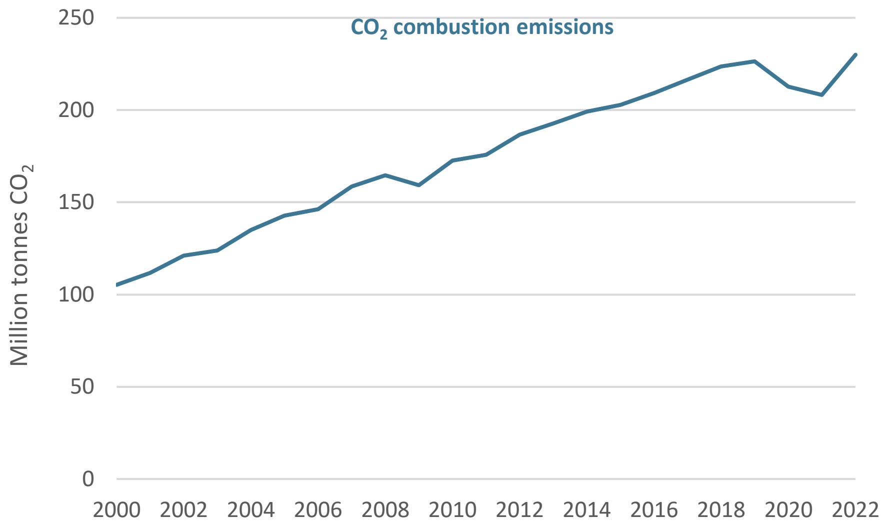
Energy Transition

Emissions

Malaysia’s carbon emissions have risen over decades due to rapid industrialisation, urbanisation, and a growing population. A shift in the energy mix, particularly increased coal use in electricity generation as natural gas reserves declined, has further increased emissions. To reduce these emissions, the government has pledged net-zero emissions by 2050, aiming to reduce carbon intensity by 45% by 2030 compared to 2005 levels. Initiatives include the NETR, carbon pricing strategies, and renewable energy expansion.

A steady increase in emissions from 2000 until around 2018 was attributed to increased industrial activity, population growth, and reliance on fossil fuels for energy generation. This was followed by a decline during 2020 due to the global COVID-19 pandemic, and a sharp rebound in 2021–22 aligned with the global economic recovery.

Figure 10: Malaysia's CO_2 combustion emissions (million tonnes), 2000 to 2022



Source: EGEDA (2024)

Energy Security

Malaysia prioritises energy security to ensure reliable, affordable, and sustainable energy for economic growth and societal needs. The strategy involves diversifying its energy mix, expanding renewable energy adoption, and enhancing energy efficiency. Malaysia has shifted to include renewables in its energy portfolio, which is historically reliant on fossil fuels, reducing dependency on this single source and improving resilience.

The government's NETR is a comprehensive framework for achieving energy security and sustainability. To enhance energy security in Malaysia, NETR outlines key components of energy security that include diversification of energy sources, renewable energy expansion, energy efficiency and conservation, grid modernisation and stability, development of energy storage, and a hydrogen economy.

Furthermore, PETRONAS, Malaysia's oil company, is leading carbon capture and storage projects to develop low-carbon energy solutions while exploring hydrogen as an alternative energy source. Energy efficiency measures are also being promoted across industries and households to optimise energy consumption.

Malaysia is also enhancing regional energy cooperation and grid connectivity through the ASEAN power grid advancement program to improve supply reliability.

APEC Energy Goals

There are two energy-related objectives that APEC member economies have agreed to meet as a collective: to improve energy intensity and double the share of modern renewables.

Energy Intensity Goal

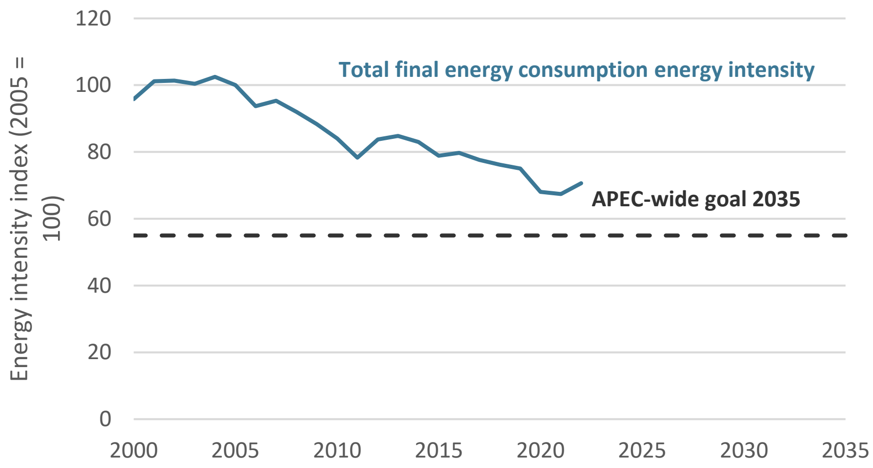
In 2011, APEC member economies agreed to increase their ambition to reduce energy intensity by 45% in 2035, relative to a 2005 baseline. The original goal was a 25% improvement by 2030.

APEC is on track to achieve this improvement in energy intensity. The goal does not impose individual economic targets, but it is possible to track the progress of individual APEC economies relative to the overarching proportional improvement.

Malaysia's total final energy consumption energy intensity (excluding non-energy) declined steadily from 2005 to 2020, dropping by approximately 20-25%. However, the current trend shows that while progress has been made, further reductions are needed to reach the

APEC-wide energy intensity goal for 2035, which is represented by the dashed horizontal line at around 60% of the 2005 baseline. (Figure 11).

Figure 11: Malaysia's total final energy consumption intensity index, 2000 to 2022 (2005 = 100)



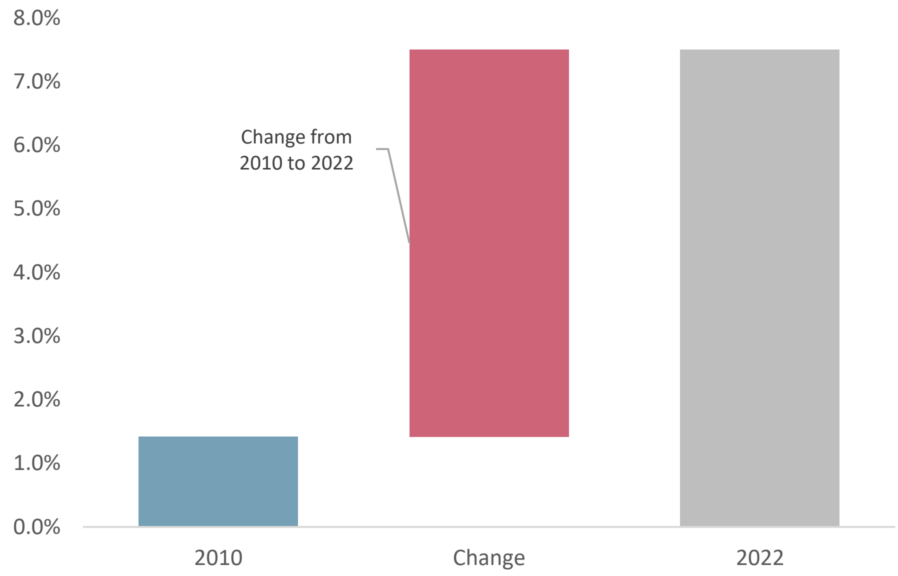
Source: EGEDA (2024)

Doubling of Renewables

The second energy goal involves doubling the share of modern renewables in the APEC energy mix from 2010 to 2030. There is no economy-level goal for individual member economies, but improvements by individual economies will contribute to the doubling goal.

Malaysia's modern renewable energy share from 2010 to 2022 increased from approximately 1% in 2010 to around 7-8% in 2022. By 2021, the proportional share had surged more than 7.5%, indicating a more than fourfold increase in modern renewables compared to 2010 (Figure 12).

Figure 12: Malaysia's modern renewable energy share, 2010 and 2022

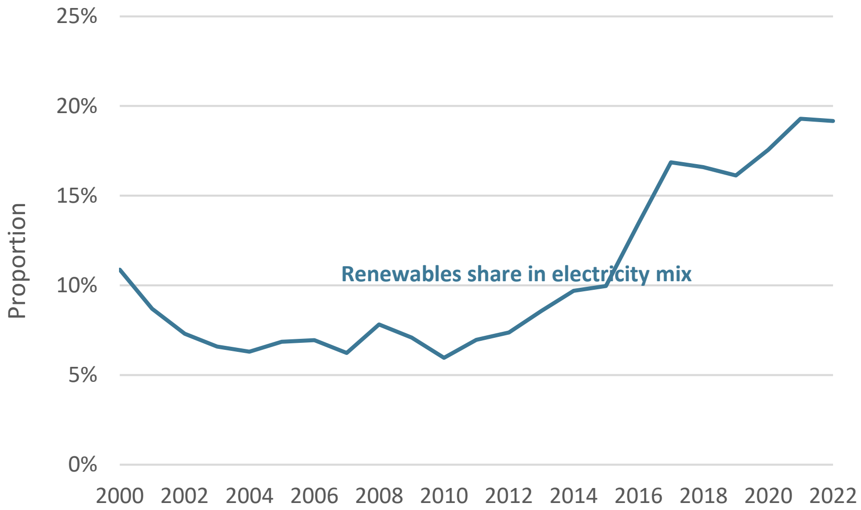


Source: EGEDA (2024)

Note: All other renewables (biomass used by industry, hydro, geothermal, etc.) are considered modern renewables. Modern renewables also include the share of electricity that is generated from renewable sources.

In 2022, Malaysia's electricity generation from renewables reached nearly 20%, tripling the level seen in 2010 (Figure 13). Moreover, there was significant growth in renewables-based electricity generation, increasing from 7 TWh in 2010 to 37 TWh in 2022. This growth was propelled by Malaysia's RE policies and bolstered by various RE plans and initiatives,such as the Feed-in Tariff (FiT) scheme, solar auctioning, and the rooftop solar quota under the Large-Scale Solar, Net Energy Metering, and Self Consumption Program.

Figure 13: Malaysia's renewable generation share, 2000 to 2022



Source: EGEDA (2024)

Energy Policy

Energy Policy	Details	Reference
National Petroleum Policy 1975	To ensure the efficient utilisation of indigenous petroleum resources to facilitate the economy’s industrial, and economic development while maintaining effective regulation and the economy’s majority control over the oil and gas industry's ownership, management, and operation.	Ministry of Economy
National Energy Policy 1979	To achieve an efficient, secure, and environmentally sustainable supply of energy.	Ministry of Economy
National Depletion Policy 1980	To prolong the lifespan of the economy’s oil and gas reserves by safeguarding against over-exploitation and prioritising domestic needs for future energy security, with production caps imposed on oil and natural gas reserves.	Ministry of Economy
Four-Fuel Diversification Policy 1981	To enhance the reliability and security of the energy supply by reducing over-dependence on oil as the single fuel source by diversification to four primary fuels: oil, natural gas, hydroelectricity, and coal.	Ministry of Energy Transition and Water Transformation
Five-Fuel Diversification Policy 2000	To introduce RE as an alternative fuel source to complement the four focus fuel sources identified in the Four-Fuel Diversification Policy and encourage efficient energy utilisation.	Ministry of Energy Transition and Water Transformation
National Policy on the Environment 2002	To promote continuous economic, social, and cultural progress and enhance the quality of life of Malaysians through environmentally sound and sustainable development. This includes stewardship of the environment, continuous improvement of environmental quality, and consumption and production patterns, along with sustainable use of natural resources.	Ministry of Natural Resources and Environmental Sustainability
National Biofuel Policy 2006	To promote the use of biofuels, in alignment with the Five-Fuel Diversification policy, as an environmentally friendly, sustainable, and viable energy source to reduce dependency on fossil fuels and promote the well-being of all stakeholders in agricultural and commodity-based industries by ensuring stable and remunerative prices.	Ministry of Natural Resources and Environmental Sustainability
National Green Technology Policy 2009	To promote energy efficiency while enhancing economic development to facilitate the growth of the green technology industry, increase the economy’s capability and capacity in green technology development, ensure sustainable development and conservation of the environment for future generations, and enhance public awareness of green technology.	Ministry of Natural Resources and Environmental Sustainability
National Renewable Energy Policy and Action Plan 2009	To enhance the utilisation of indigenous RE resources to contribute towards the economy’s supply security and sustainable socioeconomic development by increasing RE contribution in the economy’s power generation mix, facilitating the growth of the RE industry, ensuring reasonable RE generation costs, conserving the environment for future generations, and enhancing awareness of the role and importance of RE.	Ministry of Energy Transition and Water Transformation

National Policy on Climate Change 2010	To promote the effective management of resources and enhanced environmental conservation to strengthen economic competitiveness and improve quality of life, integrate climate change considerations into the economy's policies, and strengthen institutional and implementation capacities to address challenges and opportunities related to climate change.	Ministry of Natural Resources and Environmental Sustainability
New Energy Policy 2010	To promote energy security, economic efficiency, and environmental and social objectives through the five key pillars of energy pricing, supply, efficiency, governance, and change management. Highlights include the gradual reduction of energy subsidies, such as gradual gas price revisions to converge with market pricing, initiatives to secure and manage reliable energy supply with third-party access, the building of Re-Gasification Terminals and RAPID and FiT for RE sources, and encouraging studies on alternative energies for increased energy source diversification, increased energy efficiency and various enablers such as energy sector governance.	Ministry of Economy
Nationally Determined Contribution to the UNFCCC 2015	To unconditionally decrease the GHG emission intensity of GDP by 35% in 2030 compared to the 2005 level and by a further 10% on the condition of receipt of climate finance, technology transfer and capacity building from developed economies.	Ministry of Natural Resources and Environmental Sustainability
National Energy Efficiency Action Plan 2016	To enhance energy efficiency with a target of 8% reduction (saving up to 594 MWh) in electricity demand by 2025 through energy efficiency initiatives, enabled by the implementation of the energy efficiency plan, strengthening of the institutional framework and capability development, implementation of a sustainable funding mechanism, and promotion of private sector investment in energy efficiency initiatives.	Ministry of Energy Transition and Water Transformation
Green Technology Master Plan 2017–2030	Outlines the strategic plans/immediate course for green technology development to create a low-carbon and resource-efficient economy.	Ministry of Natural Resources and Environmental Sustainability
Green Technology Financing Scheme 1.0, 2.0, 3.0 and 4.0	A special financing scheme to support the development of green technology in the energy, building, manufacturing, transport, waste management and water sectors.	Malaysia Green Technology and Climate Change Corporation
Malaysia's Roadmap Towards Zero Single-Use Plastics 2018–2030	Towards zero single-use plastics for a cleaner and healthier environment in Malaysia by 2030.	Ministry of Natural Resources and Environmental Sustainability

National Automotive Policy 2020	To encourage new growth areas through the integration of technologies such as the Next Generation Vehicle, Mobility as a Service and Industrial Revolution 4.0 (IR4.0) that are in line with the development of future technologies.	Ministry of International Trade and Industry
Peninsular Malaysia Generation Development Plan 2020 (2021–2039)	Electricity demand is projected to grow by 0.6% p.a. for 2021–30 and 1.8% p.a. for 2030–2039. To achieve the RE capacity mix target from 20% to 31% by 2025, large hydro resources will be included as part of the RE for consistency and 1178 MW of new RE capacities will be developed in the Peninsular Malaysia from 2021 onwards. To increase RE capacity to 40% by 2035, an additional 2414 MW of RE capacity will be developed. The total new RE capacity would consist of 93% solar and 7% non-solar energy. To develop 6077 MW of new capacity (thermal energy and RE) by 2030 and 9924 MW of new capacity (thermal energy and RE) beyond 2030.	Energy Commission
Low-Carbon Mobility Blueprint 2021–2030	To focus on improving vehicle fuel economies and emissions, adopting EVs, low-emission vehicles and alternative fuels, and reducing GHG emissions and energy via mode shifts.	Ministry of Natural Resources and Environmental Sustainability
National Low-Carbon Cities Masterplan 2021	To help guide the implementation of low-carbon developments and initiatives.	Ministry of Natural Resources and Environmental Sustainability
Nationally Determined Contribution to the UNFCCC 2021	To unconditionally decrease GHG emission intensity of the GDP by 45% in 2030 compared to the 2005 level.	Ministry of Natural Resources and Environmental Sustainability
The Twelfth Malaysia Plan 2021-2025	A medium-term plan for the Shared Prosperity Vision 2030, with the objective of 'A Prosperous, Inclusive, Sustainable Malaysia'. Under the plan, the energy sector will address the energy trilemma, especially on energy security and sustainability.	Ministry of Economy
National OGSE Industry Blueprint 2021-2030	An effort to help shape the Oil and Gas Services and Equipment (OGSE) industry and adapt to the rapidly evolving global needs of the global market.	Ministry of Economy
Malaysia Renewable Energy Roadmap 2022–2035	To support further decarbonisation of the electricity sector in Malaysia through the 2035 milestone, from 2022 to 2035.	Ministry of Energy Transition and Water Transformation

Sabah Gas Master Plan 2022	A collaborative effort between the Sabah State Government and PETRONAS to sustainably pursue the full potential of Sabah's domestic natural gas industry.	Sabah State Government and PETRONAS
Third Industrial Master Plan (IMP3) 2030	Manufacturing: to grow at 5.6% annually, contributing 29% to GDP in 2020, and total investments of MYR 412 billion (MYR 28 billion annually). Non-government services: to grow at 7.5% annually and contribute 60% to GDP in 2020, and total investments of MYR 688 billion (MYR 46 billion annually).	Ministry of International Trade and Industry
Post COVID-19 Development Strategy 2030	To ensure Sarawak can embark on a full-fledged transformation capitalising on mega-trends around the world such as globalisation, the new industrial revolution, the circular economy, and the transition towards a low-carbon economy.	Economic Planning Unit Sarawak
National Energy Policy 2022-2040	To enhance macroeconomic resilience and energy security, achieve social equitability and affordability, and ensure environmental sustainability. The document is subject to periodic reviews every three years to ensure that the targets are achievable and to keep in line with international development in the energy transition pace.	Ministry of Economy
National Energy Transition Roadmap 2050	To accelerate energy transition efforts. This roadmap is vital for steering Malaysia's shift from a traditional fossil fuels-based economy to a high-value green economy. The NETR requires a whole economy approach, encompassing federal and state governments, industry, the public, and the international community.	Ministry of Economy
Hydrogen Economy and Technology Roadmap 2050	To guide the development of Malaysia's hydrogen economy. This roadmap is a supporting document to the National Energy Policy 2022-2040 (NEP), which will pave the way to achieving environmentally sustainable, long-term energy security for Malaysia, driven by technological innovation.	Ministry of Science, Technology, and Innovation

Notable Energy Developments

Energy development	Details	Reference
Malaysia's Data Centre Growth	Malaysia emerges as a leading data centre hub, Malaysia anticipates significant growth in electricity demand from data centres, projecting a demand to exceed 11 000 MW by 2035.	Minister of Investment, Trade, and Industry
Electric Vehicle (EV) Development	Proton, a leading Malaysian automaker, launched its first electric vehicle, the e.MAS 7, aiming to strengthen its position in the growing EV market. This move aligns with Malaysia's strategy to increase EV and hybrid vehicle adoption, targeting 20% of new car sales by 2030	Ministry of Transport and PROTON Malaysia
Malaysia Aviation Decarbonisation Blueprint (MADB)	The Malaysian government unveiled a plan to achieve net-zero emissions in the aviation sector by 2050. The strategy includes reducing carbon emissions through improved aircraft technology, increased use of SAF like biofuels, and carbon offset schemes.	Ministry of Transport
Corporate Renewable Energy Supply Scheme (CRESS)	Launched in September 2024, CRESS enables businesses to purchase green electricity directly from renewable energy developers via the economy's grid.	Single Buyer
Energy Exchange Malaysia (ENEGEM)	Energy Exchange Malaysia (ENEGEM) was developed as the designated platform to facilitate sales of renewable energy or green electricity between Malaysia and neighbouring economies. ENEGEM acts as the marketplace to sell green electricity through a bidding mechanism	Single Buyer
Climate Change Bill Public Consultation	Malaysia initiated a public consultation on the proposed Climate Change Bill. The bill aims to establish a comprehensive framework to regulate, implement, and enforce actions leading towards a low-carbon economy. It includes provisions for creating a National Climate Fund to support climate change initiatives and the operations of a regulatory entity overseeing carbon trading platforms and related services.	Ministry of Natural Resources and Environmental Sustainability

Useful Links

Bank Negara Malaysia – www.bnm.gov.my

Department of Statistics Malaysia – www.dosm.gov.my

Energy Commission – www.st.gov.my

Grid System Operator – www.gso.org.my

Malaysia Energy Information Hub – www.meih.st.gov.my

Malaysia Green Technology Corporation – www.mgtc.gov.my

Malaysian Palm Oil Board – www.mpob.gov.my

Ministry of Economy – www.epu.gov.my

Ministry of Energy Transition and Water Transformation – Ministry of Energy Transition and Water Transformation

Ministry of Natural Resources and Environmental Sustainability – Ministry of Natural Resources and Environmental Sustainability

Ministry of Finance – www.mof.gov.my

Ministry of Investment, Trade, and Industry – www.miti.gov.my

Ministry of Plantation and Commodities – www.mpic.gov.my

Ministry of Science, Technology, and Innovation – www.mosti.gov.my

PETRONAS – www.petronas.com

Prime Minister's Office – www.pmo.gov.my

Sabah Electricity Sdn. Bhd. – www.sesb.com.my

Sarawak Energy Berhad – www.sarawakenergy.com

Sustainable Energy Development Authority (SEDA) Malaysia – www.seda.gov.my

Single Buyer Department – www.singlebuyer.com.my

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Mexico

Introduction

Mexico has abundant fossil energy resources and significant renewable energy potential. However, for over a decade, this economy has struggled to sustain or increase oil and gas production to meet its growing energy demands. This challenge is particularly acute for gas, as Mexico depends heavily on imports of this fuel. Additionally, Mexico has faced difficulties in producing sufficient refined petroleum products.

Mexico's proximity to the United States enables it to import energy at competitive prices, reducing the urgency of energy self-sufficiency strategies. Mexico imports U.S. natural gas through a robust, interconnected pipeline system and also brings in a significant amount of refined petroleum products.

Mexico's gas production had been declining since 2013, but the past two years have seen a partial recovery. In 2023, output reached 4996 million cubic feet per day, a 4.1% increase over 2022 levels. While exploration and extraction contracts awarded to the private sector under the now outdated 2014 energy reform helped stabilise production, their overall impact remains limited, with private entities accounting for 4.9% of total gas output in 2023.

In 2023, crude oil production reached 1.7 million barrels per day, a 1.9% year-on-year increase. The private sector recorded an 11% rise in crude output, while Petroleos Mexicanos (PEMEX), the publicly owned oil and gas company, reported 0.7% growth. Overall crude oil production growth was constrained by declining productivity in mature fields, which make up the largest share of PEMEX's producing assets.

Mexico's government follows an energy self-sufficiency strategy centred on fossil fuels, with PEMEX as its key pillar. The goal is to produce at least 1.8 million barrels of crude oil per day and stabilise natural gas output at approximately 5000 million cubic feet per day. Significant efforts and investments have been made to revitalise the domestic refining industry, leveraging the domestic hydrocarbon supply to reduce reliance on energy imports.

In March 2025, Mexico approved a new energy reform that alters private sector participation in oil and gas production and in the power sector. This reform restores a dominant role to PEMEX and to Comisión Federal de Electricidad (CFE), the publicly owned electricity company, within their respective industries. The administration hopes to attract private investment while ensuring the viability of its energy companies.

Table 1: Mexico's macroeconomic data and energy reserves

Key data [a, b]		**Energy reserves** [c, d]	
Area (million km^2)	2.0	Oil (billion barrels)	6.1
Population (million)	129	Gas (trillion cubic feet)	6.3
GDP (2021 USD billion PPP)	2838	Coal (million tonnes)	1211
GDP per capita (2021 USD PPP)	21 874	Uranium (kilotonnes U < USD 130/kgU)	2500

Source: a SRE (2024); b World Bank (2024); c Energy Institute (2024); d NEA (2023)
Note: Reserves are total proved reserves and identified recoverable resources for uranium.

Energy Supply and Consumption

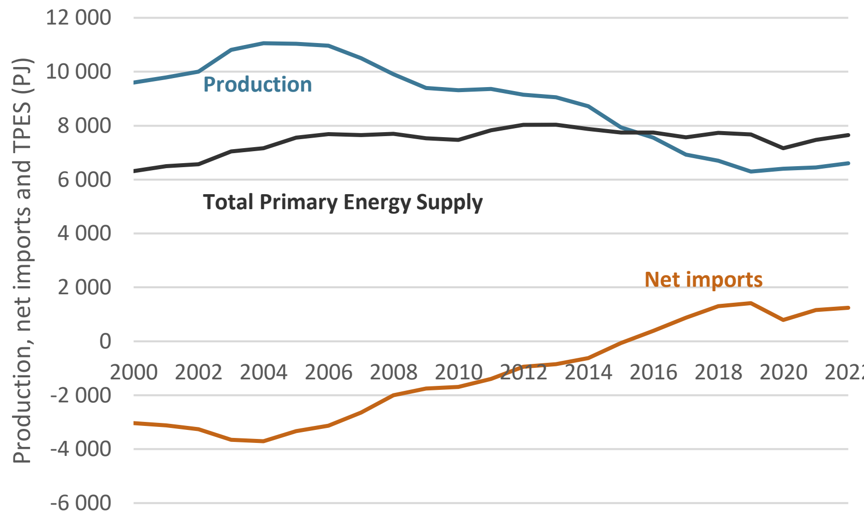
Total Primary Energy Supply

Mexico's energy production has declined by 40% since oil production peaked at 3380 Mbd in 2004. Total primary energy supply (TPES), which includes imports, exceeded domestic production for the first time in 2016, and it is expected that this trend will continue unless the decline in crude oil and gas production is reversed. The production of these hydrocarbons started to show signs of stabilisation from 2019 due to new developments in the Sureste Basin.

Until 2015, Mexico was a net primary energy exporter, with crude oil making up the bulk of its energy exports. However, rising natural gas imports from the United States outpaced these exports. Declining oil and gas production further increased reliance on U.S. gas, widening the primary energy import gap. Between 2016 and 2021, net primary energy imports tripled.

Over the next decade, natural gas imports are expected to continue rising to meet growing domestic demand and could be re-exported to international markets. Several liquefied natural gas (LNG) projects are being considered in Mexico, leveraging its geographic location and logistical advantages to expand the trade of U.S. gas, primarily targeting Asian and European markets. The New Fortress Altamira FLNG (floating LNG terminal) is already in operation, while the Energia Costa Azul LNG project is set to begin operations by the end of 2025.

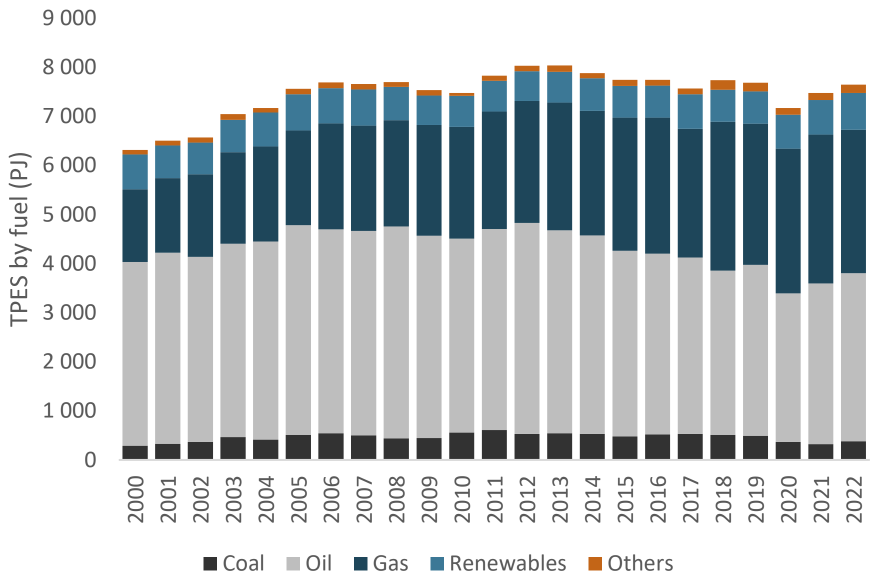
Figure 1: Mexico's energy supply, production, and net imports (PJ), 2000 to 2022



Source: EGEDA (2024)

In 2022, TPES grew by 2.6% as economic activities continued to rebound, supported by a significant decline in COVID-19 cases compared to the previous year. Oil saw the largest absolute increase, driven by a slight rise in production and higher utilisation of domestic refineries. Coal supply had the second-largest absolute increase, as industrial demand partially recovered and coal-fired generation expanded in response to reduced gas imports from the United States, which prioritised domestic consumption during winter in the northern hemisphere due to gas production challenges in the Haynesville region.

Figure 2: Mexico's energy supply by fuel (PJ), 2000 to 2022

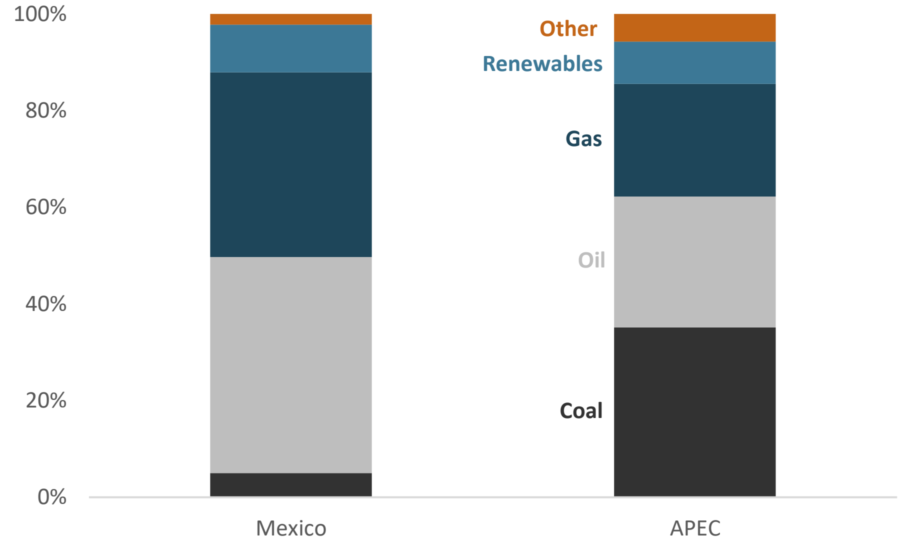


Source: EGEDA (2024)

Although natural gas's share of TPES declined in 2022, it continues to challenge oil as the main primary energy source. From 2010 to 2021, oil's share in TPES fell from 53% to 44%, while natural gas increased from 30% to 41%. Since the mid-2000s, factors such as abundant and affordable U.S. gas and expanded natural gas infrastructure have enabled Mexico to increase its gas supply despite a decline in domestic production. An extensive and integrated pipeline network ensures gas reaches demand centres, supplying the industrial, building, and power sectors.

Mexico has significant potential for renewable energy generation, with wind and solar energy penetration increasing rapidly over the last decade; however, renewables still lag behind fossil fuels. In 2022, renewables made up 9.8% of TPES, while modern renewables (including wind, solar and modern biomass energy) accounted for just 6.6% of TPES.

Figure 3: Energy supply mix, Mexico and APEC, 2022



Source: EGEDA (2024)

One of the main differences between Mexico's energy supply mix and APEC's is the lower share of coal. Compared to the APEC region, Mexico has access to abundant domestic and imported gas, making it a more competitive fuel than coal, particularly for power generation.

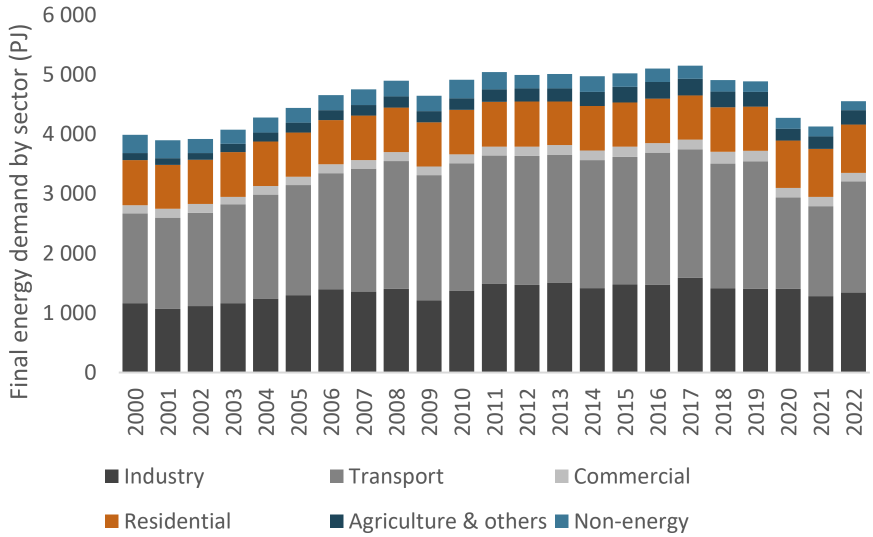
In Mexico, oil's share of the energy supply mix is higher (44%) compared to APEC (27%), due to the relatively high domestic oil production and sizeable refining industry. Mexico operates seven oil refineries, with the most recent, Dos Bocas, located in the state of Tabasco in the southern region, beginning operations in the second half of 2024.

Total Final Consumption

In 2022, total final consumption (TFC) in Mexico partially rebounded, showing a 10% growth compared to the previous year. Economic activities began to recover as COVID-19 cases significantly declined. TFC growth was primarily driven by the transportation and industrial sectors, which saw increases of 23% and 4.7%, respectively.

TFC in the commercial sector continued to contract in 2022, as the economic recovery in this sector was delayed by factors such as social distancing policies, including working from home, and general economic uncertainty. In the residential sector, TFC saw a slight increase, as working-from-home policies remained in place.

Figure 4: Mexico's final consumption by sector (PJ), 2000 to 2022

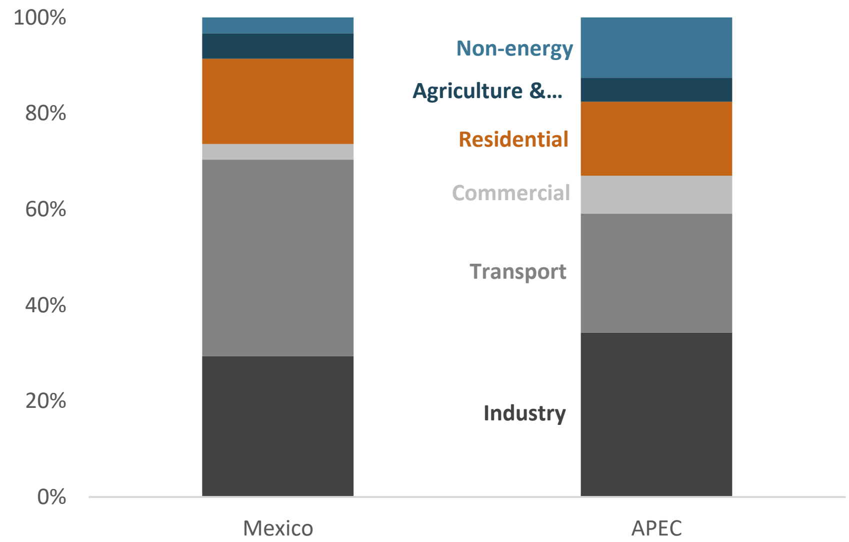


Source: EGEDA (2024)

Mexico's TFC has been largely driven by the transport sector, which accounted for 41% of TFC in 2022. The mountainous geography found in Mexico, extensive trade with the United States, and high vehicle ownership contribute to making this sector the dominant energy consumer. The transport sector is primarily dependent on oil-refined products such as diesel and gasoline.

The industrial sector is the second-largest consumer, accounting for 29% of TFC. This sector relies heavily on electricity, natural gas, and coal.

Figure 5: Final consumption by sector, Mexico and APEC, 2022



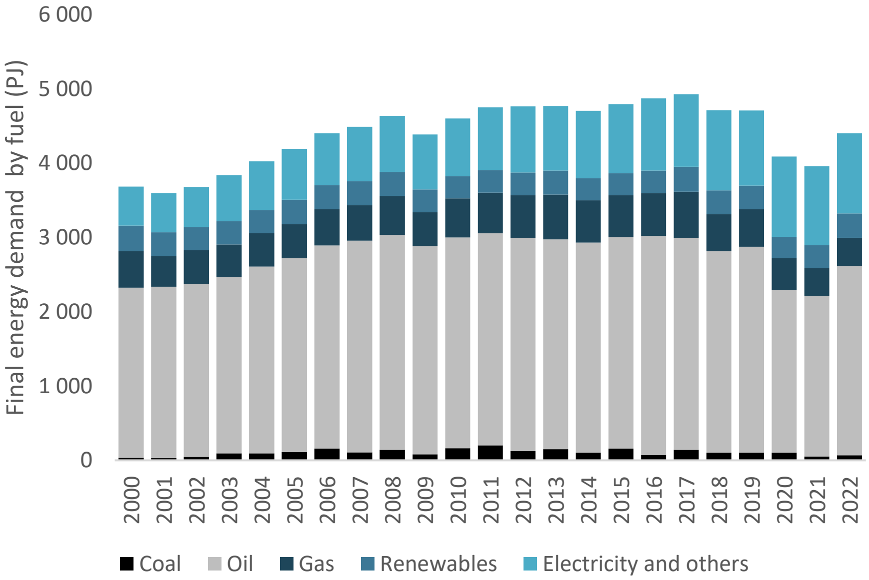
Source: EGEDA (2024)

Final Energy Demand

In 2022, final energy demand (FED) in Mexico increased by 11% compared to the previous year, as economic activities began to recover with significantly fewer COVID-19 cases. Oil demand saw the largest increase, driven by the partial rebound in demand in the transport sector. Electricity demand experienced an increase of 1.7%, driven by an increase in electricity demand by the industry.

The FED of natural gas grew marginally in 2022, with sluggish demand growth in the industry sector due to high prices and gas supply issues, including reduced gas availability from the United States towards the end of the year.

Figure 6: Mexico's final energy demand by fuel (PJ), 2000 to 2022



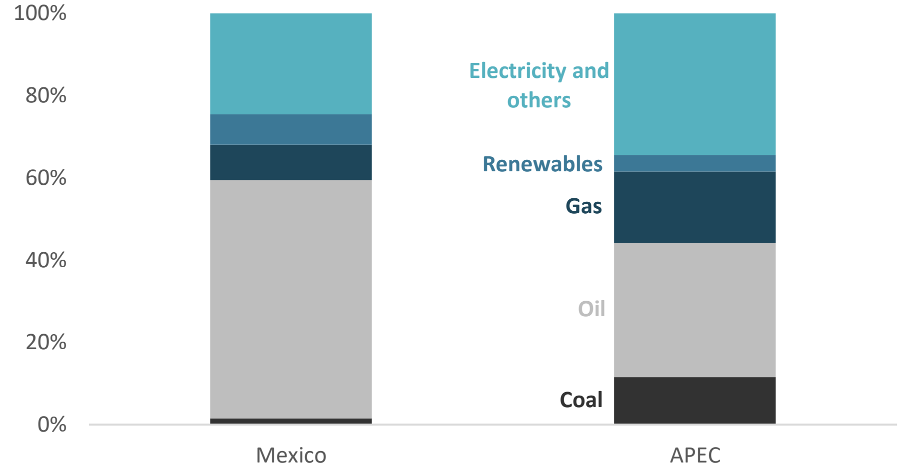
Note: Does not include non-energy sector consumption of energy products.

Source: EGEDA (2024)

Mexico is heavily reliant on fossil fuels to meet its final energy demand. In 2022, oil accounted for the largest share of FED at 58%. This high reliance on oil, compared to the APEC region, is explained by Mexico's domestic oil production and refining industry, access to refined product imports from the United States, and strong energy demand in the transport sector.

Although Mexico has a sizeable gas supply, most of it is used for electricity generation, with some use in industry. Gas is not a major source of energy in the buildings and transport sectors. The natural gas share of FED stands at 8.7%, about half of the share for the APEC region. The coal share in Mexico's FED mix is notably low at 1.5%, reflecting its limited role beyond the industry sector.

Figure 7: Final energy demand fuel share, Mexico and APEC, 2022



Source: EGEDA (2024)

Renewable energy in Mexico, accounting for 7.4% of FED, is nearly double the share observed in the APEC region. Most of the final energy demand for renewables comes from the use of solid biomass for domestic activities such as cooking and water heating.

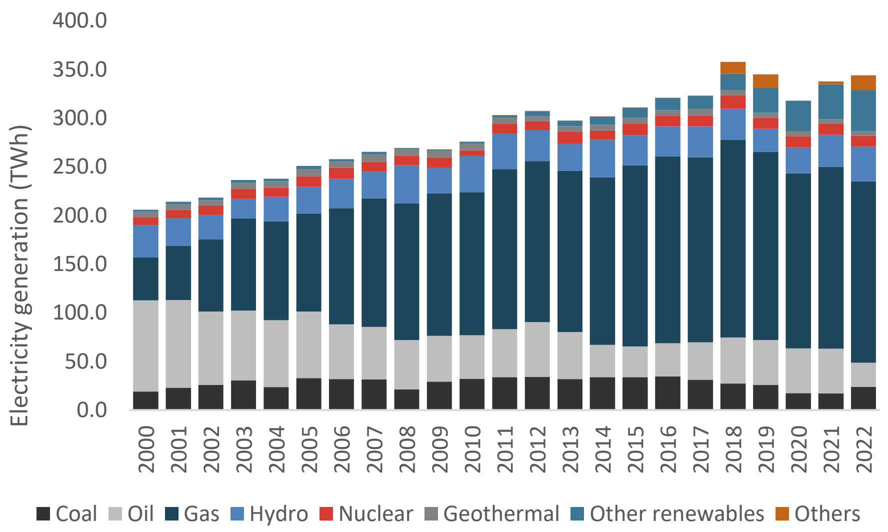
Electricity comprises 24% of the final energy demand in Mexico, below the APEC total share of 34%. The current reliance on hydrocarbons in transport, industry, and in commercial buildings, as well as the use of solid biomass for domestic activities, has prevented electricity from playing a larger role in Mexico's energy mix.

Transformation

Power Sector

In 2022, total electricity generation in Mexico increased by 1.8% compared to the previous year. This growth was driven by rising electricity demand in the industry as economic activities continued to recover. Electricity generation in 2022 nearly returned to the pre-pandemic levels of 2019.

Figure 8: Mexico's electricity generation by fuel, 2000 to 2022



Source: EGEDA (2024)

In 2022, gas accounted for 54% of total electricity generated in Mexico making gas, by far, the main source of power generation. Its share has steadily increased over the past two decades, supported by domestic supply and affordable gas imports from the United States. This growth has reduced the role of fuel oil and coal in power generation.

The share of electricity generation from wind and solar has also grown significantly, especially in the past five years, making it the second-largest source of electricity in Mexico. In 2022, wind and solar power accounted for 12% of total electricity generated.

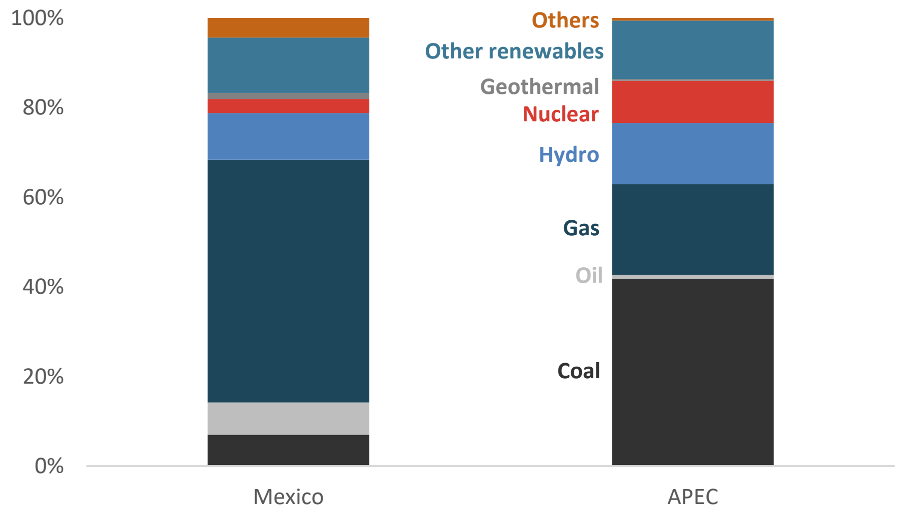
In 2022, the composition of electricity generation by fuel in Mexico differed significantly from that of the APEC region. In APEC, coal was the primary source of electricity, accounting for 42% of total generation, largely due to its dominant role in China's power sector.

Gas is the second-largest source of electricity in the APEC region, accounting for 20% of total generation. Its share is driven by the availability of domestic production or competitively priced imports in several APEC economies.

In 2022, renewable electricity had a smaller share in Mexico than in the APEC region. Hydro, geothermal, and other renewables (mainly solar and wind) accounted for 24% of total generation in Mexico, compared to 27% in APEC. Mexico's Electric System Development Program (PROSEDEN) 2024-38 outlines a goal to accelerate renewable energy expansion, with a particular focus on wind power.

The share of nuclear generation in Mexico is significantly lower than in the APEC region, as the focus has remained on fossil fuels and the role of PEMEX in the economy. Additionally, high capital costs and a lack of policy emphasis on nuclear energy have hindered the expansion of nuclear capacity.

Figure 9: Electricity generation fuel share, Mexico and APEC, 2022



Source: EGEDA (2024)

Refining

Mexico prioritises increasing the utilisation of its domestic refining system. The seventh refinery, Dos Bocas, located in Tabasco with a capacity of 340 000 barrels per day, began operations in the second half of 2024. Additionally, since 2019, significant investments have been made to maintain and modernise the six existing refineries, aiming to enhance capacity and reliability for processing heavy crude oil. In 2022, PEMEX acquired full ownership of the Texas Deer Park refinery to strengthen control over refined product imports from the United States.

Energy Transition

Emissions

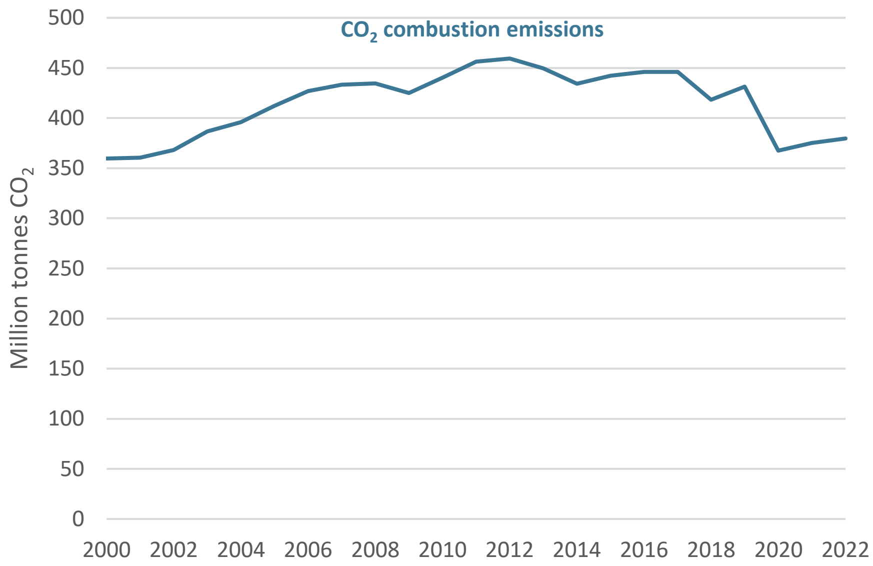
Mexico's CO_2 emissions follow the same trend as final energy consumption; the trajectory in emissions reported between 2000 and 2022 is more influenced by changes in final energy consumption than by decarbonisation efforts. However, Mexico has started to implement emissions reduction measures, especially in the power sector.

The shift away from coal and fuel oil in the power sector has been the primary driver of CO_2 emissions reduction efforts in Mexico. Between 2000 and 2010, electricity generation from fuel oil was cut in half, while gas-fired generation more than tripled. From 2010 to 2022, the growth in electricity generation came increasingly from lower carbon sources compared to the previous decade. Gas-fired generation increased by 26%, fuel oil use continued to decline, and wind and solar emerged as the second-largest electricity source after gas.

Coal-fired generation in Mexico began to decline sharply after peaking in 2016, shrinking by 30% between 2016 and 2022.

In November 2022, during COP27, Mexico's government made the commitment to reduce greenhouse emissions by 35% by 2030. Increased investments in renewable power generation are expected to help meet this goal.

Figure 10: Mexico's CO_2 combustion emissions (million tonnes), 2000 to 2022



Source: EGEDA (2024)

Energy Security

Mexico has abundant hydrocarbon resources and significant renewable energy potential. However, oil and gas production has declined over the past decade due to limited investment in upstream activities and the natural depletion of major fields. Long-term underinvestment in the refining system has also constrained the production of refined oil products.

The combination of falling domestic production and rising consumption has increased reliance on energy imports. Over the past decade, imports of gas and refined oil products have grown substantially.

The current development plan prioritises energy security by expanding domestic oil and gas production and strengthening refining infrastructure. While hydrocarbon output has stabilised, further efforts are needed to sustain upstream operations and foster collaboration with the private sector. Additionally, investing in gas storage will be crucial to mitigating risks from market volatility and geopolitical challenges.

APEC Energy Goals

There are two energy-related objectives that APEC member economies have agreed to meet as a collective: to improve energy intensity and to double the share of modern renewables.

Energy Intensity Goal

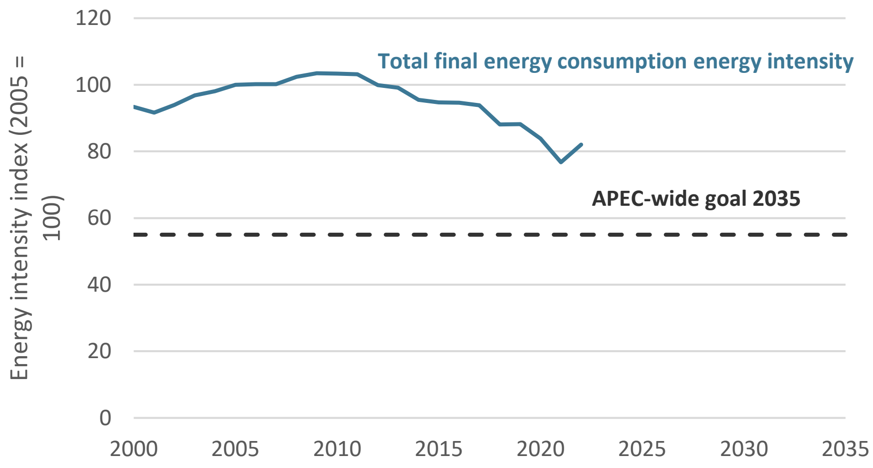
In 2011, APEC member economies agreed to increase their target to reduce energy intensity by 45% in 2035, relative to a 2005 baseline. The original goal was a 25% improvement by 2030, relative to a 2005 baseline.

APEC is on track to achieve this energy intensity improvement. The goal does not impose individual economy targets, but it is possible to track the progress of individual APEC economies relative to the overarching proportional improvement.

Total final energy consumption intensity in Mexico has decreased by 18% from the 2005 baseline. However, in 2022, energy intensity increased as final energy demand growth in the transport sector outpaced GDP growth.

Most of the energy efficiency gains over this period have come from the residential sector, with industry and commercial buildings also showing improvements, though to a lesser extent. Mexico has focused on enhancing energy efficiency in construction, appliances, and lighting (CEPAL, 2018). However, the transport sector presents the greatest challenge in reducing final energy intensity.

Figure 11: Mexico's total final energy consumption intensity index, 2000 to 2022 (2005 = 100)

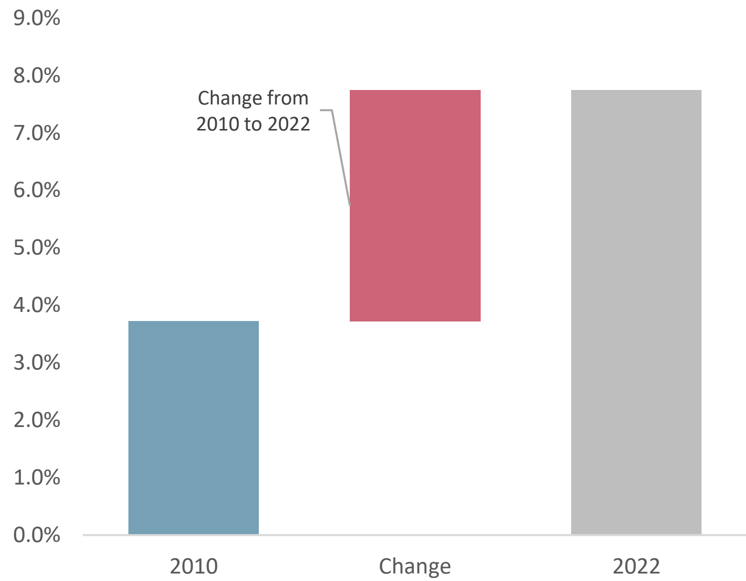


Source: EGEDA (2024)

Doubling of Renewables

The second energy goal involves doubling the share of modern renewables in the APEC final energy consumption mix for the period 2010 to 2030. There is no economy-level goal for individual member economies, but improvements by individual economies will contribute to the doubling goal.

Figure 12: Mexico's modern renewable energy share, 2010 and 2021



Source: EGEDA (2024)

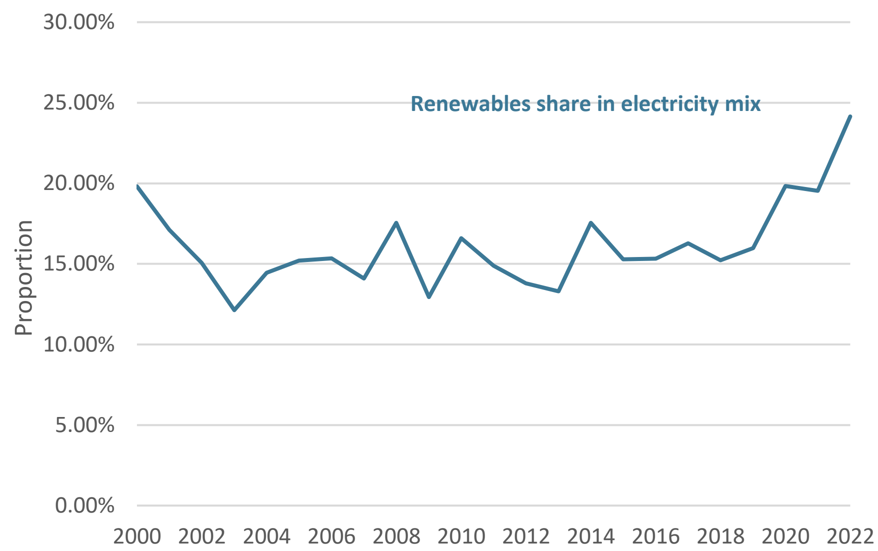
Note: Biomass used in the residential and commercial sectors is assumed to be traditional biomass and is not included in the definition of modern renewables. All other renewables (biomass used by industry, hydro, geothermal, etc.) are considered modern renewables. Modern renewables also include the share of electricity that is generated from renewable sources.

From 2010 to 2022, Mexico's share of modern renewables more than doubled, reaching 7.8% in 2022. Increased private sector participation in utility-scale projects has helped accelerate wind and solar capacity growth. Mexico has the potential to be one of the most competitive producers of wind and solar energy globally. Given this potential, the CFE is expected to take on a greater role in the development of modern renewable energy projects.

Mexico's renewable electricity generation share reached 24% in 2022, up from 20% in 2000. However, its growth has been moderate, as gas-fired generation has expanded to meet most of the additional electricity demand.

The government of Mexico has taken a cautious approach to expanding renewable energy, partly due to grid reliability concerns. New investments are expected from independent projects and public-private partnerships while maintaining CFE's leading role in the electricity market. PROSEDEN 2024-38, Mexico's electric sector development plan, highlights a growing focus on solar and wind projects to meet rising electricity demand.

Figure 13: Mexico's renewable generation share, 2000 to 2022



Source: EGEDA (2024)

Energy Policy

Energy policy	Details	Reference
National Development Plan 2025-30	This plan outlines the main policy objectives and priorities of the current six-year (2018–2024) presidential administration.	Office of the President
Energy Reform (2013) * *A new reform will be published in 2025	The energy reform was a step towards modernising the energy sector without privatising public companies dedicated to the production and utilisation of hydrocarbons and electricity. The reform, both at the constitutional level and in secondary legislation, emerged from the study and assessment of various initiatives presented by political parties represented in Congress.	Ministry of Energy
Electrical Industry Law (2022 amendment)	This law aims to promote the sustainable development of the electricity industry and ensure its continuous, efficient, and safe operation for the benefit of users, while also fulfilling public and universal service obligations, Clean Energy commitments, and the reduction of pollutant emissions.	Supreme Court of Justice
National Electricity System's Development Program 2024-38 (PRODESEN)	This program details the annual plans for the power sector with a 15-year horizon. It includes key elements for generation capacity additions and retirements as well as for grid extensions and modernisation.	Ministry of Energy (SENER)
Energy Sector Program 2020-24 (PROSENER)* *New version is expected in 2025	PROSENER is a planning instrument that determines the current administration's strategies and actions towards achieving six priority objectives: to ensure energy self-sufficiency, strengthen government-owned companies, organise research and development activities, attain energy efficiency and sustainability, ensure universal energy access and make the energy sector a lever of development.	Official Federal Gazette
Crude Oil and Oil Products Perspectives 2023-37	This report includes information regarding the current state of production of crude oil and oil products in Mexico. The document outlines the efforts to integrate new infrastructure projects.	Ministry of Energy
Natural Gas Perspectives 2023-37	This report includes information regarding the current state of natural gas production in Mexico. The document outlines the efforts to integrate new infrastructure projects.	Ministry of Energy
Electric System Perspectives 2023-37	This report includes information regarding the current state of the electricity system in Mexico. The document outlines the efforts to integrate new infrastructure projects.	Ministry of Energy

Energy policy	Details	Reference
Paris Agreement Nationally Determined Contribution (NDC) 2022 Update	In November 2022, during COP27, the Mexican Government submitted an updated NDC. The submission includes an unconditional emissions reduction target from business-as-usual by up to 35% in 2030 for all greenhouse gases.	Ministry of Environment and Natural Resources (SEMARNAT)
Roadmap for Building Energy Codes and Standards for Mexico	This document provides a pathway and policy framework for increasing energy efficiency in Mexico's building sector.	Ministry of Energy (SENER)
Minimum Energy Performance Standards for 12 Appliance Groups	This set of standards regulates the energy consumption of appliances that, due to their energy demand and massive use, offer substantial energy and cost savings to end users.	National Commission for the Efficient Use of Energy (CONUEE)
National Program for Energy Management Systems (PronasgeN)	This program aims to support and bring together Energy Management Systems (EnMS), contributing to EnMS market consolidation in Mexico. Case studies have demonstrated energy efficiency improvements of at least 10% in industrial facilities upon implementing EnMS.	Official Federal Gazette
Guidelines for the Prevention and Comprehensive Control of Methane Emissions from the Oil and Gas Sector	These guidelines apply to new and existing sources across the value chain. Under the regulation, facilities must develop a Program for Prevention and Integrated Control of Methane Emissions (PPCIEM). As a starting point, facilities must identify all sources of methane and calculate an emissions baseline (base year must be within the last five years).	Ministry of Environment and Natural Resources (SEMARNAT)
Municipal Energy Efficiency Project (PRESEM)	PRESEM focuses on making energy efficiency investments in selected municipal sectors (pumping water systems, street lighting and public buildings).	Department of Industry, Science, Energy and Resources

Notable Energy Developments

Energy development	Details	Reference
Approval of the Secondary Laws of the Energy Reform of 2025	The reforms seek to modify the energy framework established by previous administrations, particularly the 2013 energy reform. The decree establishes new laws governing PEMEX, CFE, the electricity and hydrocarbons sectors, energy planning and transition, biofuels, geothermal energy, and the National Energy Commission. It also amends various provisions of the Mexican Petroleum Fund Law and the Federal Public Administration Law.	Ministry of Energy (SENER)
PEMEX's Purchase of the Deer Park Refinery	The government-owned oil company PEMEX agreed to a USD 596 million deal to buy Shell's majority interest in the joint venture 340 000 bpd refinery in Deer Park, Texas. PEMEX has acquired full ownership of the refinery, thus increasing its share of gasoline and diesel.	PEMEX
Construction of the Dos Bocas Refinery	A key aim of Mexico's oil policy is to boost domestic refining. The construction of the emblematic Dos Bocas refinery was one of the landmark infrastructure projects of the 2018-24 administration. The 340 000 bpd refinery started operations in 2024.	PEMEX
Lakatch Dry Natural Gas Offshore Field	Located in the state of Veracruz. Joint venture between New Fortress Energy and PEMEX. Potential production capacity of 300 million cubic feet per day over 10 years starting in 2024. Some 190 million cubic feet per day will be sold to New Fortress Energy which will liquefy and sell the gas to the international market. Initial LNG production of 1.4 million tonnes per year will increase to 7 million tonnes per year.	Argus Media
Altamira Floating LNG Terminal	Located in the state of Tamaulipas. US firm New Fortress Energy and CFE joint venture. Total capacity estimated: 4.2 million tonnes per year. LNG will be exported directly to Europe.	New Fortress Energy LNG
Energia Costa Azul LNG Export Project Under Construction	Located in the state of Baja California. Sempra Energy and TotalEnergies joint venture. Total capacity estimated: 3.5 million tonnes per year. Gas will be exported directly to Asia.	SEMPRA

Energy development	Details	Reference
Commissioning of the First Phase of CFE Solar Park in Sonora	The plant is owned by the publicly owned utility company, CFE, with US-backed financing Located in the port of Penasco in the state of Sonora.	Mexico Now

Useful Links

Banco de México (Banxico) – www.banxico.org.mx

Centro Nacional de Control de Energía (CENACE) – www.cenace.gob.mx

Centro Nacional de Control del Gas Natural (CENAGAS) – www.cenagas.gob.mx

Comisión Federal de Electricidad (CFE) – www.cfe.gob.mx

Comisión Nacional para el Uso Eficiente de la Energía (CONUEE) – www.conuee.gob.mx

Comisión Nacional de Seguridad Nuclear y Salvaguardias (CNSS) – www.cnsns.gob.mx

Instituto Mexicano del Petróleo (IMP) – www.imp.mx

Instituto de Investigaciones Eléctricas (IIE) – www.iie.org.mx

Instituto Nacional de Investigaciones Nucleares – www.inin.gob.mx

Instituto Nacional de Estadística y Geografía (INEGI) – www.inegi.org.mx

Petróleos Mexicanos (PEMEX) – www.pemex.com

Presidencia de la República – www.gob.mx/presidencia

Rondas México – https://rondasmexico.gob.mx/

Secretaría de Energía (SENER) – www.gob.mx/sener

Secretaría de Hacienda y Crédito Público (SHCP) – www.gob.mx/hacienda

Secretaría del Medio Ambiente y Recursos Naturales (SEMARNAT) – https://www.gob.mx/semarnat

Sistema de Información Energética (SIE) – http://sie.energia.gob.mx

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SRE (2022), https://www.gob.mx/sre/prensa/conclusion-of-mexico-s-participation-at-the-27th-conference-of-the-parties-on-climate-change?idiom=en

CEPAL (2028), https://www.cepal.org/es/publicaciones/43612-informe-nacional-monitoreo-la-eficiencia-energetica-mexico-2018

New Zealand

Introduction

Despite being one of the most geographically isolated economies in the world, New Zealand thrives due to its strong integration into international trade and financial markets. The economy benefits from abundant natural resources, high global demand for its premium agricultural products, and a robust services sector.

When compared with almost all other developed economies, New Zealand is a renewables powerhouse. Abundant hydro, geothermal, and wind resources meant that renewables accounted for 88% of electricity generation in 2023.

In 2023, the newly elected New Zealand Government announced a commitment to double renewable electricity generation by 2050, through removing regulatory barriers and building new electricity generation, transmission, and distribution infrastructure. It also announced the commitment to repeal the 2018 ban on new offshore exploration for oil and gas. This comes at the same time as downward revisions in gas reserves. New offshore exploration may alleviate current scarcity issues while the economy relies on gas for its industrial and electricity sectors.

COVID-19 movement and activity restrictions were still in place in New Zealand in 2021, with the largest city, Auckland, subject to the most stringent pandemic policies.

Despite the COVID-19 restrictions, New Zealand's annual growth rate climbed to 4.6% in 2021, surpassing pre-pandemic levels (World Bank, 2021). The growth can be partially attributed to government pandemic support measures. As seen in many economies around the world, this brought about a higher government debt burden and contributed to elevated inflation.

The Reserve Bank of New Zealand has responded to these inflationary pressures by raising interest rates, helping to ease inflation back from a high of 7.3% to a more comfortable 2.2% in December 2024 (StatsNZ, CPI, 2024). Interest rates are now coming back down, and we are seeing an improvement in business confidence.

In 2023, New Zealand's government unveiled a minerals strategy, especially focused on critical minerals, to boost exports to NZD 3 billion by 2035. This initiative emphasises sustainable mining, regional job creation, and securing vital resources to support clean energy technologies and economic resilience.

Table 1: New Zealand's macroeconomic data and energy reserves

Key data [a]		**Energy reserves** [b]	
Area (million km^2)	268	Oil (billion barrels)	0.07
Population (million)	5.1	Gas (trillion cubic feet)	1.5
GDP (2017 USD billion PPP)	225	Coal (million tonnes)	16 000
GDP per capita (2017 USD PPP)	44 042	Uranium (kilotonnes U < USD 130/kgU)	-

Source: a World Bank (2022); b Ministry of Business, Innovation and Employment (2023);

Note: Oil and gas reserves are total proved reserves, and coal is in-ground resources.

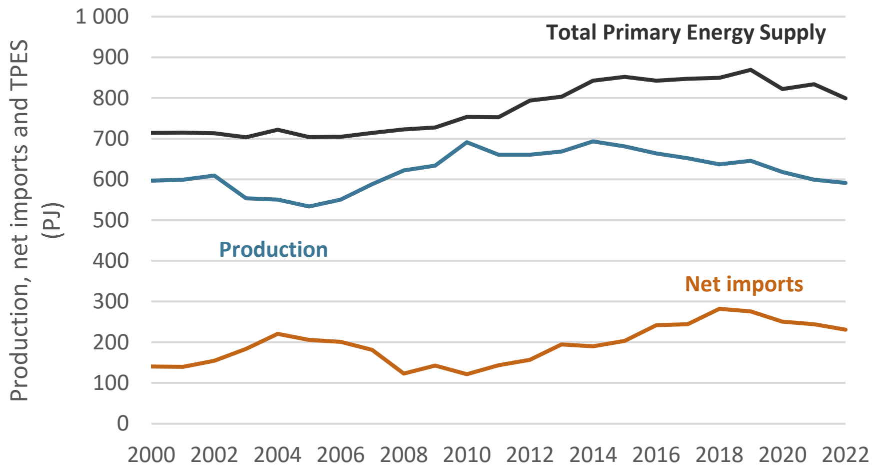
Energy Supply and Consumption

Total Primary Energy Supply

TPES (total primary energy supply) in New Zealand in 2022 was 799 PJ, which was a 4.2% annual decrease. A major cause of this decrease was a 22 PJ drop in sub-bituminous coal imports to fuel generation at the Huntly power station.

Production of fossil fuels (232 PJ) continues to slowly fall. For the previous three years, this has come mostly because of falling gas production, which is especially associated with dwindling reserves.

Figure 1: New Zealand's energy supply, production, and net imports (PJ), 2000 to 2022



Source: EGEDA (2024)

Most of New Zealand's energy exports are coal (36 PJ, 47%) and crude oil (29 PJ, 37%). Refined product exports (12 PJ, 15%) constituted the remainder in 2021, though these exports have now ended with the closure of Marsden Point oil refinery (New Zealand's only refinery) in April 2022.

New Zealand's energy imports in 2022 also changed significantly due to shifting from crude for refining (145 PJ in 2021 to 35 PJ in 2022), to refined products (132 PJ in 2021 to 258 PJ in 2022). The overall effect of this, and the 22 PJ decrease in coal imports was a 6 PJ fall in total imports.

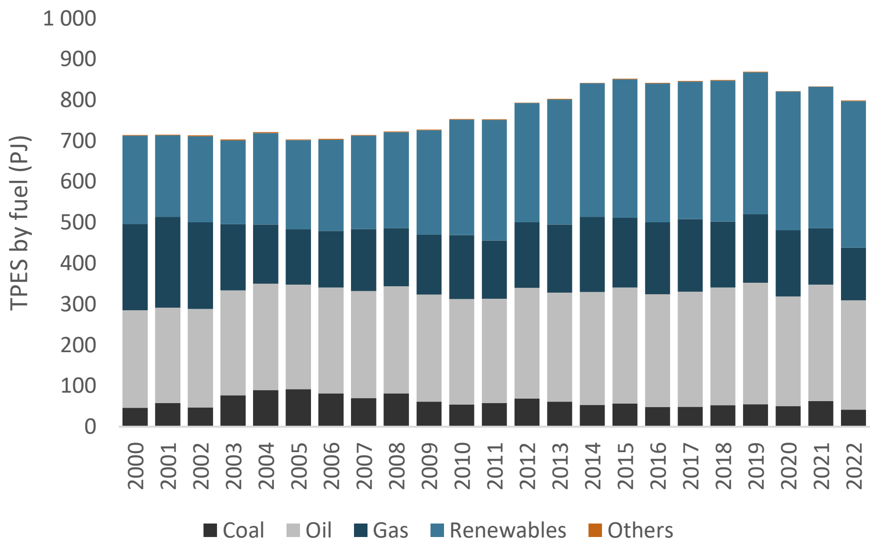
New Zealand maintains a high share of renewables in its energy mix, at 45% of TPES in 2022, which was facilitated by an 87% renewable electricity generation share (excluding combined heat and power plants).

The main sources of renewable energy supply are hydro for electricity (26%), biomass for direct use in manufacturing (6%) and electricity production (5%), and geothermal for electricity generation (56%) and some direct use (2%).

While geothermal makes up a large portion of TPES, its conversion efficiency is low (15%) resulting in a misleading view of available renewable energy in the economy. Almost 200 PJ of geothermal input energy translates into only 30 PJ of electricity generation (which is still a substantial portion compared to most other APEC economies). A small amount is also used for direct heat in industry, buildings and agriculture.

Natural gas production fell 9% (12 PJ) in 2022. This aligns with increasing gas scarcity, which is proving worse than expected, with a continual fall in net production and deliverability since 2019 as well as yearly downward revisions to proved plus probable (2P) gas reserves estimates, with the latest being 188 PJ[5] in 2024, resulting in a final level of 1300 PJ of 2P reserves as of 1 January 2024 (MBIE 2024). That is less than 10 years of useable reserves at current rates of demand.

Figure 2: New Zealand's energy supply by fuel (PJ), 2000 to 2022



Source: EGEDA (2024)

New Zealand's 130 PJ of gas production is consumed by the transformation sector (29%), end-use demand sectors (57%), and the non-energy sector (24%). Electricity generation accounts for almost all the gas consumed by transformation, whereas gas consumed by end-use sectors is mostly for industrial (and some agricultural) process heat, including heat for food processing and chemicals production (fertiliser and methanol), and a small amount for residential heating. The non-energy sector uses natural gas as a feedstock for chemical production. As a result, the industrial chemicals sector is indirectly responsible for more than half of gas consumption.[6]

As seen in Figure 3, New Zealand has a much larger proportion of renewable energy supply than for the APEC region. However, because of its low conversion efficiency, geothermal electricity generation inflates this figure. Still, New Zealand has a significantly larger proportion of supply of hydro and other renewables than most of the APEC region.

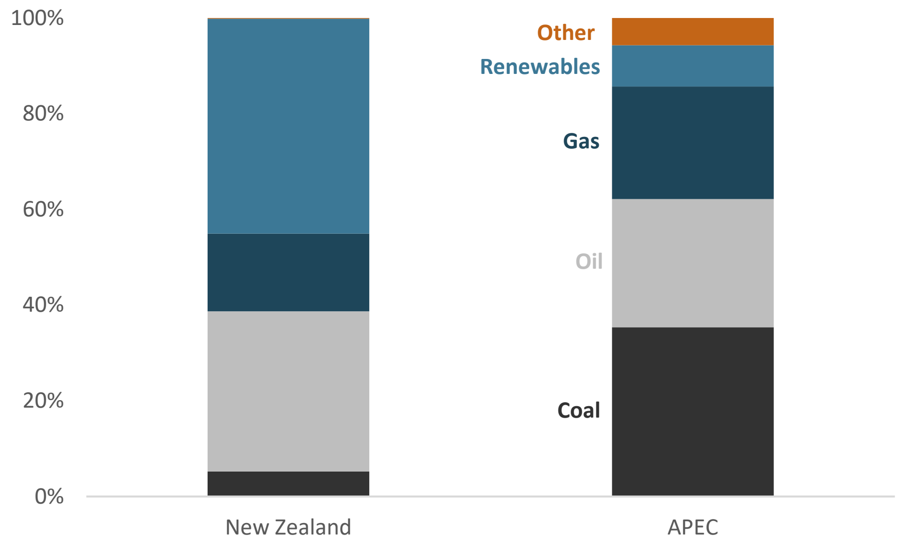
The supply share of coal in New Zealand is lower than for APEC, due to a greater reliance on renewable energy sources for electricity generation.

The oil supply share for New Zealand is much higher than for APEC. More than 80% of the oil is used in transport, supported by New Zealand's high rate of car ownership, which is among the highest in the world (around 0.7 cars per person).

[5] 100 PJ of which was downgraded from readily extractable to contingent reserves. The other 88 PJ was removed altogether from total extractable and contingent reserves.

[6] According to its definition in energy statistics, the non-energy sector is its own sector, not part of the industrial sector. However, the two sectors are directly related in most cases, because fossil fuels are used both as feedstock (non-energy use) and to produce heat for the chemical processes (industrial chemicals sector).

Figure 3: Energy supply mix – New Zealand and APEC, 2022



Source: EGEDA (2024)

Total Final Consumption

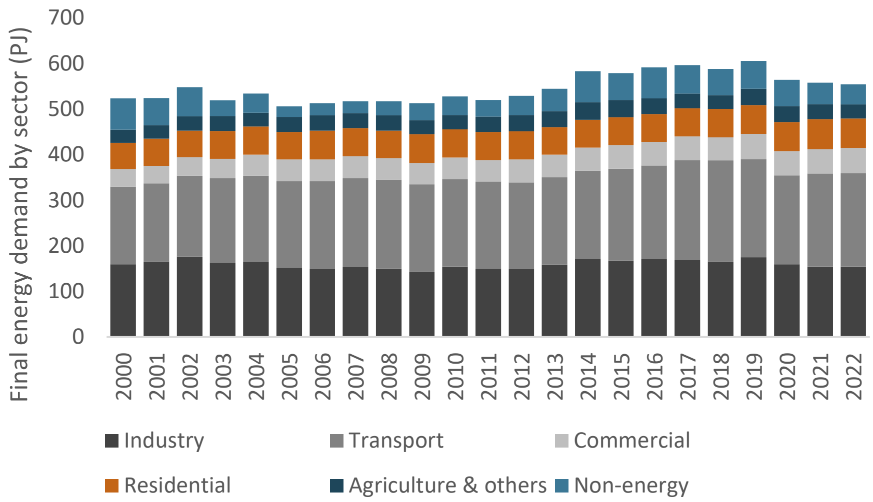
In 2022, New Zealand's total final consumption was little different from 2021, at 554 PJ.

Transport remained at the same level; however, there was a slight shift in the fuel mix. Domestic air transport continues to increase to previous levels since COVID-19 (in 2019 demand was 15 PJ and in 2022 it was 14.3 PJ) and conversely, domestic sea navigation saw a large decrease from 2.7 to 0.7 PJ (probably a structural change from refined products delivered using domestic ships, to international boats delivering refined products and using fuels recorded in bunkers or from their original port). Road transport remained almost the same with demand dropping from 189.3 PJ to 188.9 PJ.

Jet fuel for international transport (captured within the bunkers supply category in EGEDA statistics) increased from 14 to 23 PJ and marine fuels saw an increase from 4.8 to 5.9 PJ. According to the Ministry of Business, Innovation and Employment (MBIE) energy statistics, jet fuel use for international transport has still not increased to pre-COVID-19 levels, being at 39 PJ in 2024 compared to 57 PJ in 2019.

Fluctuations in the domestic natural gas price and international methanol prices impact demand for natural gas from the chemicals industry, which produces mainly methanol and ammonia. Lately, gas shortages have resulted in a decrease in end-use by the chemicals sector. The methanol producer Methanex, which uses around 40% of the gas supply, shut down for about three months in August 2024 to guarantee the gas supply for the electricity generators. Until a solution is found, it is likely the company will run only a portion of its operations, resulting in a decrease in gas demand from industry and non-energy use, and a return to average price levels for other users.

Figure 4: New Zealand's final consumption by sector (PJ), 2000 to 2021



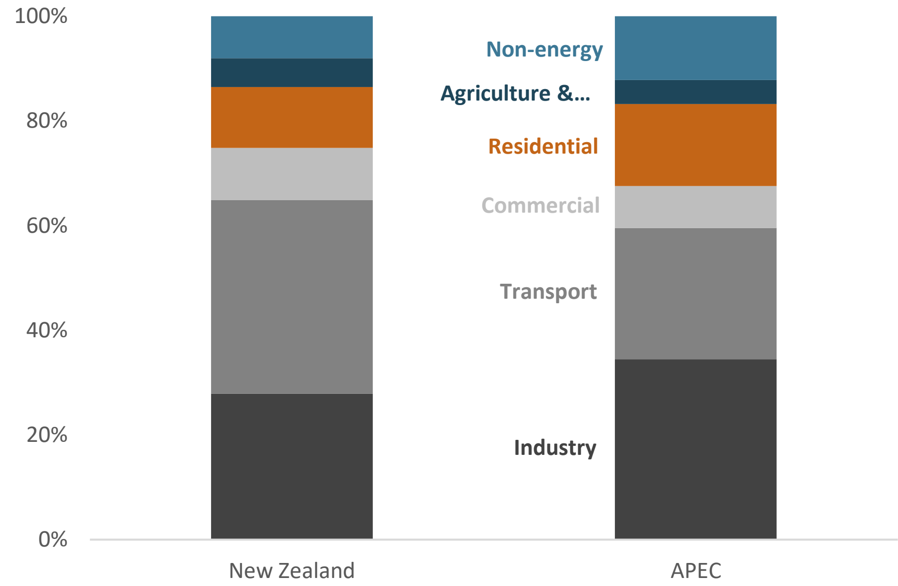
Source: EGEDA (2024)

Transportation continues to be the leading energy consumer in New Zealand, accounting for more than one-third of total final consumption. However, as of 2022, transport energy use was still about 10 PJ (5%) lower than pre-COVID-19 (2019) levels, which was largely a result of a 13 PJ (12%) decrease in gasoline demand. According to New Zealand's Ministry of Transport[7], light private vehicle activity in 2022 was down 3% compared to 2019 and the average emissions intensity of newly registered (used and unused) light vehicles was down from 195 to 172 g/km. This and a 1.9% electric vehicle (EV) stock share probably caused this drop in gasoline demand. Recent data for 2024 suggests that transport activity is above 2019 levels, but energy use is still below, leaving efficiency improvement as the major driver of decreasing energy use and emissions in transport.

In 2022, the residential sector saw a decrease in energy demand of 1.8% (1 PJ), while the commercial sector saw a 3% (2 PJ) increase in energy use.

Industrial energy use was relatively unchanged, growing from 154 to 155 PJ. There was also a -5.7% (3 PJ) decrease in non-energy use, which was mostly in natural gas (2 PJ).

Figure 5: Final consumption by sector, New Zealand and APEC, 2022



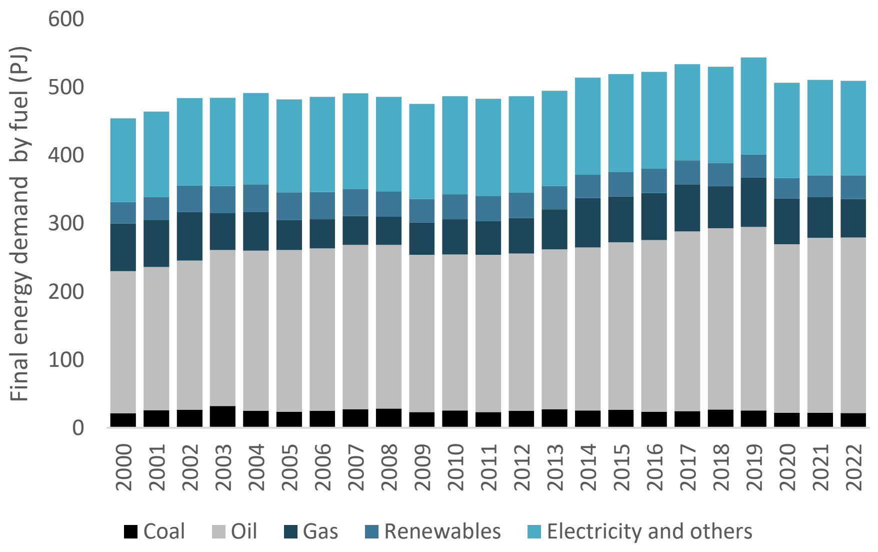
Source: EGEDA (2024)

[7] https://www.transport.govt.nz/statistics-and-insights/fleet-statistics/annual-fleet-statistics/

Final Energy Demand

Electricity consumption in New Zealand represents all demand in the 'Electricity and others' category in Figure 6. The relative use of electricity in New Zealand is comparable to other APEC economies in the industrial, residential and commercial sectors.

Figure 6: New Zealand's final energy demand by fuel (PJ), 2000 to 2022



Source: EGEDA (2024)

Note: Does not include non-energy sector consumption of energy products.

Almost all direct use of coal in New Zealand (which excludes coal use for electricity generation, cogeneration and non-energy use) is consumed by the industrial sector for process heat. Within the industrial sector, 14 PJ (80%) of this is used by food and beverage manufacturers, mainly by dairy facilities for drying milk into milk powder.

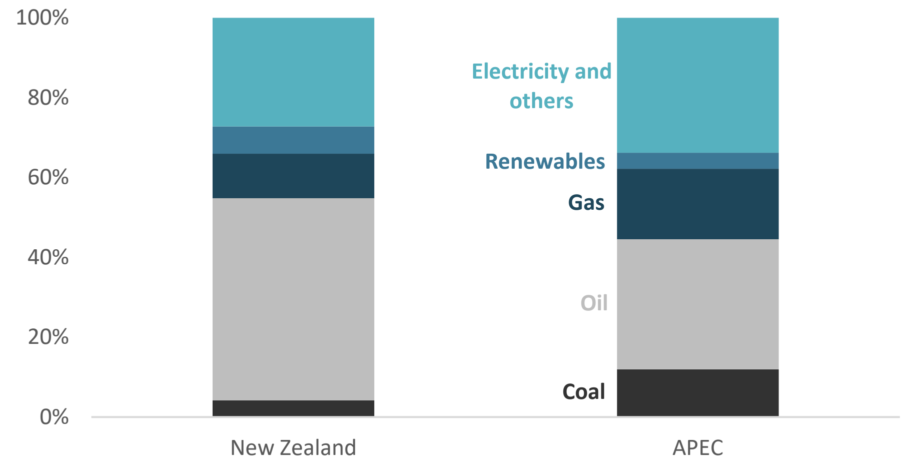
Most direct use of renewable energy (geothermal heat, solar thermal heat, biomass, biogas, renewable waste and liquid biofuels) in New Zealand is by the industrial sector for process heat. Of that, biomass accounts for 21 PJ of the 25 PJ of renewable energy consumption by the industry sector. Remaining renewables consumption is spread between residential (7 PJ), commercial (3 PJ) and agriculture (0.4 PJ) sectors.

In recent years there has been a trend of growth in biomass use for drying milk into milk powder. This is connected to the Fonterra (New Zealand's large dairy co-operative) goal of removing all coal use by 2037. This would effectively replace 13 PJ[8] of coal with a similar amount of biomass (wood pellets), or where biomass is less suited, electricity.

Oil accounts for a much higher proportion of New Zealand's energy demand than for APEC, whereas the end-use consumption share of coal, natural gas, and electricity in New Zealand are all much lower than for the APEC region.

[8] https://www.eeca.govt.nz/insights/data-tools/energy-end-use-database/

Figure 7: Final energy demand fuel share, New Zealand and APEC, 2022



Source: EGEDA (2022)

Transformation

Power Sector

In New Zealand, hydropower is the leading source of electricity generation due to the economy's favourable natural landscape. In 2022, following a dry year in 2021, there was a record amount of electricity production from hydro at 26 273 GWh (94.58 PJ compared to 94.51 PJ in 2018). Much of this can be attributed to the year being the warmest and eighth wettest year on record, leading to more water being available for generation.

Following early predictions of a dry winter, which would reduce hydro generation, the Huntly power station built up its stockpile of coal. However, because the hydrological conditions that year were actually good, there was a fall in coal generation to 1.6% of total generation in 2022, a decrease from 6% in the previous year.

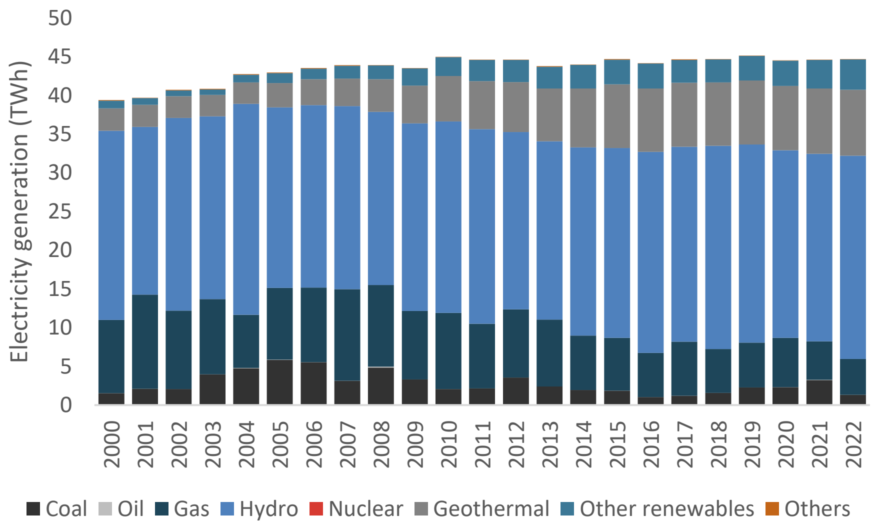
Geothermal energy plays a significant role in New Zealand's generation mix, accounting for 1035 MW (10%) of installed capacity and a record of 8514 GWh (19%) of generation in 2022. This new record was achieved because every plant including the recently built Ngāwhā OEC4, was operating at capacity. This energy source, like hydro, provides baseload generation, so it is especially important for enabling the energy transition by balancing the low capacity-factor and non-dispatchable generation from solar and wind.

Wind is becoming a major player in the generation mix, accounting for about 6% of total electricity generation in 2022, with an 8.4% (222 GWh) increase in generation compared to the following year, which was partly a result of the addition of 223MW from the Waipipi and Turitea Wind Farms in 2021. Solar is also increasing at fast rates (72% increase in 2021), but from a much lower base (0.6% of generation in 2022) compared to other resources. Solar radiation potential is much lower in New Zealand than for many other APEC economies. However, New Zealand’s favourable wind conditions have contributed to significant growth without subsidies.

In 2024 The Offshore Renewable Energy Bill was introduced which provides a regulatory regime for offshore renewable energy. This is expected to be passed in mid-2025 with the goal of having the first feasibility permits granted in 2026. Enabling the development of offshore renewable energy, especially wind, will help to drive more growth in renewable capacity and generation.

Like coal, but with even more short-term flexibility, natural gas generation can be turned on or off according to supply from renewable sources. Electricity generated from natural gas also fell in 2022 from 11 to 10% of total electricity generation.

Figure 8: New Zealand's electricity generation by fuel, 2000 to 2022



Source: EGEDA (2024)

New Zealand is small enough that its only aluminium smelter (Tiwai Point) is influential enough to account for a significant proportion of electricity consumption (around 13%). Plans for the smelter are a significant component in the economy's electricity generation planning.

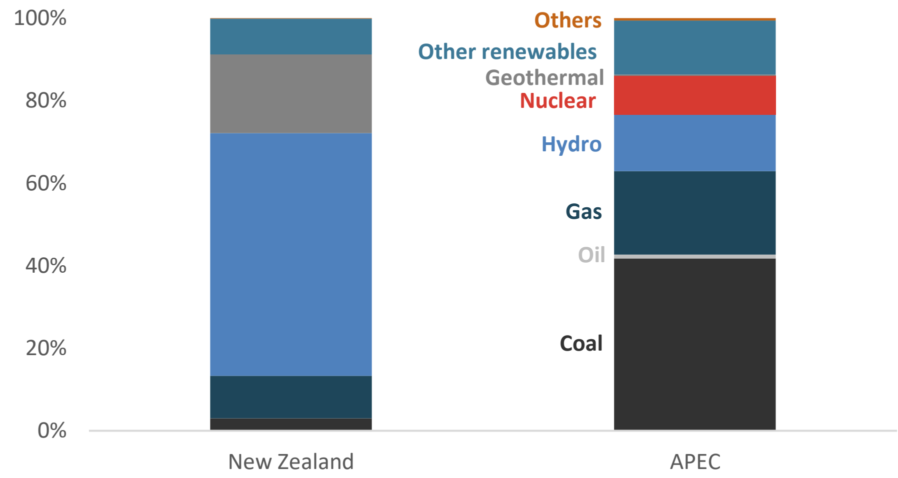
Before 2023, the Tiwai Point aluminium smelter had exclusive access to approximately 400 MW of the Manapouri dam hydroelectric plant (total capacity of 854 MW). Recent transmission network upgrades mean that the Manapouri dam can now provide all its power to New Zealand's main grid.

As of May 2024, the Tiwai Point aluminium smelter has entered into a series of 20-year electricity supply agreements with New Zealand's major energy generators: Meridian Energy, Contact Energy, and Mercury NZ.

These contracts, extend until at least 2044, and provide the smelter with a combined 572 megawatts of electricity, predominantly sourced from the Manapouri dam. This is important because it helps to guarantee the generators a large amount of predictable demand, and without it there was likely to be a large oversupply of electricity.

A significant feature of these agreements is also the incorporation of demand response capabilities. The smelter has committed to reducing its electricity consumption by up to 185 megawatts during periods of grid stress or high demand. This flexibility enhances the stability of New Zealand's electricity supply, effectively positioning the smelter as a large-scale emergency energy provider.

Figure 9: Electricity generation fuel share, New Zealand and APEC, 2022



Source: EGEDA (2024)

Refining

The closure of New Zealand's Marsden Point refinery was due to dwindling profits and increased competition from overseas refineries. The decision was finalised halfway through 2021 and the refinery closed on 31 March 2022. In the last ten years, the refinery has been producing around half of New Zealand's gasoline and diesel consumption requirements and almost all of its jet fuel. Imported crude was relied on due to domestic crude production being too sweet (low in sulphur) for the Marsden Point refinery. This meant that New Zealand was still subject to price movements in the international oil market. Fuel from the refinery was also traded at the same price as the international market, so the closure will probably not have an impact on consumer prices. A minimum fuel stockholding obligation for fuel importers will come into effect on 1 January 2025. This is expected to improve fuel security.

Energy Transition

New Zealand Steel, in partnership with EECA (Energy Efficiency and Conservation Authority) are building an electric arc furnace to replace half of the coal being used at New Zealand's only steel mill. The project is scheduled for completion in the end of 2025. This has the potential to reduce almost 8 PJ of coal use (most of which is in coke ovens). The government portion of the funding for this project was provided through the Government Investment in Decarbonising Industry fund.

New Zealand's share of renewables in electricity generation is among the highest in the world, at 87% in 2023. Additional gains in the short- to medium-term are uncertain given that fossil fuels provide valuable baseload and backup functions. This topic is explored in the *APEC Energy Demand and Supply Outlook, 8th Edition* with an update available in the *9th Edition*, due for publication in the second half of 2025.

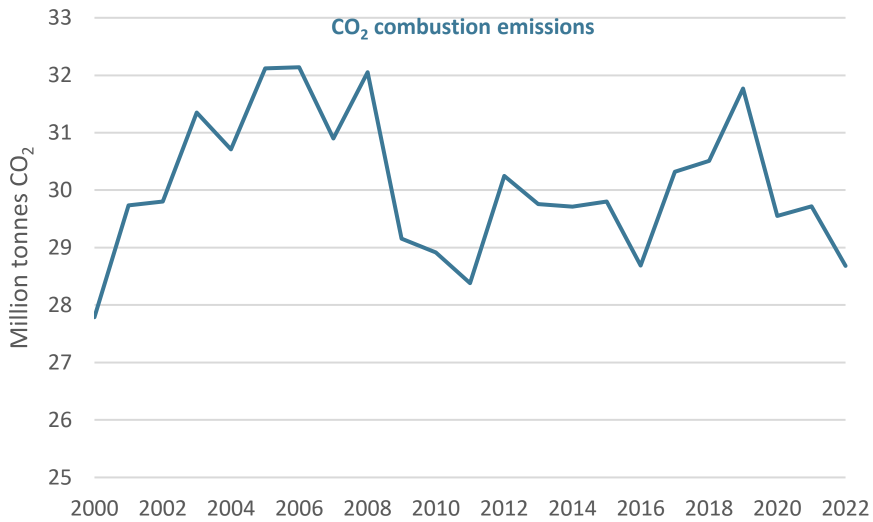
New Zealand's government is updating the way it co-invests in public electric vehicle (EV) chargers with the private sector to accelerate the delivery of EV chargers across New Zealand. They are targeting 10,000 by 2030, so that there will be one public charge point to around 40 EVs. This will remove people's 'range anxiety'. The new strategy will offer concessionary loans of up to 50% of project costs, have a 0% interest rate, and a maximum tenure of 13 years.

Emissions

Since 2000, New Zealand has seen a 3% increase in CO_2 combustion emissions from the energy sector. These emissions were initially rising to 2005, declined, and then have followed an upward trend since 2010, with a 7.0% drop in 2020 due to COVID-19. Now, because of the drop in coal usage at Huntly power station (a result of good hydro generation conditions), emissions are 3.5% lower than they were in 2021, and at their lowest level since 2011. The long-term increase since 2000 is mostly due to growth in CO_2 combustion emissions from transport, which has increased its energy use by 20% since 2000.

To help meet its 2050 climate goals, New Zealand has adopted a system of emissions budgets. The second Emissions Reduction Plan (ERP2) was released in December 2024. It outlines strategies and actions for the 2026–30 period and sets the course for future budgets. The document also confirms that ERP2 confirms that NZ is on track to meet the first emissions budget (2022–25) and the second (2026–30).

Figure 10: New Zealand's CO_2 combustion emissions (million tonnes), 2000 to 2022



Source: EGEDA (2024)

Energy Security

Expected in mid 2025, the NZ government will introduce an Energy and Electricity Security Bill that (i) scraps the long-standing 50 MW/250 MW ceilings on lines-company ownership of generation so they can invest directly in new solar, wind and geothermal projects, (ii) creates fast-track consenting powers for a floating LNG import terminal and other "critical fuel" infrastructure, and (iii) enables emergency draw-down of hydro lakes and other security-of-supply interventions. Together, these measures are intended to unlock private investment, raise regional resilience, and curb the wholesale-price spikes that have accompanied recent gas shortages and dry-year hydro conditions.

On 9 August 2021, New Zealand saw its highest-ever peak electricity demand. This demand, combined with insufficient available electricity generation, led to supply interruptions that affected more than 34 000 households. The challenge of increasing peak demand cannot be met by increasing non-dispatchable solar and wind capacity. A complementary increase in flexible and dispatchable generation assets or storage is required to facilitate a much higher build-out of solar and wind to meet this increasing peak demand. Demand-side solutions are also being explored to play a part.

Closing the Marsden Point oil refinery has implications for how oil stocks are held. In late 2021, New Zealand held 25% of its domestic oil stock as crude oil. By late 2022, the share had fallen to 12% and will probably fall further as Marsden Point is decommissioned and the remaining crude oil is removed.

In November 2022, the government unveiled a policy package aimed at bolstering fuel resilience. This move was in response to the closure of Marsden Point, evolving geopolitical dynamics, and the ongoing transition towards a low-carbon energy sector. The policy's key elements include:

- Minimum fuel stockholding requirement: from 1 January 2025, fuel importers with access rights to bulk storage facilities will be under an obligation to maintain a minimum stock of fuel: an average of 28 days for gasoline, 24 days for jet fuel, and 21 days for diesel
- Reserve diesel stock: the government is exploring various strategies to manage a reserve diesel stock within New Zealand, targeting a volume of approximately 70 million litres. This quantity aligns with the economy's diesel consumption over seven days.

APEC Energy Goals

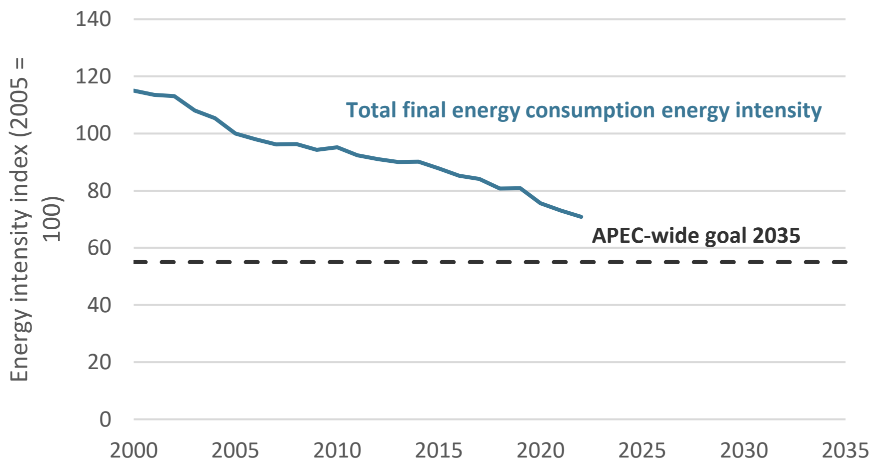
There are two energy-related objectives that APEC member economies have agreed to meet as a collective: to improve energy intensity and double the share of modern renewables.

Energy Intensity Goal

In 2011, APEC member economies agreed to increase their ambition to reduce energy intensity by 45% in 2035, relative to a 2005 baseline. The original goal was a 25% improvement by 2030, relative to a 2005 baseline.

APEC is on track to achieve this energy intensity improvement. The goal does not impose individual economy targets, but it is possible to track the progress of individual APEC economies relative to the overarching proportional improvement.

Figure 11: New Zealand's total final energy consumption intensity index, 2000 to 2022 (2005 = 100)



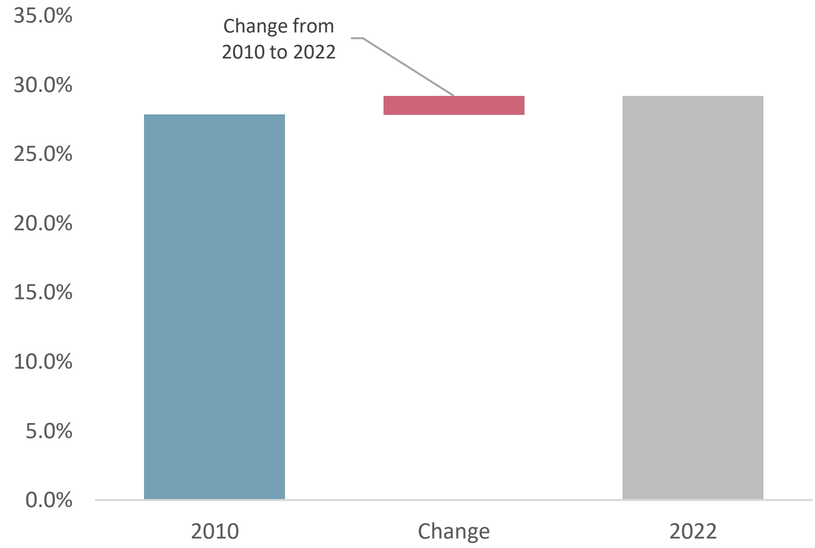
Source: EGEDA (2022)

In 2022, New Zealand's energy intensity (of total final consumption) was 2.2 PJ per billion USD purchasing power parity (PPP) of GDP, which represented a 27% improvement since 2005. This improvement is occurring at a similar pace to that of the wider APEC region.

Doubling of Renewables

The second energy goal involves doubling the share of modern renewables in the APEC energy mix for the period 2010 to 2030. There is no economy-level goal for individual member economies, but improvements by individual economies will contribute to the doubling goal.

Figure 12: New Zealand's modern renewable energy share, 2010 and 2022



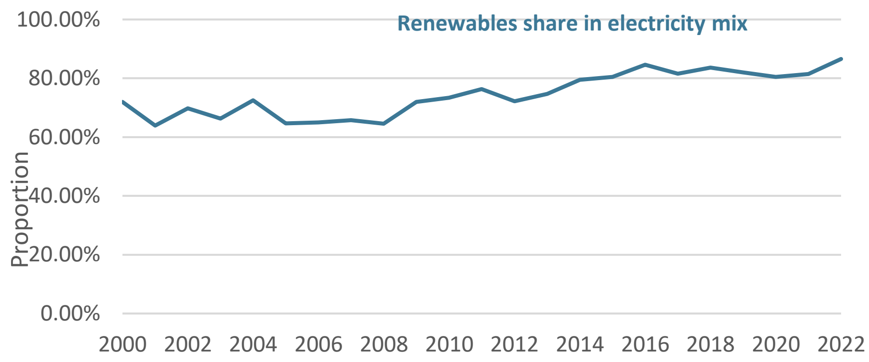
Source: EGEDA (2024)

Note: Biomass used in the residential and commercial sectors is assumed to be traditional biomass and is not included in the definition of modern renewables. All other renewables (biomass used by industry, hydro, geothermal, etc.) are considered modern renewables. Modern renewables also include the share of electricity that is generated from renewable sources.

New Zealand has the highest proportion of modern renewables in its energy mix of all other APEC member economies, at 29% in 2022. APEC's overall renewables share increased to 10% in 2021. New Zealand has the potential to contribute to APEC's goal of doubling renewables by 2030, but its current high share makes additional contributions more difficult than for most other APEC economies.

Electrify NZ, the flagship of the second Emissions Reduction Plan, commits New Zealand to doubling renewable electricity by 2050. The programme aims to set up a one stop fast track consenting path for major wind, solar, geothermal and grid projects, shrink most RMA consent times to under a year (with 35 year durations), and give councils clearer national policy to enable new build. The offshore renewables bill and updated electricity market rules will follow to integrate the extra supply and support the economy-wide EV charger rollout.

Figure 13: New Zealand’s renewable generation share, 2000 to 2022



Source: EGEDA (2024)

Energy Policy

Energy Policy	Details	Reference
Climate Change Response (Zero Carbon) Amendment Act	In 2019, the Act set 2050 targets for net zero emissions (excluding biogenic methane) and a 24–47% reduction in biogenic methane emissions below 2017 levels.	Ministry for the Environment
NDC 2030 Target (2021-2030)	New Zealand submitted its second Nationally Determined Contribution (NDC2) in January 2025, committing to reduce net emissions 51–55% below gross 2005 levels by 2035. The 2030 target of a 50% reduction remains in place.	Ministry for the Environment
Emissions trading scheme	Domestic ETS includes price ceilings, price floors, and five-year emissions budgets. Agriculture remains excluded. First period: 2021-2025 (354 $MtCO_2eq$).	Ministry for the Environment
Oil and Gas Exploration Ban Repeal	Progressing through Select Committee: the Crown Minerals Amendment Bill aims to repeal the offshore oil and gas exploration ban.	Parliament
New Zealand Energy Efficiency and Conservation Strategy (NZEECS)	A new strategy is under development to replace the 2017-2022 strategy, aiming to focus on industrial emissions and energy conservation.	Ministry of Business, Innovation and Employment (MBIE)
The Gas Amendment Act 2021	Improved gas market transparency, increased financial penalties for non-compliance with gas regulations.	MBIE
Māori and Public Housing Renewable Energy Fund	NZD 28 million allocated to trial small-scale renewable technologies, reducing energy costs and improving heating in homes.	MBIE
Funding for Heaters and Insulation	Warmer Kiwi Homes provides grants covering two-thirds of ceiling/underfloor insulation costs.	Energy Efficiency and Conservation Authority
Public Sector Decarbonisation	Carbon Neutral Government Program mandates emission reporting and offsets for public agencies, backed by a NZD 200 million fund.	Energy Efficiency and Conservation Authority
New Climate Strategy	In July 2024, the government announced a new climate strategy focusing on resilient infrastructure, clean energy production, climate innovation, and forestation.	Ministry for the Environment

Notable Energy Developments

Energy development	Details	Reference
Marsden Point Oil Refinery Converted into an Import Terminal	In 2022, Refining NZ shut down New Zealand's only oil refinery; it now operates as an import terminal to improve fuel security.	Argus Media
New Zealand's Battery Project Cancellation	The new government cancelled the Lake Onslow pumped hydro project (3-8.5 TWh) in 2023, which was still in its planning stage.	MBIE
Emissions Reduction Plan (ERP) Released in late 2024	The first ERP was published in 2022. A second Emissions Reduction Plan (ERP2) has now been released, outlining actions for the 2026-2030 period.	Ministry for the Environment
Hydrogen development	The Interim Hydrogen Roadmap (August 2023) highlights projects and partnerships with Singapore, Japan, and South Korea for hydrogen technology development.	MBIE
Geothermal research funding	GNS Science's supercritical geothermal work received a new boost through the Regional Infrastructure Fund (RIF), which also explores projects like the proposed northern 'energy bridge'.	GNS Science
Investigation into power outages	Inquiry into the 9 August 2021 outage that impacted 34,000 households identified recommendations for grid resilience.	MBIE
Resource Strategy for minerals and petroleum	In January 2025, New Zealand launched a revised Minerals Strategy along with a national Critical Minerals List to support clean technology supply chains.	MBIE
Offshore Wind Bill Progressing	The Offshore Renewable Energy Bill is progressing through Parliament and is expected to be enacted by mid-2025, providing a framework for offshore wind development.	MBIE
Carbon Capture, Utilisation and Storage (CCUS) Framework	The government is developing a regulatory framework for carbon capture, utilisation, and storage (CCUS) to support emissions reduction in hard-to-abate sectors.	Beehive
Review of the energy efficiency regulatory system for products and services	A new five-year energy efficiency strategy is under development to replace the NZEECS 2017-2022.	MBIE
New energy research development centre (Ara Ake)	Ara Ake supports energy innovation by assisting developers with funding and market entry opportunities.	Ara Ake
Electricity Market Review	The Minister for Energy and the Minister for Resources have initiated a review of the performance of electricity markets. The review began in early 2025 and is expected to be completed in June 2025.	MBIE
Energy Competition Task Force	The Electricity Authority and Commerce Commission established a joint Energy Competition Task Force to address competitiveness and pricing in energy markets.	Electricity Authority

Huntly Coal Power Station transition plan	Progressing: The government supports a biomass transition at Huntly. At the 2025 Investment Summit, wood pellets were promoted as a key strategy to cut coal dependence.	Beehive
Kohirā Solar Farm Commissioned	In February 2024, Lodestone Energy's Kohirā Solar Farm near Kaitaia began transmitting electricity to the grid, contributing 55 GWh annually.	MBIE
Kaiwera Downs Wind Farm Stage 1 Completed	In November 2023, Mercury Energy completed Stage 1 of the Kaiwera Downs Wind Farm near Gore, adding 43 MW capacity with 10 turbines.	MBIE
Southland Wind Farm Proposal	Contact Energy proposed the Southland Wind Farm near Wyndham, planning 55 turbines with a total capacity of 300 MW, potentially the largest in New Zealand.	MBIE
Uplift in Renewable Electricity Generation Projects	As of January 2024, new renewable electricity generation projects have nearly doubled, with 5,000 GWh of new generation committed, primarily in geothermal, solar, and wind.	MBIE
Proposed National Policy Statement for Renewable Electricity Generation	Aimed at significantly increasing electricity generated from renewable resources to achieve emissions reduction targets and energy goals.	MBIE
Fuel Security Study 2024	In early 2024, the government released a comprehensive fuel security study assessing risks to liquid fuel supply and proposing strategies for resilience.	MBIE
Electricity Policy Statement 2024	A new Electricity Policy Statement was released in October 2024, outlining government expectations for electricity sector performance and planning.	MBIE
Energy Security Announcements 2024	In 2024, the government announced a package of actions to bolster energy security, including investment in renewable generation and fuel infrastructure.	Beehive

Useful Links

Emissions Reduction Plan – https://environment.govt.nz/what-government-is-doing/areas-of-work/climate-change/emissions-reduction-plan/

Energy statistics and modelling (Ministry of Business Innovation and Employment [MBIE]) – https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-statistics-and-modelling/energy-statistics/

Energy and Natural Resources homepage (MBIE) – https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/

Energy in New Zealand annual report (MBIE) – https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-statistics-and-modelling/energy-publications-and-technical-papers/energy-in-new-zealand/

Industrial heat pumps for process heat – https://www.eeca.govt.nz/insights/eeca-insights/industrial-heat-pumps-for-process-heat/

IEA Energy Policy Review for New Zealand – https://www.iea.org/reports/new-zealand-2023

Energy minister announcements – https://www.beehive.govt.nz/portfolio/nationalactnew-zealand-first-coalition-government-2023-2026/energy

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EGEDA (Expert Group on Energy Data Analysis, APEC Energy Working Group) (2021), *APEC Energy Database* – https://www.egeda.ewg.apec.org/egeda/database_info/index.html

Energy statistics and modelling (Ministry of Business Innovation and Employment [MBIE]) – https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-statistics-and-modelling/energy-statistics/

Department of the Prime Minister and Cabinet (DPMC) – https://www.dpmc.govt.nz/our-business-units/covid-19-group

Papua New Guinea

Introduction

Papua New Guinea (PNG) occupies the eastern half of New Guinea and about 600 smaller islands, and it is a major Pacific Island economy. Its capital, Port Moresby, is located on the southeastern coast. PNG is linguistically diverse, with over 800 languages. Only 13% of its population lives in urban areas, making it one of the most rural economies in the world.

Despite abundant resources (minerals, forests, marine life, and agricultural land) PNG's challenging geography and dispersed islands complicate infrastructure and infrastructure development. Customary land titles and law-and-order concerns affect investment but maintain cultural integrity and fairness in development.

Widespread poverty and limited infrastructure persist, with low electricity access (about 20%) and reliance on fuelwood. The National Energy Authority's (NEA) Corporate Plan (2023–27) aims to raise electricity access to 70% by 2030 and cut diesel use. The NEA oversees energy policy, regulation, and data, having taken over these responsibilities from PNG Power in 2021, allowing PNG Power to focus on operations and service delivery.

Agriculture employs nearly 80% of the population and, along with larger-scale production, contributes about 30% of GDP. Mining dominates exports, with gold, silver, oil, gas, nickel, cobalt, and copper driving revenue. PNG's nickel and cobalt are important for the global energy transition.

PNG exports of liquefied natural gas (LNG), mostly to China and Japan, are more than double its domestic energy use. It is important that PNG can maximise its return on its use of its gas and mining resources to increase economic growth. As an example, there is a proposed policy whereby the private gas companies will supply 15% of gas extraction to the economy, instead of converting it to LNG.

Table 1: PNG's macroeconomic data and energy reserves

Key data [a]		**Energy reserves** [b, c]	
Area (million km^2)	462 840	Oil (billion barrels)	0.16
Population (million)	9.9	Gas (trillion cubic feet)	5.8
GDP (2017 USD billion PPP)	37	Coal (million tonnes)	-
GDP per capita (2017 USD PPP)	3 670	Uranium (kilotonnes U < USD 130/kgU)	-

Source: a World Bank (2022); b BP (2022); c UN (2022)

Note: Reserves are total proved reserves and reasonably assured recoverable resources for uranium.

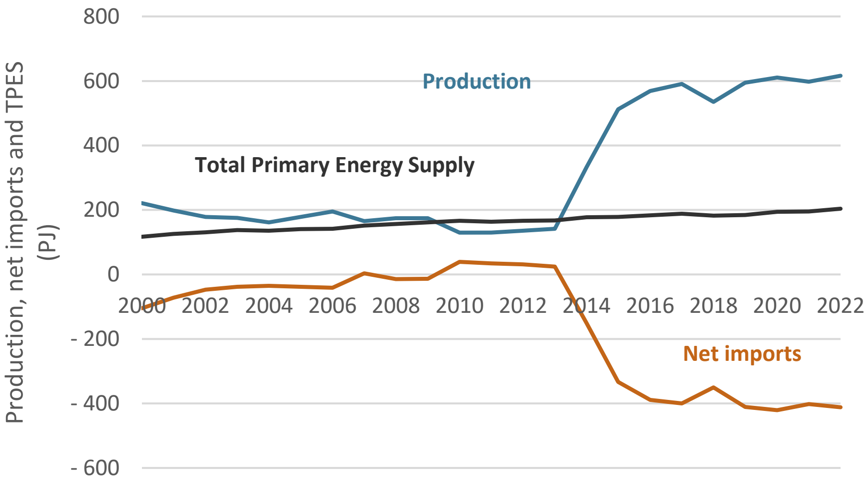
Energy Supply and Consumption

Total Primary Energy Supply

In 2022, the Total Primary Energy Supply (TPES) was 204 PJ, a 4.2% increase from the year before. The growth was driven by increased oil and gas supply in the transport and industry sectors. When excluding an increase in residential fuelwood use, renewable energy supply remained steady.

Oil was the largest contributor to TPES in 2022, making up 41%. Renewables were a close second, contributing 40%. Natural gas accounted for 18%.

Figure 1: PNG's energy supply, production, and net imports (PJ), 2000 to 2022



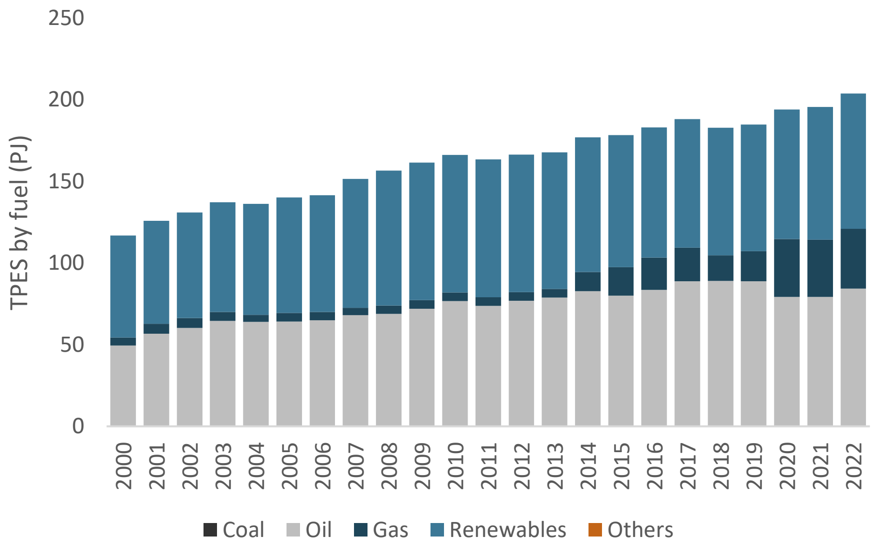
Source: EGEDA (2024)

Most of PNG's refined oil supply is split mainly between imported diesel (30 PJ) and heavy fuel oil (20 PJ), with a small amount (1.6 PJ) of gasoline supply and jet fuel (2.5 PJ). This is unique in comparison to the rest of the APEC region, where gasoline is one of the refined oils with the highest supply. It is different in PNG because of the relatively low road transport activity, and the higher ratio of diesel to gasoline-fuelled vehicles. The economy also exports all its naphtha (26 PJ), which is an output from its oil refinery.

Crude oil makes up about 53 PJ of the economy's oil supply. The economy exports almost all its crude oil production (about 52 PJ) but also imports about the same amount to be used in its refinery (Napa Napa refinery). The majority of the economy's crude exports are of the Kutubu blend which is considered a premium crude because it is light and sweet and therefore easy to refine.

PNG has abundant gas resources, with significant production starting in the mid-2010s. In 2022, 92% of the gas production was exported as LNG, totalling 452 PJ compared to 37 PJ of TPES for domestic use. The high volume of exported gas results in a large negative net import balance. The total gas supply has doubled since 2019.

Figure 2: PNG's energy supply by fuel (PJ), 2000 to 2022



Source: EGEDA (2024)

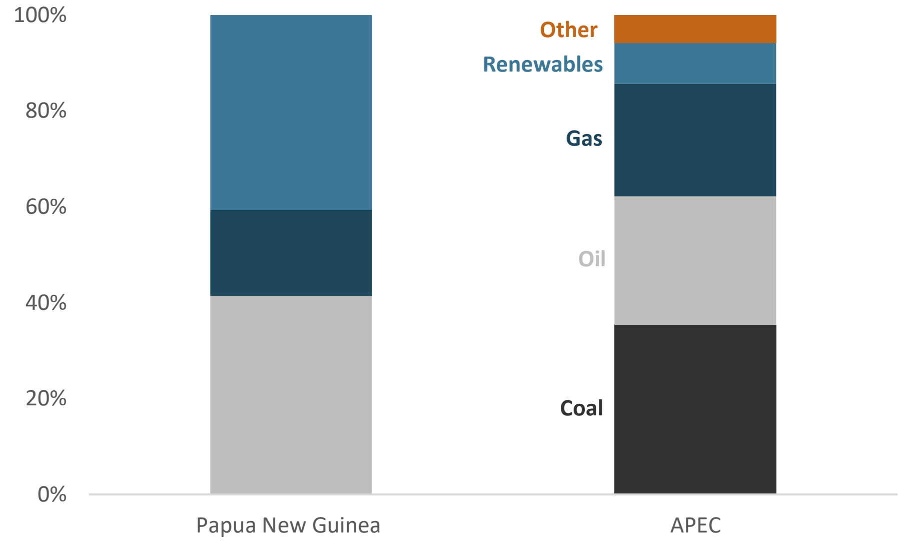
In PNG, all the gas that is used as well as what is transformed into LNG, makes its way through the PNG LNG plant (475 PJ capacity pa.), which is near Port Moresby. Of the 37 PJ of domestic use, the plant uses about 26 PJ of gas in the production process (which is classified as own use and losses). The last 11 PJ of domestic use is split between auto producers (off-grid-connected industrial producers) (5 PJ), and the Port Moresby Gas Power Plant (6 PJ), which is connected to the Port Moresby main grid.

The TPES of renewables in PNG is primarily (86%, 73 PJ) traditional biomass, which is mostly used for residential use, while a small amount is used by industry – mainly palm oil plants using their own waste for heat and electricity production. It should be noted that there is substantial difficulty in correctly estimating traditional biomass use, so this value is subject to significant uncertainty. As such, any indicators involving this estimate should be treated with caution.

Besides the use of biomass, 4% of renewables TPES is hydro (4 PJ) and geothermal (4%, 4 PJ) for electricity generation. The geothermal TPES is slightly exaggerated because of the low conversion efficiency of geothermal energy to electricity.

PNG's TPES composition differs significantly from the wider APEC region since the economy lacks coal-fired electricity generation and any coal consumption. Oil and renewables have a larger share of TPES compared to the APEC average.

Figure 3: Energy supply mix – PNG and APEC, 2022



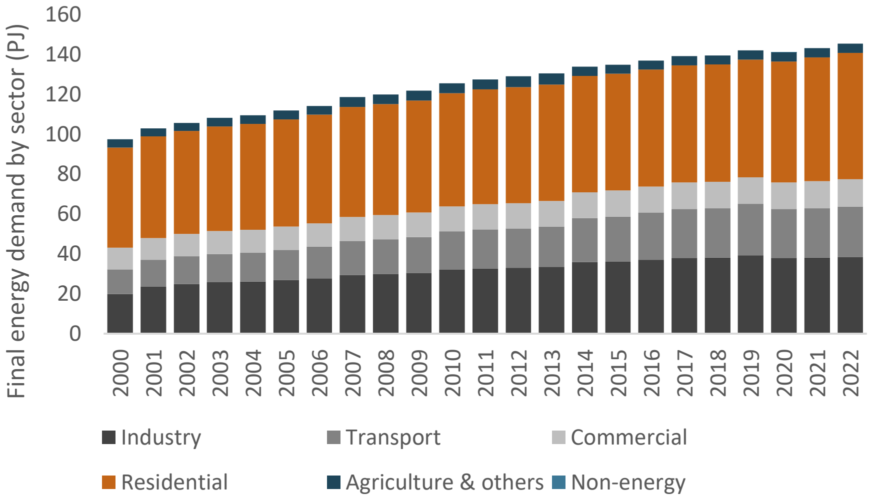
Source: EGEDA (2024)

Total Final Consumption

In 2022, PNG's total final energy consumption was around 145PJ. The residential sector accounted for about 44% of energy use, followed by the industrial sector (27%) and the transport sector (17%). Even though it makes up about 30% of GDP, the agricultural sector accounted for 5 PJ (3%) of energy use, of which the majority (about 90%) was diesel. There is no non-energy consumption in PNG.

Energy demand in PNG has been growing since 2000, albeit at a slower pace than GDP. Notably, the transport sector has doubled its energy use and the industrial sector has seen a similar increase. This increased energy demand stems from increased industrial output and transport activity, which highlights the crucial role of energy in driving economic growth.

Figure 4: PNG's final consumption by sector (PJ), 2000 to 2022



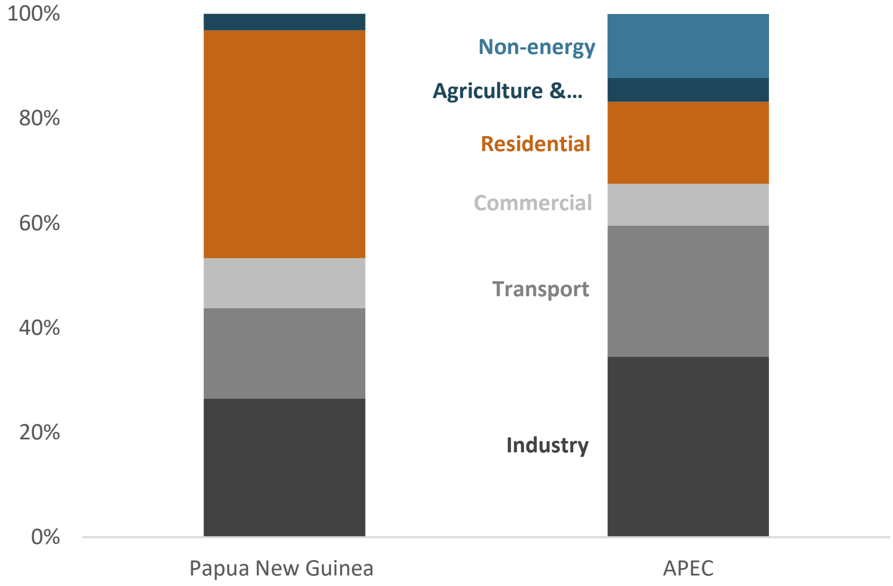
Source: EGEDA (2024)

PNG's underdeveloped road infrastructure, absence of used car quality import controls, and high rural population reduce transport efficiency and energy use in the sector. The few roads available are poorly maintained, and key regions like the populous Highlands are not even connected by road to the capital, Port Moresby. Despite a slight increase in road infrastructure from 2000 to 2015, the subsequent decline in road infrastructure and rapid population growth have reduced per capita road availability, according to the Asian Transport Outlook (2024). These conditions have curbed the growth of transport activity and energy use for road vehicles, making it modest compared to other APEC economies. PNG’s NEA will work with Customs PNG and the Transport Department to develop a regulation on used vehicle quality standards and engine capacities.

The residential sector is the largest energy consumer (44% of total final consumption) but has only seen a 26% increase since 2000 (total final consumption of all sectors increased by 49%). This comes from the fast growth of the other sectors, which is to be expected as the economy develops.

In the densely populated Highlands region, it is cold all year, which increases the need for fuelwood for heating. This raises the demand for biomass, which in turn increases the environmental and health challenges associated with traditional biomass use. Throughout PNG, replacing the reliance on traditional biomass for cooking, heating and lighting with cleaner alternatives could have significant health impacts for the population and could help preserve local ecosystems. It may also improve energy intensity through more efficient energy types.

Figure 5: Final consumption by sector, PNG's and APEC, 2022

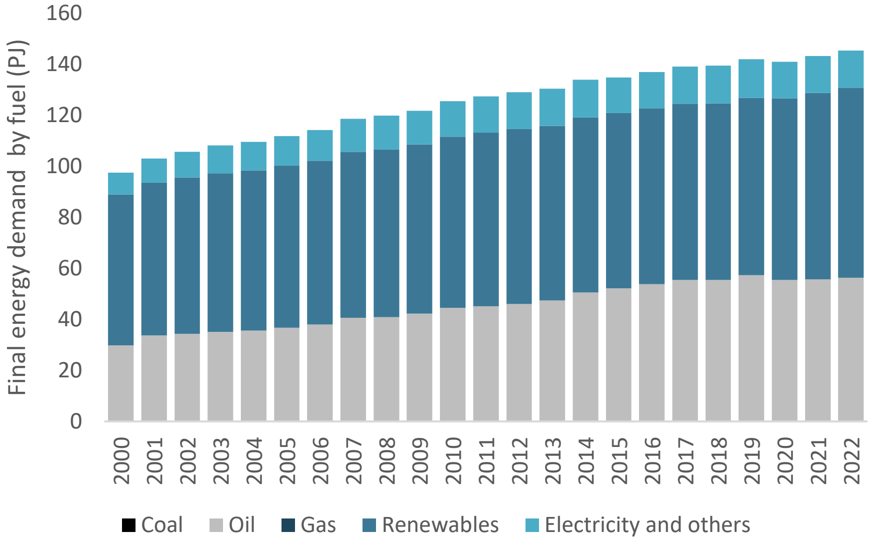


Source: EGEDA (2024)

Final Energy Demand

PNG's energy demand in 2022 was dominated by oil (39%) and renewables (51%), of which the majority was fuelwood for residential use. Electricity consumption was 10% of the final energy demand and was mostly consumed by the industrial sector.

Figure 6: PNG's final energy demand by fuel (PJ), 2000 to 2022

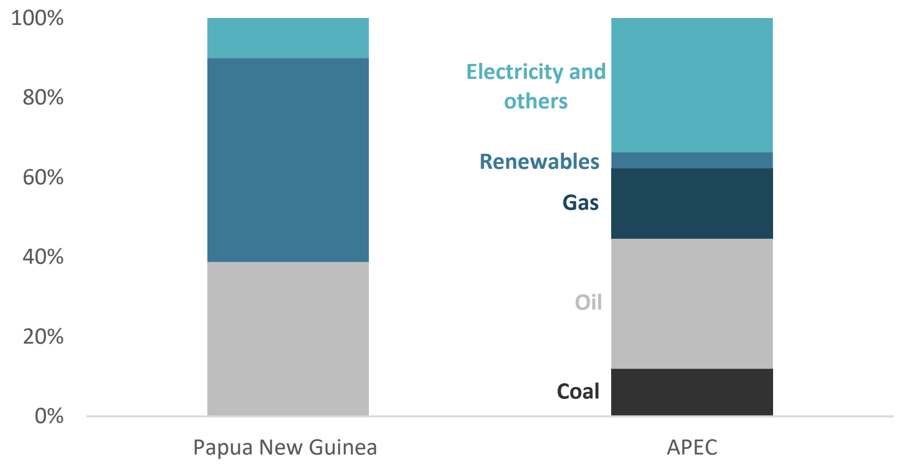


Source: EGEDA (2024)

Note: Does not include non-energy sector consumption of energy products.

Compared to the rest of APEC, PNG's energy use comprises a greater share of oil and renewables. This largely stems from PNG having no use of coal and a negligible amount of gas use, so the other fuel types take their place. Relative use of renewables is especially high compared to other economies.

Figure 7: Final energy demand fuel share, PNG and APEC, 2022



Source: EGEDA (2024)

Transformation

Power Sector

PNG's electricity network is relatively undeveloped. Only around 20% of the population has access to the electricity network, and it is known to have reliability issues. Because of the dispersed population and rough topography, building the network to reach people in rural areas is extremely challenging technically and financially.

Because of the rough topology of the land, the electricity network is currently split into different grids. The three main grids are the Port Moresby, Gazelle and Ramu grids, while there are at least 19 geographically isolated mini grids that serve smaller provincial centres. These mini grids are almost entirely powered by diesel and fuel oil generators, which results in high generation costs.

Given the geographical constraints of the county, the Government of PNG, through the NEA, has developed the Off-Grid Regulation 2023, which will be the enabling mechanism to drive the implementation of the National Electrification Rollout Plan (NEROP) to connect 70% of PNG's population to the grid by 2030, but using strictly renewable energy sources. This is also expected to require financial assistance from other APEC economies. The rollout will help to stimulate economic activity, and quality of life and will improve energy intensity. It will probably also involve connecting the grids, which may help with improving network stability.

Partly due to the poor transmission infrastructure, PNG's electricity use is low compared to the APEC average, and total electricity generation is also low. A significant 92% of energy used for electricity generation is from diesel and heavy fuel oil compared to 55% of output electricity coming from those sources. This high use is because of the mobility of these fuels, lower upfront costs, and operational flexibility during frequent blackouts. However, the use of oil for electricity generation is relatively expensive and inefficient in the long term. So, it is expected that oil use for generation will decrease in future years with more investment in PNG's large reserves of renewable and natural gas resources.

Gas currently provides about 19% of total generation output, of which half is from auto producers, and half is from the PNG LNG plant and is connected to the Port Moresby Grid. Hydropower is the largest source of renewable electricity (at 23%, while geothermal contributes 2.0%). There is a small amount of generation using biomass (0.2% in the palm oil plantations) and biogas (0.6%) from other auto producers.

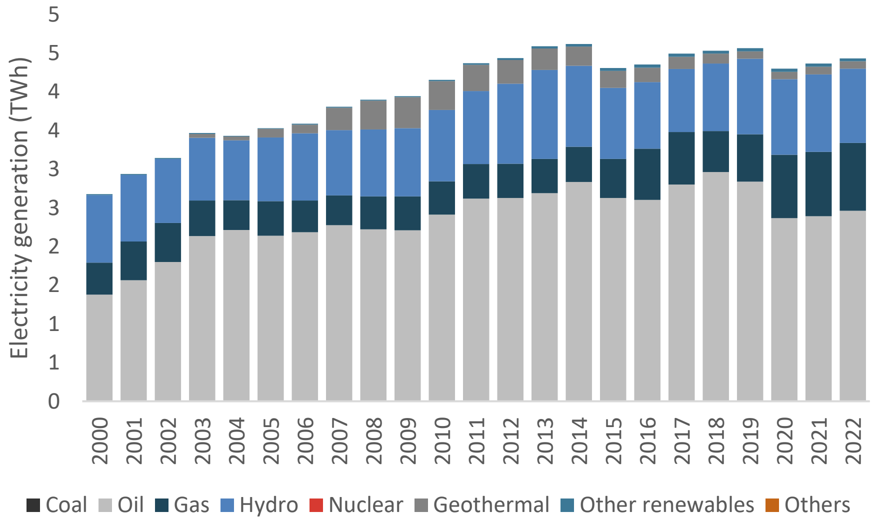
Estimates show that two-thirds of electricity generation and consumption in PNG is by industrial sector auto producers, such as mining facilities or plantations, which are quite far away from urban centres and are not often connected to the grid. However, in some cases, they do supply their excess power to their small local grids, which helps to improve grid stability and access in these areas.

One other area of improvement has been the development of off-grid solar for lighting, which means that around 60% of the population has access to electricity if off-grid solar (for lighting) is considered (this does not count towards the NEROP). However, fuelwood, charcoal, liquid petroleum gas (LPG) and kerosene are still needed for cooking and heating.

PNG uses a large proportion of oil for generation compared to the APEC average, as it relies heavily on low-capacity oil generators for electricity generation. The prominence of hydro and geothermal generation in PNG is partly due to the small amount of generation capacity needed to make those sources significant, relative to the APEC average and the economy's total.

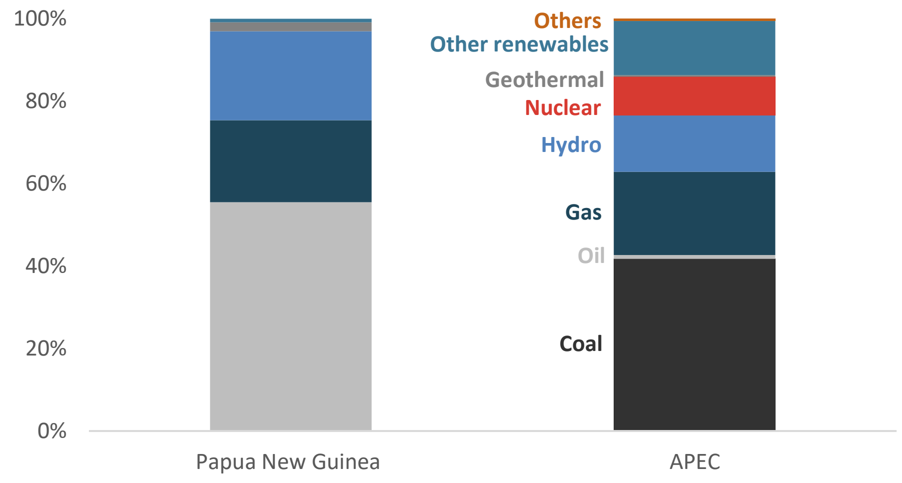
In terms of input fuel quantities for electricity generation, there was 22 PJ of fuel oil use, 11 PJ of natural gas and 7 PJ of diesel use for electricity generation. The remaining generation (about 1200 GWh, 4 PJ) came from renewables. It is estimated that these inputs generated 16 PJ of electricity, although there could be a significant margin of error, especially because of the difficulty of estimating the electricity output of diesel generators.

Figure 8: PNG's electricity generation by fuel, 2000 to 2022



Source: EGEDA (2024)

Figure 9: Electricity generation fuel share, PNG and APEC, 2022



Source: EGEDA (2024)

Refining

PNG has an oil refining capacity of 33 000 barrels per day (73 PJ per year), and the economy produced 58 PJ of petroleum products in 2022. This is not enough to satisfy domestic consumption, so the economy imports most of the refined oil it uses, and most of its production is exported. Furthermore, the crude oil that is refined in PNG is currently imported.

The economy's LNG plant, just outside of Port Moresby, has a capacity of 8.3 mtpa, which is equivalent to 475 PJ of natural gas, and produced 451 PJ of LNG in 2022. There is a new project, the Papua LNG project, which is expected to be completed by the end of 2027, and will increase the plant's capacity to almost 14 mtpa.

One benefit of the development of the LNG plant is that the residential sector has been able to use LPG (of which total residential LPG consumption was 0.2 PJ), which is a cleaner alternative to kerosene (kerosene makes up about 2.5 PJ of total residential energy use) or fuelwood (72 PJ) for heating and cooking.

Energy Transition

PNG's energy transition goes hand-in-hand with its growth. One of PNG's biggest challenges is building the infrastructure it needs to enable the supply of new energy types to its population. This is made even harder by the difficult topography of the economy.

The major project of increasing access to electricity will help to give 70% of the population alternatives to fuelwood and kerosene. Increased access will probably also result in an increase in the reliability of the electricity network. These two improvements may help to counter the reliance on oil generators, which are particularly popular because they can be transported to remote areas, require less capital, and provide backup capabilities.

The economy has abundant gas resources and currently exports most of its gas as LNG. There are potential areas where this gas could be used domestically, such as electricity generation and production of other fuels (e.g., ammonia, LPG), or for industrial purposes. Also, if the rest of the world transitions to gas instead of coal and oil, LNG exports could become more profitable for the economy.

Besides traditional biomass, which includes fuelwood, the economy also has significant potential for non-traditional renewable energy, especially renewable electricity generation types. As the government continues to invest in electrification and renewable energy, the energy mix in PNG is expected to shift away from imported oil and towards renewable energies and natural gas, which are more economically and environmentally sustainable energy sources for the future.

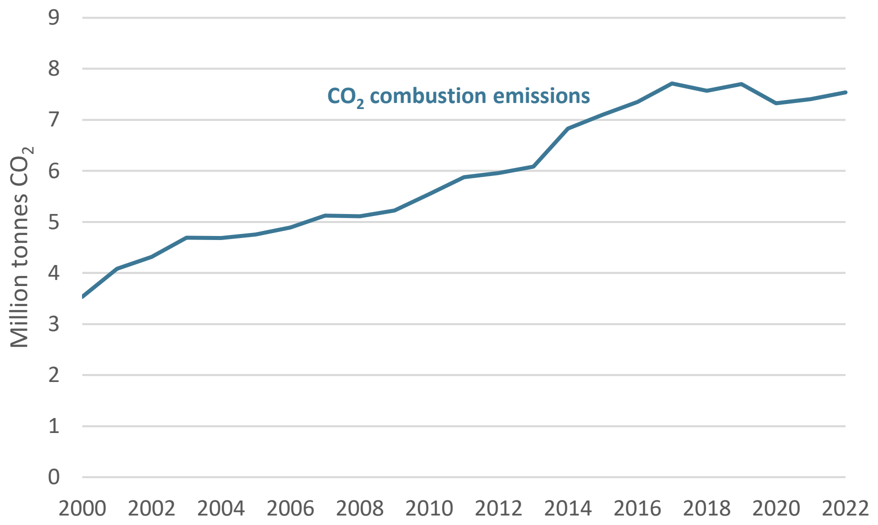
Energy transition topics are further covered in the PNG chapter of the APEC Energy Demand and Supply Outlook.

Emissions

PNG emitted about 7.5 million tonnes of CO_2 combustion emissions in 2021, but this was only about one-thousandth of APEC's total CO_2 combustion emissions. PNG's emissions are expected to grow quickly over time as the economy increases power generation, as well as its industrial and transport activity.

The majority of PNG's CO_2 combustion emissions currently come from electricity generation (40%), transport (20%), and industry (20%). The emissions from burning fuelwood are not considered.

Figure 10: PNG's CO_2 combustion emissions (million tonnes), 2000 to 2022



Source: EGEDA (2024)

Energy Security

PNG's energy security issues are defined by its reliance on imports for most of its oil use (oil makes up 39% of total consumption). In 2023, there was a 30-day shortage of aviation fuel in PNG, forcing local airlines to suspend flights. This was very costly for the economy, especially since much domestic transport is by air. For example, the capital Port Moresby is not connected by road to the second largest city, Lae, and the nearby, highly populated, Highlands region. Similar oil shortages continue to affect the economy, which is linked to finance woes.

Means of improving the economy's energy security could include increasing the oil stockholding limits or diversifying the sources of energy supply. Improvements to the economy's financial situation will also be helpful.

PNG's effort to improve the access to and reliability of its electricity network can be considered an important project for increasing energy security as it will decrease reliance on oil for electricity generation. This will in turn decrease the negative effects of oil shortages.

APEC Energy Goals

There are two energy-related objectives that APEC member economies have agreed to meet as a collective: to improve energy intensity and double the share of modern renewables.

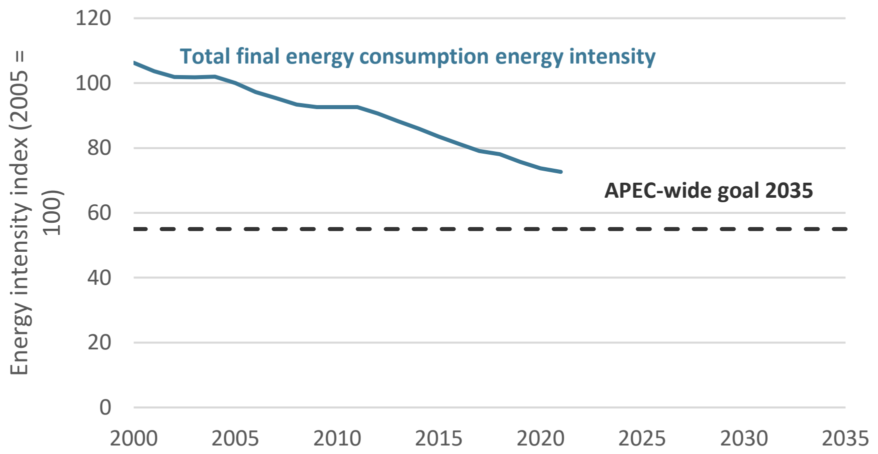
Energy Intensity Goal

In 2011, APEC member economies agreed to increase their ambition to reduce energy intensity by 45% in 2035, relative to a 2005 baseline. The original goal was a 25% improvement by 2030, relative to a 2005 baseline.

APEC is on track to achieve this energy intensity improvement. The goal does not impose individual economy targets, but it is possible to track the progress of individual APEC economies relative to the overarching proportional improvement.

PNG has improved its energy intensity over the past two decades and this improvement is expected to continue, particularly with the implementation of the NEROP and the Energy Labelling and Minimum Energy Performance Standards for Appliances, Equipment and Lighting Products Regulation 2024. The economy's energy intensity in terms of total final energy consumption was 64 PJ per billion USD PPP in 2022, which was a 34% improvement from 2000. The improvement in energy intensity is also driven by the growth of the economy through LNG exports since 2014. The APEC region has set a goal of reducing energy intensity by 45% by 2035, compared to the 2005 baseline, but this target is not applicable to individual economies.

Figure 11: PNG's total final energy consumption intensity index, 2000 to 2022 (2005 = 100)

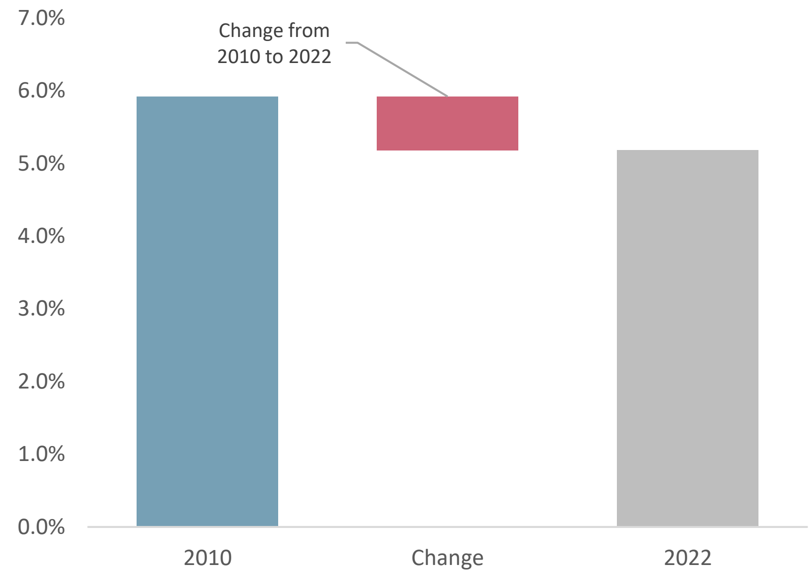


Source: EGEDA (2024)

Doubling of Renewables

The second energy goal involves doubling the share of modern renewables in the APEC energy mix for the period 2010 to 2030. There is no economy-level goal for individual member economies, but improvements by individual economies will contribute to the doubling goal.

Figure 12: PNG's modern renewable energy share, 2010 and 2022



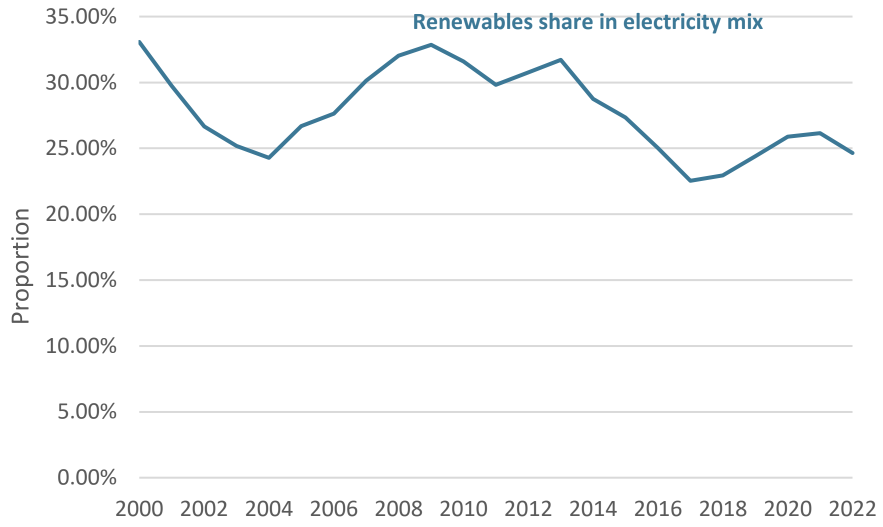
Source: EGEDA (2024)

Note: Biomass used in the residential and commercial sectors is assumed to be traditional biomass and is not included in the definition of modern renewables. All other renewables (biomass used by industry, hydro, geothermal, etc.) are considered modern renewables. Modern renewables also include the share of electricity that is generated from renewable sources.

PNG has a modern renewable energy share of 5.2%. This has changed very little since 2010, which is because all energy types increased by about the same amount. Traditional biomass consumption is not designated as part of the modern renewables share, but if it were, PNG's renewables share would be around 50%.

PNG has a renewable generation share of 25% and the majority of this comes from hydro (88%) and geothermal electricity generation (9%). There is a small but quickly growing amount of solar at 0.4%. The rest comes from biogas (2.0%) and biomass (0.7%) generation in the industrial sector. The share of renewables in generation has remained at about the same level since 2000. The intermediate variation was due to new capacity developments such as the expansion of the Lihir gold mine geothermal generation scheme.

Figure 13: PNG's renewable generation share, 2000 to 2022



Source: EGEDA (2024)

Energy Policy

Energy policy	Details	Reference
100% Renewable Energy	This is a target to achieve 100% renewable electricity by 2050.	Vision 2050
NEROP	Rate of 70% access to electricity by 2030 and 100% by 2050.	Vision 2050, National Energy Policy 2017-2027
Enhanced Nationally Determined Contribution (NDC) (2020)	The NDC was revised to target a 78% share of installed capacity of renewable energy by 2030.	Enhanced Nationally Determined Contribution
Domestic Resource Utilisation	The government will ensure 15% of gas reserves in new oil and gas projects will be made available for domestic gas utilisation.	National Energy Policy 2017-2027
Energy Labelling and Minimum Energy Performance Standards for Appliances, Equipment and Lighting Products Regulation 2024	A drafted regulation for reducing PNG's imports and use of low energy-efficient and substandard electrical appliances.	National Energy Agency
Corporate Plan for 2023-2027	Outlines the strategic direction and key objectives that will guide the NEA's efforts over the next five years. One of the Corporate Plan's goals is to reduce the use of diesel-powered generators from 200 megawatts per annum to 150 megawatts per annum by 2027.	Corporate Plan for 2023-2027
National Energy Authority Act 2021	Passed in April 2021, it will decommission all the regularity powers and functions of PNG Power Limited and vest them with the NEA. The National Energy Authority Act also empowers the government to collect energy data from private groups to obtain statistics.	Energy Authority Act

Notable Energy Developments

Energy development	Details	Reference
Amendment to the Mining Act and the Oil and Gas Act	The Mining Amendments introduce a 'live data' reporting obligation and give entities priority in tenement applications over 'reserved land'. The O&G Amendments give the minister greater flexibility in determining whether to grant or refuse petroleum development licences and affect the sanctity of petroleum and gas agreements.	New PNG Energy laws commence

Papua LNG Project	The project participants and the government have reaffirmed their commitment to this project, and it is expected to proceed. When complete it will add six mpta of LNG production.	NASDAQ
PNG Electrification Partnership	USD 1.7 billion of international funding from Australia, Japan, New Zealand, and the United States has been pledged to help achieve the target of 70% of electrification by 2030. Some of this money is already being committed to projects.	Post Courier
Proliferation of Off-Grid Solar Lighting	Some 60% of Papua New Guinean households are now using off-grid solar technology with off-grid solar lighting products and battery-based torches and lanterns, which are now effectively replacing kerosene lamps.	PNG Off-Grid Report

Useful Links

United Nations – https://papuanewguinea.un.org/

The World Bank – https://www.worldbank.org/en/country/png

International Monetary Fund – https://www.imf.org/en/Countries/PNG

PNG Environmental Data Portal – https://png-data.sprep.org/

Asian Development Bank – https://www.adb.org/countries/papua-new-guinea/main

PNG Development Strategic Plan 2010-2030 – https://png-data.sprep.org/dataset/png-development-strategic-plan-2010-2030

National Energy Authority Policy Framework – https://nea.gov.pg/policy-legal-framework/

References

Asian Transport Outlook (2024), Country Profile, https://asiantransportoutlook.com/analytical-outputs/countryprofiles/profile-papua-new-guinea/

Peru

Introduction

Since the COVID-19 pandemic, Peru has returned to a growth path, although at a slower rate than in past decades. Peru's GDP was estimated at a constant 2021 USD 521 billion PPP in 2022. The National Institute of Statistics and Informatics (INEI) estimates that Peru's GDP decreased by 0.6% in 2023. Peru's GDP grew 3.3% in 2024.

According to the Ministry of Energy and Mines (MINEM), Peru has the fifth-largest proved natural gas reserves in South America, estimated at 7.9 trillion cubic feet (TCF) in 2023. These reserves are in the Southern Jungle region (Ucayali, Madre de Dios) and the Northern Coast, Talara, where natural gas liquids reserves are estimated to be 348 million barrels (MMB). Peru also ranks sixth in proved oil reserves in South America, with these reserves estimated at 325 MMB. In APEC, Peru ranks 11th in crude oil production and 9th in natural gas production. However, due to its heavy dependency on fossil fuels used in transport and industry and the stagnant level of domestic production, Peru has become a net importer of hydrocarbons.

Peru's proved mineral coal reserves are around 3.5 million tonnes, with approximately 64% consisting of anthracite and the rest bituminous (MINEM, 2024). Most of the reserves are in the La Libertad, Ancash, Cajamarca and Lima regions.

Peru's proved uranium reserves are estimated at around 1800 tonnes, located in Puno, a southern Andean region in Peru. Peru does not exploit these reserves for energy use, although there has been interest in exploring new uranium deposits.

Table 1: Peru's macroeconomic data and energy reserves

Key data [a]		**Energy reserves** [b, c]	
Area (million km^2)	1.3	Oil and natural gas liquids (billion barrels)	0.7
Population (million)	34	Gas (trillion cubic feet)	7.9
GDP (constant 2021 USD billion PPP)	521	Coal (million tonnes)	3.5
GDP per capita (constant 2021 USD PPP)	15 287	Uranium (reasonable recoverable tonnes U, <USD 130/kgU)	1400

Source: [a] World Bank (2024); [b] Peru's Energy Balance 2022 (2024); [c] Annual Book of Hydrocarbons 2023(2024)

Note: Reserves are total proved reserves and reasonably assured recoverable resources for uranium.

Peru has abundant renewable energy potential, including hydropower, solar, wind, and geothermal, most of which remains unexploited. Following the installation of the first solar and wind power plants as a result of the renewable energy auctions held between 2010 and 2016, Peru has seen the installation of privately invested solar and wind power plants. In 2024, the 80 MW Matarani and the 115 MW Clemesi solar power plants were inaugurated. Additionally, the 177 MW Wayra Extension wind power project began commercial operation in June 2024.

Energy Supply and Consumption

The following analysis is based on Peru's energy statistics for 2022, collected by the Expert Group Energy Data Analysis (EGEDA).

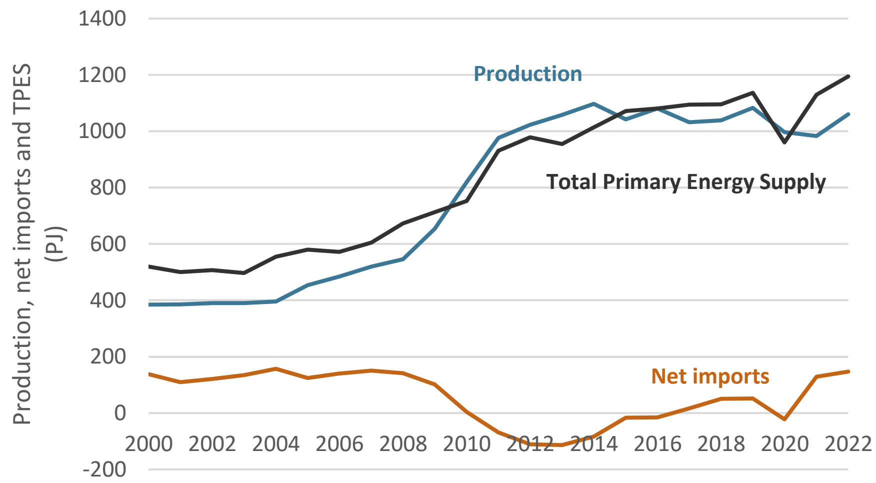
Total Primary Energy Supply

Peru's energy statistics (EGEDA, 2024) show that total energy primary supply grew by 5.8% in 2022 compared to 2021, reaching 1195 PJ, up from 1130 PJ the previous year. This growth indicates that Peru's total primary energy supply has recovered the trend observed prior to the COVID-19 pandemic in 2020.

Almost 90% of the total primary energy supply is met by domestic production, while the remainder is satisfied by imports. However, imports of primary energy have been increasing since 2017, except in 2020, indicating that domestic primary energy production has not grown at a rate sufficient to meet rising energy demand. Furthermore, domestic primary energy production has remained stable since 2014, except in 2020 and 2021, suggesting that increases in energy demand needs must be met through imports. In 2022, domestic primary energy production increased by 7.9% compared to 2021, going from 983 PJ to 1061 PJ, mainly due to an increase in natural gas liquids (NGL) production[9].

Primary energy imports reached 147 PJ (EGEDA, 2024), representing a 14% increase from 2021. These levels of net imports are similar to those observed between 2003 and 2008 before Peru became a net energy exporter between 2010 and 2016 due to natural gas exports. According to Peru's Energy Balance (MINEM, 2024), crude oil net imports accounted for almost 94% of these imports, and coal imports represented the remainder.

Figure 1: Peru's energy supply, production, and net imports (PJ), 2000 to 2022



Source: EGEDA (2024)

Renewable primary energy production decreased in 2022, primarily due to a 6.8% decline in hydropower production compared to 2021, caused by droughts during the year. Total biomass production for traditional use also decreased by approximately 5.0%, probably reflecting adjustments based on economic growth estimates used to calculate this consumption. In contrast, solar and wind energy production increased by about 5.0% during the same period.

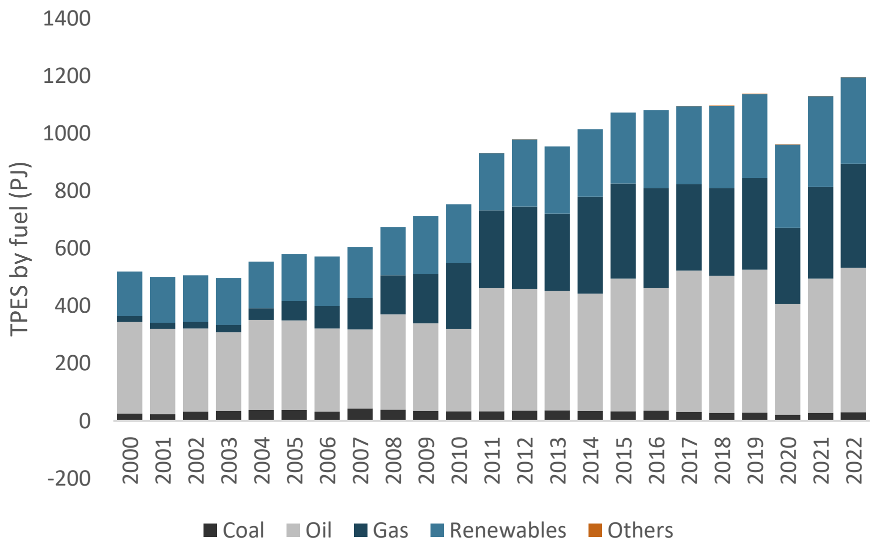
Since 2014, crude oil and NGL production have been declining. After a 25% decrease in crude oil production during the COVID-19 pandemic in 2020, Peru has been unable to recover crude oil production levels to

[9] EGEDA reports natural gas liquids production under the oil and oil products production account. In EGEDA, natural gas production refers specifically to natural gas that has natural gas liquids or condensates removed.

pre-pandemic levels. In contrast, natural gas production increased 20% in 2022 mainly due to an increase in exports.

Although coal represents a small share of Peru's total primary energy supply, an increase in coal supply has been observed since 2020. Domestic production and imports rose by 33% and 50%, respectively, in 2022 compared to 2021, reaching 5.2 PJ and 13 PJ respectively. This growth was driven by higher industrial demand, primarily from cement producers and coal-fired thermal power plants. These included the Ilo 2 power plant, which supplies the electricity market and self-producers, and which was needed to compensate for restrictions on hydropower.

Figure 2: Peru's energy supply by fuel (PJ), 2000 to 2022

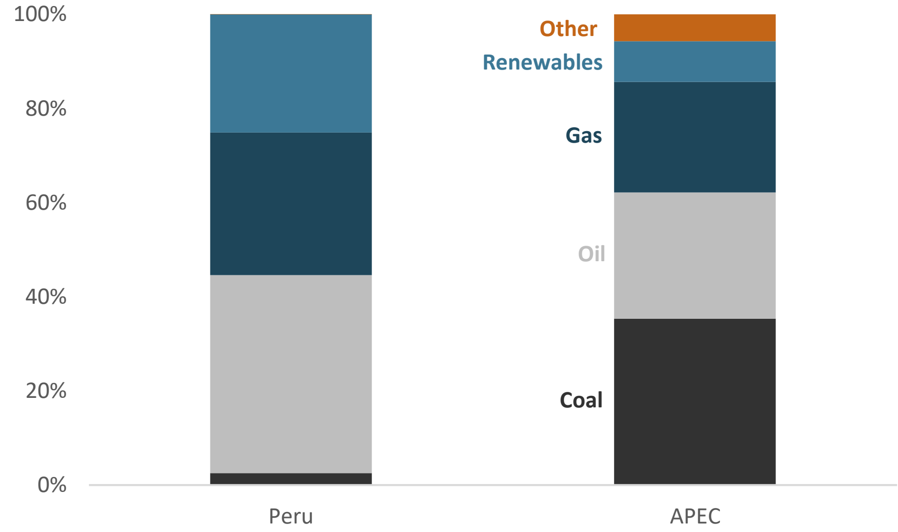


Source: EGEDA (2024)

Peru's energy supply mix exhibits differences with respect to APEC's. In Peru, coal represents just 2.0% of the energy supply mix, mainly consumed by industry. On the other hand, coal is 35% of the energy supply mix in APEC, serving as a major fuel for electricity generation in the electricity market.

Another important difference observed between Peru's and APEC's energy mix is the share of oil. In 2022, the oil share was 41% in Peru, mainly consumed by transport while oil represented 27% in APEC.

Figure 3: Energy supply mix, Peru and APEC, 2022



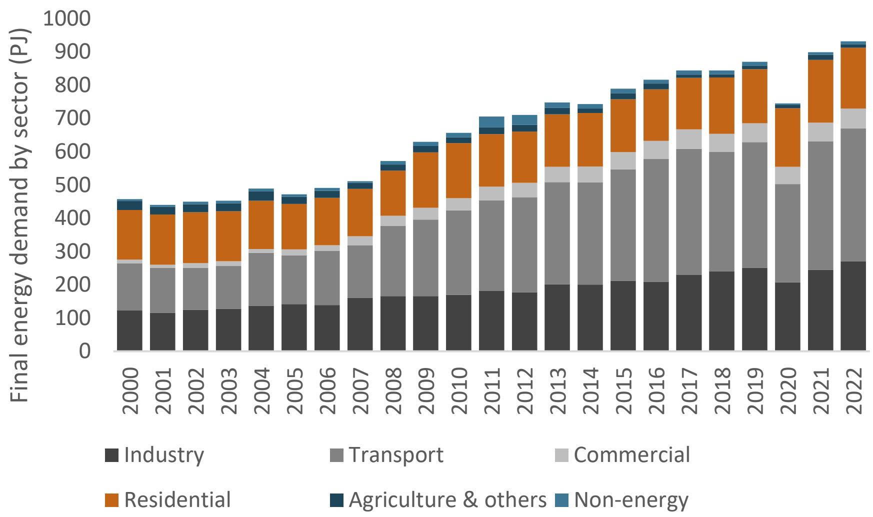
Source: EGEDA (2024)

Total Final Consumption

Peru observed an increase in total final consumption in all sectors. Total final consumption reached 931 PJ in 2022, representing an increase of 3.6% compared to 899 PJ in 2021. This growth was primarily driven by the industrial sector, which recorded the largest gain of 26 PJ, an 11% increase from 2021, mainly due to higher fuel oil demand. The transport sector saw an increase of 14 PJ, representing a

3.6% growth, while the commercial sector grew by 2.0 PJ. Residential energy consumption was reduced in 6 PJ in 2022, reflecting a 3.0% decrease.

Figure 4: Peru's final consumption by sector (PJ), 2000 to 2022



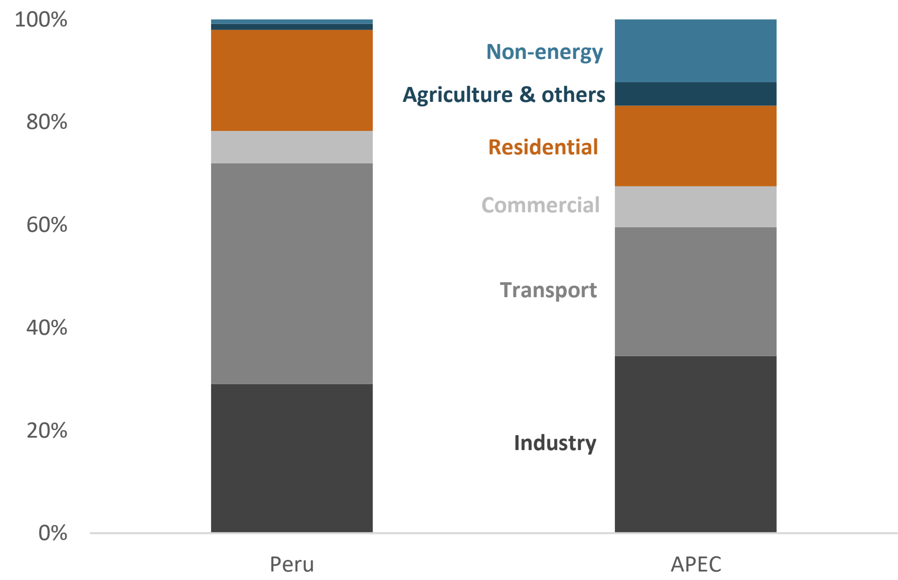
Source: EGEDA (2024)

Transport remains the largest consumer of energy products, accounting for 43% of total final consumption. Industry, which includes mining, is the second-largest consumer at 29%, followed by the residential sector at 20%. The share of industry has remained stable at around 29% since 2000, while the share of the residential sector decreased from 30% in 2000 to 20% in 2022, indicating slower energy growth in residential consumption, mainly due to the replacement of inefficient traditional biomass, which is used for cooking and water heating, by cleaner and more efficient options such as LPG.

This final consumption by sector mix highlights that decarbonisation is particularly challenging for Peru, as the transport sector is considered one of the hardest to decarbonise and in which to implement fuel-switching strategies.

In APEC, industry is the largest consumer, representing 35% of total final consumption. Transport accounts for 25%, while buildings represent 24%.

Figure 5: Final consumption by sector, Peru and APEC, 2022



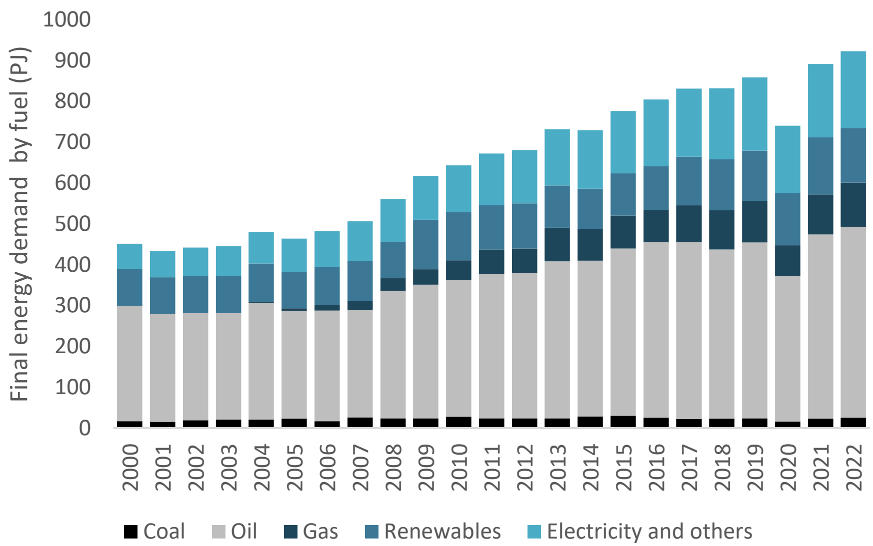
Source: EGEDA (2024)

Another significant difference is found in the non-energy sector, where Peru's non-energy consumption of energy products is minimal, largely due to the underdevelopment of the petrochemical industry in Peru.

Final Energy Demand

In 2022, final energy demand grew by 3.5% from 2021 levels, reaching 923 PJ. Oil and oil products remain the primary source of energy, supplying approximately 51% of the final energy demand (467 PJ), which also represents a 3.5% increase compared to 2021.

Figure 6: Peru's final energy demand by fuel (PJ), 2000 to 2022

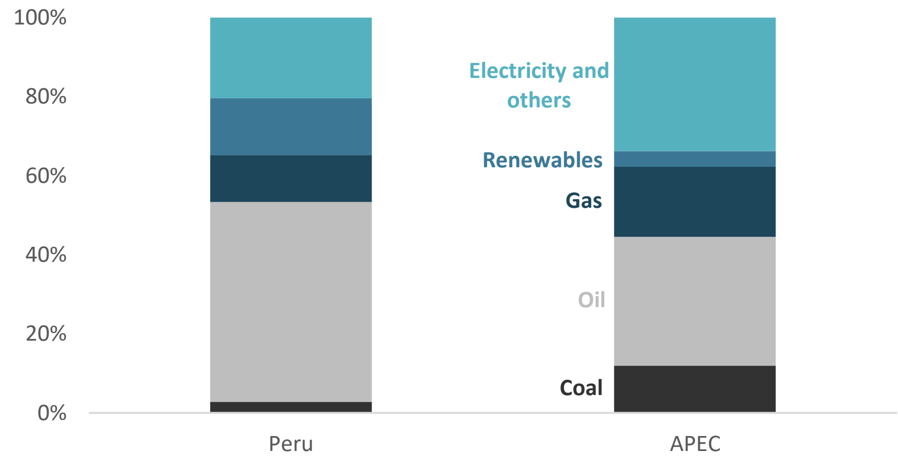


Source: EGEDA (2024)

Note: Does not include non-energy sector consumption of energy products.

Natural gas demand grew across all sectors. In the residential and commercial sectors, natural gas consumption reached 10 PJ and 9 PJ, reflecting growth rates of 11% and 14%, respectively, compared to 2021. The transport sector also saw a significant increase in natural gas consumption, reaching 31 PJ, an increase of 28% from 2021. In the industrial sector, natural gas consumption rose to 58 PJ, marking a 3.5% increase compared to 2021 levels. These figures are aligned with the information provided in Peru's Energy Balance 2022, which reports an increase in natural gas residential users, reaching around 1 610 000 residential clients by December 2022. Additionally, the Automotive Association of Peru reported 74 512 vehicles were converted to natural gas in 2022. Peru consumes between 200 to 250 x10^3 bpd of liquid oil products. Domestic production satisfies around 35% of this demand.

Figure 7: Final energy demand fuel share, Peru and APEC, 2022



Source: EGEDA (2024)

Renewable energy consumption decreased in 2022, mainly due to a reported decline in biomass use.

Electrification of energy demand in Peru is lower than the average observed across APEC as a region. In Peru, electricity accounts for 20% of the final energy demand, compared to 34% in APEC. Peru's space heating energy demand is minimal; consequently, fossil fuels are primarily used in the transport sector, as well as for cooking and water heating in buildings, and for thermal processes in industry. The electrification of demand, mainly in buildings, presents opportunities for Peru's energy transformation.

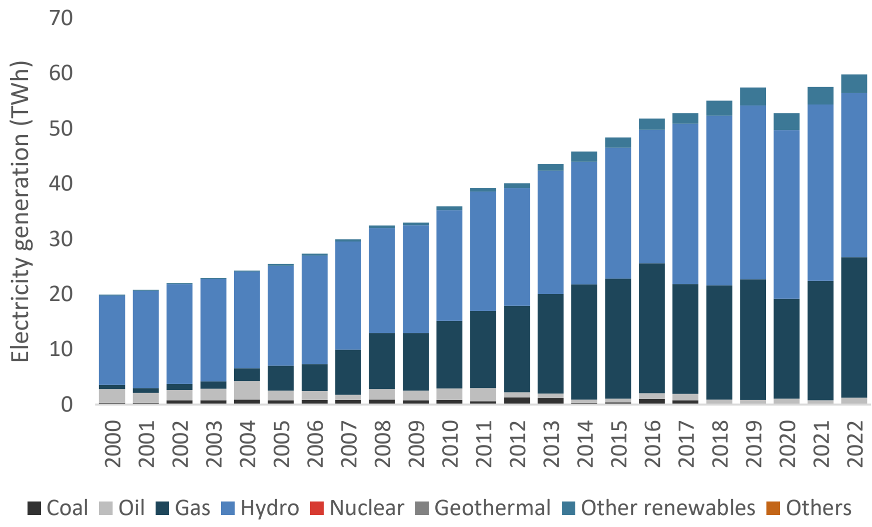
Transformation

Power Sector

In 2022, Peru's electricity generation totalled 59 806 gigawatt-hours (GWh), representing a 4.0% increase compared to 2021. Renewable energy sources accounted for 55% of total electricity generation, with hydropower contributing 50% and non-conventional renewable energy sources providing 5.4%. Hydropower production declined by 6.8%, decreasing from 31 926 GWh in 2021 to 29 744 GWh in 2022. Conversely, non-conventional renewable energy generation increased by 5.6%, rising from 3 198 GWh in 2021 to 3 371 GWh in 2022 (EGEDA, 2024)

Natural gas-fuelled electricity generation increased significantly, growing by 19% from 21 337 GWh in 2021 to 25 424 GWh in 2022. Coal-based power generation decreased by 9.8%, falling from 129 GWh in 2021 to 117 GWh in 2022. In contrast, diesel-fuelled power generation experienced a notable increase of 30%, rising from 871 GWh in 2021 to 1 130 GWh in 2022.

Figure 8: Peru's electricity generation by fuel, 2000 to 2022

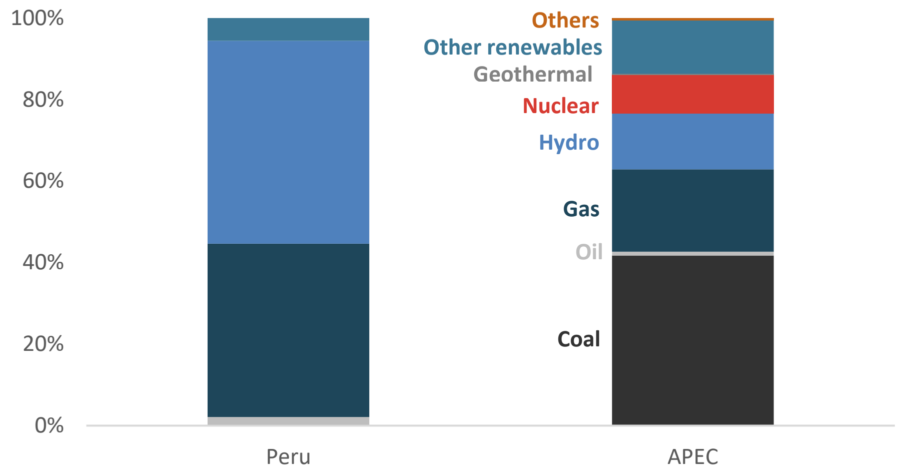


Source: EGEDA (2024)

Compared to APEC, Peru's electricity generation is dominated by hydropower and natural gas. According to Peru's 2019 greenhouse gas inventory, the power sector accounts for approximately 8.0% of emissions, a share that is lower than the APEC average.

Peru still has significant potential for hydroelectric power and other renewable energy sources.

Figure 9: Electricity generation fuel share, Peru and APEC, 2022



Source: EGEDA (2024)

Refining

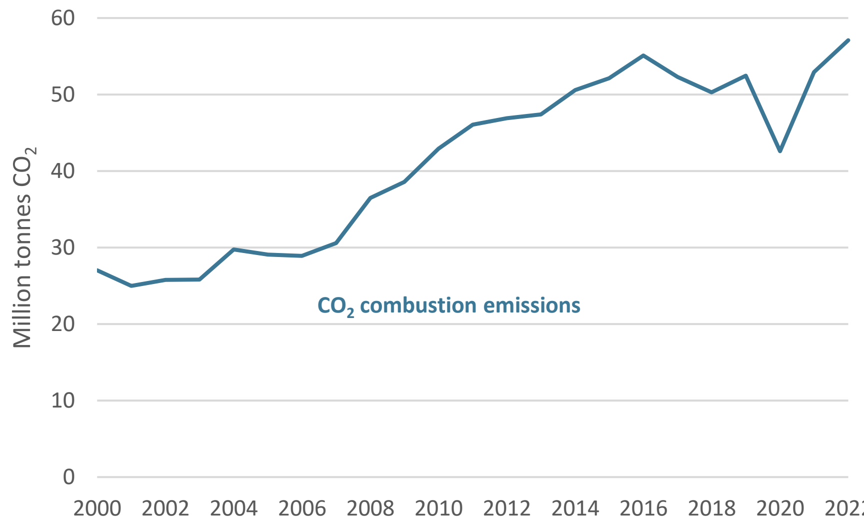
In 2022, the upgraded Talara Refinery was inaugurated after having been shut down since 2019 for modernisation. Trial operations began in 2023, and by 2024, the upgraded Talara Refinery was processing approximately 90 thousand barrels per day. Peru's total refinery capacity is around 246 700 barrels per day.

Energy Transition

Emissions

Peru increased CO_2 combustion emissions for the second consecutive year, reaching 57 million tonnes per year, an increase of 8.0% from the 2021 level. Since 2000, Peru has almost doubled its emissions indicating that economic and population growth has been supported mainly by an increase in fossil fuel demand. The emission increase observed in 2022 was due to increases in transport and industry activities.

Figure 10: Peru's CO_2 combustion emissions (million tonnes), 2000 to 2022



Source: EGEDA (2024)

Despite the growth in emissions, Peru remains one of the lowest CO_2 emitters in APEC. Peru ranks 16th in total CO_2 emissions and 19th in CO_2 emissions per capita, producing almost half the emissions per capita of Mexico and Viet Nam, which rank 16th and 17th respectively.

Energy Security

Between 2010 and 2022, the total energy supply grew 3.9% per year, a faster rate than the total domestic primary energy production at 2.2% per year.

The diversification of the energy matrix, with an emphasis on renewable energy and energy efficiency, along with the development of the natural gas industry, are important objectives outlined in Peru's National Energy Policy 2010-50. These are regarded as two cornerstones of the strategy to strengthen energy security.

In 2022, hydroelectric power generation was adversely affected by droughts, increasing thermal power generation.

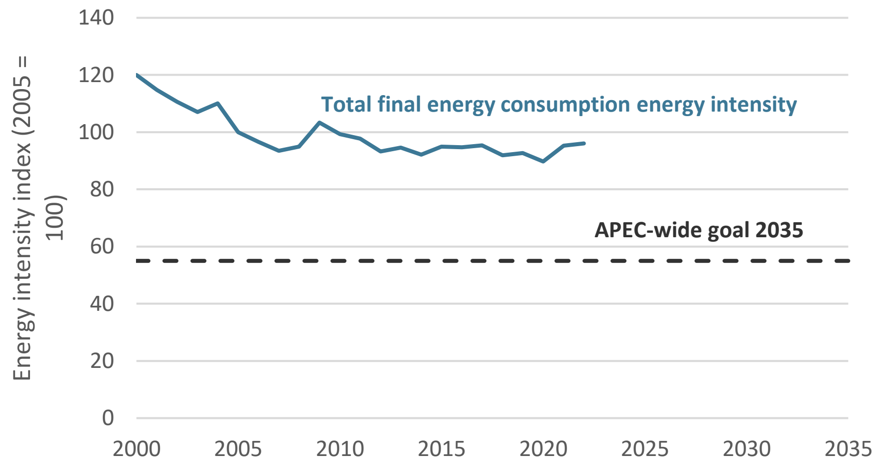
APEC Energy Goals

APEC member economies have collectively agreed on two energy-related goals: improving energy intensity and doubling the share of modern renewables in the energy fuel mix. These goals do not impose individual targets for member economies.

Energy Intensity Goal

In 2011, APEC member economies agreed to raise their target for reducing energy intensity to 45% by 2035, relative to a 2005 baseline. The original goal was a 25% improvement by 2030, using the same baseline.

Figure 11: Peru's total final energy consumption intensity index, 2000 to 2022 (2005 = 100)



Source: EGEDA (2024)

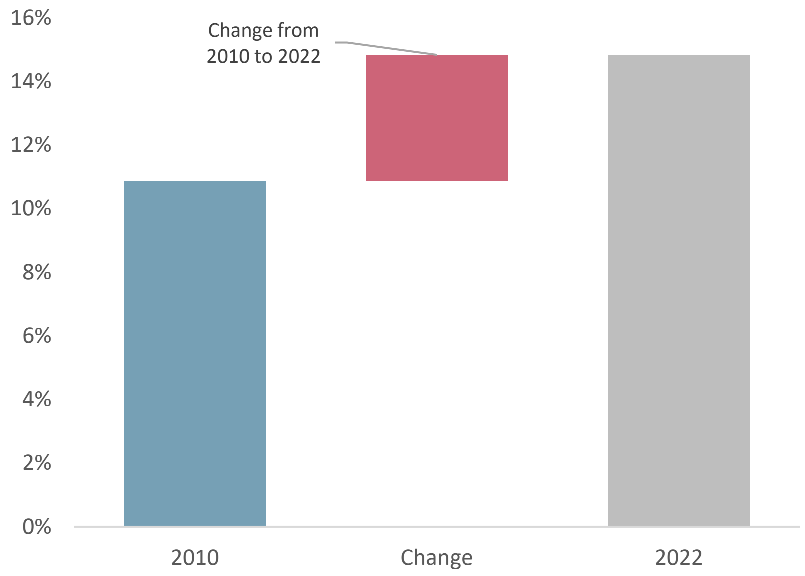
From 2009 to 2020, including the pandemic year, there was a slow downward trend in energy intensity. However, after 2020, the trend reversed, showing an upward trajectory due to the economic crisis and global slowdown. In 2022, the energy intensity index increased by 0.8% compared to 2021.

Doubling of Renewables

The second energy goal involves doubling the share of modern renewable energy in the APEC energy mix from 2010 to 2030.

In the case of Peru, most of this share comes from renewable energy used for electricity production. Peru's share increased from 11% in 2010 to 15% by 2022. This share represents a decline from the 16% reported in 2021. Nearly half of Peru's electricity generation relies on hydropower. Consequently, the severe droughts that affected South America reduced hydropower output in 2022.

Figure 12: Peru’s modern renewable energy share, 2010 and 2022

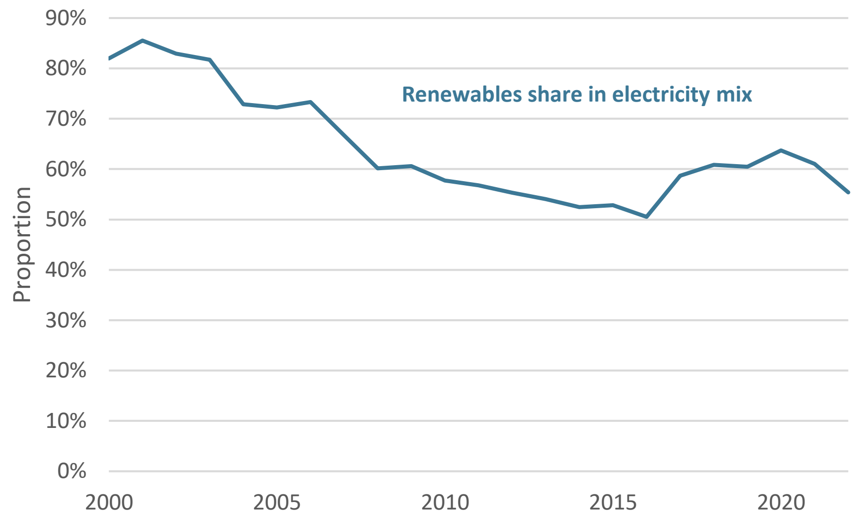


Source: EGEDA (2024)

Note: Biomass used in the residential and commercial sectors is assumed to be traditional biomass and is not included in the definition of modern renewables. All other renewables (biomass used by industry, hydro, geothermal, etc.) are considered modern renewables. Modern renewables also include the share of electricity that is generated from renewable sources.

However, Peru’s share of modern renewable energy remains one of the highest among APEC economies, comparable to Indonesia at 17% and Thailand at 14%, and the economy ranks 6th in the region.

Figure 13: Peru’s renewable generation share, 2000 to 2022



Source: EGEDA (2024)

In the early 2000s, hydropower accounted for approximately 80% of total electricity generation, with the remainder primarily generated from diesel. However, after the Camisea natural gas project began operations, natural gas-fuelled power plants became more prominent. This shift transformed the power sector's fuel mix and reduced the share of renewables in electricity generation.

As mentioned above, the decline in the share of renewables in 2022 was due to the decline of hydropower output due to droughts. Additionally, a pipeline of renewable projects outside the auction scheme is expected to be integrated into the grid in the coming years. This development is likely to further increase the share of renewables in Peru's electricity generation mix.

Energy Policy

Energy policy	Details	Reference
Natural Gas Massification	Massification of natural gas by use of the Social Energy Inclusion Fund. The government plans to build a natural gas distribution network for seven regions.	ProInversion
National Plan for Rural Electrification	The objective of the Rural Electrification Plan is to achieve a reduction in greenhouse gas emissions by using renewable energy in rural areas for the provision of electricity. In 2018, rural electrification reached 87% of coverage, while economy-wide electrification was 92%. The policy target is to reach 100% by 2022.	Ministry of Energy and Mines
The Southern Peruvian Gas Pipeline	This pipeline will increase the natural gas transportation capacity to 800 million cubic feet per day by 2025 through the following pipelines: • Camisea-Lima (500 km); Peru LNG (300 km). • Ica-Marcona (300 km); Marcona-Mollendo loop (500 km). • Central Highlands-Trujillo (1 100 km); Trujillo-Piura (500 km); Piura-Tumbes (400 km).	Ministry of Economy and Finance
Electric Vehicle Charging Infrastructure	Peru has approved statutory provisions for the charging infrastructure and electricity supply for electric vehicles. A proposal for specific regulations for the installation and operation of electric vehicle charging stations has been presented.	Ministry of Environment
Energy Efficiency Audits	In 2021, Peru approved legal requirements for energy efficiency audits to promote energy efficiency in public and private buildings.	Ministry of Environment
Energy Efficiency Labelling Regulation	In 2017, the technical regulation for energy efficiency labelling for 12 types of equipment was approved. However, the requirement of presenting a certificate of conformity before using the labels was postponed.	Ministry of Energy and Mines
Energy Efficiency Standards	A new set of technical specifications for washing machines and lights for street lighting has been approved. The government is obligated to acquire new products according to these new specifications.	Ministry of Energy and Mines
Nationally Determined Contribution (NDC)	Peru has updated the unconditional and conditional NDCs. The unconditional target changed from 20% to 30% and the conditional target changed from 30% to 40% emission reductions by 2030.	Ministry of Environment
Declaration of Climate Emergency as of the Utmost Interest	Peru declared the climate emergency as of the utmost importance emergency and prioritised actions to implement NDCs, including setting a goal of achieving 20% non-conventional renewable energy in the electricity mix.	Ministry of Environment

Road Map for Smart Grids in Distribution 2023-30	This document proposes actions to modernise the electric distribution system that include regulatory reforms and the development of incentives and financing for smart grid projects.	Ministry of Energy and Mines
Law for the Promotion of Green Hydrogen	The purpose of this law is to promote the research, development, production, transformation, storage, conditioning, transportation, distribution, commercialization, export, and use of green hydrogen as a fuel and energy carrier in its various applications.	Congress
Law N° 32249 that amends Law N° 28832	Law to ensure the efficient development of electricity generation to guarantee a safe, reliable, and efficient electricity supply and promote the diversification of the energy matrix.	Congress

Notable Energy Developments

Energy development	Details	Reference
Wayra Extension Started Operations	Wayra Extension, 177 MW wind project, started operations in Jun 2024. This project has an investment of USD 188.5 million.	COES
Clemesi and Matarani Photovoltaic Solar Power Plants were officially Inaugurated	The 115 MW Clemesi solar photovoltaic project was inaugurated in October 2024. This project has an investment of USD 77.8 million. Combined with the 145 MW Rubi solar plant, it forms the largest solar power complex in Peru. In November 2024, Matarani solar project was inaugurated. The power plant consist in 97 MW and was designed to supply 260 GWh of energy per year.	Clemesi-Ministry of Energy and Mines Matarani-Ministry of Energy and Mines

Useful Links

Government

Central Reserve Bank, *Banco Central de Reserva* – https://www.bcrp.gob.pe/

Committee for the Efficient Operation of the System, *Comité de Operación Económica del Sistema Interconectado Nacional* – https://www.coes.org.pe/portal/

National Institute of Statistics and Information, *Instituto Nacional de Estadísticas e Informática* – https://www.gob.pe/inei/

Ministry of Energy and Mines, *Ministerio de Energía y Minas* – www.minem.gob.pe/index2.php www.minem.gob.pe/index2.php

Ministry of the Environment, *Ministerio del Ambiente* – https://www.gob.pe/minam

Supervisory Body of Investment in Energy and Mining, *Organismo Supervisor de la Inversión de Energía y Minería* – https://www.osinergmin.gob.pe/Paginas/en/index.html

Official National Newspaper El Peruano, *Diario oficial el Peruano* – https://elperuano.pe/

Energy Associations

National Society of Mining, Oil and Energy – https://www.snmpe.org.pe/

National Society of Industries – https://sni.org.pe/

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Ministerio de Energía y Minas (2024, October 1) *Ministro Mucho inaugura Central Solar Fotovoltaica de Clemesí en Moquegua que inyectará 115 MW al SEIN* https://www.gob.pe/institucion/minem/noticias/1032157-ministro-mucho-inaugura-central-solar-de-clemesi-en-moquegua-que-inyectara-115-mw-al-sein

Ministerio de Energía y Minas (2024, November 15) *MINEM participa en lanzamiento de planta solar Matarani, que producirá 260 GWh de energía limpia anualmente* https://www.gob.pe/institucion/minem/noticias/1058382-minem-participa-en-lanzamiento-de-planta-solar-matarani-que-producira-260-gwh-de-energia-limpia-anualmente

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World Bank. (2024). *Peru*. Retrieved from https://data.worldbank.org/country/peru

The Philippines

Introduction

The Philippines is an archipelago comprising 7641 islands. The economy's archipelagic geography poses a significant challenge to achieving full electrification. As of December 2022, household electrification stood at 96%; Luzon (where the economy's capital, Manila, is) leads with a 99% electrification rate, closely trailed by Visayas at 98%, and Mindanao at 88% (DOE, 2022a). The government envisions a 100% electrification level by 2028 with more than 3 million households (over 1 million of which are in off-grid areas) remaining to be electrified. This necessitates strong government involvement in terms of infrastructure, especially in remote and isolated areas of the economy (DOE, 2023a).

The Philippines faces recurring natural calamities, including typhoons, earthquakes and volcanic eruptions. According to the 2022 World Risk Index, the Philippines ranked highest among 193 economies in terms of disaster vulnerability, sustaining billions of pesos in damage and losses primarily from tropical cyclones alone (NEDA, 2023). Together with the other energy stakeholders, the government's prime focus is to continuously improve the reliability, availability and resilience of energy infrastructure and facilities.

The economy is likewise focused on a sustainable and integrated energy environment approach by developing a roadmap towards expanding renewable energy capacity. In addition, the government is actively exploring low-carbon alternatives, such as nuclear energy, and delving into the feasibility of incorporating emerging cleaner fuels and technologies such as hydrogen, ammonia, and other energy storage systems.

In pursuit of these visions, the Marcos Administration crafted the overall government energy agenda with the so-called ARC objectives that will facilitate **a**ccess to affordable energy, secure a **r**eliable and resilient energy supply, and transition to **c**lean, sustainable, and climate-centred energy resources (DOE, 2023b).

Table 1: The Philippines' macroeconomic data and energy reserves

Key data [a, b]		Energy reserves [c, d]	
Area (thousand km^2)	343	Oil (million barrels)	3.7
Population (million)	116	Gas (billion cubic feet)	273
GDP (2021 USD billion PPP)	1078	Coal (million tonnes) [d]	2219
GDP per capita (2021 USD PPP)	9327	Uranium (kilotonnes U < USD 130/kgU)	

Sources: [a] gov.ph, [b] (World Bank, 2024a), [c, d] (DOE, 2023c)
Note: Reserves are total proved reserves and reasonably assured recoverable resources for uranium.

Other notable issuances related to the energy transition include: a) coal moratorium entitled, Advisory on the Moratorium of Endorsements for Greenfield Coal-fired Power Projects in line with improving the Sustainability of the Philippines Electric Power Industry; b) enabling policies to encourage the deployment and adoption of advanced and emerging technologies for power generation, such as energy storage systems, and c) DC2024-01-0001 entitled, Providing a National Policy and General Framework, Roadmap, and Guidelines for Hydrogen in the

Energy Sector.

The Philippines is one of the most dynamic economies in the Southeast Asia-APEC region. The service sector is rapidly expanding, including business processing outsourcing, wholesale and retail trade and tourism. These brought a record-high increase in the gross domestic product (GDP) to a historic level of USD 1078 billion (2021 USD PPP). The GDP per capita consequently rose by 6.0% to USD 9327 (2021 USD PPP) (World Bank, 2024a). According to the World Bank, as the economy sustained strong momentum from continued recovery and reforms, the Philippines is on track to transition from lower-middle to upper-middle-income status in this fiscal year (World Bank, 2024b).

Since the enactment of the Renewable Energy Act in 2008, the Philippines has made considerable progress in advancing its domestically produced energy sources, consequently increasing the renewable share in the economy's energy mix. In view of the expected huge amount of renewable energy capacities that will be added to the grid, the DOE has formulated the Smart and Green Grid Plan (SGGP). This will assist the DOE in making policy decisions, enhancing technical competencies, identifying policy gaps and challenges, as well as recommending appropriate solutions through policy development and government interventions.

The SGGP aims to complement the 2023-2050 Philippine Energy Plan encapsulating the strategic plans and programs of the government geared towards the holistic development of the transmission sector in the near term and beyond.

The Philippines has a modest amount of domestic resources. As of December 2022 (between 2012 to 2022), indigenous petroleum production reached 17 billion barrels of crude oil, 42 billion barrels of condensate, and 1475 trillion cubic feet of natural gas, while coal production stood at 120 billion metric tonnes (DOE, 2022a).

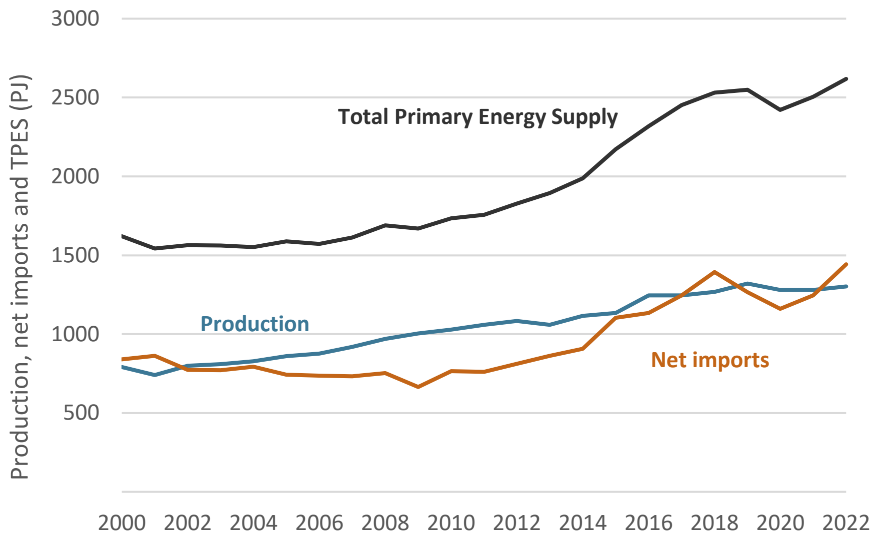
Energy Supply and Consumption

Total Primary Energy Supply

The Philippines' total primary energy supply (TPES) continued to show recovery as the widespread impact of the COVID-19 pandemic started to wane. TPES grew 4.6% to 2618 PJ in 2022, marking a record-high volume of energy supply in the economy. This was well over the pre-pandemic level (2.7%), 3.7% above its ten-year average and over 8.0% more than the 2020 level, at the height of the COVID-19 pandemic. Although accounting for a very minute share of TPES, the more than 50% increase from non-renewable energy wastes (58%) in 2022 spurred the overall growth of the primary energy supply in the Philippines. More significantly, the oil supply, which comprised one-third of the economy's TPES, grew by 12% in 2022. In contrast, the gas supply continued its descent (7.4%) given the looming depletion of the economy's single gas source. Among renewables, wind alone recorded a considerable drop of almost 19% in 2022, but this was offset by the significant increases in solar (24%) and all other renewables [(including hydro, geothermal and biomass), 2.9%].

The Philippines has historically been a predominant net importer, primarily of oil and coal, not to mention bioethanol. After a sharp decline in 2020, net imports continued rebounding and posted a notable increase of about 7.6% in 2022. The increase in total supply can be attributed to the almost 10% rise in imports in 2022. This resurgence was primarily in response to the heightened domestic energy demand, particularly in power generation. Both coal and oil imports contributed in part to this significant uptrend, in terms of volume. On the other hand, albeit with a minimal share, bioethanol drove the economy's total imports in general, posting almost 23%, the highest growth recorded in the last decade. Oil, which historically accounted for more than 50% of the total imports, saw an almost 14% increase, while coal grew almost 5.0% from 2021 to 2022 (Figure 1).

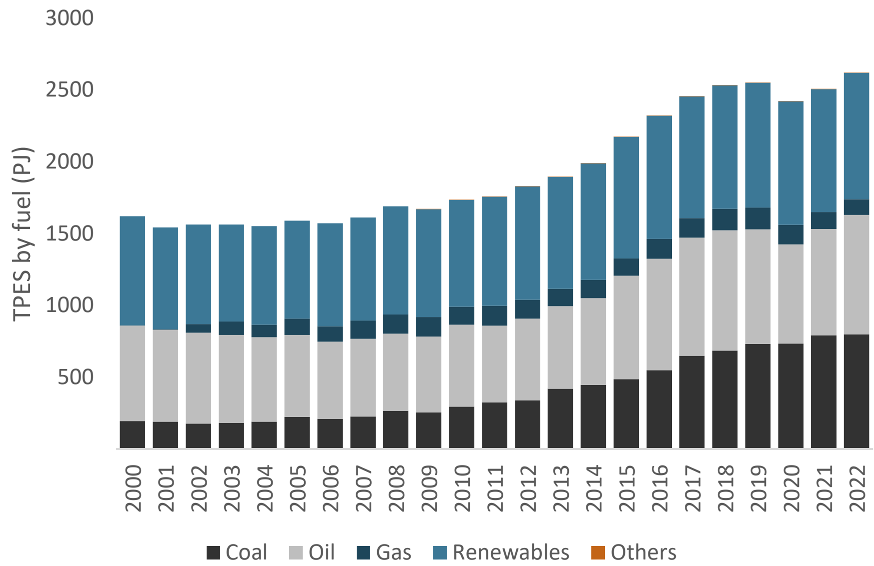
Figure 1: The Philippines' energy supply, production, and net imports (PJ), 2000 to 2022



Source: EGEDA (2024)

The economy is relentless in harnessing its domestic energy sources and hence, is historically more than self-sufficient. Although domestic production started to slow down in recent years, in 2022 it was still 50% of TPES. This was largely composed of renewables, which accounted for more than 60% of the economy's total production. Likewise, coal continued to be significant in the economy's overall primary consumption and has accounted for more than 20% of the production (Figure 2).

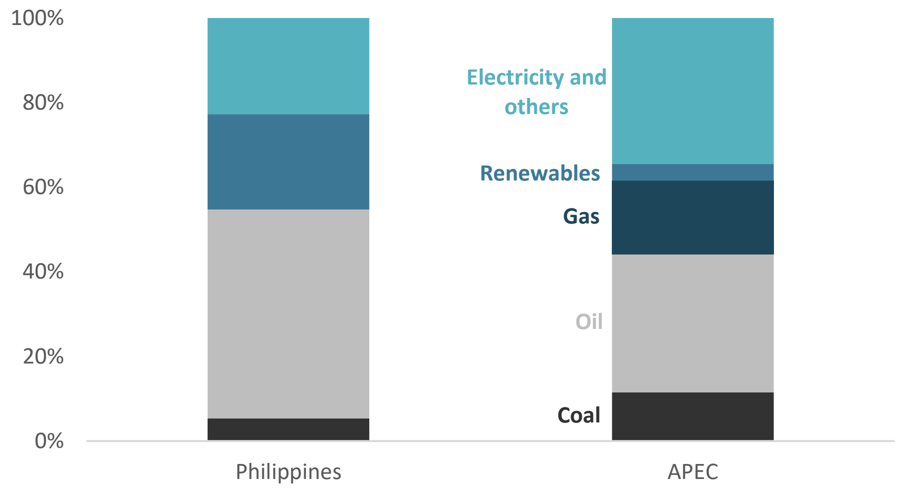
Figure 2: The Philippines' energy supply by fuel (PJ), 2000 to 2022



Source: EGEDA (2024)

While it may possess a smaller energy supply compared to other economies within APEC, the Philippines stands out for its commitment to harnessing domestic energy sources. Notably, renewable energy, primarily generated locally, held a relatively prominent position within the economy in 2022, surpassing the APEC average. The relative share of oil in the energy mix exceeded that of the APEC average. Similarly, coal, predominantly utilised for power generation, maintained a proportionate share relative to the APEC levels. However, gas and other fuel sources constituted a smaller portion of the energy mix compared to the broader APEC region (Figure 3).

Figure 3: Energy supply mix, the Philippines and APEC, 2022



Source: EGEDA (2024)

Total Final Consumption

Surprisingly, the continuous recovery from the COVID-19 pandemic two years later does not seem to have been reflected in the economy's final consumption trends in general. The total final consumption (TFC, including non-energy use) grew modestly by just over 2.0% from the 2021 level to 502 PJ in 2022.

Expansion in the economy's three largest energy-consuming sectors was primarily attributed to the growth in TFC, which recorded increases in 2022. Energy consumption in transport (34% of TFC) rose by over 12%, although about 16 PJ short of its pre-pandemic level. The sector drove the overall final consumption of the economy as mobility and other economic activities progressed after the COVID-19 pandemic. The all-time high growth in domestic air transport consumption (77%) from the previous year to over 14 PJ in 2022 signalled the waning of the effect of COVID-19 as travelling returned. Likewise, the 11% expansion in road transportation from 2021 to 2022 reflected upsurges in passenger traffic.

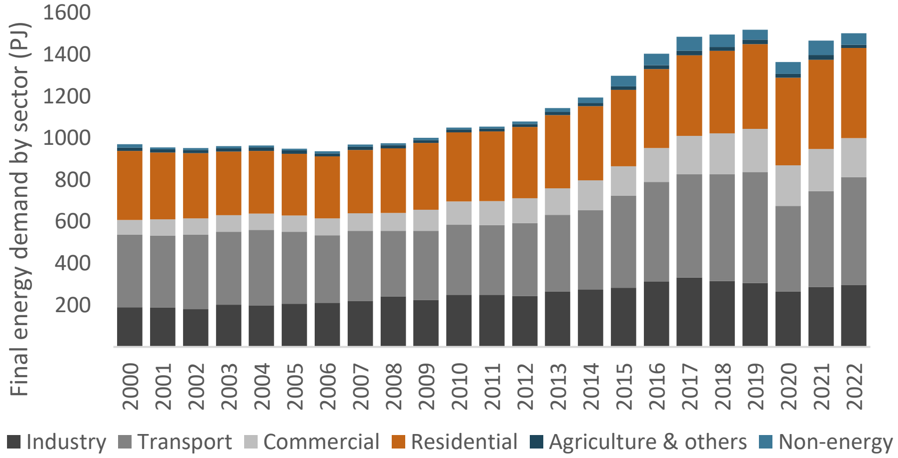
Consumption in the industry sector (20% of TFC) grew by over 4.0% to around 297 PJ in 2022 as industrial activities increased. Surprisingly, mining and quarrying, which accounted for just around 10% of the industry consumption, boosted the overall industry consumption with a 29% increase in 2022. On the other hand, the food and beverage industry, the largest manufacturing subsector (37%), grew by just 6.0% from 2021 to 2022.

Energy consumption in the residential sector, which accounts for 29% of TFC, grew by just over 1.0%. Nevertheless, this brought household energy consumption levels to a record high of more than 430 PJ in 2022. This can be attributed to the rise in the use of liquefied petroleum gas (LPG) products (4.0%), probably for cooking, in the sector in 2022.

In contrast, energy consumption in the commercial sector (12% of TFC) unexpectedly, slid by over 8.0% in 2022 due mainly to the declining use of diesel in the sector (DOE, 2022). A similar trend was seen in agriculture, forestry and fishery (1.0% of TFC) and non-energy (4.0% of TFC), two of the economy's smallest energy sectors. The sectors recorded a huge drop of almost 31% and over 21%, respectively. The collective decreases in energy consumption from these sectors explained the minimal increase recorded by TFC in 2022 (Figure 4).

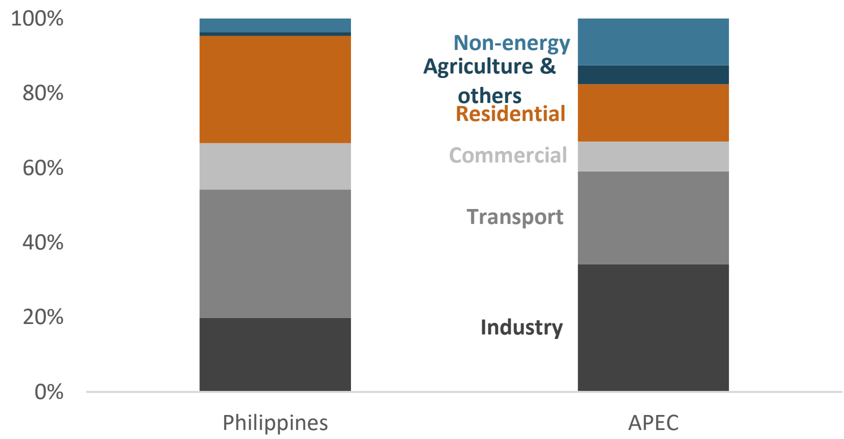
The transport, residential, and industry sectors had greater prominence in the Philippines compared to the broader APEC region. While these sectors were directly impacted by the pandemic, they displayed resilience and began to recover following the relaxation of quarantine restrictions (Figure 5).

Figure 4: The Philippines' final consumption by sector (PJ), 2000 to 2022



Source: EGEDA (2024)

Figure 5: Final consumption by sector, the Philippines and APEC, 2022



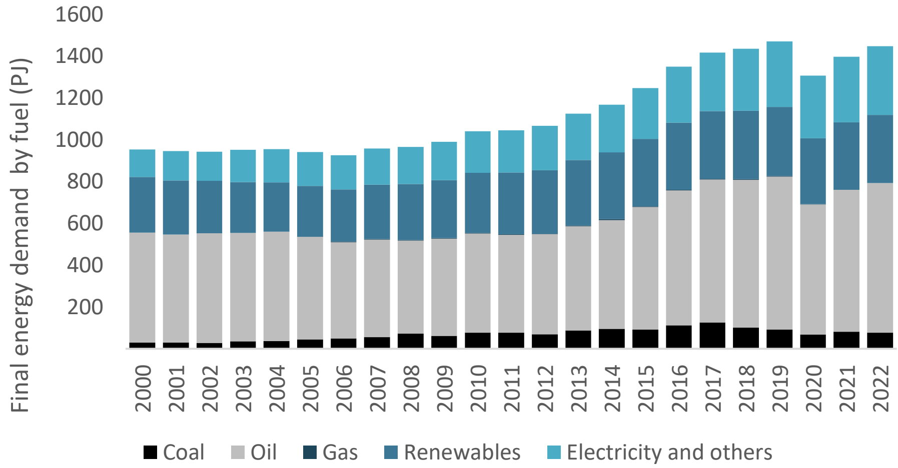
Source: EGEDA (2024)

Final Energy Demand

Total final energy consumption (TFEC-excluding non-energy) grew at a slower pace compared to 2021, expanding by just over 3.0% to 1448 PJ in 2022. This was well below the pre-COVID-19 consumption level by almost 2.0% (23 PJ) (Figure 6).

Historically comprising the lion's share of the economy's TFEC, oil was likewise responsible for the overall growth with its over 5.0% increase in 2022. Almost 70% of the oil demand was for transport use, and the increase was an indication of the sector's returning mobility on the back of the economy relaxing its COVID-19 travel policy. However, the increase was about 4 percentage points short of the rebound rate in 2021.

Figure 6: The Philippines' final energy demand by fuel (PJ), 2000 to 2022



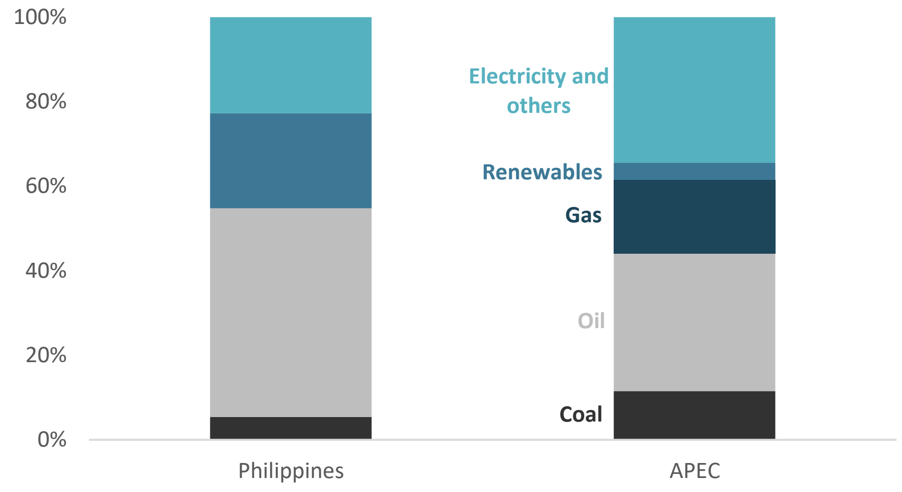
Source: EGEDA (2024)

Electricity posted the second-highest growth of more than 4.0% to an all-time high consumption level of 329 PJ in 2022. It constituted 23% of the Philippines' TFEC and was the major fuel source in the household (39%) and industry (32%) sectors. Interestingly, electricity consumption increased at a more rapid pace in the services sector (15%) than the two previously mentioned sectors in 2022. Nevertheless, even at a slower pace, electricity consumption in the household (1.0%) and industry (4.0%) sectors brought them to historic levels of 127 PJ and 104 PJ, respectively, in 2022.

Renewable energy continued to play an important role in the economy's TFEC, with a 23% share. However, renewable consumption increased modestly to just over 1.0% in 2022 as the residential sector (with over 70% of renewables) shifted its fuel preference from traditional to modern fuel for its household activities. In contrast, coal consumption dropped by more than 4.0% in 2022. As expected, gas consumption has almost totally disappeared from the economy's final energy consumption.

Road transport is widely accessible and prevalent in the Philippines, which has led to the economy's continued dependence on oil for transportation needs. This is reflected in its relative share compared to APEC. Many households are still relying heavily on biomass for their energy needs. This was reflected in the economy's growing utilisation of renewable sources, and hence, the share exceeded that of APEC. While electricity consumption is lower in the Philippines compared to APEC, its proportion in the economy's fuel mix remains significant. Direct coal usage is confined to specific industrial sub-sectors in the Philippines, resulting in a smaller share compared to APEC (Figure 7).

Figure 7: Final energy demand fuel share, the Philippines and APEC, 2022



Source: EGEDA (2024)

Transformation

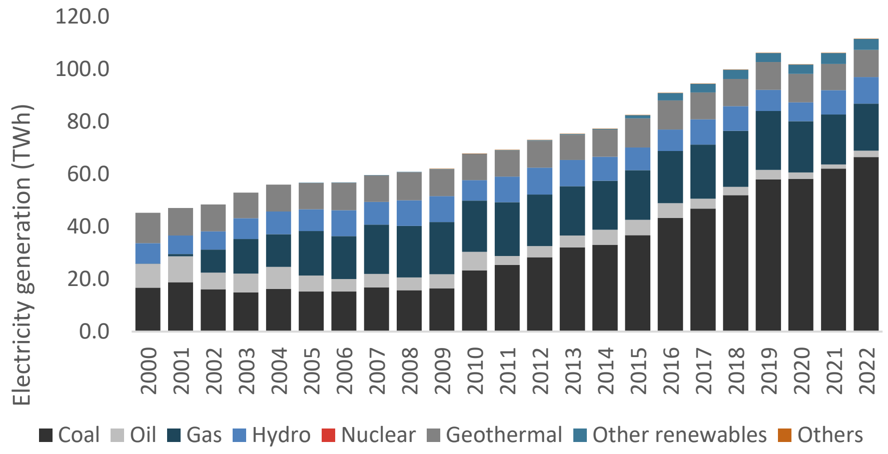
Power Sector

The Philippines' electricity generation surged by 5.1%, reaching a historic level of almost 112 TWh in 2022 (Figure 8). Fossil fuels have historically accounted for more than 50% of the electricity generation in the Philippines. For instance, coal alone has been dominating the economy's power generation for more than two decades, owing mainly to its availability and baseload characteristics. It grew 7.1% to the highest level ever of 66 430 GWh, or around 60% of the economy's power generation in 2022. Its compound annual growth rate (CAGR) between 2000 and 2022 was 6%, the fastest rate among fuel sources and even faster than the total power generation's CAGR during those periods. Notably, the contribution from oil, which had been fluctuating over the past decade, experienced a never-before-seen growth of over 55% to 2518 TWh in 2022. However, oil generation in 2022 was well below the pre-pandemic level by 33% compared with 2019. Electricity output from gas, on the other hand, as seen from the declines experienced in the last two years, dropped by over 6.0% in 2022 to a level first seen 15 years ago. This was due to the depletion of the economy's largest natural gas resource.

Renewable energy sources played a crucial role in meeting the Philippines' energy demand in 2022. Electricity output from renewable energy sources (including hydro, geothermal, solar, biomass, wind, etc.) comprised a quarter of the economy's power generation and saw almost 6.0% growth. The growth of hydropower, although three times slower than the pace of the previous year, significantly surged by almost 10% to just over 10 000 GWh in 2022. Similarly, power generation from geothermal rose 4.1% from the 2021 generation output of over 10 400 GWh. In contrast, the combined biomass, solar, and other renewables, after a strong rebound from the previous year's output, dipped by just less than 1.0% in 2022.

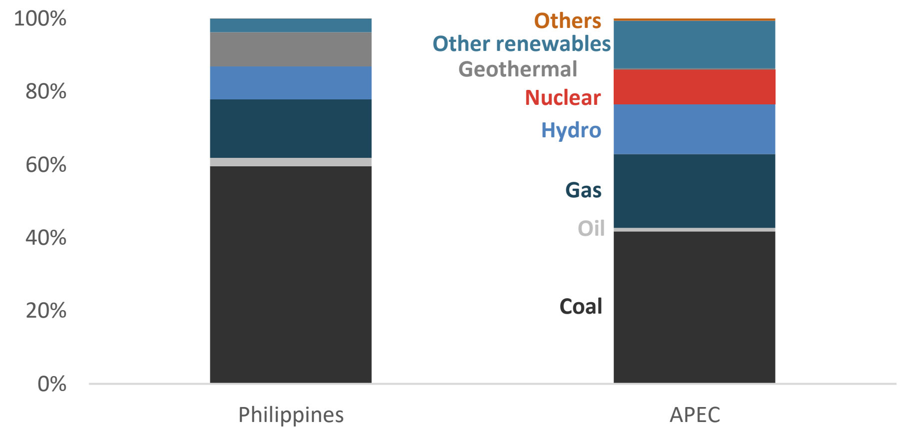
The share of geothermal power generation in the Philippines' power generation mix remained noteworthy when compared to APEC. Given the Philippines' heavy reliance on coal for electricity generation, its share stood out prominently compared to its APEC counterparts. Meanwhile, oil-based power generation slightly exceeded the APEC average, whereas gas, owing to depleting reserves, fell below the current APEC level. The relative shares of other generation sources either stood at zero (in the case of nuclear) or were smaller compared to the APEC-wide power generation mix (Figure 9).

Figure 8: The Philippines' electricity generation by fuel, 2000 to 2022



Source: EGEDA (2024)

Figure 9: Electricity generation fuel share, the Philippines and APEC, 2022



Source: EGEDA (2024)

Energy Transition

The Philippines made a significant commitment to address climate change by submitting its Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change. The NDC outlines a bold target: a 75% reduction in greenhouse gas (GHG) emissions compared to the business-as-usual scenario spanning 2020-30. This mitigation goal comprises both unconditional and conditional elements, with 2.7% being unconditional and 72% conditional upon receiving resources from developed economies. These resources are essential for implementing mitigation actions across various sectors including agriculture, waste management, industrial processes, product use, transport, and energy (NEDA, 2023).

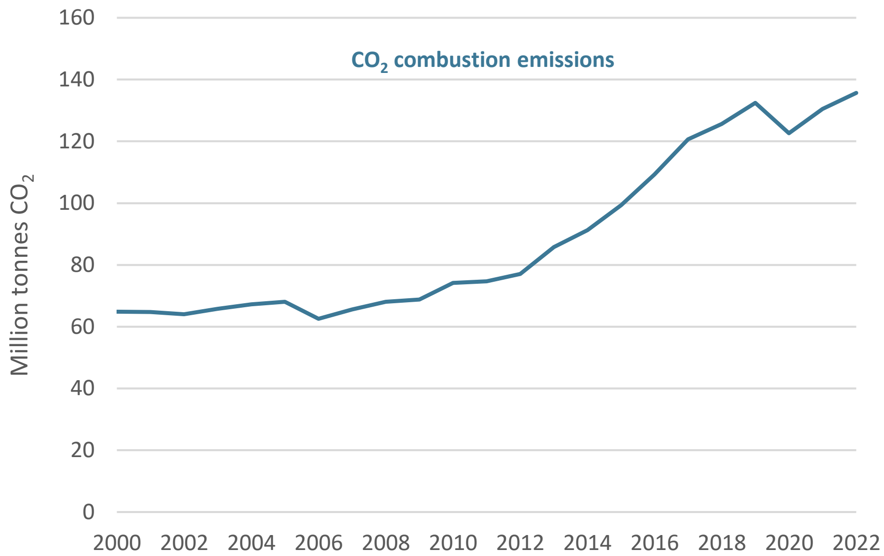
Under the Marcos Administration's Philippine Development Plan 2023-2028, the transition to a low-carbon economy stands out as a key strategy in the government's efforts to address climate change and bolster disaster resilience (NEDA, 2023). This underscores the economy's commitment to sustainable development and emphasises the importance of collaborative efforts on both economy and international levels to tackle the challenges posed by climate change.

Emissions

Unfortunately, given huge increases in oil and coal consumption, the total CO_2 emissions experienced a significant 4.0% increase to reach 136 $mtCO_2eq$ in 2022. The resumption of economy-wide economic activity and the easing of mobility restrictions drove this resurgence.

Notably, emissions from the utilisation of coal in power generation and cement manufacturing emerged as the primary contributors to the overall CO_2 emissions. Following closely behind was the consumption of oil in the transport sector.

Figure 10: The Philippines' CO_2 combustion emissions (million tonnes), 2000 to 2022



Source: EGEDA (2024)

Energy Security

Energy security is a paramount pillar within the Philippine Energy Plan (PEP) 2023-2050, underscoring its commitment to fostering a robust and resilient economy. Embracing a forward-looking approach, the PEP 2023-2050 outlines the government's establishment of a resilient and climate-proof energy infrastructure deemed essential to safeguarding the economy's energy security and resilience in the face of evolving environmental challenges. These components constitute integral parts of a comprehensive strategy towards clean energy while ensuring the security and reliability of the energy supply (DOE, 2023b).

Recent events, including the COVID-19 pandemic and rapid shifts in technology and geopolitics, have presented notable challenges to the economy’s supply security, particularly LPG. For instance, in February 2022, the global price of LPG experienced a sharp escalation amid geopolitical uncertainties. Geopolitical tensions prompted buyers to seek alternative sources, exacerbating the situation. Coupled with soaring spot premiums and freight rates, these factors collectively exerted significant upward pressure on LPG prices.

These events required the economy to increase the use of alternative fuels and explore more of its local energy sources such as renewables. The depletion of the Philippines' sole natural gas resources is also threatening a shortage of more than 20% in the power supply. With the introduction of liquefied natural gas (LNG) in the Philippines, it now has two receiving and regasification facilities for imported LNG that will support the five existing gas-powered plants within the economy (DOE, 2023b).

The government enforces a minimum inventory requirement (MIR) to ensure a continuous, adequate and stable supply of oil. The MIR for refiners stands at an in-economy equivalent of 30 days of crude and finished products, while an equivalent of 15 days stock of finished products is required for the bulk marketers/importers and seven days for LPG importers. By the end of June 2024, the reported stock of crude oil was 2.8 million litres (ML), while the reported level of finished petroleum products stood at 2683 ML, excluding biofuels (DOE, 2024).

The Philippines is a signatory to the ASEAN Petroleum Security Agreement (APSA), which was initiated in 1986. APSA’s primary goal is to foster regional collaboration in ensuring energy security during periods of oil oversupply or undersupply. While APSA has yet to be ratified, the Philippines, as an active member of ASEAN, eagerly awaits its enactment, recognising the crucial role it can play in enhancing regional energy stability.

As economic activities rebound following the COVID-19 pandemic, the government remains steadfast in assuring consumers of a reliable and consistent power supply. Throughout previous years, efforts persisted to rehabilitate and refurbish both grid and off-grid facilities, with notable expansions in installed capacities also documented. These ongoing initiatives underscore the commitment to bolstering infrastructure and ensuring the resilience of the economy’s energy supply.

APEC Energy Goals

APEC member economies have collectively committed to achieving two significant energy-related objectives: improving energy intensity and doubling the share of modern renewables.

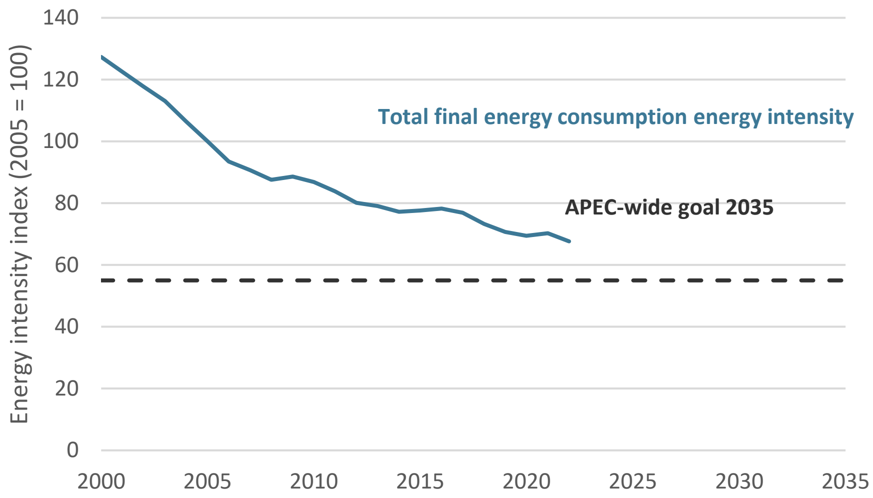
Energy Intensity Goal

In 2011, APEC member economies agreed to increase their target to reduce energy intensity by 45% in 2035, relative to a 2005 baseline. The original goal from 2007 was a 25% improvement by 2030.

APEC is currently making strides towards achieving this energy intensity improvement target. While the goal does not mandate specific targets for individual economies, it allows for tracking the progress of each APEC member relative to the overall proportional improvement.

The Philippines has witnessed a steady annual improvement in final energy intensity, averaging 2.2% since 1990. By 2022, the final energy intensity reduced by 32% compared to 2005 levels. This trend is likely to persist, buoyed by recent initiatives such as RA 11285, also known as the Energy Efficiency and Conservation Act of 2019. This legislation has transitioned energy efficiency efforts from voluntary to mandated activities, indicating a promising trajectory for continued enhancement in energy efficiency.

Figure 11: The Philippines' total final energy consumption intensity index, 2000 to 2022 (2005 = 100)



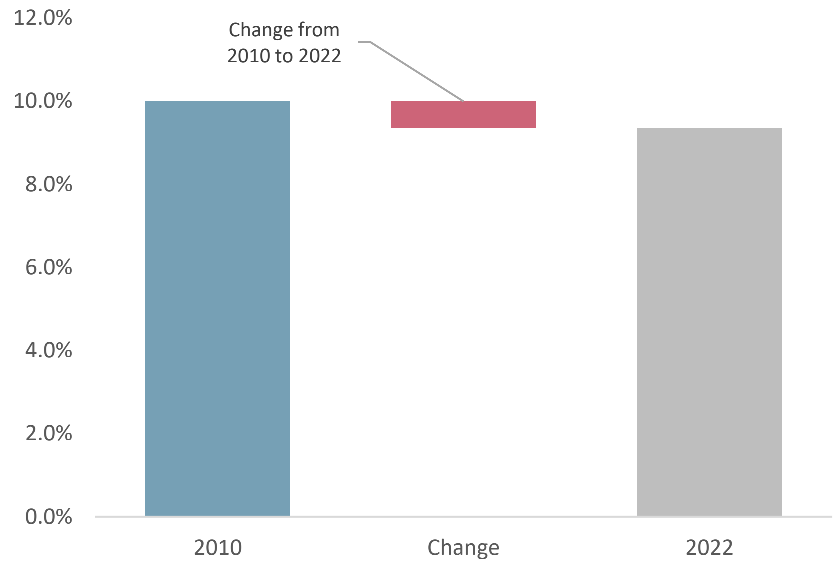
Source: EGEDA (2024)

Doubling of Renewables

The second energy goal aims to double the proportion of modern renewables in the APEC energy mix from 2010 to 2030. While no specific target is set for individual member economies, advancements made by each economy will collectively contribute to achieving the overarching doubling goal.

The enactment of the Renewable Energy Act in 2008 marked a significant step towards propelling the Philippines' renewable energy sector forward, emphasising the utilisation of locally sourced energy. Subsequent efforts have been dedicated to promoting renewable resource adoption, both for end-users and power generation. However, despite these endeavours, the share of renewables in final energy consumption experienced a decrease of 6.0% from 10% in 2010 to 9.4% in 2022. If the economy aspires to double the share of renewables in the final energy demand by 2030, an additional increase of 10.6% would be necessary (Figure 12).

Figure 12: The Philippines' modern renewable energy share, 2010 and 2022



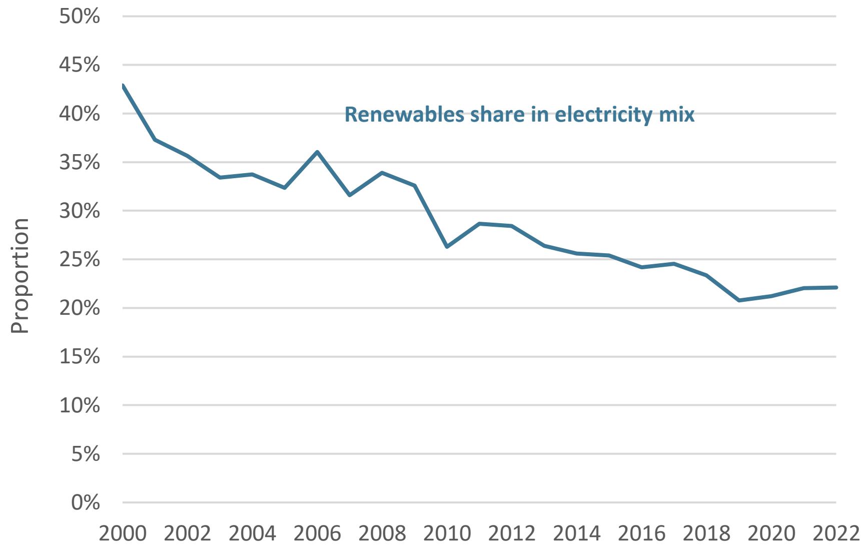
Source: EGEDA (2024)

Note: Biomass used in the residential and commercial sectors is assumed to be traditional biomass and is not included in the definition of modern renewables. All other renewables (biomass used by industry, hydro, geothermal, etc.) are considered modern renewables. Modern renewables also include the share of electricity that is generated from renewable sources.

In 2022, the share of renewables within the power generation mix increased by just less than 1.0% compared to the previous year. A closer examination reveals a concerning long-term trend. Since 2010, the share of renewables in power generation has been steadily declining at an average annual rate of 1.4%. This trend resulted in a decrease in the share of renewables from 26% in 2010 to 22% in 2022 (Figure 13).

Significant adjustments are necessary to effectively double the share of renewables in the power generation mix. To achieve this objective, the trend must experience an average annual increase of 10%, ultimately reaching 53% by 2030. This underscores the critical need for concerted efforts and innovative strategies to accelerate the integration and adoption of renewable energy sources within the power generation infrastructure.

Figure 13: The Philippines’ renewable generation share, 2000 to 2022



Source: EGEDA (2024)

Energy Policy

Under the new government's overall thrust of creating a strong foundation for inclusive growth, the energy sector is continuously guided by the following strategies a) *AmBisyon Natin 2040* (NEDA, 2023 and)b) the 8-Point Socio-Economic Agenda anchored on the Philippine Development Plan (PDP) 2023-2028 with a focus on economic and social transformation (creating more job opportunities, accelerating poverty reduction and providing affordable and clean energy, among others); and c) the United Nations' Sustainable Development Goals). Actualising these directions guided the DOE in crafting the overall government energy agenda, which aims to facilitate access to **a**ffordable energy, secure a **r**eliable and resilient energy supply, and a transition to **c**lean, sustainable, and climate-centred energy resources, known as the *ARC* objectives (DOE, 2023b)

Energy Policy	Details	Reference
NDC Targets	This policy targets an economy-wide 75% reduction of GHG emissions by 2030, relative to the business-as-usual scenario from 2000 to 2030. Of the 75% reduction target, identified policies and measures (PAMS) account for 11% or 365 MtCo2eq reduction from the business-as-usual (BAU)/Reference Scenario. Of this total, the energy sector is expected to contribute 46 $MtCo_2eq$ (13% share of the total), which translates to a 1.4% reduction in the sector's GHG emission over the BAU. PAMS that are yet to be identified will account for 64% avoidance, thereby completing the target of 75% GHG.	UNFCC
Philippine Development Plan PDP 2023-2028	A plan framed by the new administration's 8-Point Socioeconomic Agenda which seeks to address both short-term issues and medium-term constraints to growth and inclusion.	NEDA
Philippine Energy Plan (PEP) 2023-2050 Transitioning to Reliable, Clean, and Resilient Energy	The DOE's blueprint to secure the economy's energy future was created following regional consultations and information, education, and communication campaigns (IECs). This is a comprehensive energy blueprint supporting the government's long-term vision known as AmBisyon Natin 2040. PEP 2023-2050 is a transformational plan to bring in more clean energy fuels and technologies that will dominate the economy's portfolio of plans and programs for the next two decades.	Department of Energy
Power Development Plan 2020-2040	This is a master plan that integrates all the development plans for the generation, transmission, distribution, and supply sectors in grid and off-grid areas. It also outlines the recent developments in the electricity market and in off-grid and missionary areas, household electrification, and institutional support mechanisms.	Department of Energy
Republic Act (RA) 9367 (Biofuels Act 2006)	Approved on 12 January 2007, this act directs the use of biofuels by establishing the biofuel program and appropriating funds for the program and for other purposes.	Department of Energy

RA 9513 (Renewable Energy Act of 2008)	Approved on 16 December 2008, this act promotes the development, utilisation and commercialisation of renewable energy resources and for other purposes.	Department of Energy
RA 11285 (Energy Efficiency and Conservation Act of 2019)	This act institutionalises energy efficiency and conservation enhancing the efficient use of energy and granting incentives to energy efficiency and conservation projects. It facilitates the implementation of projects and programs under the National Energy Efficiency and Conservation Plan (NEECP).	Department of Energy
RA 11234 (Energy Virtual One Stop Shop Act of 2019)	This act was established to streamline the permitting process of power generation, transmission, and distribution projects. An online platform was built to streamline the processing of energy-related applications.	Department of Energy
RA 11646 (Microgrid Systems Act)	This act was promulgated to promote the use of microgrid systems to accelerate the total electrification of unserved and underserved areas in the Philippines. The Philippines Department of Energy will lead the implementation of the National Total Electrification Roadmap.	Department of Energy
RA 11697 (The Electric Vehicle Industry Development Act of 2022)	An act establishing the Comprehensive Roadmap for the Electric Vehicle (EV) Industry to accelerate the development, commercialisation and utilisation of EVs.	Department of Energy
National Renewable Energy Program (NREP)	The NREP outlines the policy framework stipulated in Republic Act 9513. The strategies set out in the Biofuels Act of 2006 form part of the implementation of the Renewable Energy Law, which is included in the NREP. The program has a 20-year RE target capacity in addition to tripling the 2010 installed capacity from 5440 MW to 15 300 MW by 2030.	Department of Energy
National Energy Efficiency and Conservation Plan (NEECP) 2023-2050	The NEECP is a comprehensive framework and plan that institutionalises energy efficiency and conservation in the Philippines across key sectors of the economy in accordance with the EE and C Act.	Department of Energy
RE Roadmap	This focuses on attaining the target of at least a 35% renewable energy share in the power generation mix by 2030 and 50% by 2040.	Department of Energy

FiT Installation Target (MW)	Policy mechanism under RE Law • Run-off river hydro (250 MW). • Biomass (250 MW). • Wind (400 MW). • Solar PV (500 MW). • Ocean (10 MW).	Department of Energy
Biofuels Roadmap	The aim is to continue the implementation of blending targets set out in the Biofuels Act of 2006, with the following measures from 2020 to 2040: • Implement a 5.0% biodiesel blend (B5) and maintain 10% ethanol (E10). • Revisit the biofuel blend requirements and available feedstock. • Implement research and development activities and demonstration projects using jatropha, waste cooking oil, microalgae, rubber and seed oil for biodiesel; and sweet sorghum, cassava, microalgae, nipa sap, and cellulosic material for bioethanol.	Department of Energy
Power Generation Roadmap	Short-term goals (2021-22): • Implement the coal moratorium. • Establish guidelines for power plant decommissioning. • Firm up the privatisation plan for the government's remaining power generation assets. Long-term goals (2023-40): • Utilise cleaner technologies for power generation. • Increase flexibility in power generation.	Department of Energy
Off-Grid Development Roadmap	Energy access for all by 2040 • Graduation and rationalisation of the Universal Charge-Missionary Electrification (UC-ME) subsidies in off-grid areas, while the "electricity access for all by 2040" is the objective of the Total Electrification Program (TEP).	Department of Energy
Alternative Fuels and Energy Technologies (AFET) Roadmap	This roadmap lays down the framework for the adoption and commercialisation of emerging and efficient energy technologies in the economy. Medium-term goal (2020-2022): • Identification of AFETs for application. Long-term goal (2023–2040): • Preparation of the regulatory and infrastructure requirements of the identified AFETs.	Department of Energy
Upstream Oil and Gas Roadmap	This roadmap focuses on attaining the following objectives by 2040: • Increase indigenous petroleum reserves to 116 million barrels of oil and 5.9 TCF of gas. • Produce 66 million barrels of crude oil and 3.5 TCF of natural gas.	Department of Energy
Upstream Coal Roadmap	Targets the increase of delineated mineable coal reserves up to 766 million tonnes by the end of 2040 with additional reserves of 65 million tonnes in the medium term and 223 million tonnes in the long term.	Department of Energy

Downstream Oil Roadmap	Improved policy governing the downstream oil industry to ensure a continuous supply of high quality and the right quantity of petroleum products in the market by 2040.	Department of Energy
Downstream Natural Gas Roadmap	To establish a world-class, investment-driven, and efficient natural gas industry that makes natural gas the preferred fuel by all end-use sectors by 2040.	Department of Energy
Energy Efficiency and Conservation Roadmap	Measurable reduction in energy intensity and consumption per year versus BAU by 2040: • Medium-term and long-term framework focusing on two priority areas, namely, the strengthening and sustaining of EE and C policies and initiatives.	Department of Energy
Executive Order (EO) 116	Establishes the NEP-IAC, an inter-agency task force led by the DOE which is tasked with conducting a study on the adoption of the economy's position on Nuclear Power Plants (NPPs) in accordance with pertinent International Atomic Energy Agency (IAEA) guidelines, relevant laws, rules and regulations.	Department of Energy
DC2018-01-0001	Concerns the adoption of energy resiliency in the planning and programming of the energy sector to mitigate potential impacts of disasters	Department of Energy
DC2020-11-0024	Concerns the adoption of the guidelines governing the 3rd Open and Competitive Selection Process (OCSP3) in the award of the renewable energy service contract, and other purposes	Department of Energy
DC2022-02-0002	Prescribes the policies and programs to promote and enhance the development of biomass waste-to-energy facilities	Department of Energy
DC2022-06-0028	Supplementing DC 2018-01-0001 on the energy resiliency planning and programming of the energy sector to mitigate potential impacts of disasters	Department of Energy

Notable Energy Developments

The Philippines Energy Working Group (EWG) representative reported the following Notable Energy Developments since EWG68 at EWG 69 hosted by Korea on 26-27 February 2024.

Energy Development	Details	Reference
3rd Green Energy Auction (GEA-3)	The Green Energy Auction Program (GEAP) is a key initiative in the government's strategy to expand renewable energy capacity and achieve a 35% share of renewables in the Philippines' energy mix by 2030. The GEA-3 has just been conducted with an offered capacity of 6.65 GW, exceeding the installation target of 485 GW in February.	Department of Energy
4th Green Energy Auction (GEA-4)	The succeeding auction round (GEA-4) will include the Integrated Renewable Energy and Energy Storage System (IRESS). The IRESS will only cover solar power plants integrated with battery energy storage systems (BESS).	Department of Energy
Renewable Energy Certificates (RECS)	The RECs are market-based instruments representing 1.0 MWh of electricity generated from eligible RE facilities. The trading of RECs officially commenced in December 2024, marking a significant milestone with the full commercial operation of the renewable energy market (REM). The REM provides a platform for trading these certificates, enabling participants to meet their RE compliance obligations under the renewable portfolio standards and currently has around 285 participants.	Department of Energy
3500 MW solar plant project	Ground-breaking in November 2024 was paired with a 4500 MW battery energy storage system (BESS) to be developed by Terra Solar Phils., Inc. Once completed, the project will become the world's largest single-site solar and BESS facility, marking a transformative moment in the economy's energy landscape. The project is expected to generate over 5000 GWh of electricity annually.	Department of Energy
Memorandum of Agreement with the Department of Environment and Natural Resources (DENR)	Signed in October 2024, this granted rights to use offshore areas covered by offshore wind (OSW) energy service contracts, including auxiliary areas, to accelerate the exploration, utilisation and development of OSW projects.	Department of Energy
Implementation of 3% coco methyl ester (CME) blend in diesel fuel	Implemented in October 2024 to benefit coconut farmers, biodiesel producers, and other stakeholders in the coconut industry, with around 900 million additional coconuts to produce 100 to 120 ML of CME requirements to satisfy a 1% mandatory increase.	Department of Energy
Philippine Nuclear Energy Program (NEP) Roadmap	Unveiled during the 68th IAEA General Conference held in Austria in September 2024. It outlines the key targets that must be achieved for the successful commercial operations of an NPP in the economy.	Department of Energy

Useful Links

Asian Development Bank – www.adb.org

Climate Change Commission (CCC) – www.climate.gov.ph

Department of Energy, Republic of the Philippines (DOE) – www.doe.gov.ph

Department of Science and Technology (DOST) – www.dost.gov.ph/

Department of Trade and Industry (DTI) – www.dti.gov.ph/

Department of Transportation (DOTr) – www.dotr.gov.ph

Independent Electricity Market Operator of the Philippines (IEMOP) – www.iemop.ph

National Power Corporation (NPC) – www.napocor.gov.ph

National Transmission Corporation (TransCO) – www.transco.ph

Philippine National Oil Company (PNOC) – www.pnoc.com.ph

Philippine Electricity Market Corporation (PEMC) – www.wesm.ph

World Bank – https://www.worldbank.org/en/country/philippines

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The Russian Federation

Introduction

The Russian Federation has the largest land area globally, spanning more than 17 million square kilometres in both Eastern Europe and Northern Asia. The combination of geography and population settlement in Russia makes it necessary for the economy to use a significant amount of energy to provide comfortable living conditions for most of the population for most of the year, which is one of the critical factors contributing to the economy having the highest energy intensity of GDP among APEC economies.

These factors have determined the development in Russia of not only centralised power supply systems but also of centralised heat supply systems, which in turn has led to the widespread development of thermal power plants with combined heat and power generation. Now Russia has the world's largest district heat supply systems, present in most major cities.

As of 1 January 2025 its population of 146 million people. lives mostly in urban areas (75%), and 68% of the population lives in the European part of Russia, which accounts for 21% of the territory.

In 2021, the GDP of the Russian Federation grew by 5.9% compared to 2020 and reached 5688 billion US dollars in PPP, due to the economy's gradual recovery after the COVID-19 pandemic. Following the growth of GDP, the indicator "GDP of the Russian Federation per capita" increased by 6.2% over the year. Russia is the third-largest energy producer in APEC. More than half of this energy was consumed within the economy, while the rest was exported. Russia was the world's largest energy exporter overall, exporting about 24 exajoules in 2021.

Russia was the third-largest power producer in APEC, accounting for 6.2% of APEC's total electricity generation in 2021, and the largest heat producer. Russia has significant reserves of fossil fuels and uranium.

Table 1: Russia's macroeconomic data and energy reserves

Key data [a]		Energy reserves [b, c]	
Area (million km^2)	17.1	Oil (billion barrels)	108
Population (million)	147	Gas (trillion cubic feet)	1321
GDP (2021 USD billion PPP)	5688	Coal (million tonnes)	162 166
GDP per capita (2021 USD PPP)	38 638	Uranium (kilotonnes U < USD 130/kgU)	202

Source: a ROSSTAT (2023); b Energy Institute (2023); c UN (2023)

Note: Reserves are total proved reserves and reasonably assured recoverable resources for uranium.

Data for 2005-21 have been updated using Russia Federal State Statistics Service energy balance tables. Data for 2000-04 and 2022 need to be processed and revised. Therefore, in this Russia chapter, data in all graphs are for 2005-21.

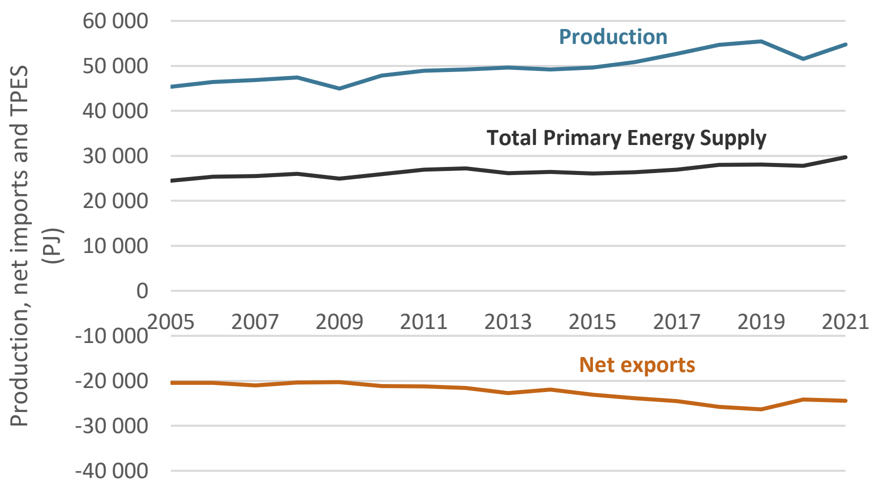
Energy Supply and Consumption

Total Primary Energy Supply

Russia is the third-largest energy producer in both APEC and the world, after China and the US. Russia's total primary energy supply (TPES) in 2021 was 34 597 PJ, a 6.8% increase compared to 2020 levels.

Energy production has grown consistently since 2005 with a compound annual growth rate (CAGR) of 1.2%. Other than 2020, the only year of decline for the period was in 2009 due to lower domestic consumption. In 2020, production declined by 7.0%, and in 2021, it rebounded to 2019 levels due to a recovery in demand mostly on domestic markets.

Figure 1: Russia's energy supply, production, and net imports (PJ), 2005 to 2021

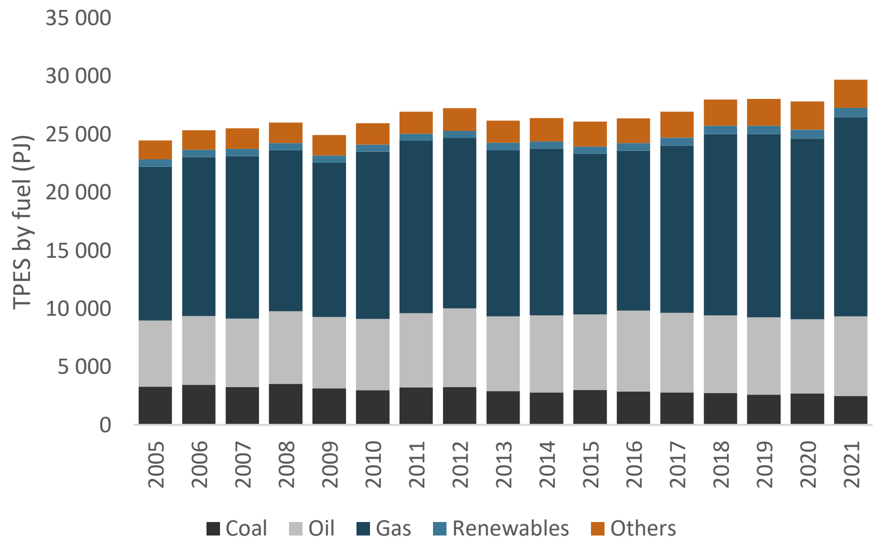


Source: EGEDA (2024)

Net exports grew at a much higher rate than production, with a CAGR of 1.8% from 2005 to 2019, but declined by around 8.0% in 2020. In 2021, net exports remained similar to 2020 levels.

Russia's TPES fuel mix was virtually unchanged for 2005-21; natural gas accounted for more than half, with a slight decrease in the share of coal. In 2021, the TPES fuel mix comprised the following: natural gas (58%), crude oil and petroleum products (23%), coal (8%) and renewables and others, including nuclear and hydro (11%). For the 2005-19 period, TPES volumes of coal were steadily declining, oil increased by 17%, others, including nuclear and hydro, increased by 41%, and renewables increased by 10%, while the volume of gas increased by 26%. In 2021, TPES increased by about 7.0% due to increased generation from gas-fired power plants.

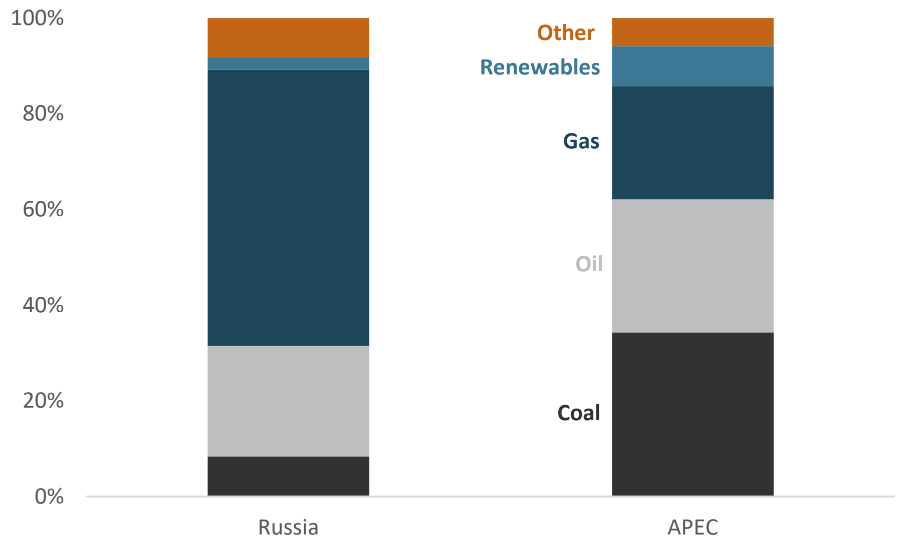
Figure 2: Russia's energy supply by fuel (PJ), 2005 to 2021



Source: EGEDA (2024)

Russia's TPES fuel mix is substantially different from that of the APEC region as a whole. The share of natural gas in Russia is more than twice as high, which is explained by its large natural gas reserves and the predominance of gas-fired power plants that account for more than 70% of the electricity produced by thermal power plants.

Figure 3: Energy supply mix, Russia and APEC, 2021



Source: EGEDA (2024)

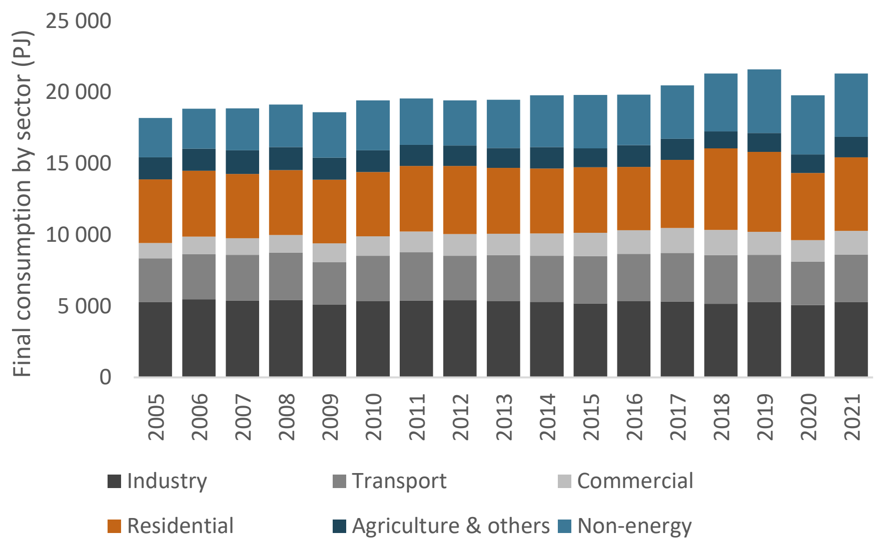
Gas consumption is distributed unevenly across the regions, due to infrastructural constraints and economic feasibility. In particular, the centers of gas production and consumption are remote from each other, the gas pipelines are mainly concentrated in the west part of the economy and the gasification rate in the Far East is about 24%. In contrast, the shares of coal and renewables in Russia are less than half of APEC's. The modest share of solar and wind-based generation in electricity production is explained by their high cost, instability and, consequently, the need to ensure energy security by virtue of the geographical peculiarities and climate.

Currently, one of the most important tasks is to integrate new types of renewable energy generation into the market - complex solutions using energy storage and hybrid systems. Renewable energy sources are one of the most attractive for remote, isolated, hard–to-reach areas with imported traditional fuels.

Total Final Consumption

Russia's final consumption in 2021 was 21 849 PJ, an increase of 7.2% in 2020. Russia is the third-largest energy consumer in APEC after China and the US.

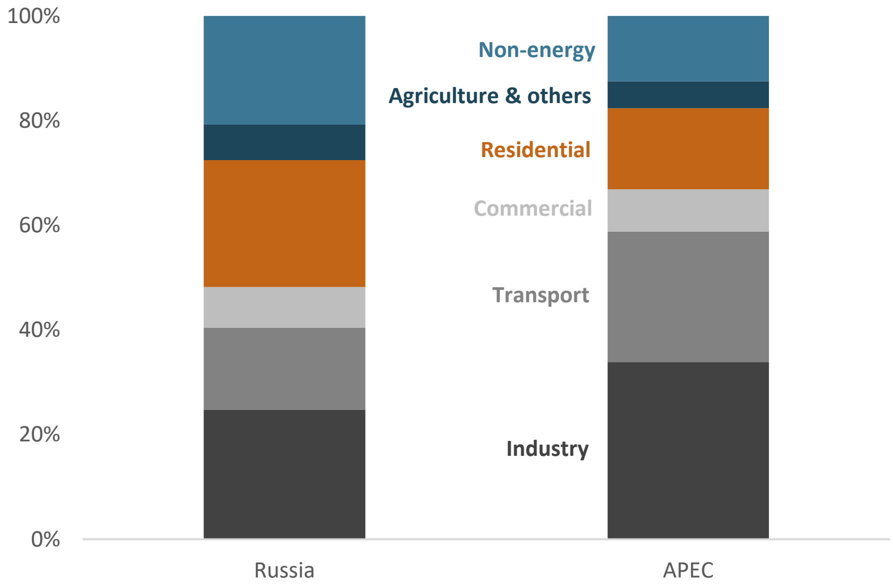
Figure 4: Russia's final consumption by sector (PJ), 2005 to 2021



Source: EGEDA (2024)

The industrial (5280 PJ, 25%) and the residential sector (5003 PJ, 24%) accounted for the two most significant shares of final energy consumption. Energy consumption in industry grew by 4.0% compared to 2020 levels. In residential buildings, consumption slightly increased largely due to seasonal factors. One of the main reasons residential buildings represent the largest consuming sector is the significant energy consumption for heating for more than half of the year. The third-largest sector was non-energy use. Non-energy use has grown by more than 60% since 2005, accounting for 21% of Russia's energy use in 2021. Energy consumption in the transport sector (3340 PJ, 16%) grew by 9.0% and reached pre-pandemic levels. Agriculture and the commercial sector accounted for the remaining 14%.

Figure 5: Final consumption by sector, Russia and APEC, 2021



Source: EGEDA (2024)

Russia, like APEC, has the same major consumer sectors: industry, transport and residential. Their overall share is almost the same, accounting for about three-quarters of total consumption. However, the fraction of each sector is different between Russia and APEC. The share of the residential sector in Russia is much higher than in APEC due to its significant heat consumption, while the share of industry and transport is lower. The non-energy use share is higher than in APEC due to the considerable consumption of petroleum products and natural gas as a feedstock in the chemical industry.

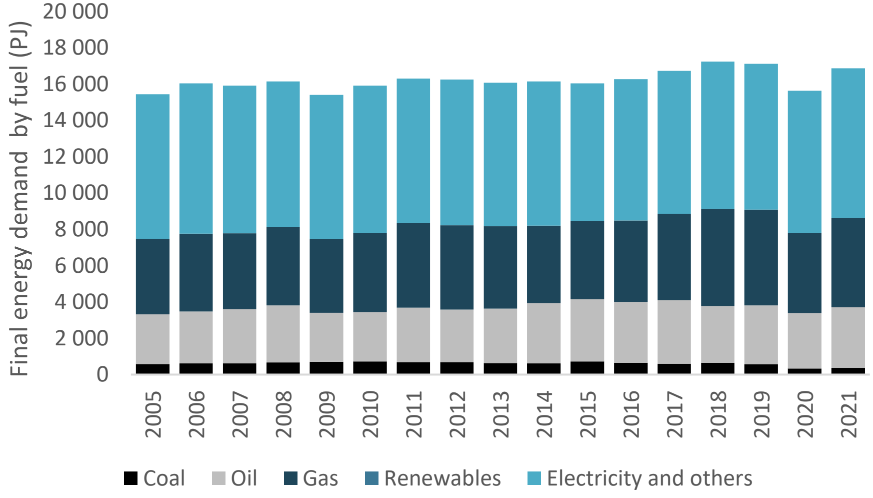
Final Energy Demand

In 2021, Russia's final energy consumption with excluding the consumption of energy products by the non-energy sector amounted to 16 877 PJ, almost 8.0% higher than in 2020. About half of the final energy consumption in 2021 was supplied by electricity and heat, the share of which decreased slightly compared to 2005 due to a decrease in heat consumption.

Correspondingly, the share of fossil fuels increased from 49% in 2005 to 51% in 2021. Natural gas accounts for more than half of the consumption of fossil fuels, and oil and petroleum products for slightly more than a third. Despite a slight increase in consumption, the share of coal is gradually decreasing.

In Russia, fossil fuels accounted for half of final energy consumption in 2021, 11% less than the APEC total. Electricity and heat accounted for the other half. In the APEC region, the share of electricity (and to a much lesser extent heat) was almost a third.

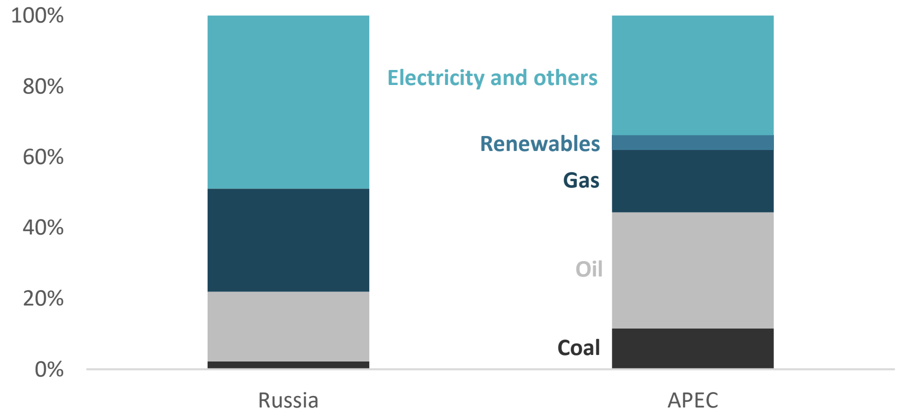
Figure 6: Russia's final energy demand by fuel (PJ), 2005 to 2021



Source: EGEDA (2024)

Note: does not include non-energy sector consumption of energy products

Figure 7: Final energy demand fuel share, Russia and APEC, 2021



Source: EGEDA (2024)

Transformation

Power Sector

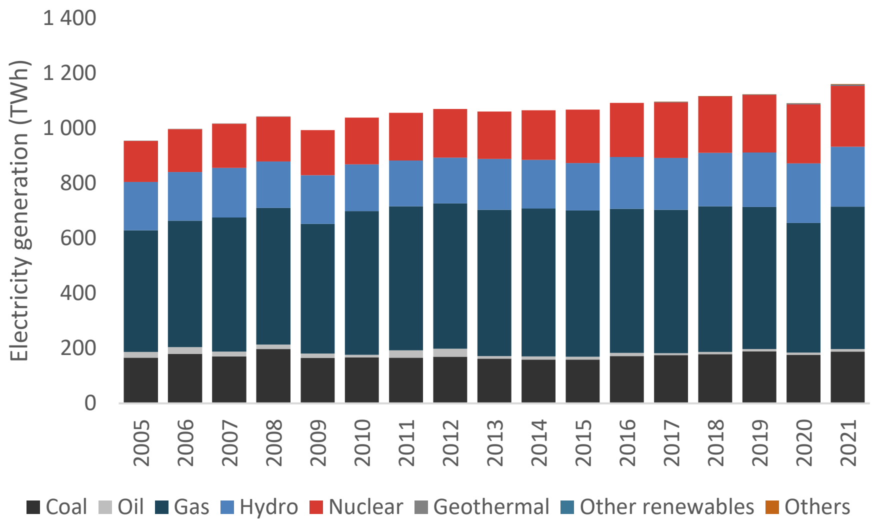
Electricity generation has grown consistently since 2005 (with a few exceptions) with a CAGR of 1.2%. In 2020, Russia generated almost 3.0% less than the previous year. In 2021, electricity generation exceeded pre-pandemic levels by 3.0%, reaching 1160 TWh. Fossil fuels accounted for the largest share of this generation (62%), of which more than 70% are produced at gas-fuelled CHP plant. The remaining 38% of electricity generation came from hydropower and nuclear power in roughly equal shares.

Electricity generation at gas-fired power plants reached 2019 levels and accounted for two-thirds of the increase in electricity generation in 2021.

The fuel mix for power generation in Russia and the APEC region is quite similar regarding the shares of fossil and non-fossil fuels. In Russia, fossil fuels comprise 62% of the generation mix, and in APEC, they account for 65%. However, the fossil fuels with the largest share in Russia and APEC differ. Natural gas accounts for a much larger share (44%) in Russia, while coal accounts for a much larger share (43%) in APEC.

The share of hydro is also different, amounting to 19% in Russia and 14% in APEC. Nuclear energy in Russia accounts for 19%, more than twice as much as in APEC.

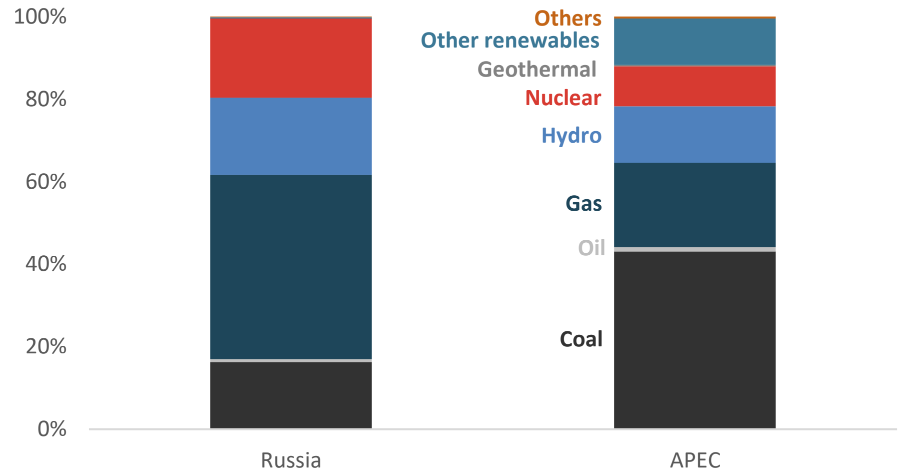
Figure 8: Russia's electricity generation by fuel, 2005 to 2021



Source: EGEDA (2024)

In the Russian Federation, the pace of adoption of solar and wind power generation lags in relation to the APEC region, which is due to their cost and the need to ensure energy security by virtue of the geographical peculiarities and climate.In APEC, the share of other renewables (primarily solar and wind) in 2021 exceeded 11%, while that share is lower than 1.0% in Russia.

Figure 9: Electricity generation fuel share, Russia and APEC, 2021



Source: EGEDA (2024)

Refining

Oil refinery capacity in Russia in 2021 was about 6.9 million barrels per day (Energy Institute, 2023), which is the third highest in the world after the US and China. In 2021, 52% of all produced oil was refined domestically (Russian Energy Agency). Diesel fuel (30%), fuel oil (18%), motor gasoline (15%) and naphtha (10%) dominated in the petroleum product output mix. More than half of the top three refined products by volume are exported. The share of fuel oil exports in 2021 was 90%, that of naphtha was 68%, and that of diesel was 47%.

Energy Transition

The presidential decree On Reducing Greenhouse Gas Emissions, adopted in November 2020, led to significant activity. It instructed the government of the Russian Federation to develop a Strategy for Socio-Economic Development of the Russian Federation with Low Greenhouse Gas Emissions until 2050.

The Strategy of Socio-Economic Development of the Russian Federation with Low Greenhouse Gas Emissions up to 2050 was approved at the end of October 2021.

According to the strategy, the development of combined-cycle gas generation, nuclear power plants, hydroelectric power plants and renewable energy sources, maximizing the potential for reducing greenhouse gas emissions in coal-fired power, including through a full transition to the best available technologies, support for innovative and climate-efficient coal combustion technologies, the replacement of low-efficiency boilers with cogeneration facilities widespread stimulation of the development and application of technologies for the capture, use and disposal of greenhouse gases, as well as the growth of the absorption capacity of the Agriculture, Forestry and Other Land Use (AFOLU) sector are considered as the factors for the net greenhouse gas emissions reduction.

The Russian Federation proceeds from the need of global recognition of the technological neutrality of measures aimed at reducing greenhouse gas emissions (non-discrimination of the reductions and acquisitions results, including from nuclear and hydropower projects); mutual recognition of the need to improve assessments of the absorption capacity of managed ecosystems, to ensure compliance with international standards of Russian climate regulation, including taxonomy, certificates of electric energy origin and a verification system for the results of "green" projects.

A number of essential documents aimed at developing energy subsectors that promote decarbonization have been adopted since 2021.: the Federal Law – On Limiting Greenhouse Gas Emissions (July 2021), The concept of the development of hydrogen energy in the Russian Federation until 2035 (August 2021), The concept for the development of production and use of electric vehicles in the Russian Federation until 2030 (August 2021), the Federal Law -On Conducting an experiment to Limit greenhouse Gas Emissions in Certain Regions of the Russian Federation (March 2022) and conducting an experiment to limit greenhouse gas emissions in the Sakhalin Region..

The Federal Law, On Limiting Greenhouse Gas Emissions, provides the introduction of a staged model for regulating such emissions. This includes the introduction of mandatory carbon reporting, to be collected and summarised by the authorised government body.

As one of the measures to limit greenhouse gas emissions, the law provides for setting targets of reducing greenhouse gas emissions. This indicator is set by the government for the Russian economy as a whole and can take into account the AFOLU and the need to ensure sustainable and balanced socioeconomic development. The law proposes the creation of a roster of greenhouse gas emissions. This roster will be the government information system, which the authorised federal executive body will maintain.

The Climate Doctrine of the Russian Federation was adopted in October 2023 by the presidential decree. Within the framework of long-term socioeconomic development of the Russian Federation and considering the economy’s interests and development priorities, it is envisaged that a balance between anthropogenic greenhouse gas emissions and their absorption will be achieved no later than 2060. To achieve this goal, additional measures have been identified to reduce greenhouse gas emissions and increase the absorption capacity of managed ecosystems.

The General Scheme for the Placement of Electric Power Facilities until 2042, approved by the Russian Government in December 2024, outlines a long-term strategy for balanced and reliable development of Russia's power system. It prioritises modernisation of aging infrastructure, increased use of nuclear and renewable energy, and reduction of dependence on thermal generation using coal. The plan aims to ensure energy security, improve environmental performance, and support economic growth through approximately 90 GW of new capacity by 2042 and a shift toward cleaner energy sources.

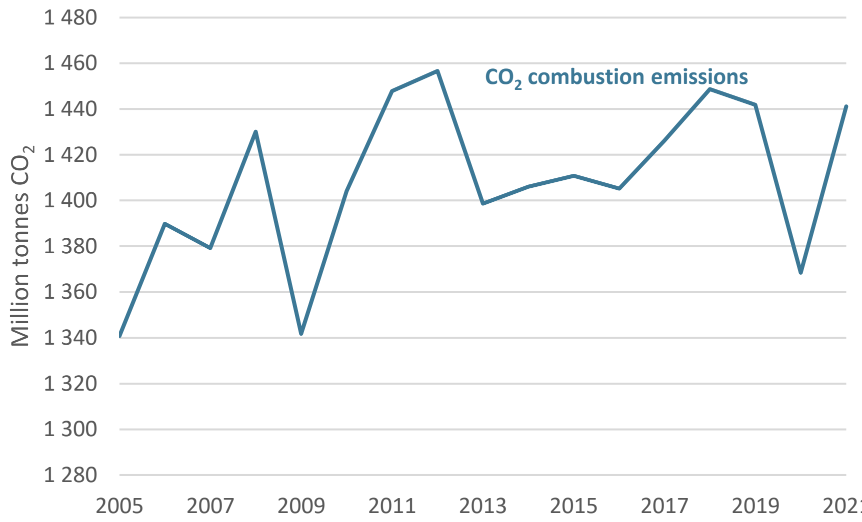
Russia's Energy Strategy 2050, adopted by the Government on 12 April 2025, sets the course for further development of a safe, efficient, and technologically independent energy system. It emphasizes maintaining stable production of oil and gas, expanding LNG exports, and increasing the role of nuclear and renewable energy sources. The strategy aims to enhance energy efficiency, reduce greenhouse gas emissions, and shift toward cleaner technologies while ensuring the economy remains a key player in global energy markets. By 2050, Russia targets deep modernisation of its energy infrastructure, stronger domestic innovation, and broader international cooperation, particularly with Asia and emerging economies.

Emissions

CO_2 combustion emissions have increased steadily since 2005 due to economic growth and development. The decrease in emissions, particularly in 2009 and 2020, reflected the decline in economic activity during economic crises.

After a significant decrease in 2013, the level of emissions remained at about the same level for four years. The notable increase in 2017-18 was mainly due to the rise in gas consumption in residential buildings.

Figure 10: Russia's CO_2 combustion emissions (million tonnes), 2005 to 2021



Source: EGEDA (2024)

Energy Security

In 2019, the Doctrine of Energy Security of the Russian Federation was adopted by decree of the President of the Russian Federation. Energy security is an essential component of national security for the Russian Federation and the foundation of the economic security system. Russia implements a model based on the principle of interconnectedness and fair risk sharing among all participants in the energy chain, balancing the interests not only energy producers and consumers, but also transit countries. The basis of ensuring the economy's energy security is the reliable and sustainable provision of energy resources and energy services to Russian consumers, as well as the fulfillment of export contracts.

The accelerated transition to a more efficient, flexible and sustainable energy systems, capable of adequately responding to the emergence and rapid transformation of new challenges and threats of a hybrid nature, is embedded in the priorities of the government energy policy of the Russian Federation. One of the priorities is to ensure energy security not only the economy as a whole, but also at the level of the subjects of the Russian Federation, especially located on geostrategic territories.

The Doctrine refers to the following as external challenges to energy security: shifting the centre of global economic growth to the Asia-Pacific region; a slowdown in global demand for energy resources and a change in its mix, including the replacement of petroleum products by other types of energy resources and the development of energy saving and energy efficiency; an increase in the world resource base of hydrocarbons; increased competition among energy exporters; changes in the international regulatory framework in the energy sector and conditions of the world energy markets, strengthening the position of consumers; the growth of LNG production and its share on the world energy markets; the formation of a global natural gas market; an increase in the share of renewable energy sources in the global energy balance, and increased international efforts in general to implement climate policy and accelerate the transition to a green economy.

APEC Energy Goals

There are two energy-related objectives that APEC member economies have agreed to meet as a collective: to improve energy intensity and double the share of modern renewables.

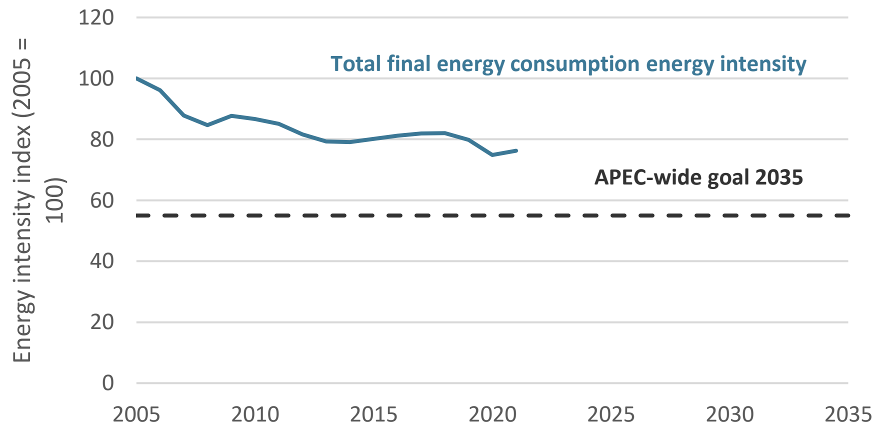
Energy Intensity Goal

In 2011, APEC member economies agreed to increase their ambition to reduce energy intensity by 45% in 2035, relative to a 2005 baseline. The original goal was a 25% reduction by 2030, relative to a 2005 baseline.

APEC is on track to achieve this energy intensity improvement. The goal does not impose individual economy targets, but it is possible to track the progress of individual APEC economies relative to the overarching proportional improvement.

As the northernmost economy in the APEC region with vast Arctic territories (28% of its land area), Russia is the most energy-intensive economy in the APEC region. However, improvements are taking place. In 2021, Russia's total final energy consumption (excluding non-energy) intensity improved by 24% compared to that of 2005.

Figure 11: Russia's total final energy consumption intensity index, 2005 to 2021 (2005 = 100)

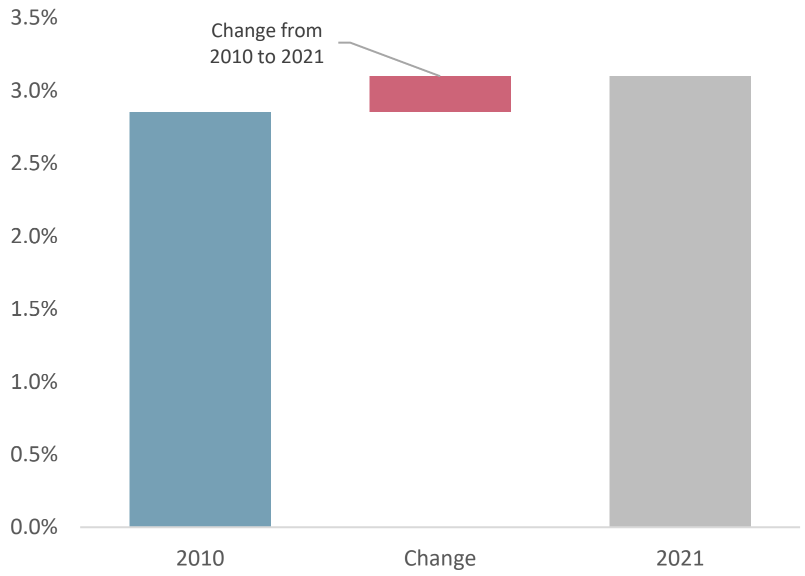


Source: EGEDA (2024)

Doubling of Renewables

The second energy goal involves doubling the share of modern renewables in the APEC energy mix for the period 2010 to 2030. There is no economy-level goal for individual member economies, but improvements by individual economies will contribute to the doubling goal.

Figure 12: Russia's renewable energy share, 2010 and 2021



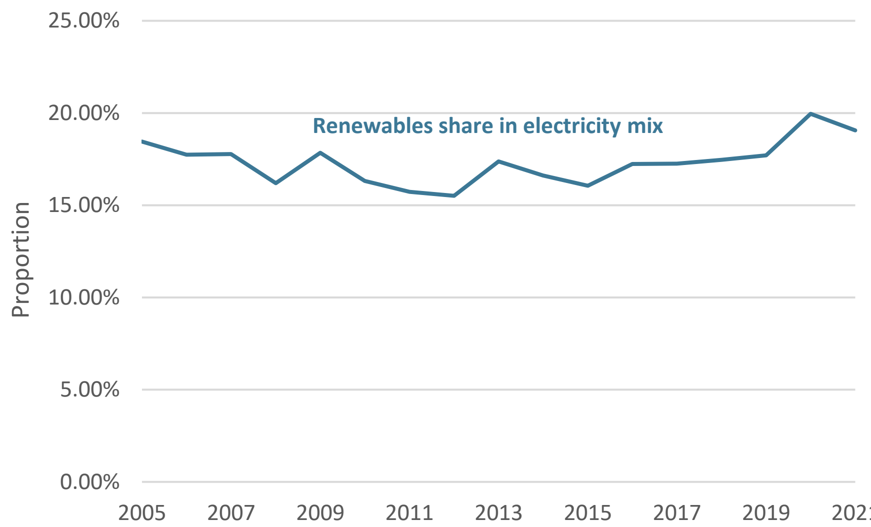
Source: EGEDA (2024)

Note: Biomass used in the residential and commercial sectors is assumed to be traditional biomass and is not included in the definition of modern renewables. All other renewables (biomass used by industry, hydro, geothermal, etc.) are considered modern renewables. Modern renewables also include the share of electricity that is generated from renewable sources.

Russia's share of renewables to final energy consumption in 2010 was 2.9%. In 2021, this share increased to 3.1%, as shown in Figure 12.

Expanding the use of renewables is carried out at its own pace in the Russian Federation. This is due to the national circumstances, and a rational and cost-effective combination of the use of centralised electricity and heat supply systems with distributed local energy, with the participation of renewable sources. As a result of reduced regulatory support, over the past eight years, prices for electricity from renewable energy generation facilities have decreased by 85% for wind power plants and by 87% for solar power plants and are closer to global analogues.

Figure 13: Russia's renewable generation share, 2005 to 2021



Source: EGEDA (2024)

The share of electricity generated by renewable energy sources in 2000-21 averaged 18-19%. Large hydropower plants (HPPs) generated almost all the electricity provided by renewables. In this regard, changes in the share of HPPs in some years are associated with low-water periods. The share of electricity generation by solar and wind power plants is less than 1.0%. However, large shares of Russia’s electricity generation are nonetheless carbon-free, with approximately 20% of electricity generated from nuclear power plants, 18% from hydropower, and less than 1.0% from other renewable sources.

Energy Policy

Energy Policy	Details	Reference
Oil and condensate production	Russia’s Energy Strategy 2050, adopted in 2025, assumes maintaining the oil and condensate production at 515 million tons/year by 2030, 530 by 2036, and 540 by 2050 through enhanced recovery, horizontal drilling, and development of complex reserves.	The Russian Government
Oil refining depth	According to Russia's Energy Strategy until 2050, adopted in 2025, the indicators for solving the tasks set are: increasing the refining depth to 90% by 2030, 90% by 2036, and 90% by 2050	The Russian Government
Natural gas production	Reach 750 bcm/year by 2030, 900 bcm by 2036, and exceed 1,000 bcm/year by 2050, supported by gasification and LNG expansion.	The Russian Government
LNG production	According to Russia's Energy Strategy until 2050, adopted in 2025, the indicators for solving the tasks set are: increase the volume of liquefied natural gas production from 32.339 million tons by 2023 to 90-105 million tons by 2030, to 110-130 million tons by 2036 and to 110-175 million tons by 2050.	The Russian Government
Utilization of associated petroleum gas	Increase associated petroleum gas use to 95% by 2030 and maintain it through 2050 to reduce flaring and emissions.	The Russian Government
Petrochemical production	According to Russia's Energy Strategy until 2050, adopted in 2025, the indicators for solving the tasks set are: achieve polymer production of at least 10 million tons per year by 2030, at least 10 million tons by 2036, and at least 14 million tons by 2050	The Russian Government
Gasification rate	Expand gas access to 74% of households by 2030, 80% by 2036, and 86% by 2050, especially in Eastern and Arctic regions. According to Russia's Energy Strategy until 2050, adopted in 2025, it is planned to increase the consumption of natural gas (methane) as a motor fuel from 2.19 billion cubic meters by 2023 to 6.7 - 9 billion cubic meters by 2030, to 11.5 - 16.8 billion cubic meters by 2036 and to 21.3 - 29.3 billion cubic meters by 2050	The Russian Government
Electricity generation	Increase output to 1,324 billion kWh by 2030, 1,388 billion kWh by 2036 and 1,588 billion kWh by 2050, driven by industrial demand, AI and data centers.	The Russian Government
Share of nuclear energy	Increase nuclear share to 12% by 2030, 18% by 2036, and 25% by 2050 through new builds and lifetime extension of existing plants.	The Russian Government
Renewable energy development	Increase installed capacity by 30% by 2030, 35% by 2036, and 40% by 2050 vs. 2023, including wind, solar, and small hydro.	The Russian Government

Alternative fuels in transport	Reach 5% vehicle fleet using alternative fuels by 2030, 10% by 2036, and 14% by 2050, including electric, gas, and hydrogen transport.	The Russian Government
Energy grid efficiency	Lower transmission losses to below 8% by 2030, below 7.5% by 2036, and 7.3% by 2050 with smart grids and digitalization.	The Russian Government
Technological sovereignty	Double use of domestic energy technologies by 2030, triple by 2036, and quadruple by 2050 to ensure independence and innovation.	The Russian Government
Workforce development	Reach 90% staffing adequacy by 2030, 94% by 2036, and 96% by 2050 through education, training, and retention policies.	The Russian Government
Emissions reduction in coal mining	Reduce GHG emissions in coal mining by 10% by 2030, 18% by 2036, and 25% by 2050 via clean technologies and coal chemistry.	The Russian Government
Russia's Energy Security Doctrine	Russia employs a multi-level approach to ensuring energy security, based on a balance of interests and risk minimisation The Doctrine's principles are legality, the priority of the domestic market, maintaining the stability of the regulatory framework, ensuring resource, financial, and personnel security of the fuel and energy complex, rational resource management and energy efficiency, promoting public-private partnerships, consideration of the interests of all stakeholders and the population, meeting environmental safety requirements, and ensuring the continuity of the energy security process. Key initiatives include improving public administration in provision of energy security, maintaining the mineral and raw material base of the fuel and energy complex and the main production facilities of fuel and energy organisations at a level necessary to ensure energy security, as well as ensuring the technological independence of the fuel and energy complex and increasing its competitiveness. The Doctrine envisions international legal protection of the interests of Russian fuel and energy organisations and power engineering, and support for the export of their products, technologies, and services. One of the strategic tasks is ensuring the technological independence of the Russian fuel and energy complex. Russia is carrying out targeted activities to implement new approaches to the development of low-carbon energy throughout the entire life cycle of nuclear power generation, hydrogen energy, renewable energy sources, and energy storage systems, using new domestic breakthrough high-tech solutions for the entire technological chain of production and use of energy resources, meeting the requirements of the economy, and for environmental friendliness, and reliability at the same time.	Ministry of Energy
Greenhouse gas emission level	Russia's Nationally Determined Contributions (NDCs) proposes reducing greenhouse gas emissions to 70% by 2030 from the 1990 baseline. The NDC level of emissions was approved by presidential decree in November 2020.	Presidential Decree

Carbon Neutrality Commitment	After approving the low-carbon development strategy, the President of Russia announced that Russia will achieve carbon neutrality by 2060.	The Russian Government
Limiting Greenhouse Gas Emissions	The Federal Law, On Limiting Greenhouse Gas Emissions, introduces a staged model for regulating such emissions. This model includes the introduction of mandatory carbon reporting, collected and summarised by the authorised government body. To regulation entities refer the largest emitters of greenhouse gases with volume released of 150,000 tons of CO2-eq. per year or more. Starting from January 1, 2023, such companies have had to report. Those who emit greenhouse gases in the amount of 50,000 tons of CO2-eq. per year or more, are subject to regulation and will submit greenhouse gas emissions reports from 1 January 2025.The document provides the establishment of a target for reducing greenhouse gas emissions. This indicator, set by the government based on the scale of the Russian economy, will take into account absorption in forests and other natural ecosystems. and the need to ensure sustainable and balanced socioeconomic development. The law proposes the creation of a roster of greenhouse gas emissions. This roster will be the government information system, which the authorised federal executive body will maintain.	Federal Law
Development of electric transport	The Concept for the Development of Production and Use of Electric Vehicles in the Russian Federation until 2030 provides three scenarios for the development of electric transport until 2030. The target scenario proposes an increase in the production of electric vehicles to 217 000 units (100 times) by 2030, an increase in the share of electric vehicles in the overall vehicle fleet to 15%, and an increase in the number of charging stations to more than 14 000 units (eight times).	The Russian Government
Installed capacity of power plants	Total installed capacity of all power plants will reach 299 GW by 2042.	The Russian Government
Share of nuclear power plants	Increase in the share of nuclear power plants in installed capacity from 12% in 2023 to 16% by 2042. Increase in the share of nuclear power plants in electricity generation from 19% in 2023 to 24% by 2042.	The Russian Government
Share of thermal power plants	Decrease in the share of thermal power plants in installed capacity from 66% in 2023 to 57% by 2042.	The Russian Government
Share of solar and wind power plants	Increase in the share of solar and wind power plants in installed capacity from 1.9% in 2023 to 7.3% by 2042.	The Russian Government
Maximum power consumption	The maximum forecast peak power consumption in Russia's energy system is 205 GW by 2042.	The Russian Government

Commissioning of new generating capacity	The total volume of newly commissioned generating capacity will be around 90 GW by 2042.	The Russian Government

Useful Links

Ministry of Energy of the Russian Federation – https://minenergo.gov.ru/en?useFallback=1

Ministry of Natural Resources and Environment of the Russian Federation – https://www.mnr.gov.ru/en/

Ministry of Economic Development of the Russian Federation – https://en.economy.gov.ru

Federal State Statistics Service of the Russian Federation https://eng.rosstat.gov.ru/

Ministry of Industry and Trade of the Russian Federation – https://minpromtorg.gov.ru/en/

Federal Customs Service – https://eng.customs.gov.ru

Federal Tariff Service – www.fstrf.ru/eng

AtomEnergoProm – http://atomenergoprom.ru/en/

Rosseti, Public Joint Stock Company (PJSC ROSSETI) – www.rosseti.ru/eng/

Association «Nonprofit Partnership Council for Organizing Efficient System of Trading at Wholesale and Retail Electricity and Capacity Market – www.en.np-sr.ru/index.htm

Gazprom – www.gazprom.com/

Rosneft – https://www.rosneft.com/

RusHydro – www.eng.rushydro.ru/

Transneft – https://en.transneft.ru/

Central Dispatching Department of the Energy Sector – https://www.cdu.ru/company/

Russian Energy Agency – https://rosenergo.gov.ru/

Singapore

Introduction

Singapore has successfully transitioned its energy mix in the past, shifting from fuel oil to natural gas over the course of two decades. Singapore is actively transitioning to a low-carbon energy mix in a process that will span the next 30 to 40 years. Singapore's 2030 Nationally Determined Contribution (NDC) commits to reducing emissions to around 60 Mt CO_2e by 2030 after peaking emissions earlier, in line with Singapore's broader vision to achieve net zero emissions by 2050. This involves an all-of-society approach, with various sectors—including government, businesses, and individuals—working together. The power sector accounts for a large proportion of the economy's Greenhouse Gases (GHG) emissions. Decarbonising the energy grid and reducing electricity consumption are therefore crucial steps towards realising Singapore's net-zero ambitions. Energy is essential for Singapore's survival and economic competitiveness. Therefore, Singapore aims to achieve a balance in the energy trilemma—energy security and resilience, environmental sustainability, and cost-competitiveness —as we work towards net-zero emissions.

Natural gas is expected to remain prominent in supporting Singapore's economy over the next few decades. Considering this, Singapore is aiming to improve the carbon efficiency of its gas-fired power plants by 10%, as well as enabling the plants to run with at least 30% hydrogen by volume.

Today, solar is the most viable domestic renewable energy source in Singapore. Singapore had achieved its 2025 target of 1.5 GWp of solar installed capacity by the end of 2024, one year ahead of schedule. It is on track to achieve its target of at least 2 GWp of solar by 2030. Beyond conventional rooftops, Singapore is looking into innovative urban applications of solar such as on water bodies and canopies over canals.

Singapore's regional electricity grid is one of the key pathways to achieve energy transition. With limited domestic renewables resources, Singapore has set a target to import around 6.0 GW of low-carbon electricity from neighbouring economies by 2035. To date, Singapore has granted conditional licences and conditional approvals to a diversified source of renewable electricity projects from Australia; Cambodia; Indonesia and Viet Nam. These will also support the broader ASEAN Power Grid, connecting Southeast Asian economies.

Table 1: Singapore's macroeconomic data and energy reserves

Key data [a, b]		Energy reserves [c, d]	
Area (km^2)	734	Oil (billion barrels)	0
Population (million)	5.6	Gas (trillion cubic feet)	0
GDP (2021 USD billion PPP)	747	Coal (million tonnes)	0
GDP per capita (2021 USD PPP)	132 469	Uranium (kilotonnes U < USD 130/kgU)	0

Source: a Department of Statistics Singapore (2024); b World Bank (2024); c BP (2024); d UN (2024)

Note: Reserves are total proved reserves and reasonably assured recoverable resources for uranium.

Being a major international maritime transport hub, Singapore is also committed to decarbonising its maritime sector. Based on the Maritime Singapore Decarbonisation Blueprint, Singapore aims to reduce its maritime emissions on all fronts, including having its port terminals' emissions reduced by 60% by 2035 from 2005 levels, having all domestic harbour craft operating on low-carbon energy sources by 2030, and having all bunkering ships powered by low and zero-carbon energy sources.

Singapore is also taking steps to transform its aviation sector towards more sustainable operations. In February 2024, the economy announced that by 2026, all flights departing from Singapore will need to incorporate at least 1.0% of sustainable aviation fuel (SAF). This will be increased to between 3.0% and 5.0% by 2030. The Singapore Aviation Authority estimates that by 2050 SAF will reduce aviation emissions by 65%. By leveraging expertise at Singapore's Neste biorefinery (one of the largest in the world) Singapore is uniquely positioned to capitalise on the SAF market.

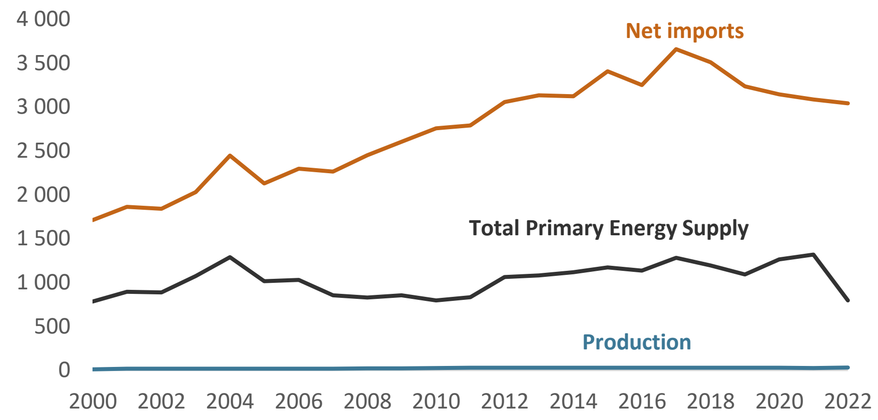
Energy Supply and Consumption

Total Primary Energy Supply

Singapore, being a net energy importing economy, imported a total of 6082 PJ of energy commodities in 2022, a decrease of 3.0% from 2021 levels. Imports of coal declined by 10% over the same period, which could be attributed to the volatility in coal prices in 2022. While crude oil and Natural Gas Liquids (NGLs) imports increased by 3.0%, imports of petroleum products declined by 6.0%. Imports of gas declined by 1.0%, mainly due to reduced contracted piped natural gas procurement from Indonesia and Malaysia, and the increase in Liquefied Natural Gas (LNG) imports during the same period did not fully offset the overall decline of gas imports. Oil (crude oil and NGLs, and petroleum products) remained the dominant import commodity, accounting for 92% of total imports in 2022.

Singapore registered a decline of 1.4% in net energy exports between 2021 and 2022, attributed mainly to reduced petroleum products imports (Figure 1). The economy's total energy supply in 2022 was 794 PJ, down from 1317 PJ in the previous year.

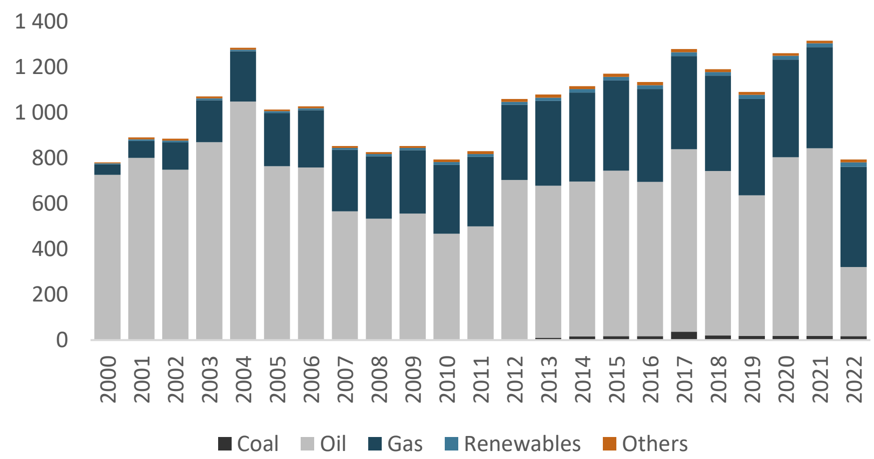
Figure 1: Singapore's energy supply, production, and net imports (PJ), 2000 to 2022



Source: EGEDA (2024)

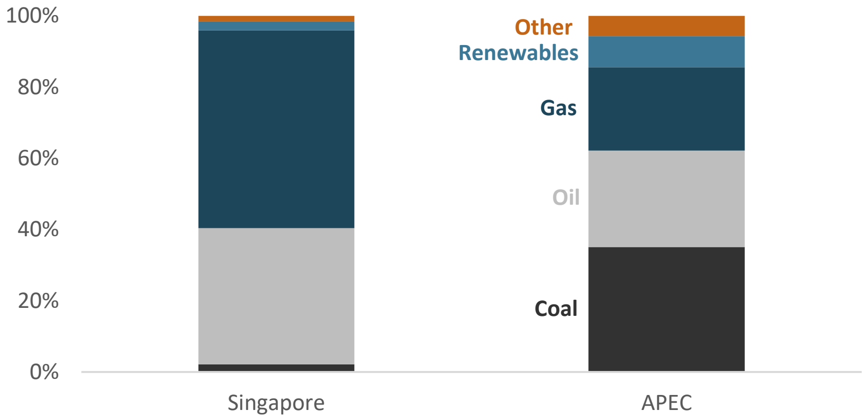
Despite the dominance of oil in Singapore's energy supply mix (Figure 2), its share has been decreasing over the past two decades, being displaced by the increased role of natural gas in the economy's supply mix. In addition to piped natural gas imports from Indonesia and Malaysia, Singapore has been procuring shipped LNG since 2013, with Australia accounting for most of the economy's LNG imports.

Figure 2: Singapore's energy supply by fuel (PJ), 2000 to 2022



Source: EGEDA (2024)

Figure 3: Energy supply mix, Singapore and APEC, 2022



Source: EGEDA (2024)

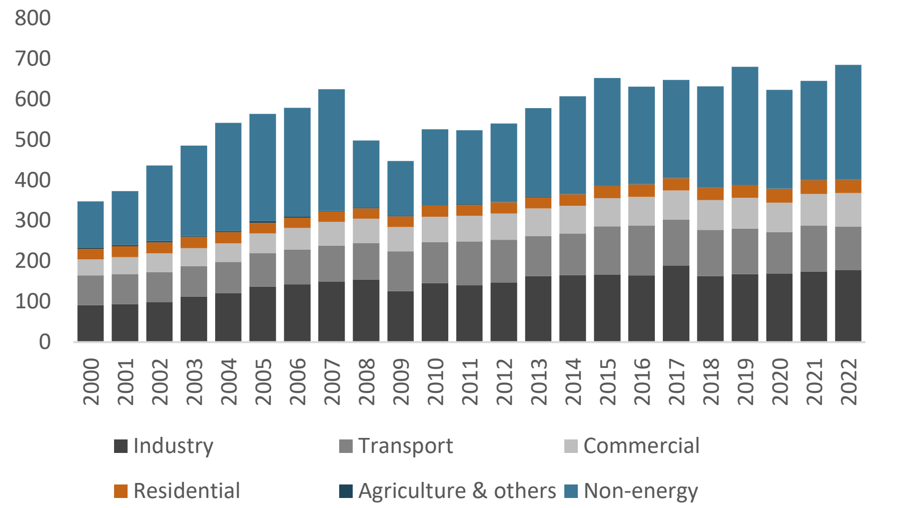
In 2022, Singapore had a higher share of oil and gas compared to the overall APEC region (Figure 3). At the same time, the share of coal in Singapore was significantly lower than APEC's coal share, given its limited use within the economy's power sector. Singapore's share of renewables is also significantly lower than in the wider APEC region, which can be attributed to constraints in land size, low wind speeds and a lack of hydro and geothermal resources, though studies on geothermal are ongoing.

Total Final Consumption

Singapore's final energy consumption reached 685 PJ in 2022, an increase of over 6.0% from 2021 levels (Figure 4). The commercial, industry and non-energy sectors drove this increase, with the non-energy sector posting a substantial growth of 16%, while the commercial and industry sectors registered increases of 7.0% and 3.0% respectively. Energy consumption in the transport sector decreased by 6.0%, probably due to a reduction in the number of gasoline and diesel-powered vehicles.

The non-energy sector (petrochemicals) continued to dominate Singapore's final consumption mix, as its share grew from 38% to 41% between 2021 and 2022.

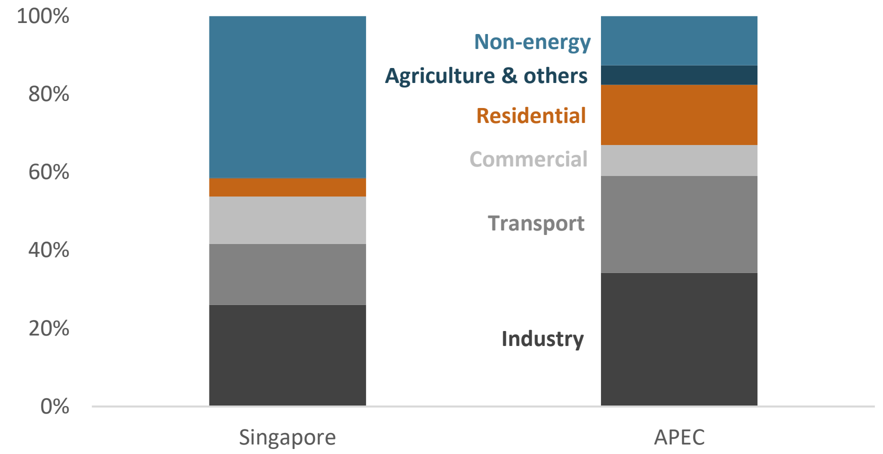
Figure 4: Singapore's final consumption by sector (PJ), 2000 to 2022



Source: EGEDA (2024)

Given the significant petrochemical landscape in Singapore, the shares of non-energy and industry sectors in final energy consumption were well above the APEC average in 2022 (Figure 5). Similarly, as a regional hub for commercial and financial activities, Singapore's economy had a higher share of final energy consumption in the commercial sector compared to APEC. Being a small-city economy, levels of residential and transport activities were lower than other economies, resulting in smaller shares of these sectors compared to those of APEC.

Figure 5: Final consumption by sector, Singapore and APEC, 2022

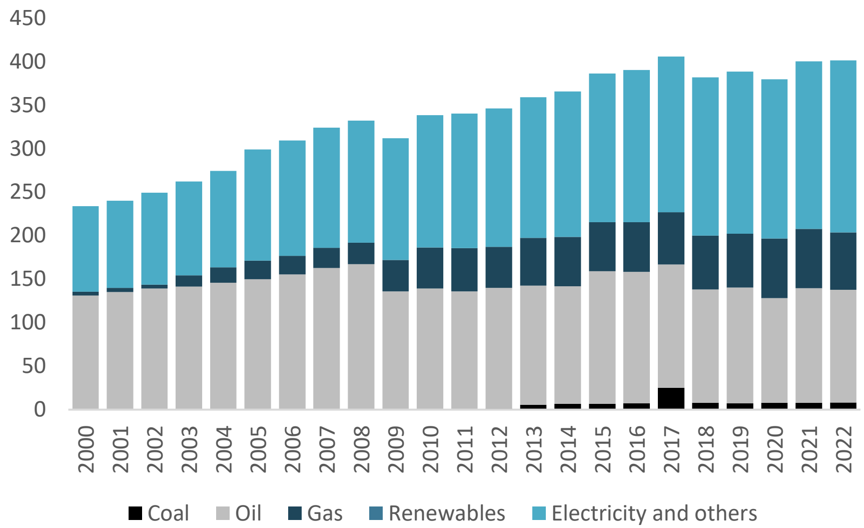


Source: EGEDA (2024)

Final Energy Demand

Singapore's final energy demand totalled 401 PJ in 2022, 0.2% higher than 2021 levels. Electricity, which constituted the largest portion of the economy's final energy demand, grew by 2.6%. Oil demand decreased by 1.8%, primarily due to the decline in motor gasoline and diesel demand in the transport sector, although the industry, commercial and residential sectors each recorded positive growths in their oil demands. The demand for gas also decreased due to declines in its consumption in both the industry and residential sectors.

Figure 6: Singapore's final energy demand by fuel (PJ), 2000 to 2022

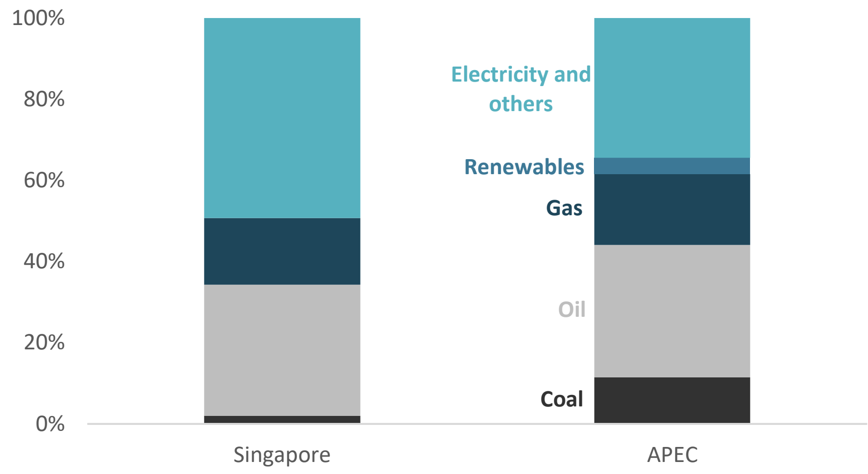


Source: EGEDA (2024)

Note: does not include non-energy sector consumption of energy products

Singapore's electricity share was significantly higher than the APEC average, given that 100% access to electricity has been achieved in the economy (Figure 7). The oil share of Singapore is identical to that of APEC, while APEC's gas share was slightly higher than that of Singapore.

Figure 7: Final energy demand fuel share, Singapore and APEC, 2022



Source: EGEDA (2024)

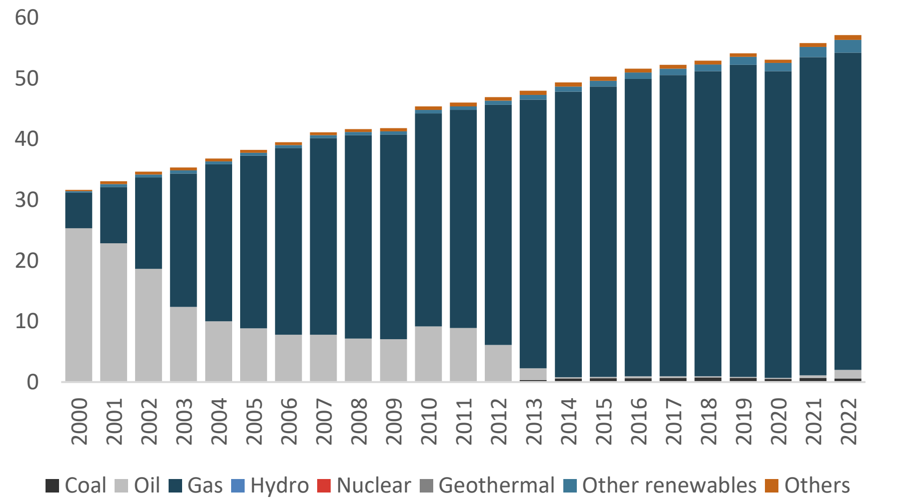
Transformation

Power Sector

Singapore's electricity generation grew by more than 2.0% from 2021 levels, reaching 57 113.7 GWh in 2022 (Figure 8). Natural gas, which accounted for 92% of the total electricity generation, registered a marginal decline. Likewise, coal utilisation in the power sector also decreased, though at a greater rate than natural gas. Comparatively, electricity generation from oil more than tripled in 2022. Parallel to Singapore's electricity generation increase, peak demand grew from 7725 MW in October 2021 to 7789 MW in May 2022.

Total electricity generation capacity amounted to 12 756 MW in 2022, up by 4.8% in the previous year. This increase was primarily due to the significant growth of solar and waste-to-energy capacities of 146 MWac (or 190 MWp, representing a 30% increase) and 136 MW (over 53% increase) respectively. The additional 136 MW of waste-to-energy capacity was from the new TuasOne plant, which is Singapore's sixth plant of its kind and is the most efficient to date. The plant is capable of combusting about 3600 tonnes of waste which can generate electricity of 120 MW per day, sufficient for powering 240 000 four-room Housing Board flats.

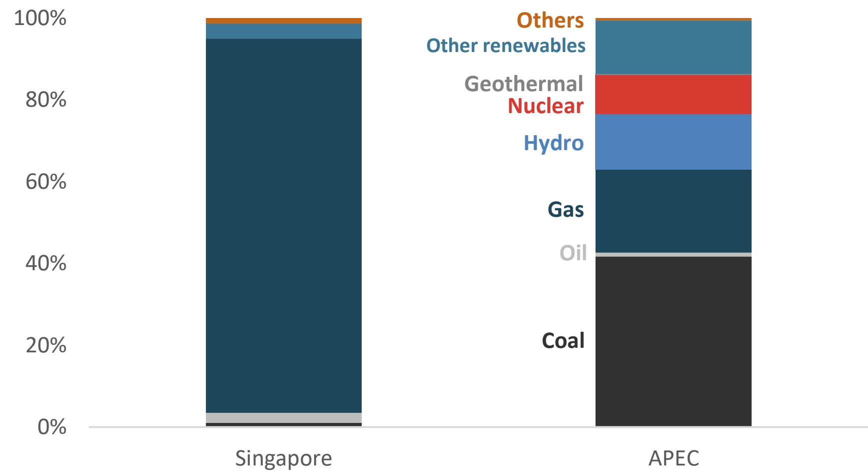
Figure 8: Singapore's electricity generation by fuel (TWh), 2000 to 2022



Source: EGEDA (2024)

The prevalence of natural gas in Singapore's electricity generation fuel share placed it well above APEC in terms of gas share in 2022 (Figure 9). Conversely, Singapore had proportionally less electricity generation from coal and renewables compared to APEC.

Figure 9: Electricity generation fuel share, Singapore and APEC, 2022



Source: EGEDA (2024)

Refining

Despite lacking domestic resources, Singapore is a major global hub for petroleum refining and petrochemicals. Currently, Singapore has three main oil refineries, located in Jurong Island, producing a total of 1482 million barrels per day, the highest in the Southeast Asia region. These are operated by Shell, Exxon Mobil Corp and Singapore Refinery Co (SRC), a joint venture between Chevron and Singapore Petroleum Co.

Singapore's refining sector contracted in 2022 from 2021 levels. Crude oil and NGLs throughput decreased by 2.0% while refinery feedstocks' input decreased significantly by 28% during the same period. Output of certain petroleum products registered growth due to a surge in demand for transport fuels (motor gasoline, diesel, jet fuels) as travel restrictions were lifted following the recovery from the COVID-19 pandemic.

On the other hand, output of petrochemicals fell in 2022 from 2021 levels, due to various factors, including weak external demand, petrochemical overcapacity and high feedstock cost.

To ease the burden faced by refiners and petrochemical companies due to the economy's carbon tax, Singapore is offering rebates of up to 76% for its planned carbon tax in 2024 and 2025. Under the tax, set at 25 SGD per tonne of CO_2 emitted, refiners and petrochemical companies would incur an additional cost of 0.80-1.00 SGD per barrel of crude oil input, according to Facts Global Energy (FGE) and Wood Mackenzie. The rebates will provide a substantial buffer for companies' profit margins, amid competition with other petrochemical giants in China and the Middle East.

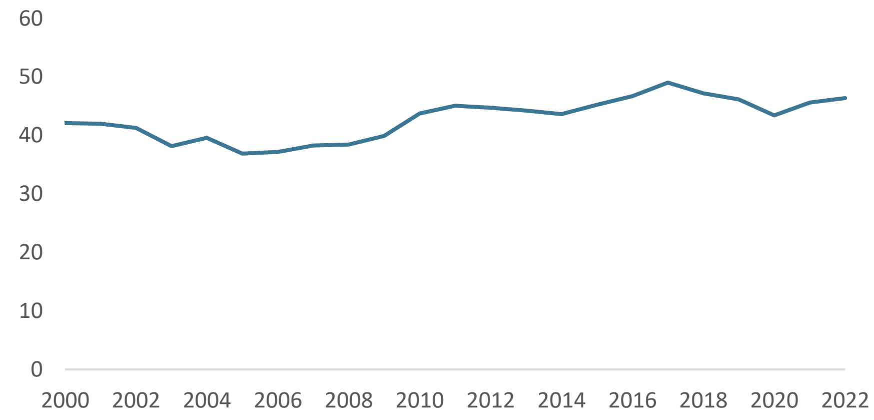
Energy Transition

Emissions

Singapore's CO_2 emissions totalled 46 million tonnes in 2022, up by 1.6% from the previous year (Figure 10). Emissions from coal and gas decreased by over 10% and 2.0% respectively, while emissions from oil increased by almost 7.0%. By sector, emissions from the power sector increased by almost 3.0%, while the industry and transport sectors recorded declines of almost 1.0% and 2.0%, respectively.

Given that the power sector is the main contributor to Singapore's CO_2 emissions, the economy is now exploring possible pathways for power sector carbon capture and storage (CCS) to meet the economy's net zero emissions goal. Recently, the Energy Market Authority (EMA) has issued a grant call to utilities and industry partners to co-fund and conduct feasibility studies for the power sector. The grant call will cover studies on carbon capture for combined cycle gas turbines (CCGTs) after combustion, and carbon capture to produce hydrogen before combustion. Both studies will also involve storing CO_2 in underground storage sites.

Figure 10: Singapore's CO_2 combustion emissions (million tonnes), 2000 to 2022



Source: EGEDA (2024)

In addition, a CCS project is being developed by Singapore to aggregate CO_2 emissions on Jurong Island for overseas storage, with Phase 1 slated to begin in 2030. If feasible, this could allow for future phases of the cross-border CCS project in Jurong Island.

Energy Security

Singapore is a net energy-importing economy, and thus energy security is a critical component for securing a stable energy supply while aiming to achieve net zero emissions goals. Gas is expected to continue being a vital commodity for addressing potential energy shortages and volatility in electricity prices in Singapore.

As Singapore gears up to develop its second LNG terminal by 2030, several agreements have been signed between Singapore LNG

Corporation (SLNG) and various partners such as Mitsui O.S.K Lines Ltd (MOL) group and Jurong Port Pte Ltd, indicating that the project has moved to the execution phase. Under the agreements, the new terminal will be located at Jurong Port where the floating storage and regasification unit (FSRU) will be permanently moored. The FSRU unit is expected to have a storage capacity of 7.1 million cubic feet and a regasification capacity of up to 5 million tonnes per annum (MTPA). The FSRU will be integrated with onshore connection infrastructure and subsequently connected to Singapore's gas transmission network.

Regarding electricity imports, Singapore has recently updated its low-carbon electricity import target from 4GW to 6GW by 2035, to meet one-third of Singapore's future energy needs. To further support the 6GW target, to date, Singapore has awarded a total of 7.35GW of conditional approvals and conditional licences to the region. Most recently, Sun Cable was granted conditional approval to import 1.75 GW of low-carbon electricity from Australia. The electricity is expected to be sourced from a solar farm in the Northern Territory, and transmitted to Singapore over a subsea cable of approximately 4300 km. Singapore has also earlier granted conditional licences for import projects comprising 2.0 GW of electricity from Indonesia, and conditional approvals for imports of 1.4 GW from Indonesia, 1 GW from Cambodia and 1.2 GW from Viet Nam.

APEC Energy Goals

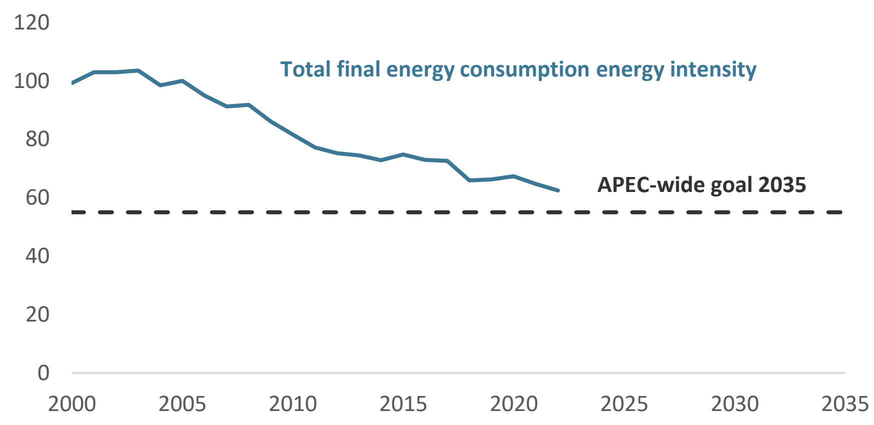
There are two energy-related objectives that APEC member economies have agreed to meet as a collective: to improve energy intensity and double the share of modern renewables.

Energy Intensity Goal

In 2011, APEC member economies agreed to increase their ambition to reduce energy intensity by 45% by 2035, relative to a 2005 baseline. The original goal was a 25% improvement by 2030, relative to a 2005 baseline.

APEC is on track to achieve this energy intensity improvement. The goal does not impose individual economy targets, but it is possible to track the progress of individual APEC economies relative to the overarching proportional improvement.

Figure 11: Singapore's total final energy consumption intensity index, 2000 to 2022 (2005 = 100)



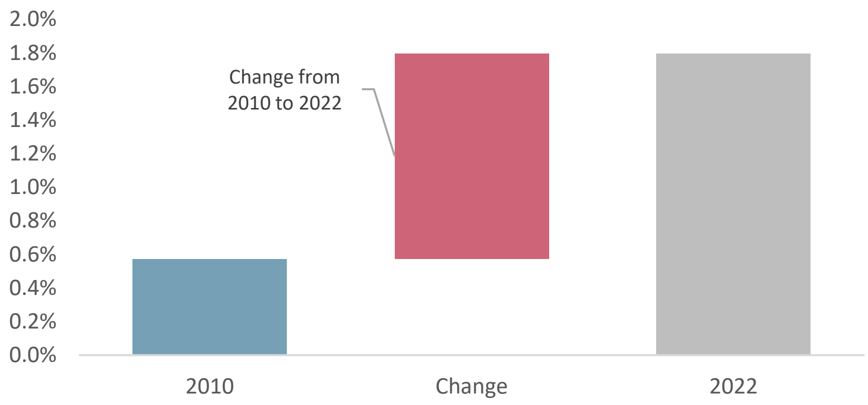
Source: EGEDA (2024)

Singapore's energy intensity continued to decrease by over 3.0% in 2022 from 2021 levels, as its GDP grew by almost 4.0% with only a marginal growth in its overall energy demand (Figure 11). From 2005 levels, Singapore has reduced its energy intensity by 38% in 2022 and appears to be on course to achieve the APEC energy intensity goal ahead of schedule.

Doubling of Renewables

The second energy goal involves doubling the share of modern renewables in the APEC energy mix for the period 2010 to 2030. Again, there is no economy-level goal for individual member economies, but improvements by individual economies will contribute to the doubling goal.

Figure 12: Singapore's modern renewable energy share, 2010 and 2022

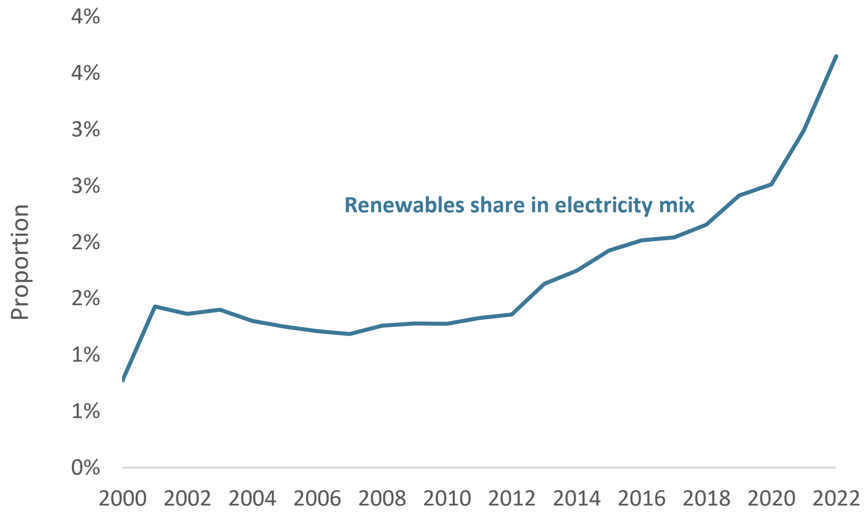


Source: EGEDA (2024)

Note: Biomass used in the residential and commercial sectors is assumed to be traditional biomass and is not included in the definition of modern renewables. All other renewables (biomass used by industry, hydro, geothermal, etc.) are considered modern renewables. Modern renewables also include the share of electricity that is generated from renewable sources.

Singapore had a very low share of modern renewables within its energy mix in 2010, given the prevalence of fossil fuels in its supply mix. The low renewable energy share in the economy is primarily due to its small size and dense urban landscape, which present significant challenges to the adoption of conventional variable wind and solar renewables at scale. Beyond land constraints, Singapore faces limitations in the viability of many alternative energy options, with solar being the only viable form of renewable energy.

Figure 13: Singapore's renewable generation share, 2000 to 2022



Source: EGEDA (2024)

Renewables accounted for 4.0% of Singapore's total electricity mix in 2022, a significant jump from 2021 levels (Figure 13). This was driven by new installations of solar and waste-to-energy power plants, which contributed to the increase in electricity generation from solar and waste. Singapore is continuing to steadily scale up its solar capacity targets in both economy-wide and housing unit targets throughout the current decade.

Energy Policy

Energy Policy	Details	Reference
Singapore Carbon Tax	The carbon tax will be raised to SGD 25 per tonne of CO_2 equivalent in 2024 and 2025, and SGD 45 per tonne of CO_2 equivalent in 2026 and 2027, with a view to reaching SGD 50–80 per tonne of CO2e by 2030.	National Climate Change Secretariat (2023)
National Hydrogen Strategy	In October 2022, Singapore announced a National Hydrogen Strategy to develop hydrogen as a major decarbonisation pathway to support the transition towards net zero emissions by 2050. Depending on technological developments and the development of other energy sources, hydrogen could supply up to half of Singapore's power needs by 2050. The five key thrusts are: • Experimenting with advanced hydrogen technologies that are commercially ready. • Investment in research and development. • Collaboration with international partners to establish a hydrogen supply chain. • Undertaking long-term land and infrastructure planning, and supporting workforce training and development.	Ministry of Trade and Industry (2022)
Nationally Determined Contribution (NDC)	Singapore's second update of its first NDC mentions the aim of reducing emissions to around 60 million tonnes of CO_2 equivalent in 2030, following an earlier peak.	National Climate Change Secretariat (2022)
Long-Term Low Emissions Development Strategy (LEDS)	Singapore strengthened its long-term LEDS to a commitment to achieve net zero emissions by 2050.	National Climate Change Secretariat (2022)
Singapore Green Building Masterplan (SGBMP), 4th edition	Serving as a roadmap to decarbonise Singapore's buildings, the SGBMP aims to achieve an '80-80-80' target by 2030: • 80% of the buildings by gross floor area to be green by 2030. • 80% of new developments to be Super Low Energy, and 80% improvement in energy efficiency, relative to 2005 levels, for best-in-class buildings by 2030.	Building and Construction Authority (2022)
Electric Vehicles Vision	Singapore aims to reduce peak emissions from land transport by 80% by or around mid-century, primarily through the electrification of vehicles: • Every Housing & Development Board (HBD) town to be an EV-ready town by 2025. • Replacement of 400 diesel buses with electric buses by 2025. • 60 000 EV charging points by 2030.	Land Transport Authority (2023)

	• Half of Singapore's public buses and taxi fleet to be electrified by 2030. 100% of vehicles to run on cleaner energy by 2040.	
Emissions Standards for Power Generation Units	EMA is placing emission standards for new and repowered fossil fuel-fired power generation units to facilitate the deployment of clean and efficient power generation units in Singapore. Under the new two-tier emission standards, generation units which are expected to run regularly will need to meet the Tier 1 standard (within 0.355 tCO_2e/ MWh emission intensity limit). Generation units that run only periodically can opt to fall under the Tier 2 standard. Under this standard, EMA will also require both Tier 1 and Tier 2 units to be at least 30% hydrogen-ready by volume, with the ability to be retrofitted to become 100% hydrogen-ready in future.	Energy Market Authority (2023)
Green Efforts in Schools	Singapore aims to: • Achieve a two-thirds reduction of net carbon emissions from the school's sector. • Achieve the goal of making 20% of schools carbon-neutral.	Singapore Green Plan 2030 (2021)
Green Energy	Singapore aims to: Deploy at least 2.0 GWp of solar energy, capable of generating electricity for 350 000 households, by 2030.	Singapore Green Plan 2030 (2021)
Greener Infrastructure and Buildings	Singapore aims to: • Decrease energy consumption of the reverse osmosis (RO) desalination process from 3.5 kWh/m^3 (current) to 2.0 kWh/m^3 by 2025, and further to 1.0 kWh/m^3 by 2030. • Make Tuas Nexus, the economy's first integrated waste and used water treatment facility, 100% energy self-sufficient by 2025. • Green 80% of its buildings (by gross floor area) by 2030. • Ensure that 80% of new buildings, by gross floor area, are super low-energy buildings from 2030. Implement an 80% improvement in the energy efficiency of best-in-class green buildings by 2030 from 2005 levels.	Singapore Green Plan 2030 (2021)
Sustainable Towns and Districts	Singapore aims to reduce energy consumption in existing Housing & Development Board (HDB) towns by 15% by 2030.	Singapore Green Plan 2030 (2021)
Sustainable Aviation	Singapore aims to: • Have electrified new airside light vehicles, forklifts, and tractors at Changi Airport from 2025. Have all airside vehicles running on cleaner energy at Changi Airport by 2040.	Singapore Green Plan 2030 (2021)

Sustainable Maritime	Singapore aims to: Have all new harbour craft operating in port waters powered by electricity, B100 biofuels and other net zero fuels from 2030.	Singapore Green Plan 2030 (2021)
SolarNova Programme	Targeting 540 MWp of solar on HDB housing blocks by 2030.	Housing & Development Board (2022)
Adjusted Early Turnover Scheme (ETS)	ETS provides an incentive to deregister older, more polluting vehicles and replace them with newer, less emitting models. The incentive comes in the form of a discounted certificate of entitlement on the registration of the new vehicle. Under the adjusted ETS, existing Euro II, III and IV Category C diesel vehicles are eligible for the ETS incentive. This scheme will run from 1 April 2023 to 31 March 2025.	Land Transport Authority (2023)

Notable Energy Developments

Energy development	Details	Reference
New Electricity Generation Capacity	The EMA has awarded PacificLight Power Pte Ltd (PLP) the right to build, own, and operate a new hydrogen-ready CCGT generating unit. The generating unit capacity is expected to be at least 600 MW and will be ready to commence operations in 2029. This follows a Request for Proposal launched under EMA's Centralised Process for new generation capacity in June 2024 to ensure sufficient power generation capacity to meet Singapore's future electricity demand.	Energy Market Authority (2025)
Energy Storage Systems	The EMA has awarded grants totalling SGD 7.8 million to two companies to explore solutions that could enhance cost-effectiveness and optimise the space required for energy storage systems (ESS). The two research and development projects will comprise a trial on the use of sodium-ion batteries in ESS and a study on the potential for locating ESS underground.	Energy Market Authority (2024)

Electricity Imports from Australia	The EMA has granted Conditional Approval to Sun Cable (Singapore) Assets Pte Ltd to import 1.75 GW of low-carbon electricity from Australia into Singapore. The imported electricity is expected to harness solar power from Australia's Northern Territory, which will be transmitted to Singapore via new subsea cables over approximately 4300km.	Energy Market Authority (2024)
Carbon Capture and Storage	The EMA has issued a grant call to power generation companies and industry partners to co-fund and conduct site-specific CCS feasibility studies for the power sector. The grant call will cover studies pertaining to a) post-combustion carbon capture for CCGTs, and b) pre-combustion carbon capture to produce hydrogen for power generation.	Energy Market Authority (2024)
Lao PDR-Thailand-Malaysia-Singapore (LTMS) Power Integration Project Phase 2	Singapore will double its power import capacity from 100 MW to 200 MW through Phase 2 of the LTMS Power Integration Project which is the first multilateral and multidirectional electricity trading project in the region. To support Phase 2, EMA has granted an extension of Keppel's electricity importer licence until 2026.	Energy Market Authority (2024)

Useful Links

Building and Construction Authority – https://www1.bca.gov.sg/

Department of Statistics Singapore – https://www.singstat.gov.sg

Economic Development Board – https://www.edb.gov.sg/

Energy Efficiency Programme Office – www.e2singapore.gov.sg/

Energy Market Authority – https://www.ema.gov.sg

Housing & Development Board – https://www.hdb.gov.sg/cs/infoweb/homepage

Land Transport Authority – https://www.lta.gov.sg

Ministry of National Development – https://www.mnd.gov.sg/

Ministry of the Environment and Water Resources – https://www.mewr.gov.sg

Ministry of Trade and Industry – https://www.mti.gov.sg

National Environment Agency – https://www.nea.gov.sg

National Climate Change Secretariat – https://www.nccs.gov.sg/

Public Utilities Board – https://www.pub.gov.sg/

Singapore Department of Statistics – https://www.singstat.gov.sg/

Singapore LNG Corporation (SLNG) – https://www.slng.com.sg/website/index.aspx

Solar Energy Research Institute of Singapore (SERIS) – www.seris.nus.edu.sg/

Temasek Holdings – https://www.temasekholdings.com.sg

Chinese Taipei

Introduction

Chinese Taipei is an archipelago comprising Taiwan, Penghu, Kinmen, and Matsu, located off China's southeast coast and Japan's southwest coast. Its GDP in 2022 reached 1509 billion (2021 USD purchasing power parity (PPP)), a 2.6% increase from the 2021 level. The population in 2022 remained at 23 million, but it is expected that there will be a decreasing trend in population in the coming decades. In addition, Chinese Taipei's GDP per capita continued at a high level relative to the APEC region, at USD 64 729 PPP in 2022.

Chinese Taipei has limited energy reserves. According to data from the CIA's World Factbook, Chinese Taipei holds only 1 million tonnes of proved coal reserves, 2.4 million barrels of proved oil reserves, and 6.2 billion cubic metres of proved gas reserves. While there is crude oil and natural gas production, it is limited. As a result, the economy heavily relies on energy imports.

In March 2022, Chinese Taipei proposed a policy framework for achieving net-zero emissions by 2050, replacing its previous target of reducing GHG net emissions to 50% of the 2005 level. Twelve key strategies were introduced, including strategies for renewables, hydrogen, CCUS, and energy storage. In December 2022, the Phased Goals and Actions Towards Net-Zero Transition set targets for 2030: 27-30% renewables, 50% gas-fired, and 20% coal-fired power generation; and for 2050: 60-70% renewables, 9-12% hydrogen, and 20-27% thermal power with CCUS. The updated NDC strengthened reduction targets to 23-25% below 2005 levels by 2030.

In February 2023, the Greenhouse Gas Reduction and Management Act was amended as the Climate Change Response Act. The revised act included a binding 2050 net-zero emissions target (Article 4), defined roles among government entities (Article 8), and implemented a carbon fee mechanism (Article 28), the establishment of the GHG Management Fund (Article 32), and transition action programs (Article 46). The "Fee-Charging Rates of Carbon Fees" were announced in October 2024 and took effect on 1 January 2025. The standard carbon fee rate is set at TWD 300 (USD 9.3) per tonne, with preferential rates of TWD 50 (USD 1.6) and TWD 100 (USD 3.0). The year 2025 will serve as a trial period, with formal implementation beginning in 2026. Energy-related legislative updates, including amendments to the Renewable Energy Development Act and Energy Administration Act, were also introduced to support the energy transition.

Table 1: Chinese Taipei's macroeconomic data and energy reserves

Key data [a]		**Energy reserves** [b]	
Area (thousand km^2)	36.2	Oil (million barrels)	2.4
Population (million)	23	Gas (billion cubic meters)	6.2
GDP (2021 USD billion PPP)	1 510	Coal (million tonnes)	1
GDP per capita (2021 USD PPP)	64 729	Uranium (kilotonnes U < USD 130/kgU)	---

Source: a IMF (2024); b CIA (2024)

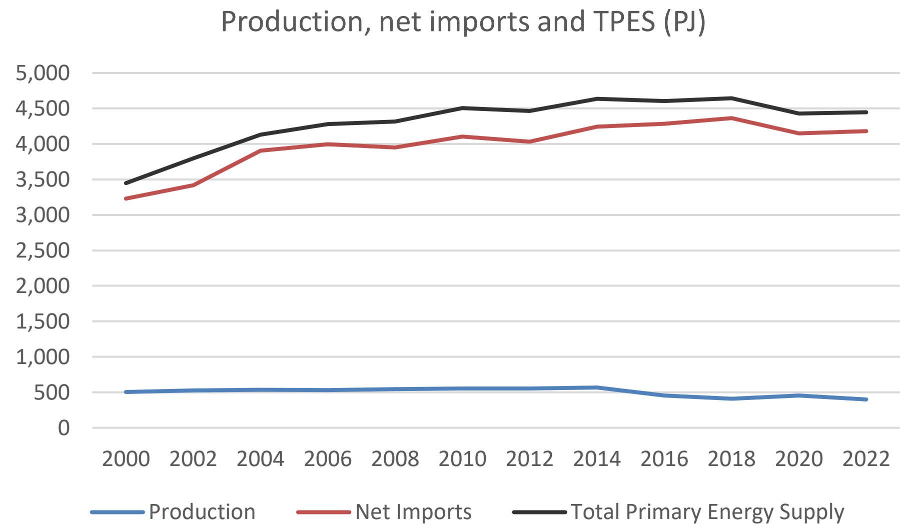
Note: Reserves are total proved reserves and reasonably assured recoverable resources for uranium.

Energy Supply and Consumption

Total Primary Energy Supply

The total primary energy supply (TPES) in Chinese Taipei dropped by 3.4% to 4435 PJ in 2022 (Figure 1). This decrease resulted from declines in coal (-5.7%) and oil (-4.9%), while gas increased by 3.6%, comprising 35%, 33%, and 23% of TPES in 2022, respectively. In addition, renewable energy increased by 23% between 2021 and 2022, comprising 2% of TPES in 2022, while oil in TPES continued its downward trend, decreasing by 4.9% in 2022, with a relatively low compound annual growth from 2000 to 2022 (-0.3%).

Figure 1: Chinese Taipei's energy supply, production, and net imports (PJ), 2000 to 2022

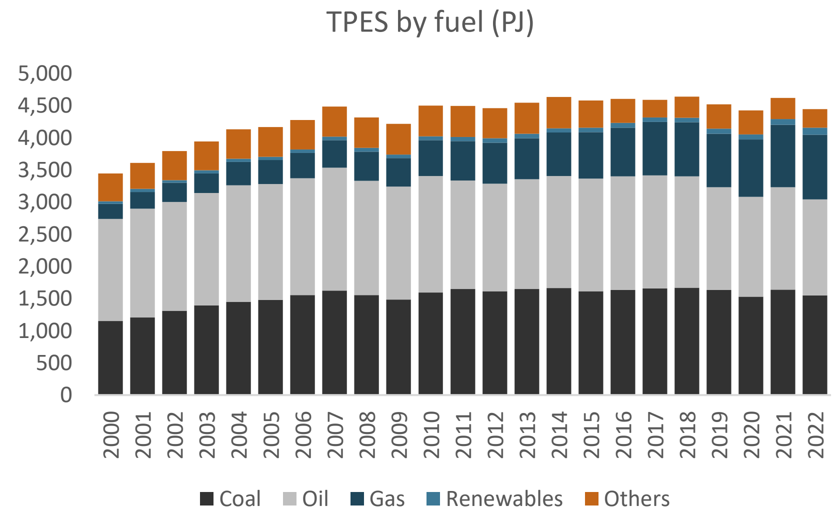


Source: EGEDA (2024)

Chinese Taipei is heavily dependent on foreign energy supplies. In 2022, net imports accounted for more than 90% of TPES but decreased by 3.9% (from the 2021 level) (Figure 1).

Oil and coal account for the majority of Chinese Taipei's energy supply, with a total of 3030 PJ (68% of TPES) in 2022. Coal is mainly used for power generation, and the oil supply is mainly used as a feedstock for the economy's fuel refineries. Gas supply, which is mainly used for power generation and industrial processes, has consistently grown for the last two decades, and increased by 6.8% to 1008 PJ in 2022 (Figure 2).

Figure 2: Chinese Taipei's energy supply by fuel (PJ), 2000 to 2022

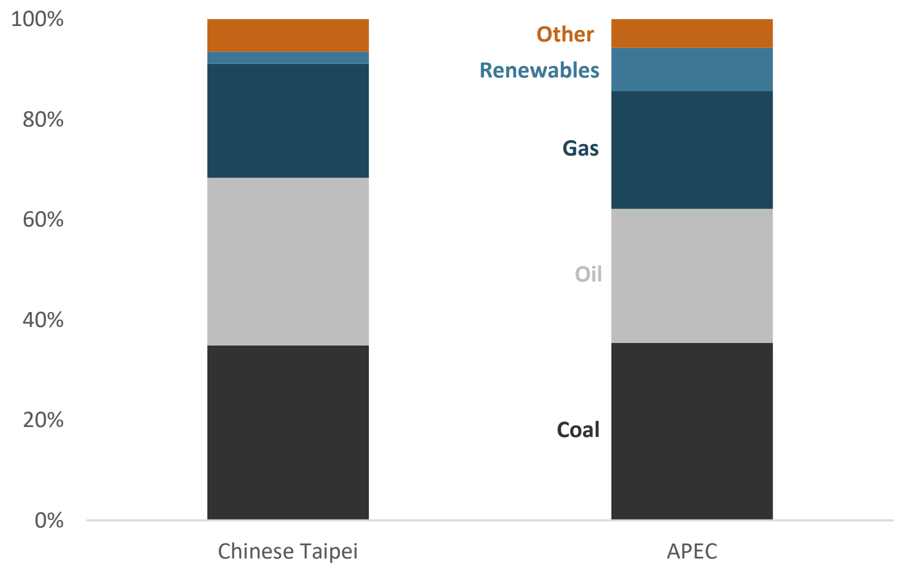


Source: EGEDA (2024)

To achieve its energy transition targets, Chinese Taipei has actively promoted renewable energy in recent years. This effort has driven a notable upward trend in renewables: the share of renewables in TPES grew by 23% from 2021 to 2022, reaching 108 PJ, primarily due to substantial increases in solar and wind energy. Geothermal energy generation rose significantly from 9 GWh in 2021 to 25 GWh in 2022, reflecting substantial percentage growth from a low starting base.

Regarding the percentage shares, compared to the aggregate APEC TPES, the Chinese Taipei TPES contains a higher share of oil and coal, but a lower share of renewable energy than the APEC region.

Figure 3: Energy supply mix, Chinese Taipei and APEC, 2022

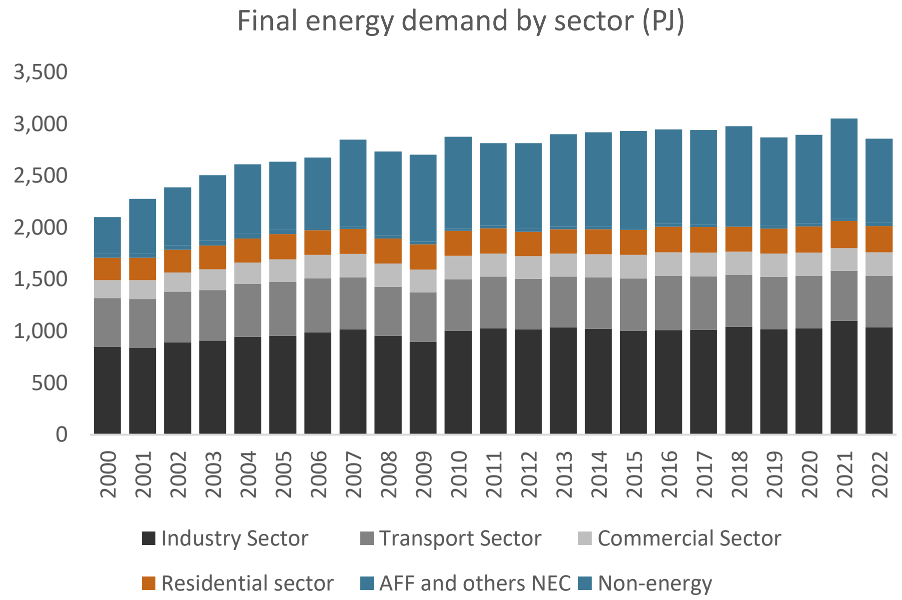


Source: EGEDA (2024)

Total Final Consumption

Total final consumption (non-energy included) in Chinese Taipei in 2022 was 2876.7 PJ, which was 6.3% lower than the 2021 level (Figure 4). The drop can be attributed to the decrease in demand by the non-energy sector in 2022. This represented the first decline in the past three years.

Figure 4: Chinese Taipei's final consumption by sector (PJ), 2000 to 2022



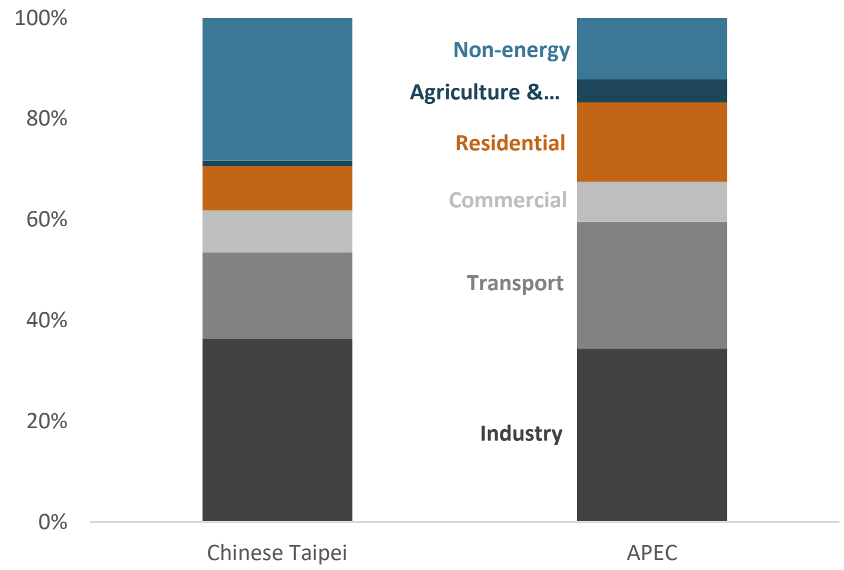
Source: EGEDA (2024)

The industrial sector, the largest energy-consuming sector, decreased by 5.5% in 2022, with a 36% share in total final consumption in 2022. It is worth noting that the machinery sector mainly comprises electrical and electronic machinery, leading to higher electricity demand in the industrial sector. In 2022, Chinese Taipei's transport sector slightly increased by 2.4% to 495 PJ and accounted for a 17.2% share of TFC.

In 2022, the share of the non-energy sector in TFC in Chinese Taipei (around 28%) remained much greater than the whole of APEC (12%). This reflects the extensive use of petroleum products as feedstock for

Chinese Taipei's refining and petrochemical industry. In contrast, with the exception of the industry sector, the shares of the other sectors (transportation, buildings, agriculture, and others) were all less than the APEC region (Figure 5).

Figure 5: Final consumption by sector, Chinese Taipei and APEC, 2022



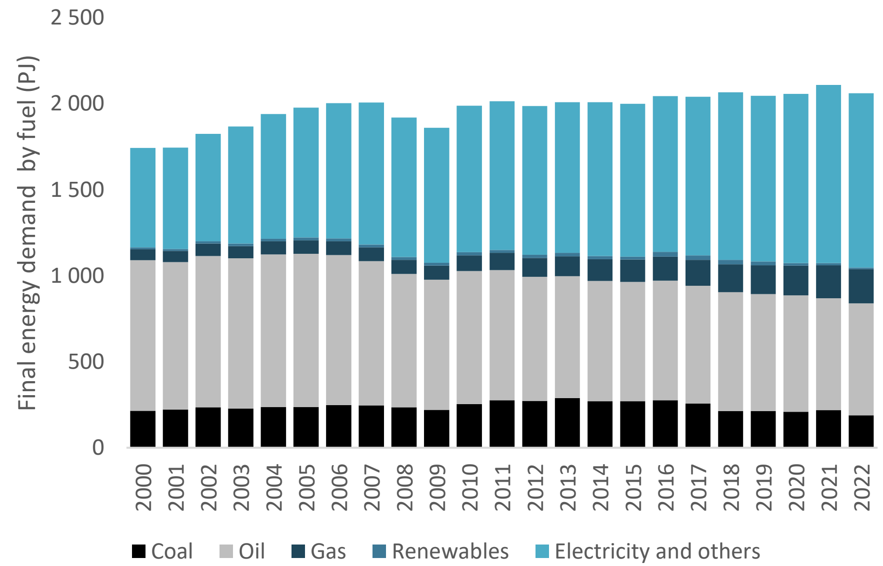
Source: EGEDA (2024)

Final Energy Demand

Total final energy consumption (TFEC) (non-energy excluded) in Chinese Taipei in 2022 was 2062 PJ, slightly lower than the 2021 level. There were decreases in coal, oil, renewables, and electricity and others, while gas and renewable electricity both increased (Figure 6).

From 2010 to 2022, the compound annual growth rate (CAGR) of TFEC was 0.3%. Although the CAGR of coal (-2.4%), oil (-1.4%) and renewables (-4.2%) were all negative, these falls were offset by the positive CAGR of gas (6.7%) and electricity (1.5%). The strong growth trend in gas was mainly due to contributions from the industrial sector, while the moderate growth trend in electricity and others resulted from the industrial and residential sectors.

Figure 6: Chinese Taipei's final energy demand by fuel (PJ), 2000 to 2022

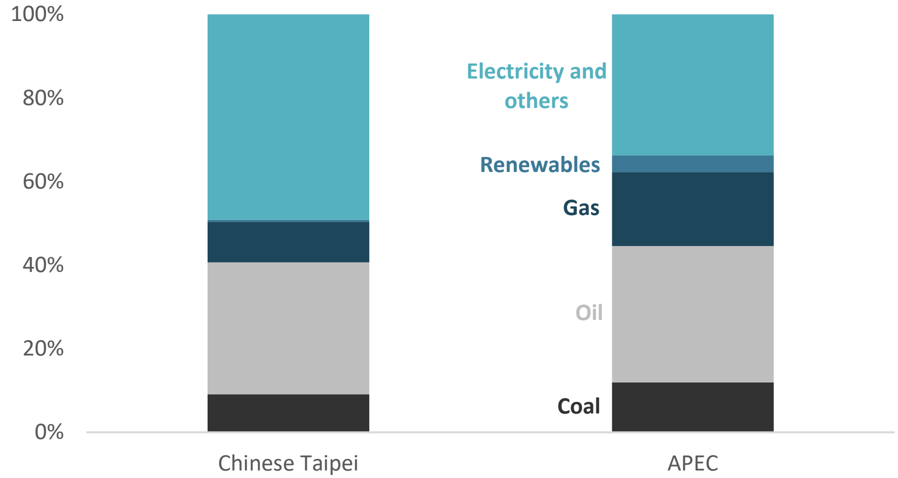


Source: EGEDA (2024)

Note: does not include non-energy sector consumption of energy products

In 2022, electricity and others accounted for around half of TFEC (49.1%) in Chinese Taipei, greater than most APEC economies except for Hong Kong, China. The relatively high share of electricity and others in TFEC was mainly due to the higher electrification rate of the industry and building sectors, especially regarding electrical and electronic machinery. The share of oil in TFEC was 31.6%, which was slightly less than the whole of APEC. The share of oil in TFEC was mainly driven by the transport sector, and it is expected to decrease with the rise of electric vehicle (EV) adoption (Figure 7).

Figure 7: Final energy demand fuel share, Chinese Taipei and APEC, 2022



Source: EGEDA (2024)

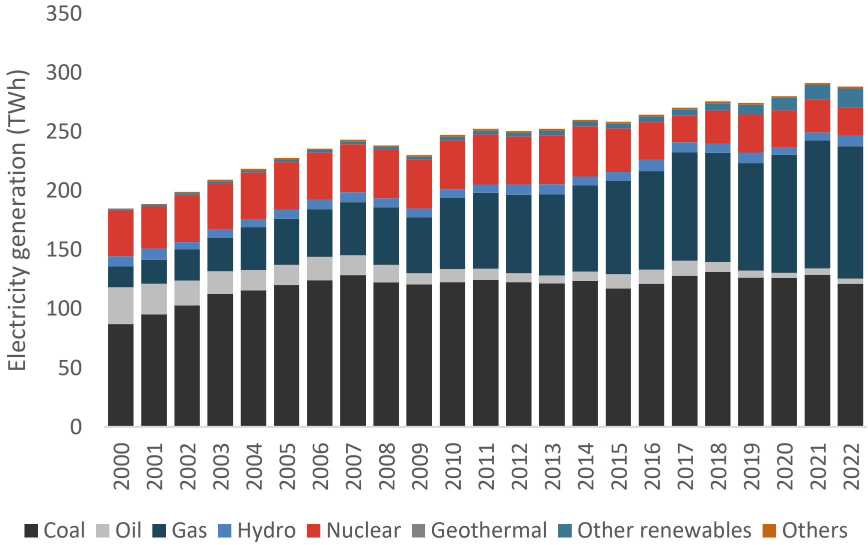
Transformation

Power Sector

Chinese Taipei's electricity generation was 288 TWh in 2022, 1% lower than in 2021 (Figure 8). The electricity generation mix in Chinese Taipei was dominated by fossil fuel power plants (coal, gas, and oil), with a share of more than 82% in 2022. Among fossil fuel power plants, coal accounted for the largest share, accounting for 42% of electricity generation, followed by gas (39%) and then oil (1.5%) in 2022.

From 2010 to 2022, the CAGR of the electricity generated by nuclear (-4.6%), oil (-7.4%), and coal (-0.1%) was negative, while electricity generated by renewables (7.8%), gas (5.3%), and hydro (1.7%) was positive. It is worth noting that nuclear power dropped 4.6% between 2010 and 2022, reflecting the decommissioning of Chinese Taipei's current nuclear power plants. According to the CAGR of electricity generation, Chinese Taipei has transitioned to more gas and renewables and reduced the amount of electricity generated by oil and nuclear during the past decade.

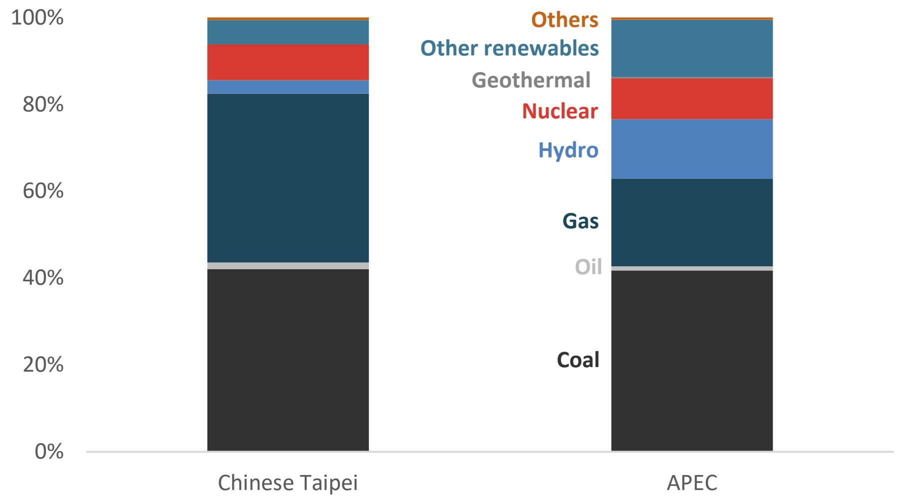
Figure 8: Chinese Taipei's electricity generation by fuel, 2000 to 2022



Source: EGEDA (2024)

In 2022, coal accounted for 42% of Chinese Taipei's electricity generation, mirroring the broader APEC level (Figure 9). Notably, the share of gas-fired electricity generation in Chinese Taipei was much higher than the overall APEC economy. This percentage is anticipated to rise further, aligning with Chinese Taipei's ambitious energy transition policy, where gas-fired generators are considered a viable option for reducing GHG emissions compared to coal-fired generation.

Figure 9: Electricity generation fuel share, Chinese Taipei and APEC, 2022



Source: EGEDA (2024)

Refining

The refining market in Chinese Taipei is an oligopoly dominated by two companies, CPC and FPCC (Formosa Petrochemical Corp. Company). CPC is a public-owned enterprise primarily focused on gasoline and diesel production and tasked mainly with meeting domestic oil demands. FPCC, on the other hand, specialises in producing petrochemical products, with an emphasis on exporting petrochemical products, gasoline and diesel.

Currently, three refineries are operating in Chinese Taipei: CPC Taoyuan Refinery (200 kb/day), CPC Dalian Refinery (400 kb/day), and FPCC Mailiao Refinery (540 kb/day); total capacity is currently 1140 kb/day. CPC Dalian Refinery and FPCC Mailiao Refinery are highly integrated with petrochemical production.

However, due to China's cancellation of tariff preferences on petrochemical products under the Cross-Straits Economic Cooperation Framework Agreement, the short-term refining market in Chinese Taipei is expected to be sluggish. With the massive adoption of EVs for the coming decades, based on the net-zero policy, Chinese Taipei’s refineries may respond by developing high-quality petrochemical production lines.

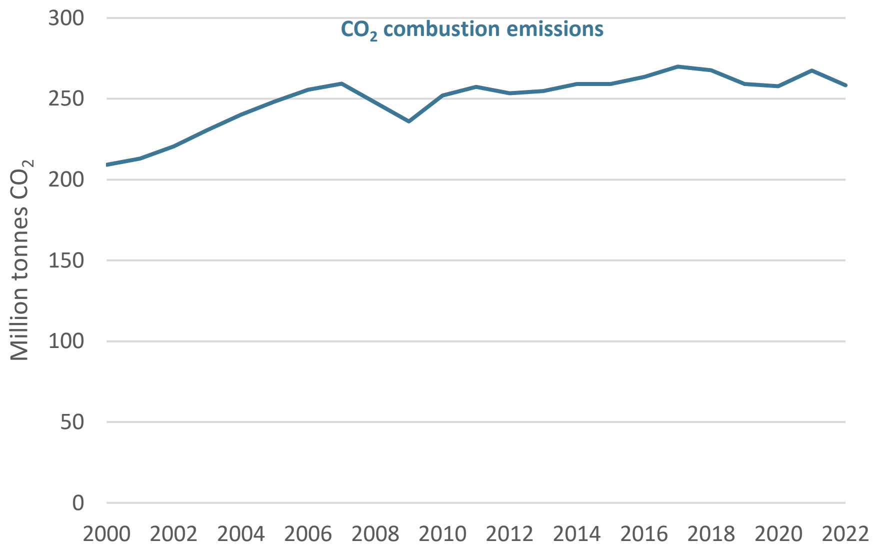
Energy Transition

To stabilise the power supply, improve air quality, and create a nuclear-free homeland, Chinese Taipei aims to achieve 60-70% renewables, 20-27% thermal power with CCUS, 9-12% hydrogen, and 1% others in its power mix by 2050. The economy’s last nuclear power plant is expected to complete the decommissioning process in 2025. In addition, the GHG emission reduction goal was initially set to be 24±1% lower than the 2005 level by 2030 and reach the net-zero emissions goal by 2050, which is committed legally in the Climate Change Response Act.

Emissions

The CO_2 combustion emissions in Chinese Taipei decreased after 2017 but rebounded in 2021. In 2022, the emissions were 258 million tonnes of CO_2, approximately 3.4% lower than the 2021 level (Figure 10). In addition, the emissions level has exceeded 250 million tonnes of CO_2 since 2010. At the current reduction speed, it appears challenging to achieve the net-zero GHG emission goal by 2050.

Figure 10: Chinese Taipei's CO_2 combustion emissions (million tonnes), 2000 to 2022



Source: EGEDA (2024)

Energy Security

Promoting the energy transition in Chinese Taipei is driven by the goal of enhancing energy security. The strategic approach involves maximising renewable energy utilisation over the coming decades, coupled with substantial investments in grid infrastructure, demand flexibility, and electric energy storage. This is aimed at reducing dependency on imported energy and ensuring stability in the energy supply. Additionally, as part of the energy transition plan, there is an increased focus on natural gas usage. Currently, there are two LNG terminals, with plans to expand to six terminals to meet natural gas demand. These additional terminals are under construction or in the planning stage. Diversifying LNG import sources and establishing long-term LNG contracts are also seen as measures to bolster energy security and address potential energy crises.

APEC Energy Goals

There are two energy-related objectives that APEC member economies have agreed to meet as a collective: to improve energy intensity and to double the share of modern renewables.

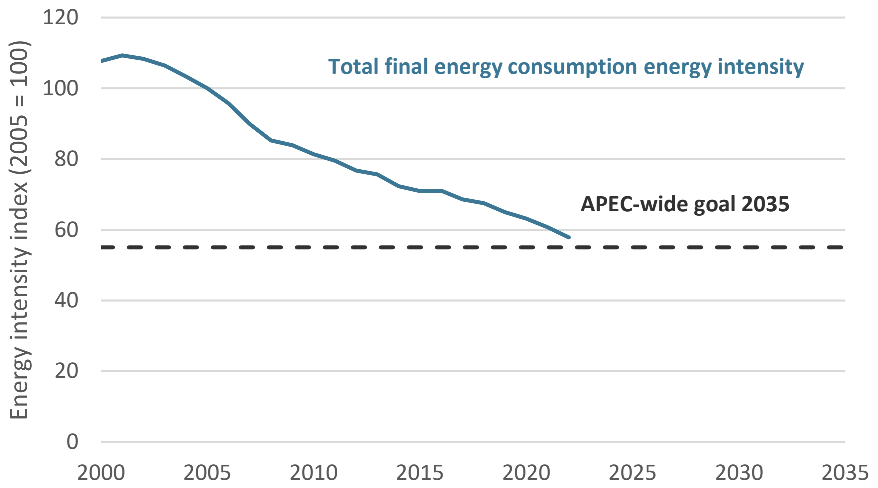
Energy Intensity Goal

In 2011, APEC member economies agreed to increase their ambition to reduce energy intensity by 45% in 2035, relative to a 2005 baseline. The original goal was a 25% improvement by 2030, relative to a 2005 baseline.

APEC is on track to achieve this energy intensity improvement. The goal does not impose individual economy targets, but it is possible to track the progress of individual APEC economies relative to the overarching proportional improvement.

In 2022, the final energy intensity of Chinese Taipei's TFEC improved by 42%, compared with the 2005 level (Figure 11). A similar energy intensity trend is also seen in energy intensity based on TPES and TFC.

Figure 11: Chinese Taipei's TFEC intensity index, 2000 to 2022 (2005 = 100)

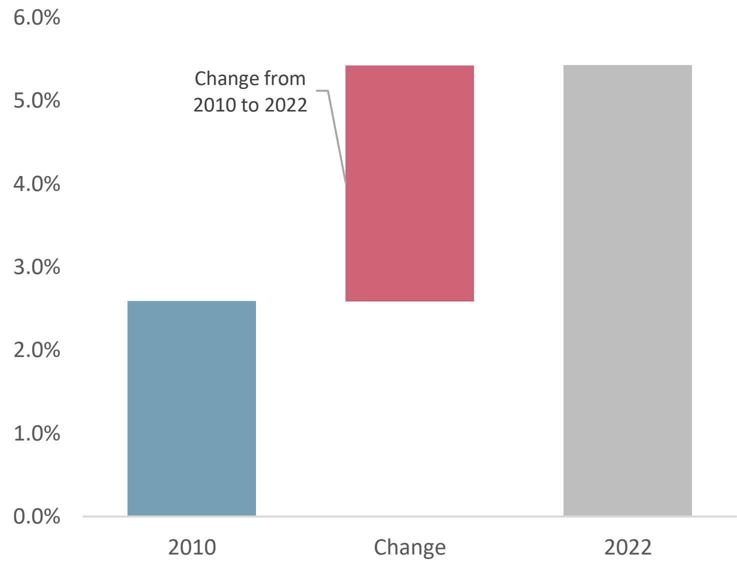


Source: EGEDA (2024)

Doubling of Renewables

The second energy goal involves doubling the share of modern renewables in the APEC energy mix for the period 2010 to 2030. There is no economy-level goal for individual member economies, but improvements by individual economies will contribute to the doubling goal.

Figure 12: Chinese Taipei's modern renewable energy share, 2010 and 2022



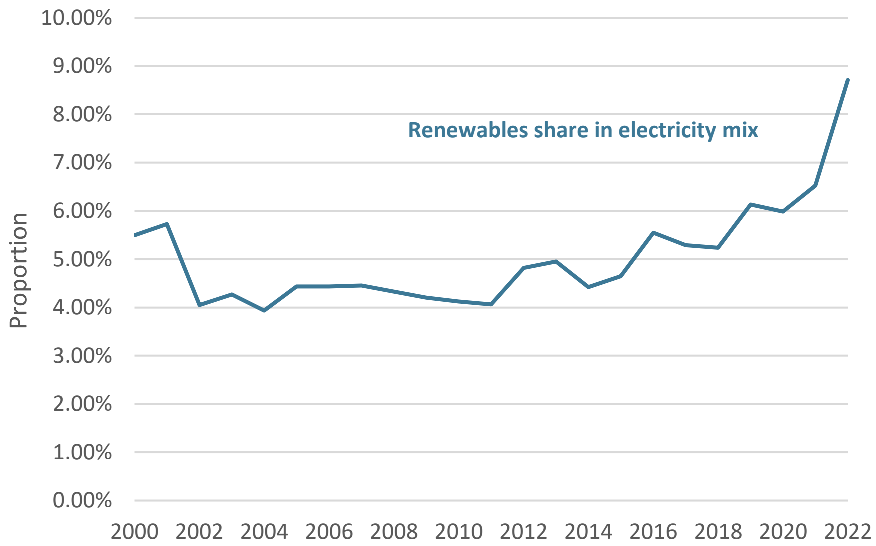
Source: EGEDA (2024)

Note: Biomass used in the residential and commercial sectors is assumed to be traditional biomass and is not included in the definition of modern renewables. All other renewables (biomass used by industry, hydro, geothermal, etc.) are considered modern renewables. Modern renewables also include the share of electricity that is generated from renewable sources.

Chinese Taipei's share of modern renewables in TFEC was 2.5% in 2010. It increased to 5.4% in 2022, representing a 78% improvement from 2010 to 2022 (Figure 12). The APEC-wide doubling goal will require the share of APEC's modern renewables to reach 12% by 2030.

The electricity generation from renewable energy in Chinese Taipei increased by 24% from 2021 to 2022, reaching a share of 9% of the total electricity generation in 2022 (Figure 13). This significant growth reflects the continued expansion of renewable energy capacity through solar and wind.

Figure 13: Chinese Taipei's renewable generation share, 2000 to 2022



Source: EGEDA (2024)

The share of renewables in electricity generation was relatively stable in the 2000s but has been slowly growing over the past decade since the adoption of the Feed-in Tariff (FIT) mechanism in 2010. It is expected that the share of renewable generation can further grow as Chinese Taipei aims to expand its share to 60-70% by 2050 (NDC, 2022).

Energy Policy

Energy Policy	Details	Reference
Regulations Governing the Collection of Carbon Fees	Regulations were announced on 29 August 2024 comprising the supporting mechanism for implementation of the carbon fee system of the Climate Change Response Act including: 1. Entities subject to carbon fees: The fee will be levied on power and manufacturing industries that emit more than 25 000 metric tonnes of carbon dioxide equivalent per year. 2. Payment timing: Starting from the year following the rate's effective date, feepayers must calculate and pay the carbon fee by the end of May each year, based on the greenhouse gas emissions from the previous year (1 January to 31 December). 3. Carbon fee calculation: The carbon fee payable is calculated by multiplying the chargeable emissions by the applicable fee rate. This mechanism provides different adjustment coefficients for industries with high carbon leakage risk. Entities with high carbon leakage risk must have and submit a self-determined reduction plan approved by the central competent authority to qualify for this mechanism. In addition, the charged emissions of such industries must not be deducted from the 25 000 metric tonnes of carbon dioxide equivalent.	Ministry of Environment [MOE] (2024)
Designated Greenhouse Gas Reduction Goals for Entities Subject to Carbon Fees Regulations for Administration of Self-Determined Reduction Plans	According to Article 29 of the Climate Change Act, entities that submit a self-determined reduction plan—including strategies such as switching to low-carbon fuels, adopting negative emission technologies, improving energy efficiency, utilising renewable energy, or enhancing industrial processes—may apply for approval of preferential rates. The regulations include: 1. Designated GHG Reduction Targets: Two methods are provided for determining designated reduction targets: one is based on the industry-specific reduction rates derived from the Science-Based Targets initiative (SBTi), and the other uses benchmarks from both domestic and international best available technology alongside the 2030 NDC. 2. Self-Determined Reduction Plan: Entities wishing to qualify for the preferential fee rate must select one of the target calculation methods, set their designated reduction targets for 2030, and submit a self-determined reduction plan for review by a team formed by the central competent authority.	Ministry of Environment [MOE] (2024)

Energy Policy	Details	Reference
	3. Performance review: The central competent authority will annually review the implementation progress of self-determined reduction plans. Entities must submit a report on the previous year's progress in the implementation of their self-determined reduction plan before the end of April each year. If entities meet progress targets, they may apply for the preferential fee rate for that year.	
Regulations for Periodic Regulatory Goals and Approaches of the Greenhouse Gas Emissions	In accordance with Article 11 of the Climate Change Response Act (formerly the Greenhouse Gas Reduction and Management Act), regulations are established for phased control targets and methods as follows. 1. Timelines and Period: Timelines for each phase are set on a five-year cycle, encompassing periods from 2016 to 2030. Each sector is required to devise action plans and submit annual progress reports. (Article 2, 3). 2. Sectoral phased control targets: Key elements and reference basis (Article 4). 3. Greenhouse gas emission control action plans: Basis for setting sectoral emission control targets (Article 5). 4. Assessment indicators: Inclusion in greenhouse gas reduction promotion plans and sectoral emission control action plans (Article 6). 5. Procedures for setting phased control targets (Articles 7 and 8). 6. Public hearing procedures and information disclosure methods for phased control targets (Article 9). 7. Review of implementation and achievement of phased control targets (Article 10).	Ministry of Environment [MOE] (2024)
Renewable Energy Development Act	Chinese Taipei has drafted amendments to the Renewable Energy Development Act, which were officially announced on 23 October 2024, for public consultation. The key points of the proposed amendments are as follows: 1. Revised definitions of biomass energy and renewable energy generation facilities, excluding waste utilisation from eligibility for incentives and subsidies (Amended Articles 3, 4, and 13). 2. New requirement for facility owners to dismantle, recycle, or take appropriate action after the expiration of a renewable energy generation licence, self-use generation registration, or facility	Ministry of Economic Affairs [MOEA] (2024)

Energy Policy	Details	Reference
	certification (Amended Article 4-1). 3. Obligation for building owners or administrators to maintain and manage solar PV facilities throughout the building's lifespan for newly constructed, expanded, or renovated buildings that meet specific conditions (Amended Article 12-1). 4. Penalties introduced for failing to dismantle, recycle, or maintain solar PV facilities as required (Amended Articles 20-2 and 20-3). 5. Relaxed land use regulations for directional wells in geothermal energy exploration and development, allowing greater heat extraction while ensuring minimal surface impact (Amended Articles 15-6 and 15-7). 6. Adjustments to the legal authorisation of renewable energy certificates and raising the regulatory authority level for the oversight of shared booster stations. (Amended Articles 3-1 and 8).	
Electricity Act	Chinese Taipei has drafted amendments to the Electricity Act, which were officially announced on 7 August 2024, for public consultation. The key points of the proposed amendments are as follows: 1. Amendment to Electricity Industry Definitions: Introduces a new category for specified electricity suppliers and defines specified electricity suppliers and energy storage facilities; revises the definition of renewable energy electricity sellers, removing the restriction that sales can only be made to end-users; aligns the definition of renewable energy generation facilities of the Renewable Energy Development Act. (Amended Article 2) 2. Removal of Restrictions on Transmission and Distribution Operators: Eliminates the restriction that transmission and distribution operators cannot engage in other electricity businesses. Requires them to implement accounting separation and revises corresponding penalties. (Amended Articles 6 and 75) 3. Electricity Market Oversight and Trading Platform Regulation: Mandates that the electricity regulatory authority review the operation and effectiveness of the electricity trading platform based on market development; allows the establishment of an independent trading entity or mandates measures to enhance neutrality; introduces penalties for electricity trading platform	Ministry of Economic Affairs [MOEA] (2025)

Energy Policy	Details	Reference
	operators failing to comply with regulatory requirements. (Amended Articles 11 and 78-1) 4. Application Procedures for Specified Electricity Suppliers: Establishes a licensing process for specified electricity suppliers; requires businesses that participated in the electricity trading platform before the amendment to obtain a license within a specified period after the amendment takes effect. (Amended Article 15) 5. Amendments to Power Sales Business Regulations: Removes the restriction preventing electricity sellers from establishing major power generation facilities and revises corresponding penalties. (Amended Articles 47 and 74)	
Energy Administration Act	Chinese Taipei has drafted amendments to the Electricity Act, which were officially announced on 30 July 2024, for public consultation. The key points of the proposed amendments are as follows: 1. Inclusion of Renewable Energy and Thermal Energy in the Energy Act: Expands the definition of energy under this act to include renewable energy and thermal energy. (Amended Article 2) 2. Authorisation for Regulations on Designated Energy Products: Revises the scope of authorisation for the management regulations on designated energy products. Grants the central competent authority the power to delegate certain regulatory responsibilities to local governments. (Amended Article 6) 3. Requires energy suppliers to publicly disclose energy sales statistics: The types, scope, period, method, and timing of disclosure shall be determined by the central competent authority through public announcements. (Amended Article 6-1) 4. Authorises local governments to conduct inspections and audits of energy users in accordance with this act. (Amended Article 19-1) 5. Grants the competent authority the right to publicly disclose the names of companies violating this act. Introduces new violation categories and increases fines for certain offences. (Amended Articles 20, 20-1, 21, 22, and 24) 6. Grants the central competent authority the power to establish implementation rules without requiring approval from the Executive Yuan. (Amended Article 29)	Ministry of Economic Affairs[MOEA] (2025)

Energy Policy	Details	Reference
Regulations on Registration of Private-use Power Generation Facilities	Chinese Taipei has drafted amendment to the Regulations on Registration of Private-Use Power Generation Facilities, which were officially announced on January 24, 2025, for public consultation. The proposed amendment is as follows: To ensure that developers of ground-mounted solar PV installations fully consider the impacts on land use, ecology, and landscape, ecological and landscape requirements have been incorporated into the document submission requirements under Annex 1 of Article 3 of the Self-Use Power Generation Equipment Registration Regulations.	Energy Administration, Ministry of Economic Affairs[MOEA] (2025)
Regulations on Registration of the Electricity Industry	Chinese Taipei has drafted amendments to the Regulations on Registration of the Electricity Industry, which were officially announced on 24 January 2025, for public consultation. Based on Article 24 of the Electricity Act and considering that ground-mounted solar PV power generation facilities require large-scale land use, and to ensure the right of residents to be informed, amendments to certain provisions of this regulation have been proposed. 1. New requirement for solar PV power generation businesses to submit proof of holding public consultations when applying for construction or expansion permits (Amended Article 3). 2. New provision specifying that the format of inspection documents for municipal and county (city) government consent letters will be determined separately by the electricity regulatory authority (Amended Article 3-1). 3. New regulations outlining the procedures and related requirements for public consultations on solar PV project construction or expansion plans (Amended Articles 3-2 and 3-3). 4. New provision detailing the required content and procedures for public consultations on solar PV work plans (Amended Article 3-4).	Energy Administration, Ministry of Economic Affairs[MOEA] (2025)
Regulations for Installation and Management of Renewable Energy Generation Equipment	Chinese Taipei has drafted amendment to the Regulations for Installation and Management of Renewable Energy Generation Equipment, which were officially announced on 24 January 2025, for public consultation. The proposed amendment is as follows: The revised regulations specify that ground-mounted solar PV installation applicants must comply with the Landscape and Ecological Assessment Principles for Ground-Mounted Solar	Energy Administration, Ministry of Economic Affairs[MOEA] (2025)

Energy Policy	Details	Reference
	PV Installations established by the central competent authority. To ensure consistency, applicants must submit the required forms and diagrams in the format designated by the central competent authority. Accordingly, Annex 1 of Article 7 of these regulations has been revised to clarify the document submission requirements for renewable energy generation equipment approval and record filing applications.	
Regulations Governing the Installation and Administration of Gas Stations	The amendment made on 28 June 2024 addressed the development of hydrogen vehicles, the diversification of gas station operations, and the facilitation of hydrogen refueling station deployment, the amendment includes the following key revisions: 1. The title "Co-location of Gas Stations and Automobile Liquefied Petroleum Gas (LPG) Station" is revised to "Co-location of Gas Stations and LPG Stations or Hydrogen Refueling Stations." (Revised chapter 5) 2. Provisions for the co-location of gas stations and hydrogen refueling stations are introduced. (New Articles 18-1, 19-1 and 19-2) 3. Gas stations are permitted to operate hydrogen refueling stations. Additionally, the previous rule, which prohibited continued operation of co-located services after the revocation of approval, has been removed. (Revised Article 26) ~~5~~ 4. In line with the amendment to Article 26, Paragraph 7, the prohibition on continuing co-located operations after a gas station ceases operations has been deleted. (Revised Article 35)	Energy Administration, Ministry of Economic Affairs[MOEA] (2024)
Stationary Fuel Cell Power Generation System Subsidy Program	To accelerate the commercialisation of stationary fuel cell power generation systems, foster the development and application of diverse energy sources, and enhance domestic distributed generation capacity, a subsidy program has been established. Qualified organisations may apply for support when installing stationary fuel cell systems with a capacity of at least 1 kW but not exceeding 500 kW per year. The subsidy amount ranges from TWD 50 000/kW to TWD 70 000/kW, depending on specific installation conditions. The program is implemented annually, with the application period set from May 1 to May 31 each year, starting in 2024.	Energy Administration, Ministry of Economic Affairs[MOEA] (2024)

Energy Policy	Details	Reference
Demand Response Load Management Program 2024	In January 2024, Taipower updated the Demand Response Load Management Program, which encompasses planned demand response, emergency demand response, demand bidding, direct load control (exclusive to schools), and demand response by electrical energy storage (limited to regulated users under the Renewable Development Energy Act).	Taipower (2024)
2025 Feed-in Tariffs of Renewable Energy Electric Power	Chinese Taipei has been introducing the FIT mechanism since 2010. The FIT rate for 2025 was unveiled on 3 January 2025. Compared to 2024, the FIT rate for rooftop solar PV systems between 1 kW and 10 kW remains unchanged, while other categories have seen slight reductions. A new FIT tier for small hydropower (1–100 kW) has been introduced to reflect cost differences by scale. The FITs for other renewable energy installations including onshore and offshore wind farms as well as hydro power and geothermal remain the same as the rates last year	Energy Administration, Ministry of Economic Affairs [MOEA] (2025)
Energy-Efficient Subsidies for Residential Appliance Replacement	In December 2022, Chinese Taipei introduced the "Energy-Efficient Subsidies for Residential Appliance Replacement," earmarking a budget of NTD 23.7 billion (approximately USD 713 million) from 2023 to 2026. The initiative seeks to incentivise households to replace outdated air-conditioners and refrigerators with new units with Level 1 energy efficiency ratings. The maximum subsidy per unit is capped at NTD 3000 (USD 90), with each household eligible to apply for one air-conditioner and one refrigerator under this program.	Energy Administration, Ministry of Economic Affairs [MOEA] (2024)
Regulations on Setting Energy Conservation Targets and Implementation Plans for Energy Users from 2025 to 2028	In accordance with Articles 8, 9, and 10 of the Energy Administration Act, the government of Chinese Taipei revised the regulations, which were announced on 2 January 2025, to establish new energy-saving targets and implementation plans. The energy-saving rate requirement for users with a contracted capacity exceeding 10,000 kW, including government-owned enterprises, has been raised from 1.0% to 1.5%. However, the target remains at 1.0% for the education, healthcare and social services, transportation services, and government offices and research institutions. Additionally, users with a contracted capacity between 800 kW and 10 000 kW will also maintain the 1.0% energy-saving target.	Energy Administration, Ministry of Economic Affairs [MOEA] (2025)

Notable Energy Developments

Energy development	Details	Reference
Carbon Pricing Policy	In 2024, Chinese Taipei implemented a carbon pricing scheme. Entities subject to carbon fee collection include those in the power and manufacturing industries with annual emissions reaching 25 000 metric tonnes of carbon dioxide equivalent. The "Fee-Charging Rates of Carbon Fees" were announced in October 2024 and took effect on 1 January 2025. The standard carbon fee rate is set at TWD 300 (USD 9.3) per tonne, with preferential rates of TWD 50 (USD 1.6) and TWD 100 (USD 3.0). The year 2025 will serve as a trial period, with formal implementation beginning in 2026.	Ministry of Environment [MOE] (2024)
Electricity Wholesale and Retail Price Review	Governments regulate electricity prices in Chinese Taipei; based on Article 49, Article 9, and Article 10 of the Electricity Act, MOEA established a committee to review electricity prices and related tariffs for electricity system operations. The committee conducts biannual reviews of electricity prices in March and September and provides recommendations to MOEA. Chinese Taipei increased electricity prices for industrial users by an average of 13% starting 16 October 2024, to reflect rising fuel cost. Meanwhile, tariffs for households and food retailers will remain unchanged to help stabilise living costs. The increase marks the second electricity price hike in 2024 and the fourth increase for industrial uses in the past three years.	Energy Administration, Ministry of Economic Affairs [MOEA](2024)
Electricity Transmission and Distribution Tariffs Review	On 3 January 2025, Chinese Taipei adjusted electricity rates. The power dispatch and transferred distribution fees increased due to higher fuel prices and infrastructure upgrades. Meanwhile, auxiliary service and transferred transmission fees decreased, influenced by private resource participation, reducing purchase prices through competitive bidding, including energy storage and self-generated power devices. The Meter Rate Lighting Service and Low Voltage Power Service users' rates will remain unchanged, while the rates for High Voltage and Extra High Voltage users will be increased by 45%. This will result in an average increase of 24%.	Energy Administration, Ministry of Economic Affairs [MOEA](2025)
Promoting Deep Energy-Saving Plan	To enhance energy efficiency, Chinese Taipei launched the Promoting Deep Energy-Saving Plan, investing TWD 35 billion (USD 1.1 billion) from 2024 to 2027 to save 20 600 GWh and cut 10 $MtCO_2$, focusing on digital management, equipment upgrades, and energy audits. Three key strategies are as follows. 1. Large Energy Users (4900 enterprises): Raising the energy-saving target from 1% to 1.5% for users with a contracted capacity exceeding 10 MW implementing tax reductions for high energy-efficient equipment, encouraging energy efficiency partnerships among large companies and SMEs, and introducing a three-stage ESCO development plan.	Energy Administration, Ministry of Economic Affairs [MOEA](2025)

Energy development	Details	Reference
	2. Small and Medium Enterprises (1.4 million businesses): Introducing Energy Service Companies (ESCOs), conducting energy audits, and applying digital and low-carbon solutions. ESCO project financing and credit guarantees are in place to support investment. 3. Residential Households (14 million): Expanding appliance replacement subsidies, aiming to replace 4.1 million old units by 2026 with high-efficiency models. Policies, technology, and finance drive energy savings and low-carbon goals.	
Maanshan Nuclear Power Plant decommissioned	Chinese Taipei is maintaining its nuclear-free policy in 2025, with no life extensions or new nuclear plant construction since 2017. Four reactors in three plants were decommissioned from December 2018. Kuosheng (No.2) Nuclear Power Plant was decommissioned in March 2023. Regarding the last two reactors in Maanshan (No.3) nuclear power plant, contributing around 8% to the total electricity supply, one shut down in July 2024 and the other will shut down in May 2025.	Taipower (2025)
Solar PV Development in 2024	By the end of 2024, the additional capacity of solar PV power capacity was 1.9 GW, and the cumulative capacity of solar PV was 14 GW, which was far behind the 2025 target, 20GW.	Energy Administration, Ministry of Economic Affairs [MOEA](2025)
Wind Development in 2024	By the end of 2024, the additional capacity of wind power capacity reached a record of 1.2 GW, and the cumulative capacity of wind power was 3.9 GW, which was far behind the 2025 target of 5.6 GW.	Energy Administration, Ministry of Economic Affairs [MOEA](2025)

Useful Links

Architecture and Building Research Institute, MOI – https://www.abri.gov.tw/en/Default.aspx

CPC – https://www.cpc.com.tw/en/

EA (Energy Administration), MOEA – https://www.moeaea.gov.tw/ECW/english/home/English.aspx

Electricity Price and Related Tariff Review – https://www3.moeaea.gov.tw/ele102/Content/Messagess/contents.aspx?MmmID=654246034150461022

Energy labelling website – https://www.energylabel.org.tw/

Energy Statistics Information System – https://www.esist.org.tw/

Feed-in tariffs (FIT) review – https://www.moeaea.gov.tw/ECW/RENEWABLE/news/News.aspx?kind=1&menu_id=767

Formosa Plastics Group – https://fpg.com.tw/tw

Government institute, K-12 and university energy audit reporting system – https://egov8.ftis.org.tw/home

Manufacturing energy audit reporting system – https://emis.itri.org.tw/energyaudit/

Minimum Energy Performance Standards (MPES) website – https://www.meps.org.tw/

MOE (Ministry of Environment) – https://www.moenv.gov.tw/

MOE Climate Change Talks platform – https://www.climatetalks.tw/

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Thailand

Introduction

Thailand has an area of 513 120 square kilometres (km^2). Thailand's population in 2022 was 71.7 million, 0.13% increased from the previous year. Gross domestic product (GDP) increased to USD 1 487.9 billion, a 2.5% increase compared to the previous year. Thailand faces constraint in its domestic energy resources. The production of domestic resources, primarily gas extracted from the Gulf of Thailand, continued to decline from peak in 2014. As of the end of 2021, Thailand possessed proven reserves amounting to 95 million barrels of crude oil and 3 445 billion cubic feet of natural gas (EPPO, 2023). Additionally, there were approximately 1.1 billion tonnes of coal reserves at the close of 2020 (EI, 2023). At the current production rates, the domestic supply of oil and natural gas is expected to be depleted within approximately three years.

Thailand is highly dependent on energy imports, with approximately 92% of its crude oil and 30% of its gas supply coming from imports in 2023 (EPPO, 2023). Moreover, given that most of Thailand's proven coal reserves consist of low-calorific-value lignite coal, the economy depends on imported bituminous coal to fulfil the energy requirements of both the power and industrial sectors.

Table 1: Thailand macroeconomic data and energy reserves

Key data [a]		**Energy reserves** [b, c]	
Area (km^2)	513 120	Oil[b] (end 2021, million barrels)	95
Population (million)	71.7	Gas[b] (end 2021, billion cubic feet)	3 445
GDP (2021 USD billion PPP)	1 488	Coal (million tonnes)	1 063
GDP per capita (2021 USD PPP)	20 752	Uranium (kilotonnes U < USD 130/kgU)	n/a

Source: [a] World Bank (2024); [b] EPPO (2023); [c] EI (2024)

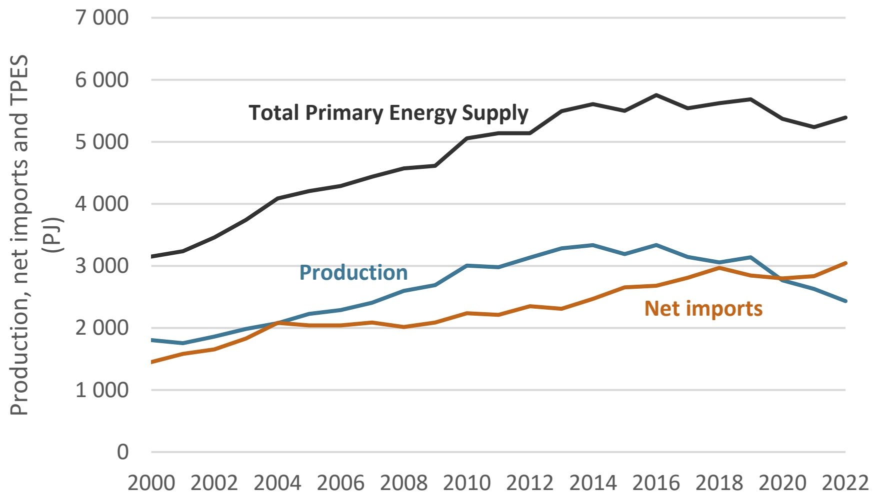
Note: Reserves are total proved reserves and reasonably assured recoverable resources for uranium.

Energy Supply and Consumption

Total Primary Energy Supply

In 2022, Thailand experienced a 2.9% increase in its total primary energy (TPES), amounting to 5 391 PJ. The 7.5% reduction in production compared with the previous year attributed to a noticeable rise in net imports, with 2022 witnessing a surpassing of net imports over domestic production for the third consecutive years (Figure 1).

Figure 1: Thailand energy supply, production, and net imports (PJ), 2000 to 2022

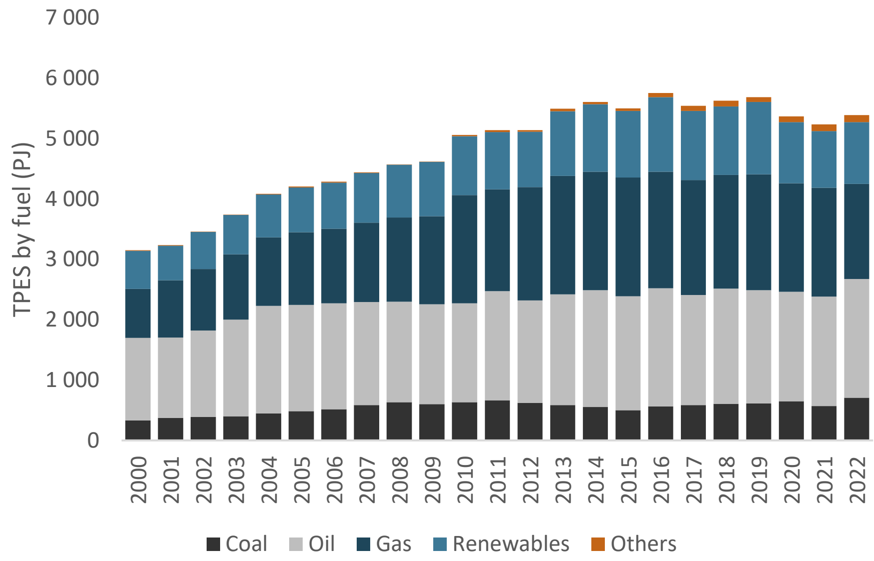


Source: EGEDA (2024)

Fossil fuels play a dominant role in Thailand's energy supply mix, with coal, oil, and gas contributing to 79% of TPES in 2022 despite its declines from peak at 90% for seven consecutive years in 2015 (Figure 2). Coal experienced strongest growth in 2022 despite its 13% share mix in TPES, reaching an all-time high since 2000. Gas supply has continued its decline for seven consecutive years while renewables have been on the rises. Depleting domestic gas reserves led to an increased import of liquefied natural gas (LNG). The share of domestic gas production to imported gas, including both pipeline and LNG, was recorded as 62:38 in 2022.

To address the challenges and enhance energy security, the government has undertaken initiatives such as expanding LNG receiving terminals, implementing more regasification systems, and constructing gas storage tanks. These efforts aim to support higher LNG receiving capacity, with a target of reaching 46 million metric tonnes per annum (MMTPA) by 2027. Notably, the recently completed LNG receiving terminal, known as Terminal 2 or T-2, with a capacity of 7.5 MMTPA with an additional expansion capacity of 7.5 MMTPA, already started to receive its first LNG cargo in 2022.

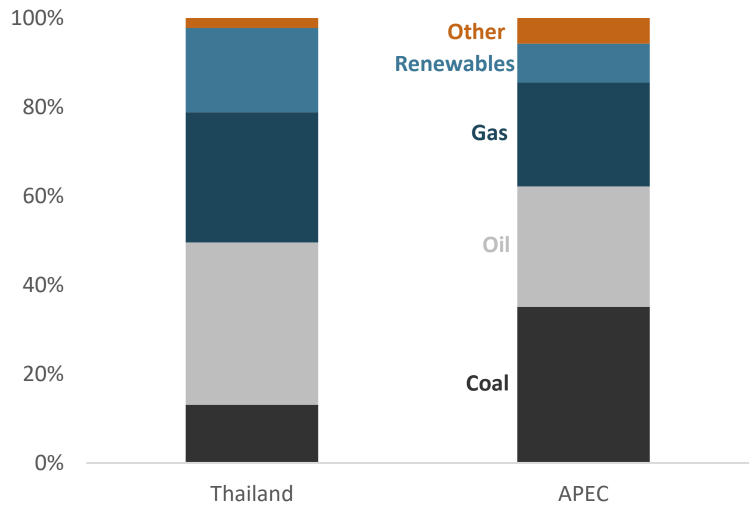
Figure 2: Thailand energy supply by fuel (PJ), 2000 to 2022



Source: EGEDA (2024)

Compared to APEC, Thailand possesses a substantially smaller proportion of coal supply (Figure 3). This is largely attributed to the economy relying on a limited coal deposit in Mae Moh, Lampang province, for power generation. Thailand has been actively transitioning towards cleaner energy sources, particularly gas, amplifying the prominence of gas in its energy mix following the discovery of domestic gas in the 1980s. As for renewables, hydro and solar energy constitute the primary sources. Notably, Thailand engages in the energy trade of hydroelectric power from Lao PDR, a move facilitated by its geographical proximity coupled with investment from Thai companies to exploit in Laos' substantial hydropower potential.

Figure 3: TPES mix – Thailand and APEC, 2021

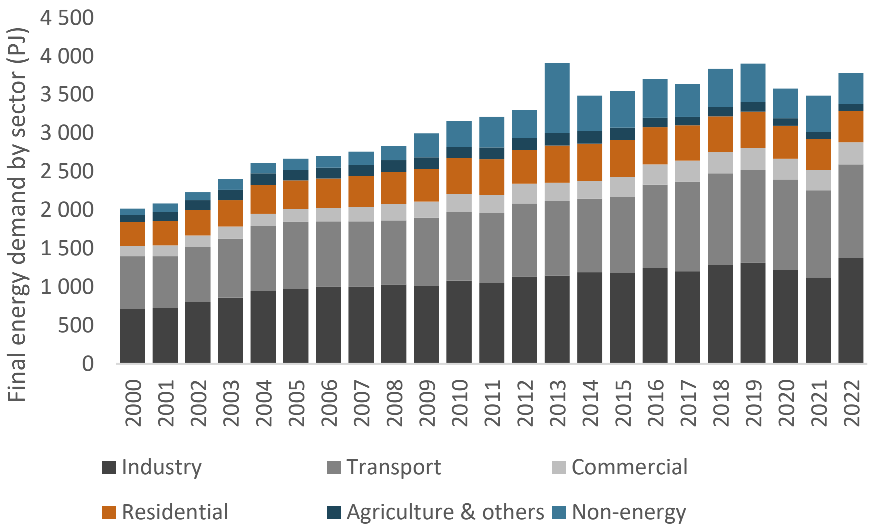


Source: EGEDA (2024)

Total Final Consumption

Total final consumption in 2022 was 8% higher than 2021, signalling its rebound from the Covid pandemic. The industry sector experienced strongest growth at 22%, followed by transport and commercial sectors at 8% each. This was attributed to the rebound of export manufacturing and tourism industries. The non-energy sector, mostly petrochemicals, experienced a notable decline at 15% due to global oversupply of petrochemicals.

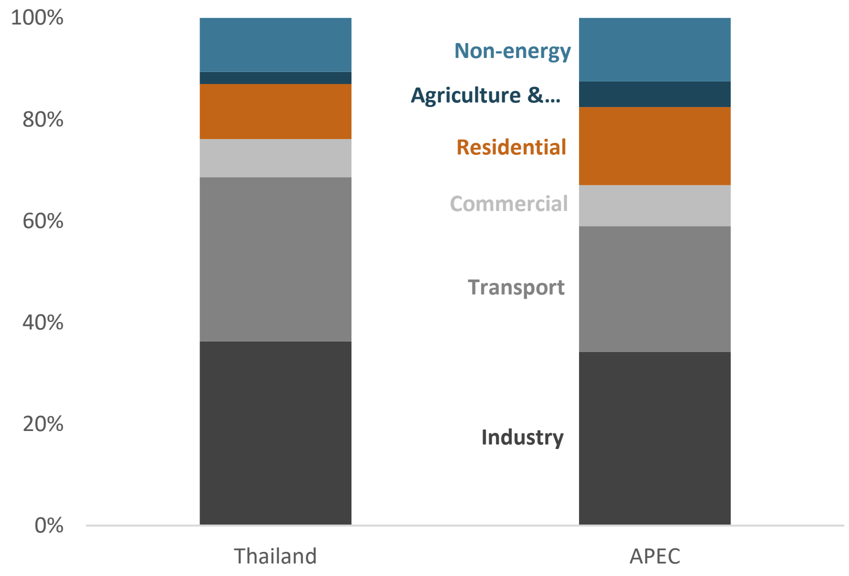
Figure 4: Thailand final consumption by sector (PJ), 2000 to 2022



Source: EGEDA (2024)

Thailand's industry sector exhibited a comparable market share to that of APEC (Figure 5). Notably, the transportation segment surpassed APEC's share by a substantial 8 percentage points, while conversely, the residential sector lagged by 5 percentage points.

Figure 5: Final consumption by sector, Thailand and APEC, 2022

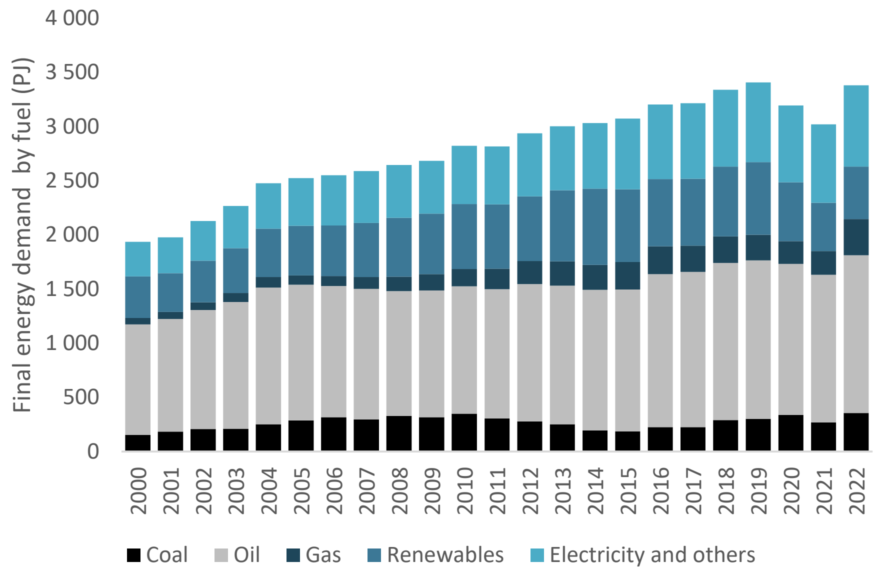


Source: EGEDA (2024)

Final Energy Demand

Thailand experienced a 12% increase in its final energy demand in 2022 (Figure 6). Fossil fuels constituted more than 60% of this final energy demand. Over the past decade, Thailand witnessed a rise in the growth of oil and gas demand, whereas the growth in coal demand decreased. In 2022, coal and gas exhibited strong growth rates at 32% and 55%, respectively, reflecting growth in industry sector. Additionally, electricity demand increased by 4% due to higher manufacturing output for export-oriented goods. However, total final energy demand has not yet reached the pre-Covid level in 2019.

Figure 6: Thailand final energy demand by fuel (PJ), 2000 to 2022



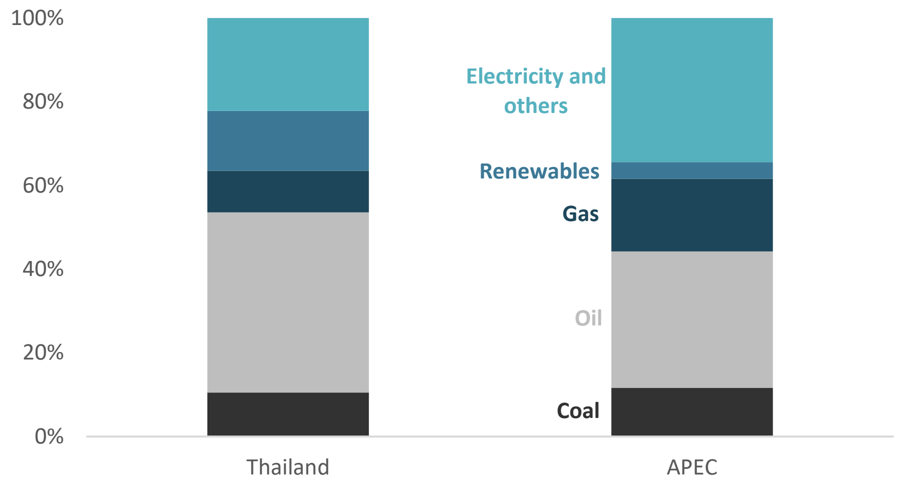
Source: EGEDA (2024)

Note: Does not include non-energy sector consumption of energy products.

The composition of Thailand's final energy demand differs from that of APEC in several aspects. The predominant share of oil demand, primarily driven by the transport sector, especially due to the influence of the tourism industry, accounted nearly 50%. Additionally, the share of renewables, particularly biomass sourced from the agricultural sector, reached 14% in 2022, surpassing 4% of APEC's figures significantly (Figure 7).

On the other hand, the demand shares of gas and electricity, along with other sources, fall below the corresponding shares in APEC. This discrepancy reflects a distinct final energy demand pattern in Thailand compared to the broader APEC region.

Figure 7: Final energy demand fuel share, Thailand and APEC, 2022



Source: EGEDA (2024)

Transformation

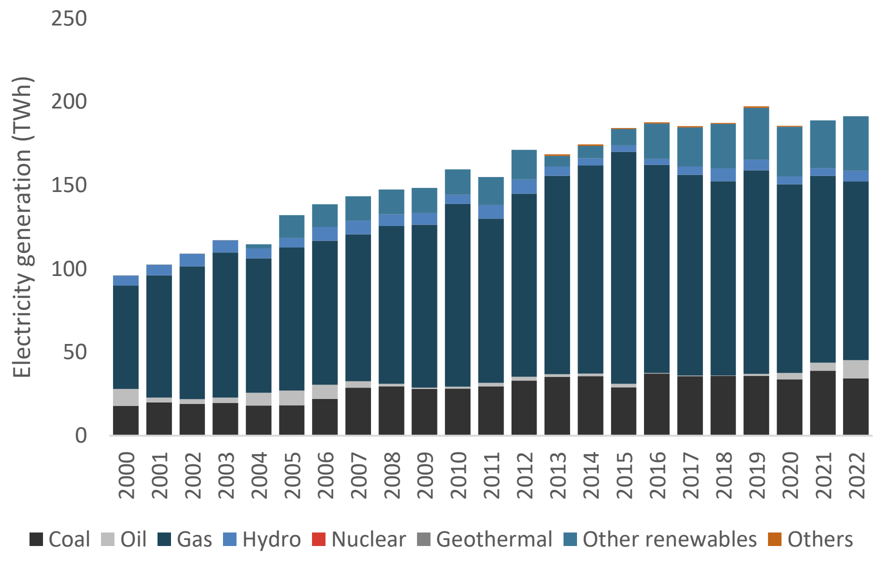
Power Sector

Power generating capacity stood at 53.3 GW as of end of December 2022 (EPPO, 2023). EGAT and independent power producers (IPP) made up 63% of this capacity. The remainder comprised of small power producers (PPA and direct PPA), very small power producers, and imports. Particularly, Thailand currently imports hydroelectricity from Lao PDR and has electricity exchange arrangements with Malaysia to enhanced overall grid stability during demand fluctuation.

Electricity generation saw a slight uptake (Figure 8), reaching 191.3 TWh in 2022, predominantly relying on natural gas (56%). The year-on-year percentage growth since 2015 has been at around 1% with an exception during the pandemic. Comparing this trend alongside a continual rise in electricity demand suggests a decoupling of electricity demand from generation growth, aligning with the Thai Government's effort to improve energy efficiency and leverage technological advancements, particularly in the steel and automobile industry.

Given Thailand's initial abundance of natural gas resources from the Gulf of Thailand, and recognising the lower emissions associated with gas compared to coal and oil, the economy predominantly utilised gas for electricity generation. However, Thailand currently faces the challenge of a diminishing domestic gas supply, necessitating an increased reliance on LNG imports.

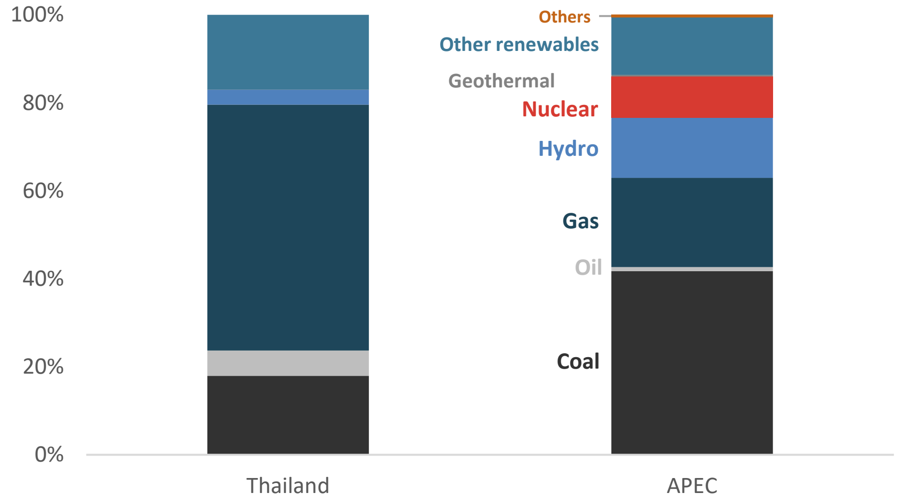
Figure 8: Thailand electricity generation by fuel, 2000 to 2022



Source: EGEDA (2024)

The dominance of natural gas becomes evident when comparing it to the generation mix observed for APEC (Figure 9). Additionally, Thailand exhibits a relatively lower proportion of coal and hydroelectricity generation. Continuous growth in other renewables is expected to be driven by supportive policies, abundant renewables potential, especially solar and biomass, and the growing cost competitiveness of related technologies.

Figure 9: Electricity generation fuel share, Thailand and APEC, 2022



Source: EGEDA (2024)

Refining

Thailand is among the few economies in APEC's Southeast Asia that have a self-sufficient policy in the production of petroleum products. The petroleum refining sector in Thailand comprises six major refineries and one small refinery for military use. In 2022, Thailand's refinery capacity stood at 1 245 thousand barrels per day (kb/d), compared with 1 021 kb/d of domestic petroleum product consumption (EPPO, 2023). Furthermore, the refinery sector also serves as a major supplier of petroleum products to neighbouring economies at 25 million liters per day (EPPO, 2023). Crude oil intake by refineries was slightly under 1 million barrels per day in 2022, indicating an approximately 82% utilisation rate (EPPO, 2023). Substantial decline in domestic crude oil production resulted in a higher import volume. Thailand produced 79 kb/d of crude oil and condensates and imported 992 kb/d of crude oil, representing 92% of total supply of crude oil and condensate. Sources of crude oil imports in 2023 comprises of the middle-east (62%), the far-east (13%), and others (25%).

Energy Transition

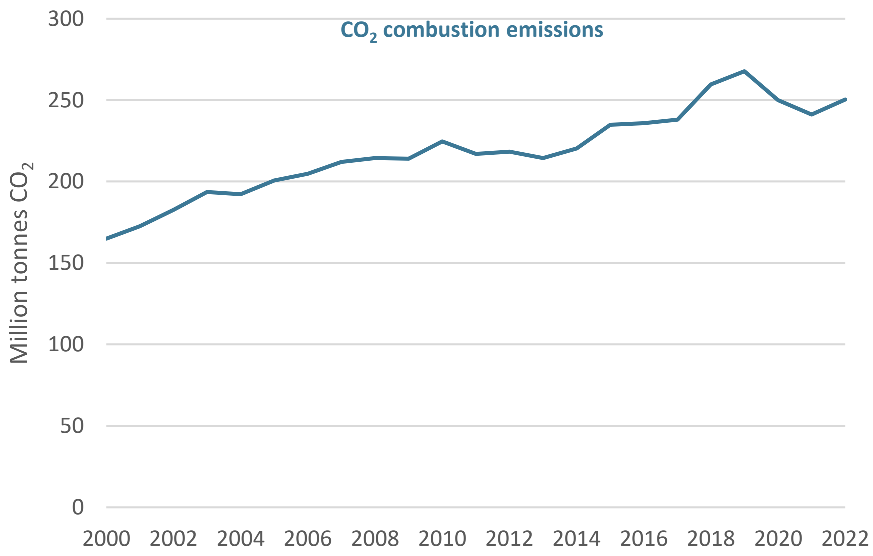
Thailand has committed to energy transition as evidenced by the Long-term Low Greenhouse Gas Emission Development Strategy. This strategy outlines the economy’s commitment to achieve carbon neutrality by 2050 and net zero greenhouse gas emissions by 2065. In 2021, the Thai Government introduced the promotion of electric vehicles (known as the 30@30 policy), which aims to achieve a minimum 30% production of low or zero-emission vehicles by 2030. The objective is to position Thailand as a leading hub for electric vehicle production in the ASEAN region.

The Thailand Integrated Energy Blueprint (TIEB), introduced in 2015 and partially revised in 2018 with the target year of 2037, serves as a guiding framework for the long-term direction of the energy landscape and value chain. The Blueprint covers five key development areas: power, energy efficiency, alternative energy, gas and oil. Revisions to the targets are expected with the assumption of a new government in 2023.

Emissions

Under Thailand's 2nd Updated Nationally Determined Contribution (NDC) published in November 2022, Thailand aims to reduce relative GHG emissions of 30-40% by 2030, with the more ambitious reduction dependent on international support. Thailand expects to emit 555 million tonnes of carbon dioxide equivalent ($MtCO_2eq$) in the 2030 in the business-as-usual.

Figure 10: Thailand CO_2 combustion emissions (million tonnes), 2000 to 2022



Source: EGEDA (2024)

Over the past two decades, Thailand has witnessed a continuous increase in CO_2 combustion emissions, primarily attributed to the economy's dependence on fossil fuels for its development. The power sector has been the primary contributor to these emissions, accounting for 35% of the total in 2022 (EPPO, 2023). In 2022, there was a slight increase at 1.5% in emissions to 247 million tonnes compared to the previous year contributed from transport sector due to increases in tourism activities. Emissions from power and Industry sectors continues to decline. Specifically, emissions from power generations in Thailand continues to decline at average rate of 2.4% per annum since 2019 as a result of higher share of modern renewables, despite increasing electricity generations. On a contrary, emissions from transport in 2022 has exceeded the pre-Covid level in 2019.

Energy Security

Thailand's self-sufficiency, a ratio of domestic production to total primary energy supply, has shown a decline, reaching about 31% in 2022. Within the economy, 8%, 39%, and 62% of crude oil, coal, and gas supply, respectively, is produced domestically in 2022. Particularly, productions of domestic natural gas declined to 2 648 million standard cubic feet per day (mmscfd), marking a 17% decline from the previous year. This decline is notable when compared to the peak of gas production of 4 070 mmscfd in 2014, attributed to resource depletion. LNG imports in 2021 was averaged at 943 mmscfd, an 14% increase from the previous year to compensate for a decline in domestic production.

APEC Energy Goals

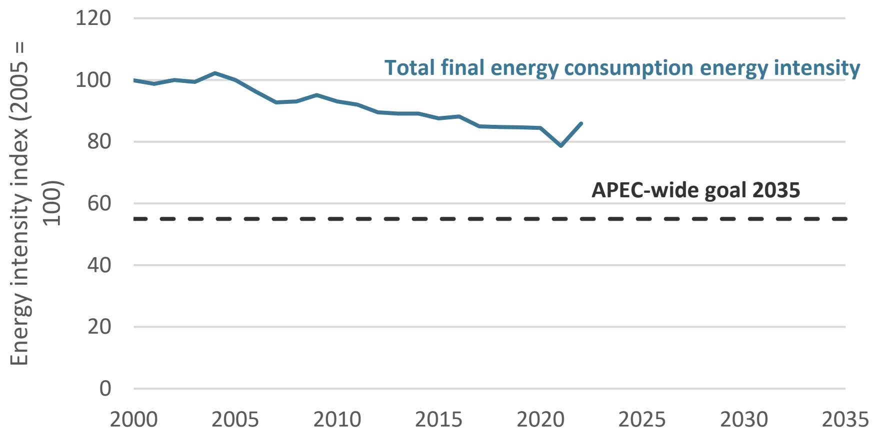
There are two energy-related objectives that APEC member economies have agreed to meet as a collective: to improve energy intensity and double the share of modern renewables.

Energy Intensity Goal

In 2011, APEC member economies agreed to increase their ambition to reduce energy intensity by 45% in 2035, relative to a 2005 baseline.

The original goal was a 25% improvement by 2030, relative to a 2005 baseline.

Figure 11: Thailand total final energy consumption intensity index, 2000 to 2022 (2005 = 100)



Source: EGEDA (2024)

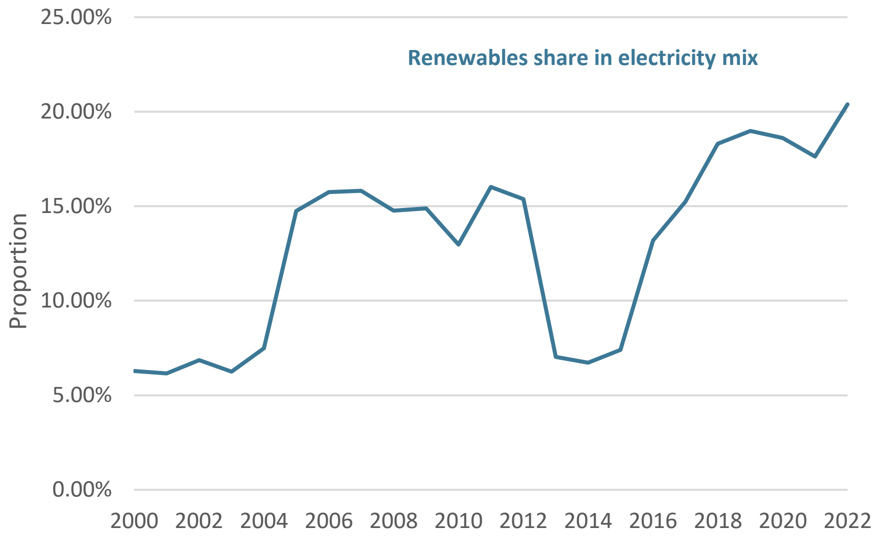
APEC is on track to achieve this energy intensity improvement. The goal does not impose individual economy targets, but it is possible to track the progress of individual APEC economies relative to the overarching proportional improvement.

Increases in total final consumption by 12% in 2022 compared to 2021 has led to an increase energy intensity for Thailand. The energy intensity index increased to 86% from 79% in the previous year.

Doubling of Renewables

The second energy goal involves doubling the share of modern renewables in the APEC energy mix for the period 2010 to 2030. There is no economy-level goal for individual member economies, but improvements by individual economies will contribute to the doubling goal.

Figure 13: Thailand renewable generation share, 2000 to 2022



Source: EGEDA (2024)

Between 2010 and 2021, Thailand experienced a 7-percentage point increase in its share of modern renewable energy, reaching 20%. Although Thailand experiences lower annual growth rates compared to APEC, the economy's modern renewable energy share surpassed that of APEC. APEC aims to achieve a 12% share of modern renewable energy by 2030.

Energy Policy

Energy policy	Details	Reference
2nd Updated NDC	30-40% GHG emissions reduction relative to a projected business-as-usual level by 2030 (555 MtCO2eq). Additionally, Thailand aims to increase the target of renewable energy share in the new power generation to 50% within 2050 by introducing a feed-in tariff scheme, projects without fuel cost, industrial waste, and MSW-solar PV rooftop for the household sector.	UNFCCC
Long-Term Low Greenhouse Gas Emission Development Strategy (LT-LEDS) (Revised version)	Thailand aims to achieve carbon neutrality by 2050 and net zero GHG emissions by 2065. The strategy outlines long-term GHG mitigation actions in the energy, industrial processes and product use, agriculture, waste, as well as land use, land use change and forestry sectors.	ONEP
Thailand National Energy Plan (NEP)	Five energy development plans, including power, energy efficiency, alternative energy, oil and gas, with target year in 2037. The revision is expected to align with the revised LT-LEDS, following the assumption of the new government in 2023.	EPPO

Promotion of electric vehicles (known as the 30@30 policy)	The 30@30 policy in Thailand aims to have 30% of all vehicles produced in Thailand be zero-emission vehicles (ZEVs) by 2030.	ITA

Notable Energy Developments

Energy development	Details	Reference
Goals for clean energy and advanced energy system	Formulating an ambitious goal of renewable energy production, promoting solar and hydro-floating solar hybrid installation, and implementing CCUS and hydrogen technology.	NSTDA
Renewable energy project investment opportunity	The government has announced a call for bids to purchase 5,000 MW of electricity generated from renewable energy sources with no fuel costs (solar, wind, biogas).	DEDE
Bio-Circular-Green Economy or BCG Model	Sustaining growth and improving environment by maximum the utilisation of local energy resources and converting waste into energy.	NSTDA

Useful Links

Thailand's Energy Statistics – https://www.eppo.go.th/index.php/en/

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United States

Introduction

The United States is a geographically varied and resource-rich economy that is a major consumer and producer of energy. Comprising of 50 states and the District of Columbia (the federal capital), the United States includes 48 contiguous states situated between Canada and Mexico, with the two remaining states being Alaska, located northwest of Canada, and Hawaii, an archipelago in the Pacific Ocean. Additionally, the United States administers five inhabited territories in the Pacific and Atlantic Oceans.

The United States is historically one of the world's largest energy consumers and, of the APEC economies, the United States has the second highest share of primary energy consumption at close to 16%. The United States also has one of the highest levels of per capita final energy demand in APEC. While the United States' primary energy consumption continues to be dominated by fossil fuels, in recent years, the share of coal has decreased, and the shares of gas and renewables have increased. The economy's energy consumption is diverse, with applications in transportation, industry, residential and commercial sectors.

Since 2019, U.S. energy production has exceeded consumption. Following a long hiatus, the United States resumed the export of liquefied natural gas (LNG) in 2016 and was the top global exporter in 2024. Internationally, the United States' substantial LNG export capacity and typical feature of flexible destination clauses have provided consumers in Asia and Europe with an incentive to increase their reliance on U.S. imports. Domestically, however, environmental advocates have raised concerns about the gas industry's role in contributing to greenhouse gas (GHG) emissions. Beyond LNG, the United States also exports crude oil, petroleum products, coal, electricity, and renewable and nuclear energy equipment.

Historically, the United States has implemented initiatives to address climate change and accelerate the transition to cleaner energy sources, actively engaging in international efforts to reduce GHG emissions while implementing federal and state-level regulations and subsidies to encourage the expansion of solar and wind energy domestically. In terms of energy infrastructure, the United States has taken measures to modernise the grid to enhance resiliency and reliability. Recent changes in the U.S. Administration have led to a greater focus on increasing U.S. energy production and reducing energy prices for consumers.

Table 1: The United States' macroeconomic data and energy reserves

Key data [a, b]		Energy reserves [c, d]	
Area (million km^2)	9.9	Oil (billion barrels)	48
Population (million)	340	Gas (trillion cubic feet)	691
GDP (2022 USD billion PPP)	24 051	Coal (million tonnes)	469 000
GDP per capita (2022 USD PPP)	72 165	Uranium (kilotonnes U < USD 130/kgU)	68

Source: a U.S. Census Bureau (2024); b World Bank (2024); c EIA (2024); d IAEA & NEA (2023)

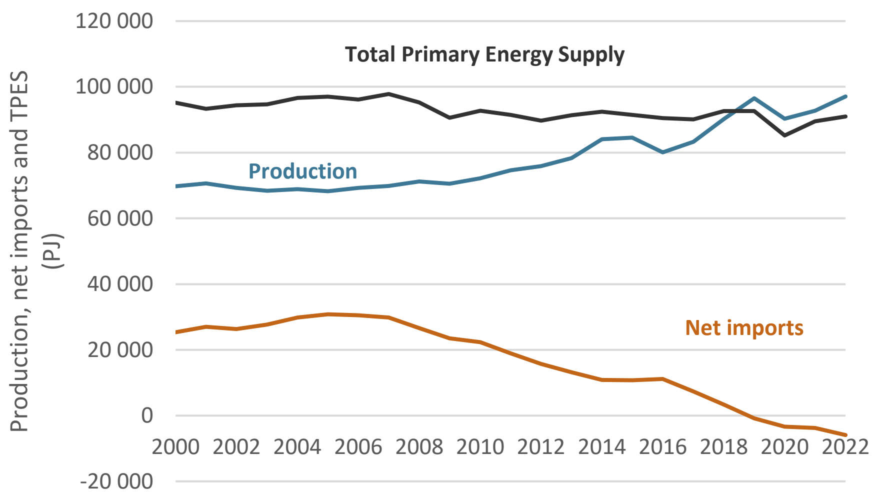
Note: Reserves are total proved reserves and reasonably assured recoverable resources for uranium.

Energy Supply and Consumption

Total Primary Energy Supply

In the United States, total primary energy supply (TPES) recovered to the pre-pandemic level in 2022, while net imports continued to decline.

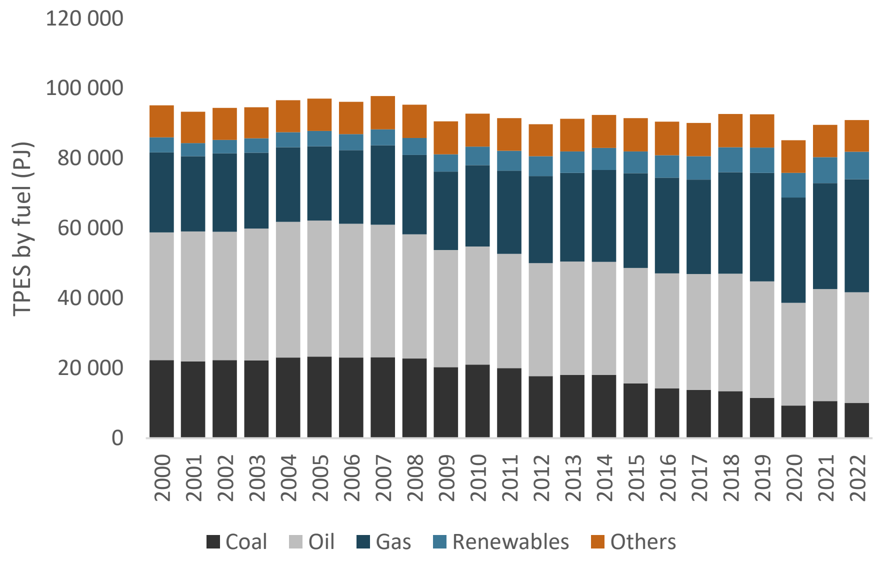
Figure 1: The United States' energy supply, production, and net imports (PJ), 2000 to 2022



Source: EGEDA (2024)

In 2019, the United States became a net total energy exporter. For the previous 60 years, domestic consumption was higher than production, with the United States importing mainly crude oil and petroleum products to make up this difference. The primary drivers of this transition from energy importer to exporter were the substantial growth in both U.S. oil and natural gas production. Although production and TPES fell in 2020 due to the COVID-19 pandemic, both began to rebound in 2021. In 2023, U.S. total energy exports were the highest on record, increasing approximately 8.0% from 2022, according to the U.S. EIA.

Figure 2: The United States' energy supply by fuel (PJ), 2000 to 2022

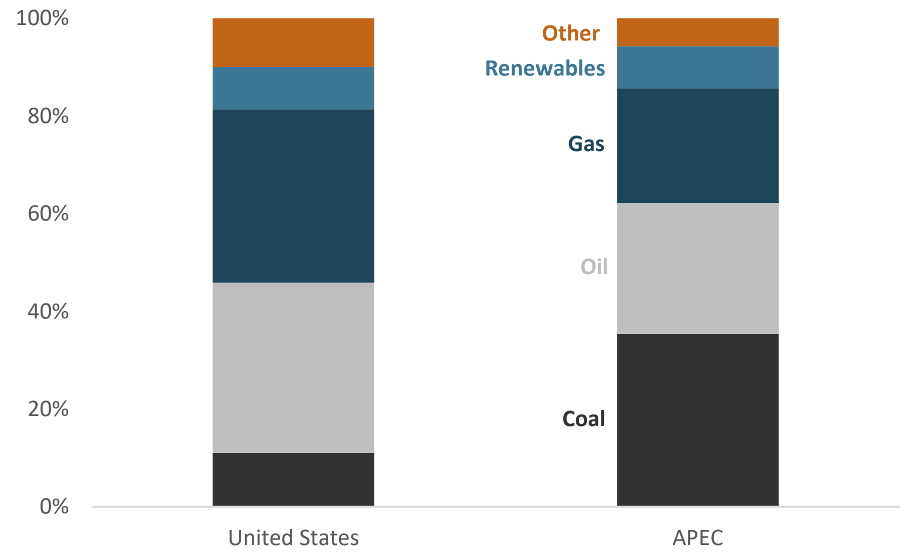


Source: EGEDA (2024)

Economic activities continued to recover post-2020 and are nearing pre-pandemic levels. According to the latest EGEDA data, in 2022, 35% of TPES came from crude oil, 35% from natural gas, and 11% from coal. Renewables accounted for 9.0% of TPES, and other sources, including nuclear and non-energy use of fuels, accounted for 10%.

In comparison to the 2022 average APEC TPES percentage shares, the U.S. primary energy supply contains an eight-percentage point higher share of oil, and a 12-percentage point higher share of gas, but a 24-percentage point lower share of coal than the APEC average. Renewables were equivalent, and for "Others", the United States' share was four percentage points higher. Overall, U.S. TPES encompasses over a quarter of APEC's total TPES at 26%.

Figure 3: Energy supply mix, The United States and APEC, 2022

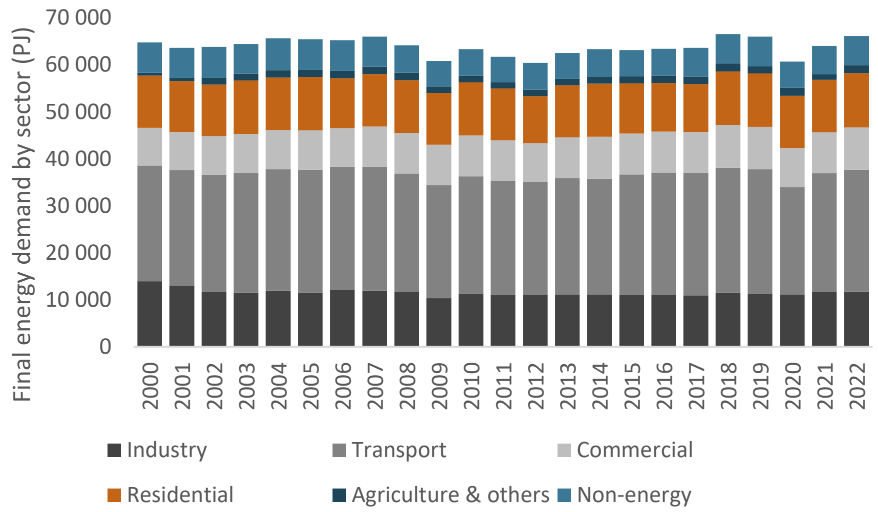


Source: EGEDA (2024)

Total Final Consumption

The United States' total final consumption in 2022, including non-energy, was 66 100 PJ, an increase of 1.1% from 2021. From 2000 through 2022, U.S. total final consumption has maintained a generally consistent plateau (Figure 4), with variations associated with macro shocks, such as the Great Recession of 2007-09 and the pandemic.

Figure 4: The United States' final consumption by sector (PJ), 2000 to 2022

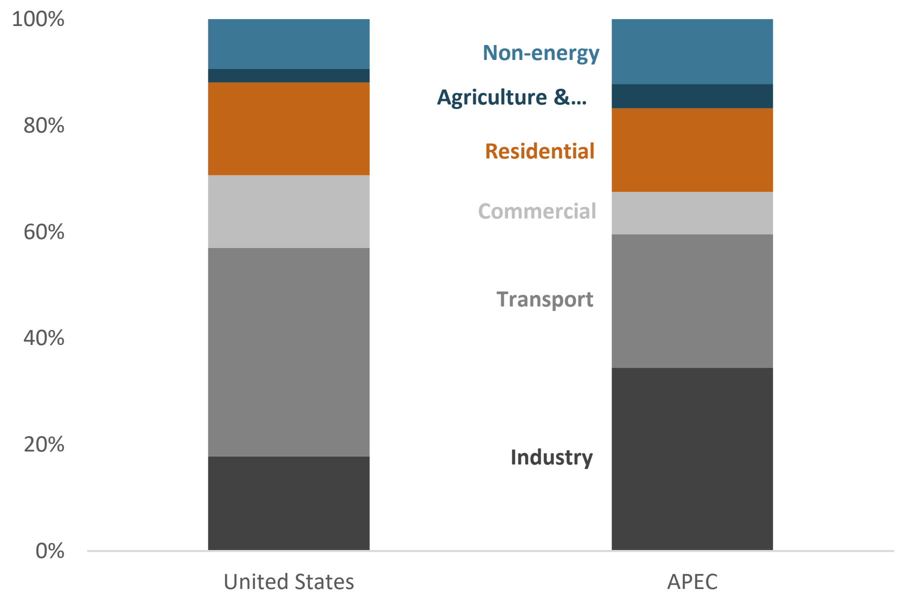


Source: EGEDA (2024)

The transportation sector continues to account for the largest share of total final consumption in the United States. In 2022, transportation's share of the total final consumption was 39%, followed by industry (18%), residential (17%), commercial (14%), non-energy (9%) and agriculture (3%).

In comparison to APEC, the transport sector's 39% share of the total final consumption in the United States is 14 percentage points higher than the APEC average, which is because there is a high level of individual car ownership in the United States. In contrast, the industry sector in the United States represents a smaller share than in the rest of APEC: in the United States, industry represents 18% of the economy whereas the industrial sector is over one-third (35%) in APEC. For the other sectors, the United States' commercial sector is six-percentage points higher than the APEC average, and the U.S. residential sector's share of total final consumption is two percentage points higher than the APEC average, the 'agriculture and others' sector is two-percentage points lower, and the non-energy sector is three percentage points lower.

Figure 5: Final consumption by sector, The United States and APEC, 2022

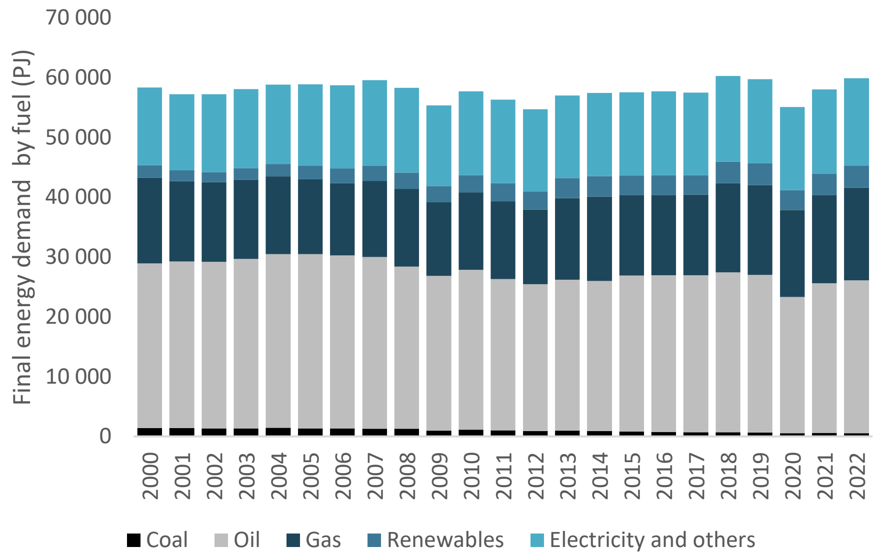


Source: EGEDA (2024)

Final Energy Demand

In 2022, the United States' total final energy consumption, which does not include non-energy sector consumption of energy products, was 59 909 PJ, which is a 3.3% increase relative to 2021.

Figure 6: The United States' final energy demand by fuel (PJ), 2000 to 2022



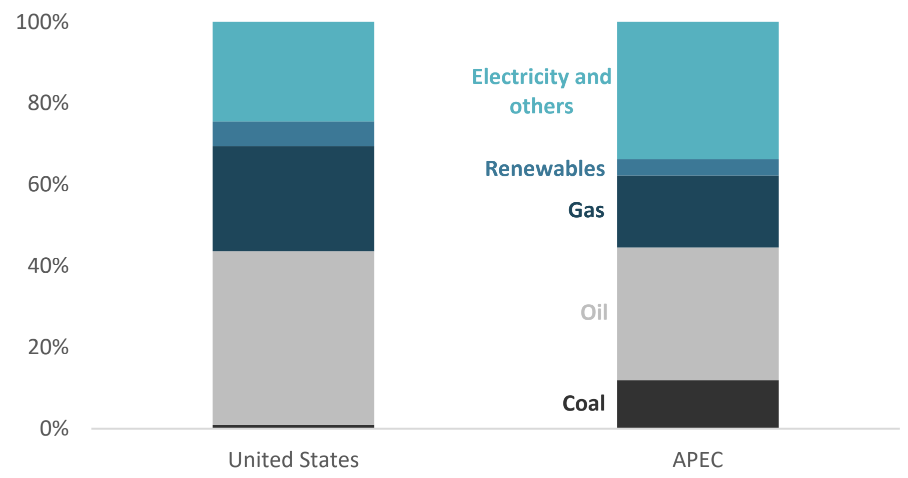
Source: EGEDA (2024)

Note: does not include non-energy sector consumption of energy products

Oil remained the dominant energy source in the United States, accounting for 43% of total final energy consumption in 2022. Natural gas and 'electricity and others' were the two other main sources, accounting for 26% and 24%, respectively.

Between 2021 and 2022, gas had the largest percentage increase at 4.5%, probably due to the phase-out of coal-fired electricity generation, the increase in domestic gas production (which has made it more affordable), and demand in the heating sector. Coal was the only source that decreased in final energy demand (-2.6%), in line with the Biden Administration's shift to less carbon-heavy energy sources. Oil increased by 2.1%, which can be attributed to an increase in post-pandemic travel as it is utilised in aviation, shipping, and road transport. Renewables increased by 2.5% in line with policy support for clean energy. Electricity and others increased by 4.3%, which aligns with the electrification of the transportation sector as electric vehicle ownership increased, as well as the electrification of other aspects of the remaining sectors, such as industrial processes and heating. In addition, high summer temperatures in some regions of the United States may have driven higher electricity demand for cooling (air conditioning). Also, the shift towards more electric-based infrastructure has led to a higher share of electricity in overall energy use.

Figure 7: Final energy demand fuel share, The United States and APEC, 2022



Source: EGEDA (2024)

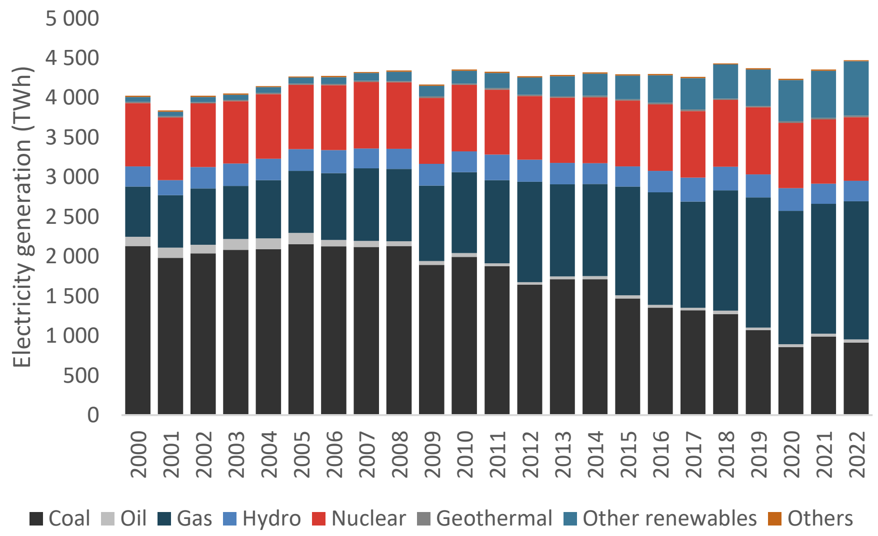
In comparison to the aggregate total final energy consumption of APEC, the United States relies less on coal than the APEC average at 11-percentage points less. The APEC average for electricity and others is one-third, but only one-quarter in the United States. The U.S. share of oil and gas is 10-percentage points and eight-percentage points higher than the APEC average, respectively.

Transformation

Power Sector

The United States generated 4473 TWh of electricity in 2022, which is 2.7% more than what was generated in 2021.

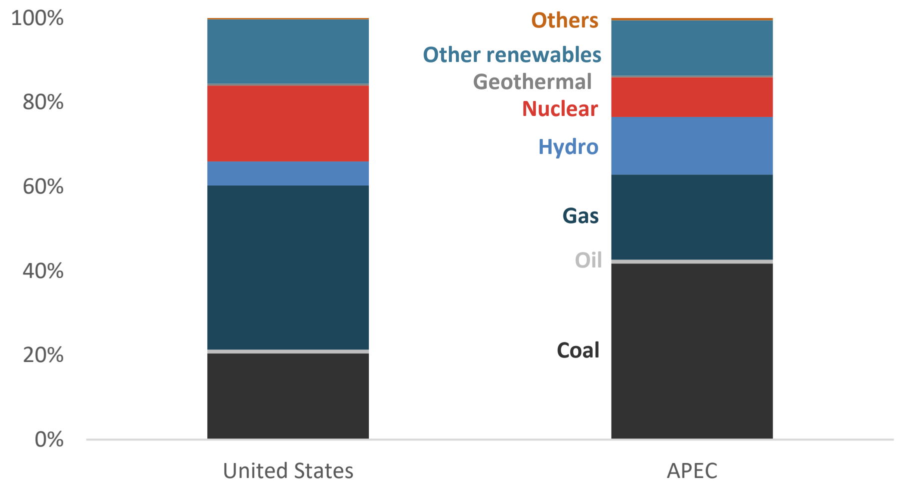
Figure 8: The United States' electricity generation by fuel, 2000 to 2022



Source: EGEDA (2024)

The amount of generation has been relatively stable; however, the fuels used to generate power in the United States have changed considerably over the last two decades. In the early 2000s, more than 50% of U.S. electricity was generated in coal-fired plants, but this share steadily declined to 20% in 2022. Over the same period, the share of gas-fired generation increased from 16% in 2000 to 39% in 2022. The shares of other fuels and technologies remained relatively constant except for non-hydro renewables, the share of which grew from 2.5% in 2000 to 15% in 2022.

Figure 9: Electricity generation fuel share, The United States and APEC, 2022



Source: EGEDA (2024)

Electricity generation by fuel type varies between the United States and the APEC average. In 2022, coal accounted for more than 40% of electricity generation in the aggregate APEC, while it consisted of only about a fifth of the total in the United States. Natural gas was the largest source of electricity generation in the United States, contributing nearly 40%, but only about a fifth in APEC. While oil represented similar shares for both, APEC member economies generally depend more on hydro than the United States, whereas the United States relies more on nuclear compared to the APEC average.

Energy Transition

The Biden Administration focused on accelerating the energy transition in the United States towards a cleaner and more sustainable future by setting goals to address climate change and reduce GHG emissions, in alignment with global efforts to tackle environmental challenges. One of the key initiatives was rejoining the Paris Agreement, which committed the United States to substantial emissions reductions. The Administration also proposed increased investments in clean energy infrastructure, research, and development as part of broader economic recovery plans. Executive orders aimed at promoting electric vehicles, advancing renewable energy projects, and enhancing energy efficiency underscored the commitment to reshaping the U.S. energy system. Additionally, efforts were made to prioritise environmental justice, offering support to communities disproportionately impacted by pollution, climate change, and job losses tied to the energy transition.

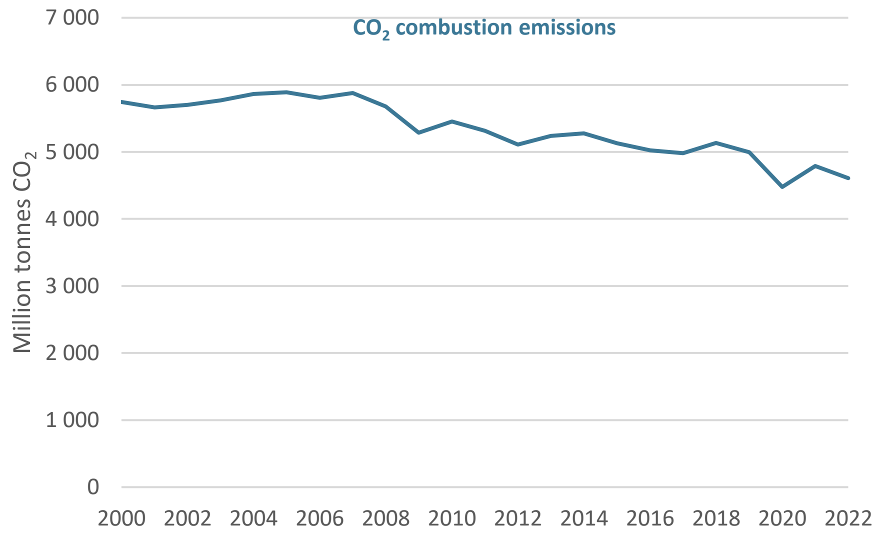
The second Trump Administration began on 20 January 2025, which led to a broadening of U.S. energy policy towards support for all energy sources. Key executive orders included the withdrawal of the United States from the Paris Agreement, the resumption of approvals for LNG exports, and the easing of regulations on oil, gas, and nuclear energy development. The administration also declared an economy-wide energy emergency, aiming to accelerate infrastructure for fossil fuels, biofuels, and nuclear power, with a particular focus on securing reliable, dispatchable power sources for critical sectors like artificial intelligence (AI). Additionally, the executive orders imposed restrictions on wind power development and sought to limit electric vehicle (EV) adoption by removing related subsidies and regulations. These actions reflect a broader strategy to prioritise U.S. energy independence and boost domestic energy production, though their long-term impact will depend on legal outcomes and industry responses.

Emissions

U.S. CO_2 emissions have varied over time, influenced by factors such as economic shifts, changes in energy consumption, and government policies. In the early 2000s, emissions rose gradually, driven by economic expansion, though this was somewhat counterbalanced by a shift from coal-based to natural gas-powered electricity generation. Emissions then decreased during the 2007-09 financial crisis. Following the recession, emissions followed a similar upward trend as the economy recovered. The adoption of technologies like solar and wind power helped lower the carbon intensity of the electricity sector. Emissions have generally trended downward, with a significant drop in 2020 due to decreased activity during the COVID-19 pandemic. These patterns reflect the ongoing shift towards a more sustainable, low-carbon energy system, marked by reduced carbon emissions from increased use of renewable energy, a decline in coal reliance, and enhanced energy efficiency.

The Expert Group on Energy Data and Analysis (EGEDA) falls under the umbrella of APEC's Energy Working Group (EWG). In addition to energy data compiled by EGEDA, CO_2 emissions from combustion activities in the energy sector are also recorded. These emissions are a subset of total GHG emissions that are considered in the context of climate change, such as under the United Nations Framework Convention on Climate Change (UNFCCC).

Figure 10: The United States' CO_2 combustion emissions (million tonnes), 2000 to 2022



Source: EGEDA (2024)

Energy Security

The United States implements a multifaceted approach to enhance its energy security. Strategies include diversifying energy sources to mitigate against overreliance on individual fuel types, promoting energy efficiency across various sectors, and maintaining a Strategic Petroleum Reserve as a safeguard against disruptions in oil supply. The United States also encourages the development of domestic energy resources, particularly through the expansion of shale gas and oil production, contributing to reduced reliance on imported fuels. Investment in renewable energy technologies, such as solar and wind power, is a key focus, supported by policies and incentives to accelerate their adoption. Modernising energy infrastructure, including the electricity grid and pipelines, is prioritised to improve overall reliability and resilience. The United States also furthers international collaborations and resilience planning against potential disruptions, such as natural disasters and cyber threats, to increase its energy security.

APEC Energy Goals

There are two energy-related objectives that APEC member economies have agreed to meet as a collective: to improve energy intensity and double the share of modern renewables.

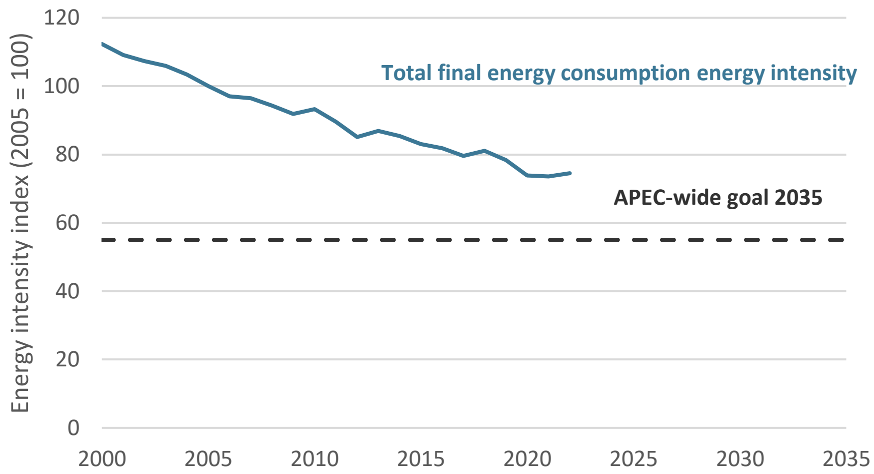
Energy Intensity Goal

In 2011, APEC member economies agreed to reduce energy intensity by 45% by 2035, relative to a 2005 baseline. The original goal was a 25% improvement by 2030, relative to a 2005 baseline.

APEC is on track to achieve this energy intensity improvement. The goal does not impose individual economy targets, but it is possible to track the progress of individual APEC economies relative to the overarching proportional improvement.

From 2005 to 2020, the United States made relatively steady progress in improving energy intensity, reflecting a more efficient use of energy in relation to economic activities. In 2020, energy intensity in the United States was 26% lower than in 2005. This trend can be attributed to numerous factors, such as advancements in energy-efficient technologies, a greater focus on energy conservation, and changes in the industrial and economic landscape. Both federal and state-level policies, alongside voluntary efforts from businesses, have helped drive energy efficiency across various sectors. U.S. energy intensity did not improve in 2021 and 2022, but it is too early to say whether this is a new trend.

Figure 11: The United States' total final energy consumption intensity index, 2000 to 2022 (2005 = 100)

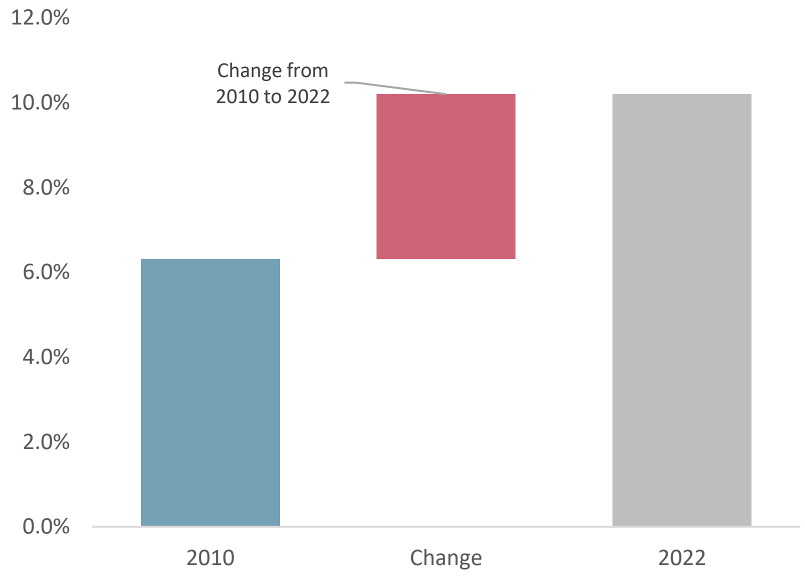


Source: EGEDA (2024)

Doubling of Renewables

The second energy goal involves doubling the share of modern renewables in the APEC energy mix for the period 2010 to 2030. APEC is on track to achieve this goal. There is no economy-level goal for individual member economies, but improvements by individual economies will contribute to the doubling goal.

Figure 12: The United States' modern renewable energy share, 2010 and 2022



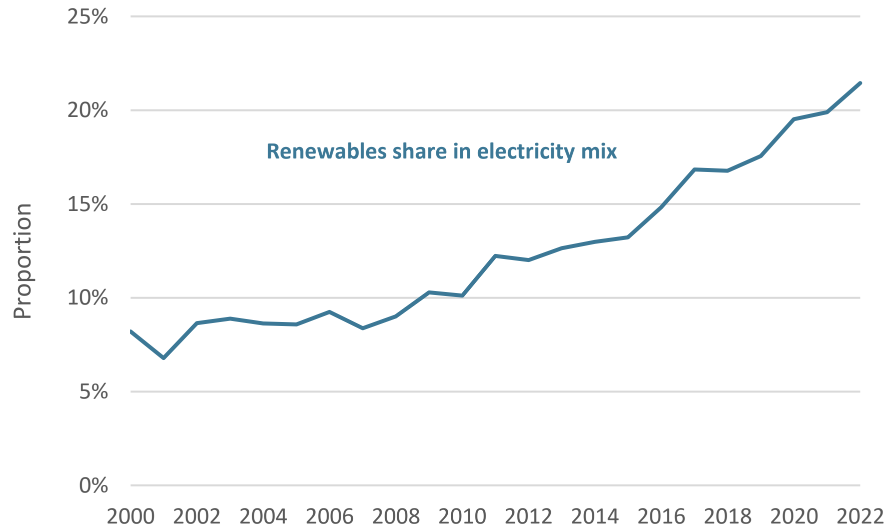
Source: EGEDA (2024)

Note: Biomass used in the residential and commercial sectors is assumed to be traditional biomass and is not included in the definition of modern renewables. All other renewables (biomass used by industry, hydro, geothermal, etc.) are considered modern renewables. Modern renewables also include the share of electricity that is generated from renewable sources.

From 2010 to 2022, the share of modern renewables in the United States' total final energy consumption (TFEC) grew from 6.3% to 10%. The latest EGEDA data from 2022 shows that renewable energy accounted for 21% of the U.S. electricity generation, up from 10% in 2010, more than doubling over this period.

This change was driven by a mix of technological progress, cost savings, and incentives like renewable energy tax credits. In particular, wind and solar power have seen substantial growth, marked by an increase in both generation capacity and electricity production. Both federal and state-level policies, alongside incentives such as tax credits, have been instrumental in promoting renewable energy development.

Figure 13: The United States' renewable generation share, 2000 to 2022



Source: EGEDA (2024)

Energy Policy*

*This section includes both policies and government-announced initiatives.

Energy Policy	Details	Reference
since 20 January 2025		
Declaring a National Energy Emergency	On 20 January 2025, an Executive Order declared an economy-wide energy emergency, highlighting the United States' energy security. The order calls for the swift development of domestic energy resources, with a focus on improving production, transportation, refining, and generation, particularly in the Northeast and West Coast. It directs federal agencies to use all available legal powers to expedite energy projects. The order also mandates interagency coordination to address energy vulnerabilities impacting the economy's defence and infrastructure gaps.	The White House
Unleashing American Energy	The Executive Order issued on 20 January 2025, outlines a federal energy policy aimed at establishing U.S. energy dominance by promoting traditional energy exploration, streamlining permitting processes, and boosting domestic production of non-fuel minerals, including rare earths. The order directs federal agencies to review and potentially rescind regulations that hinder energy development. In addition, it highlights a focus on oil, natural gas, coal, and nuclear energy. It also calls for the elimination of subsidies and mandates for EVs, reduced regulations on consumer appliances, and support for LNG export approvals. Additionally, the order pauses funds allocated under the Inflation Reduction Act and the Bipartisan Infrastructure Law.	The White House
Lifting the LNG Pause	On 21 January 2025, the U.S. Department of Energy (DOE) announced that it was ending the LNG pause. DOE resumed consideration of pending applications to export American LNG to economies without a free trade agreement with the United States in accordance with the Natural Gas Act.	The U.S. Department of Energy
Energy Policy	**Details**	**Reference**
before 20 January 2025		
Biden-Harris Administration Sets 2035 Climate Target Aimed at Creating Good-Paying Union Jobs, Reducing Costs for All Americans, and Securing U.S. Leadership in the Clean Energy Economy of the Future	On 19 December 2024, the Biden-Harris Administration announced a new 2035 climate target: a 61-66% reduction in 2035 from 2005 levels in economy-wide net GHG emissions. The U.S. Nationally Determined Contribution is an economy-wide, all GHG target of reducing net emissions. The emissions reduction strategy includes leveraging landmark investments from the Inflation Reduction Act and Bipartisan Infrastructure Law, complemented by federal standards; coordinating with local, state, Tribal, and territorial governments; and mobilising private capital.	The White House

Energy Modernisation Cybersecurity Implementation Plan	On 20 December 2024, the White House's Office of the National Cyber Director released an Energy Modernisation Cybersecurity Implementation Plan to enhance the security of America's energy systems. The plan outlines 32 initiatives aimed at improving cybersecurity across key energy technologies, such as batteries, inverters, distributed control systems, energy management systems in buildings, and electric vehicles.	Energy Modernization Cybersecurity Implementation Plan
Biden-Harris Administration Announces Historic USD 20 Billion in Awards to Expand Access to Clean Energy and Climate Solutions and Lower Energy Costs for Communities Across the Nation	The Biden-Harris Administration announced USD 20 billion in funding to support climate and clean energy projects, particularly in underserved communities. The funds are part of the Greenhouse Gas Reduction Fund, aiming to reduce carbon pollution, improve air quality, lower energy costs, and create jobs. The investment will support various clean energy initiatives, including renewable power generation, energy-efficient retrofits, and zero-emission transportation, with a focus on ensuring that at least 70% of the funds benefit disadvantaged communities.	The White House
Investing in America & Permitting Action Plan	The Biden-Harris Administration accelerated federal permitting to deploy infrastructure and clean energy projects faster, safer, and more efficiently while maintaining strong environmental protections and community engagement. Key actions included implementing the Bipartisan Permitting Reform Implementation Rule, expanding the use of expedited environmental reviews, and surpassing clean energy permitting goals for renewable projects like offshore wind and solar. Investments from the Inflation Reduction Act have strengthened federal permitting resources, while initiatives like the Justice40 plan and enhanced community engagement promote equitable benefits for disadvantaged communities.	The White House
Net-Zero Projects at Federal Facilities	As part of the Biden-Harris Administration's Investing in America agenda, the U.S. DOE in 2024 opened its second phase of Assisting Federal Facilities with Energy Conservation Technologies grant funding of USD 250 million to help federal agencies implement net-zero building projects and set an example in sustainability as the economy works to transition to clean energy and combat climate change. This opportunity furthers the goals outlined in President Biden's Federal Sustainability Plan, which aims to reach net-zero emissions from overall federal operations by 2050, including a 65% emissions reduction by 2030.	The U.S. Department of Energy
Grid Resilience and Innovation Partnerships (GRIP) Program	In 2024, DOE announced over USD 4 billion in 46 projects through the GRIP Program. The projects will deploy new, innovative transmission and distribution infrastructure and technology upgrades to enable over 20.5 GW of grid capacity, speed up interconnection for new clean energy projects, support 11 000 well-paying jobs, and catalyse over USD 14 billion in total public and private investment to bring reliable, affordable, clean energy to Americans.	The U.S. Department of Energy
Largest Single Investment to Support America's Hydropower Facilities	In 2024, the U.S. DOE announced the selection of 46 hydroelectric projects across 19 states to receive up to USD 71.5 million in incentive payments to increase the generation efficiency of the economy's existing hydropower fleet. Administered by the Grid Deployment Office and funded by the Bipartisan Infrastructure Law, the Hydroelectric Efficiency Improvement Incentive payments represent DOE's largest investment in hydroelectric facilities to date.	The U.S. Department of Energy

Building and Sustaining a 21st Century Energy Workforce	In 2024, investments through DOE's Office of Manufacturing and Energy Supply Chains helped companies create or retain nearly 50 000 jobs. In September, DOE announced over USD 2.8 billion to support affordable clean power in the Midwest through new nuclear energy facilities that will create more than 2000 well-paying union jobs. Additionally, the Industrial Training and Assessment Center Program invested USD 100 million in workforce development. In May, DOE announced the first faculty cohort for the Faculty-Applied Clean Energy Sciences Program to help teachers inspire STEM students to pursue careers in clean energy.	The U.S. Department of Energy
Advancing Public-Private Efforts to Fill Critical Gaps in the National EV Charging Network	Key Federal programs supported by the Joint Office of Energy and Transportation (Joint Office) have spurred private sector investment to grow the U.S. EV charging network to more than 205 000 public EV chargers, with nearly 1 000 new public chargers turned on every week. Thanks to the National Electric Vehicle Infrastructure Program and USD 2.5 billion Charging and Fuelling Infrastructure Program, there are 259 federally funded public charging ports operational this year across 15 states, and there are projects for 24 800 federally funded charging ports underway across the economy.	The U.S. Department of Energy
Leveraging Technology and Research for Innovation	In 2024, the DOE announced millions of dollars in investments in innovative clean energy technology, including solar energy, geothermal, and offshore wind. Additionally, from commissioning El Capitan, the fastest supercomputer in the world, to embedding energy innovators in the economy's labs to develop next-generation technologies, DOE is ensuring America is at the centre of clean energy innovation. In 2024, DOE also supported research and development opportunities, surpassing USD 1 billion in total funding to advance nuclear energy research and training, and announced over USD 200 million for small business research and development grants.	The U.S. Department of Energy
Industrial Innovation to Combat Climate Change	In October 2024, DOE announced USD 518 million to strengthen the economy's infrastructure for permanent, safe storage of carbon pollution. DOE also announced nearly USD 85 million to accelerate the manufacturing of electric heat pumps, helping to reduce energy consumption and harmful GHG emissions. In December, DOE announced USD 850 million for 40+ projects as part of the joint EPA-DOE Methane Emissions Reduction Program, which is providing a total of USD 1.36 billion to support the monitoring and mitigation of methane emissions from the oil and natural gas sector. DOE's Office of Clean Energy and Demonstrations announced the single largest effort to decarbonise the U.S. industrial sector in our economy's history: up to USD 6 billion for 30+ projects as part of the Industrial Demonstrations Program to help accelerate the commercial-scale demonstration of emerging industrial decarbonisation technologies, strengthening domestic manufacturing.	The U.S. Department of Energy

Notable Energy Developments

Energy Development	Details	Reference
Nuclear Energy Investment Surge	Major tech companies, such as Amazon, Microsoft, Meta and Google, are investing in nuclear energy to meet their growing energy demands while addressing climate goals. Google has commissioned small modular reactors for its data centres, Amazon backed X-energy's nuclear development, and Microsoft signed a 20-year deal to restart the Three Mile Island plant; however, it will take time for these investments to make an impact on the U.S. power supply as there are permitting hurdles and high building costs.	Financial Times
Major Oil and Gas Deals	U.S. oil and gas deal-making remained active in 2024, with major players like ConocoPhillips acquiring Marathon Oil for USD 22.5 billion and Diamondback Energy purchasing Endeavor Energy Resources for USD 26 billion. Although mergers slowed in the latter half of the year, analysts suggest that a business-friendly environment under a potential Trump administration and a more lenient Federal Trade Commission could spur further industry consolidation.	Financial Times
U.S. Public Opinion on Energy Sources	When the public was asked about America's energy future, 64% believed the priority should be expanding wind, solar, and hydrogen energy production. In contrast, 35% supported prioritising the exploration and production of oil, coal, and natural gas.	Pew Research Center
Plaquemines LNG and Corpus Christi Stage 3 started LNG production	On 26 December 2024, Plaquemines LNG, the eighth LNG export terminal in the United States, shipped its first cargo after achieving its first LNG production in mid-December. Corpus Christi Stage 3 (an expansion of the existing Corpus Christi LNG export terminal) also began LNG production in December 2024.	EIA

Useful Links

APEC Expert Group on Energy Data and Analysis (EGEDA) – https://www.egeda.ewg.apec.org/

Energy Institute Statistical Review of World Energy – https://www.energyinst.org/statistical-review

International Atomic Energy Agency (IAEA) – https://www.iaea.org/

OECD Nuclear Energy Agency (NEA) – https://www.oecd-nea.org/

The White House Statements and Releases – https://www.whitehouse.gov/briefing-room/statements-releases/

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U.S. Department of Energy – https://www.energy.gov/

U.S. Department of State – https://www.state.gov/

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Viet Nam

Introduction

In recent years, Viet Nam has enacted key energy policies to achieve its 2050 net zero target.

In May 2023, Decision No. 500/QD-Ttg approved the National Power Development Plan (PDP8), outlining a roadmap for decarbonisation in the power sector to 2030, with a vision towards 2050.

In July 2023, The National Energy Master Plan (NEMP) was approved, setting specific targets for oil and gas, coal, and renewable energy.

In April 2024, the PDP8 implementation plan was approved to ensure sufficient power for economic growth.

In November 2024, the National Assembly of Viet Nam officially adopted the New Electricity Law. This law is scheduled to take effect in February 2025.

Viet Nam has been one of Asia's fastest-growing economies with an average GDP growth of 6.3% from 2000 to 2022. In 2022, GDP reached USD 1289 billion (2021 USD PPP), with an 8.1% growth rate as a result of the economic recovery after the COVID-19 pandemic. Industry, construction, and services are significant sectors, accounting for approximately 80% of Viet Nam's GDP in 2022 (GSO, 2023).

In 2022, the economy's population was 100 million, with an urban population share of 38% (GSO, 2024).

Viet Nam possesses diverse natural resources, including 4.4 billion barrels of oil, 23 trillion cubic feet of gas, and 3360 million tonnes of coal (Table 1).

Viet Nam has huge potential for renewable energy sources such as hydro, solar, wind, and biomass. In 2022, renewable energy increased by 12% relative to 2021, accounting for 21% of the total primary energy supply (TPES) (EGEDA, 2024). This share is projected to rise to 85% by 2050 (NEMP, 2023).

Viet Nam's energy sector has transitioned from relying on fossil fuels to adopting cleaner energy sources to reduce greenhouse gas emissions, particularly in the power generation sector.

At the same time, the Vietnamese government has prioritised energy security, resilience, and affordability to support economic growth amid the ongoing global energy crisis and fluctuating energy prices.

Table 1: Viet Nam's macroeconomic data and energy reserves

Key data [a, b]		**Energy reserves [c, d]**	
Area (million km^2)	0.33	Oil (billion barrels)	4.4
Population (million)	100	Gas (trillion cubic feet)	23
GDP (2021 USD billion PPP)	1289	Coal (million tonnes)	3360
GDP per capita (2021 USD PPP)	12 958	Uranium (kilotonnes U < USD 130/kgU)	-

Source: [a] GSO (2024); [b] World Bank (2024); [c] BP (2024); [d] UN (2024)

Note: Reserves are total proved reserves and reasonably assured recoverable resources for uranium.

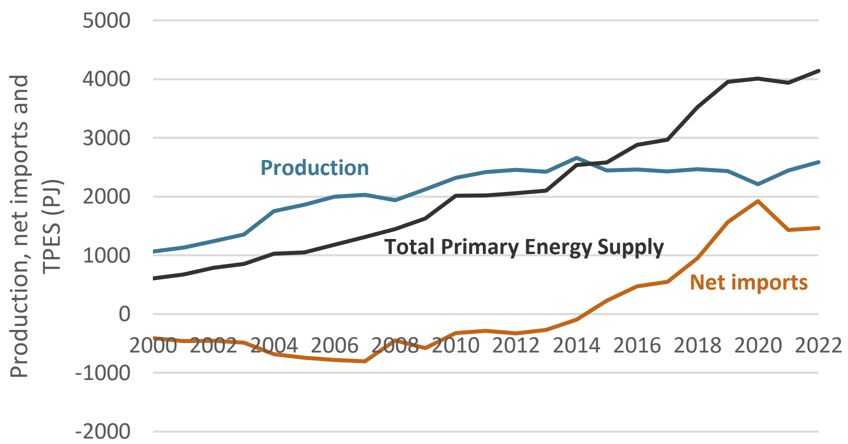
Energy Supply and Consumption

Total Primary Energy Supply

With high economic growth expected in the coming years, ensuring reliable and affordable energy supplies is one of the top priorities of Viet Nam's government. Figure 1 illustrates that the TPES rose an average of 9% per year from 2000 to 2022, driven primarily by increased production up to 2014 and increased imports after 2014. In 2022, TPES increased by 5.1% to 4139 petajoules (PJ) compared to the previous year (EGEDA, 2024).

Indigenous energy production declined after peaking in 2014, but rebounded in 2021 and continued to rise in 2022. In 2022, indigenous energy production increased by 5.9% due primarily to increased renewable energy production.

Figure 1: Viet Nam’s energy supply, production, and net imports (PJ), 2000 to 2022



Source: EGEDA (2024)

Viet Nam has abundant coal resources in the northern provinces, anthracite and semi-anthracite coal in Quang Ninh province and sub-bituminous coal in the Red River Delta provinces (Thai Binh, Hai Duong, Hung Yen, Nam Dinh, Hai Phong and Ha Nam). To date, indigenous coal has been produced mainly in the Quang Ninh coal basin. This coal basin produces around 40 million tonnes of coal annually, accounting for approximately 90% of domestic coal production.

Currently, there is no production from the Red River Delta area due to technical and economic challenges. According to the Development Strategy of the Coal Industry for 2030, which includes a vision for 2045, the government plans to initiate pilot mining operations in the Red River coal basin before 2040. If these trials are successful, industrial-scale mining may commence before 2050 (DSCI, 2024).

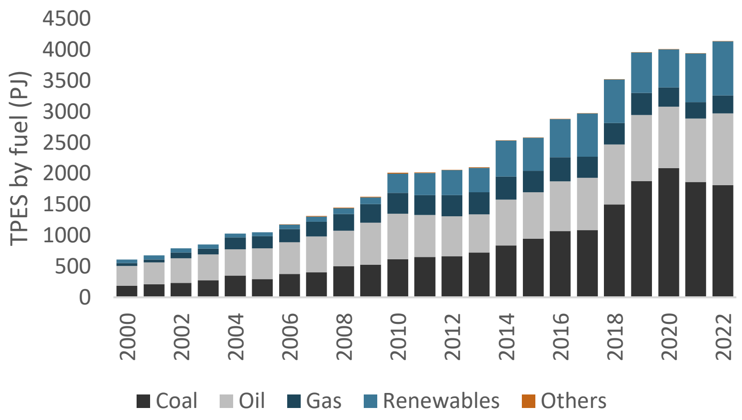
Crude oil and natural gas are mainly extracted offshore in the south of Viet Nam. However, economic crude oil reserves are expected to become depleted some time before 2030. A significant recent natural gas development is the Ca Voi Xanh project in the central provinces (Quang Nam and Quang Ngai). Upstream and midstream components of this project belong to a joint venture project between the Exxon Mobil group and the Viet Nam National Oil and Gas Group, which expects to start initial gas production by 2028. Based on economic assumptions, the production will continue until the field reaches its economic limit in 2047 (Offshore Technology, 2023). It will supply gas-fired power generation and petrochemical plants in Viet Nam's central region, such as Mien Trung 1 and 2, and Dung Quat 1 and 3.

Hydropower is the most significant renewable energy source, contributing approximately 36% to the electricity generation mix in 2022. Viet Nam aims to utilise hydropower and other renewable sources to partially replace fossil fuels through electrification, with the goal of achieving net zero emissions by 2050.

Viet Nam was a net energy exporter for several decades; however, since 2015, it has become a net energy importer. This shift is primarily due to significant growth in energy demand and a decline in domestic production. In recent years, energy imports have surged dramatically, except for 2021, and they are expected to continue to rise in the coming decades. In 2022, net imports increased by approximately 2.4% to meet the high energy demand.

Viet Nam's TPES by fuel has continuously increased since 2000 to meet the high energy demand for rapid economic growth, except in the year 2021 (Figure 2). In 2022, energy demand (and therefore TPES) grew as a result of the economic recovery from the COVID-19 pandemic. The oil and gas supply spiked by 13% and 9%, respectively, compared to the previous year. However, the coal supply dropped 3% from 1864 PJ in 2021 to 1808 PJ in 2022.

Figure 2: Viet Nam's energy supply by fuel (PJ), 2000 to 2022



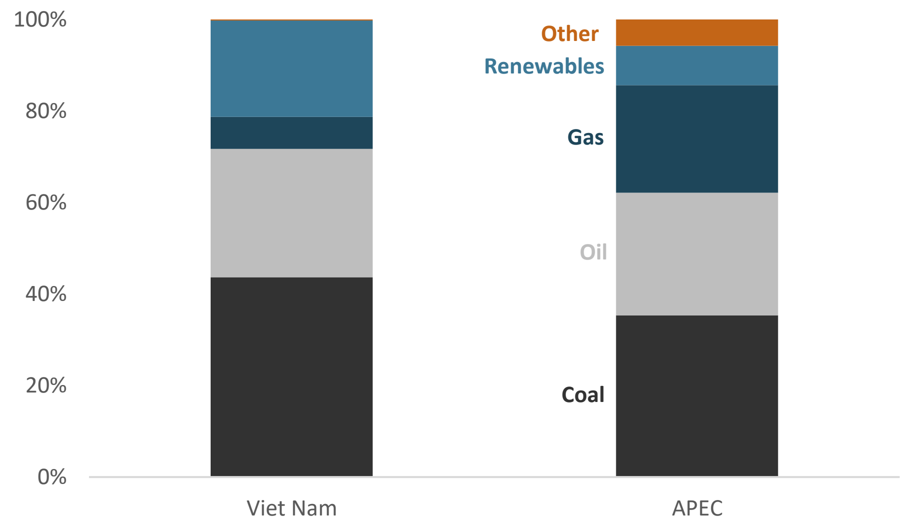
Source: EGEDA (2024)

The renewables supply continued to rise from 782 PJ in 2021 to 873 PJ in 2022 (EGEDA, 2024). The high growth in renewable energy supply resulted from renewable energy-promoting policies such as the feed-in tariff (FiT) mechanism (Watson Farley, 2019). However, Viet Nam has faced several challenges that have hindered renewable energy production, such as insufficient smart grid technologies, limited electricity storage systems, and constrained power transmission capacity.

Coal-fired power plants and energy-intensive industries (steel making, aluminium smelting, cement manufacturing, and fertiliser production) have contributed significantly to coal supply growth in recent years.

Figure 3 illustrates the energy supply mix for Viet Nam and the APEC region in 2022.

Figure 3: Energy supply mix, Viet Nam and APEC, 2022



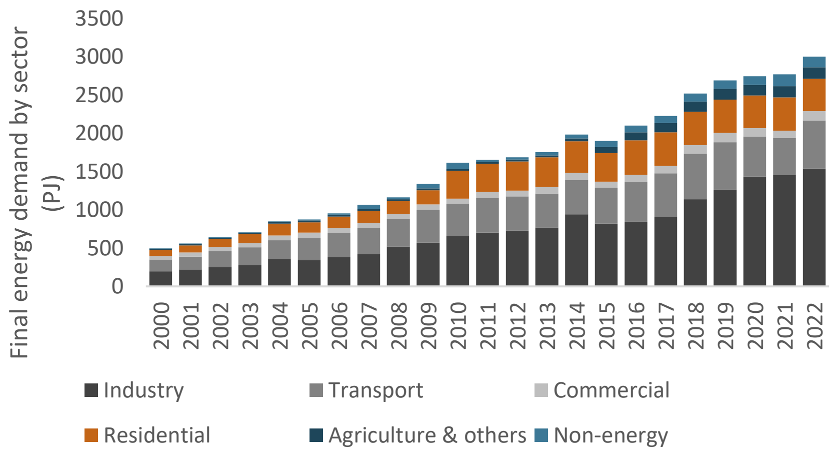
Source: EGEDA (2024)

In Viet Nam, coal played a significant role, comprising nearly 44% of the total energy supply in 2022. This proportion is notably higher than coal's share in the APEC region, which stands at 35%. Oil's share in Viet Nam's energy supply mix was approximately 28%, 1.3% higher than the APEC region's oil share. However, Viet Nam's gas share accounted for only 6.9% of the energy supply mix, much lower than the APEC gas share (24%). The renewables share accounted for 21% of Viet Nam's energy supply mix, more than double the APEC region's renewables share (8.6%).

Total Final Consumption

Viet Nam's total final consumption (energy plus non-energy use of fuels) grew 8.5% annually from 2000 to 2022 (Figure 4). This large increase resulted from significant growth in GDP and population. The total final consumption in 2022 was 3003 PJ, a rise of 8.3% compared to the previous year.

Figure 4: Viet Nam's final consumption by sector (PJ), 2000 to 2022

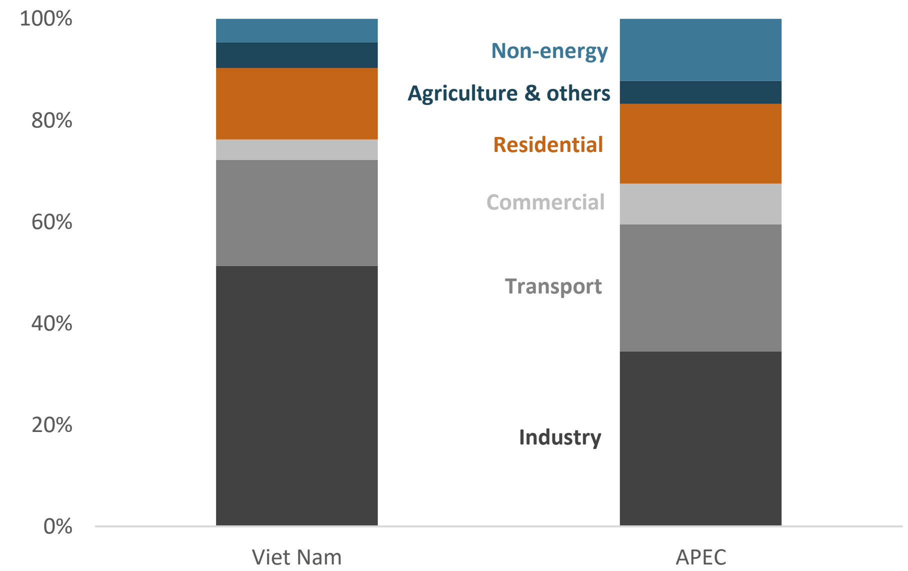


Source: EGEDA (2024)

In 2022, the industrial sector was the largest end-use sector, representing 51% of total energy consumption (including non-energy uses). Following this, the transport sector accounted for 21% of energy consumption. The commercial sector made up 4%, while the residential sector represented 14%. Finally, the combined share of agriculture, forestry, fishery, and other uses was only 5%.

Figure 5 shows the final consumption by sector for Viet Nam and APEC in 2022.

Figure 5: Final consumption by sector, Viet Nam and APEC, 2022



Source: EGEDA (2024)

Energy consumption for Viet Nam's industry accounted for over half of the total final energy consumption (51%), much higher than APEC's average (35%). Governmental policy to accelerate industrialisation and modernisation drives Viet Nam's extensive energy use in the industrial sector (Politburo, 2018). In contrast, Viet Nam's transport sector share is lower than that of the APEC region.

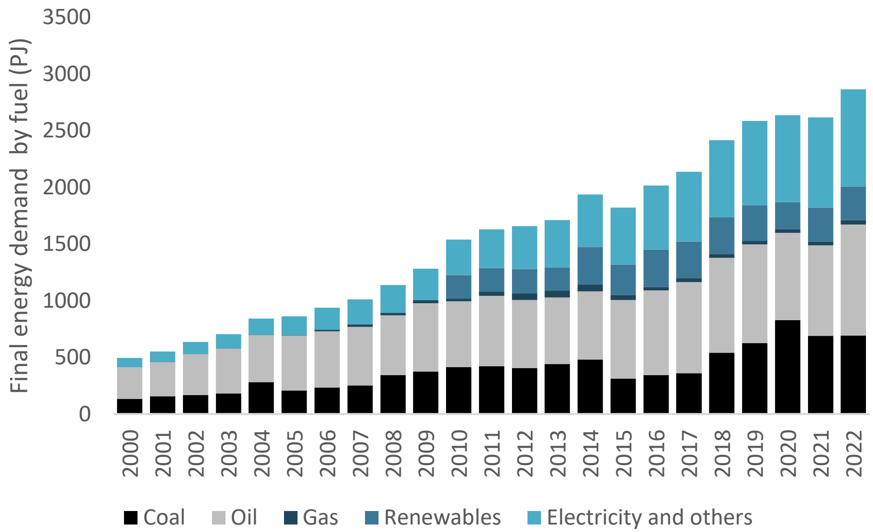
The energy consumption share in the residential and commercial sectors in Viet Nam was lower than that of APEC, while agriculture and others had similar shares in Viet Nam and APEC.

The energy consumption in the non-energy sector in APEC had a larger share than that of Viet Nam.

Final Energy Demand

In 2022, fossil fuels represented approximately 60% of Viet Nam's final energy demand (Figure 6). Among these fossil fuels, oil was the most consumed, making up about 34% of the total demand, followed by coal at 24%.

Figure 6: Viet Nam’s final energy demand by fuel (PJ), 2000 to 2022



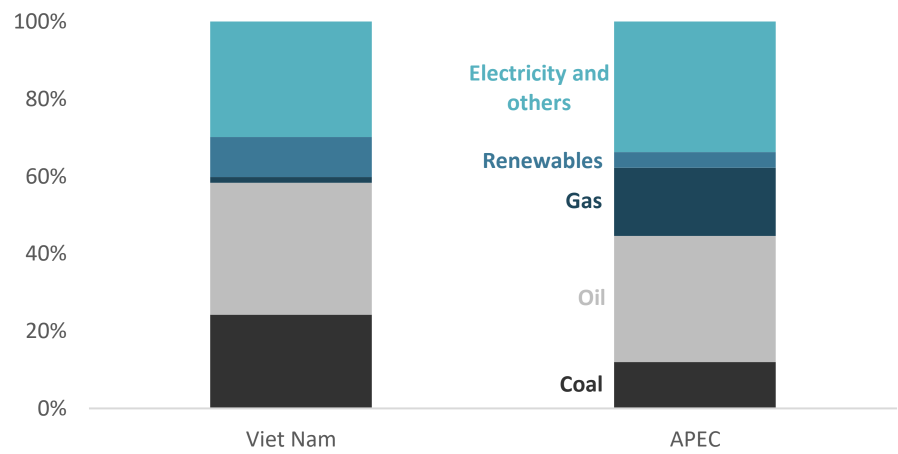
Source: EGEDA (2024)

Note: does not include non-energy sector consumption of energy products

Electricity and other sources together accounted for nearly 30% of the final energy demand while gas constituted only 1.4%. Additionally, renewable energy sources contributed approximately 10% to Viet Nam's final energy demand.

In 2022, coal accounted for more than double the share of final energy demand in Viet Nam compared to the APEC region (Figure 7). Additionally, the share of oil in Viet Nam's energy demand was slightly higher than that of the APEC region. However, natural gas demand in Viet Nam was only 1.4% of its final energy demand, significantly lower than the APEC average of 18%. On the other hand, the share of renewable energy in Viet Nam was nearly three times greater than that of the APEC region. The shares of electricity and other energy sources showed only a small difference between Viet Nam and the overall APEC region.

Figure 7: Final energy demand fuel share, Viet Nam and APEC, 2022



Source: EGEDA (2024)

Transformation

Power Sector

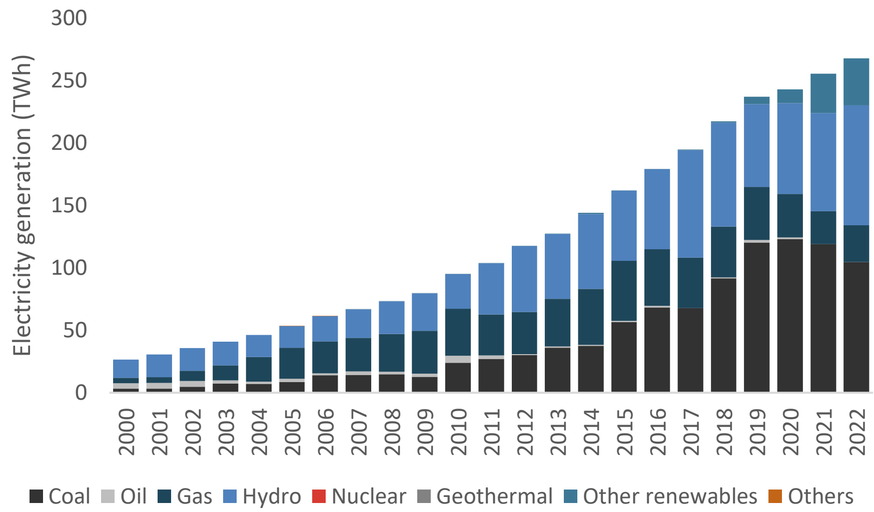
Figure 8 illustrates electricity generation by fuel in Viet Nam from 2000 to 2022. During this period, the economy experienced rapid growth in electricity demand, with an annual growth rate of 11% (EGEDA, 2024). Although the electricity grid is interconnected throughout Viet Nam's entire geography, different generation technologies tend to be concentrated in specific regions due to domestic energy resource distribution. For example, coal-fired power plants are primarily located in the north, whereas gas-fired power plants, as well as solar and wind farms, are mostly situated in the south.

In 2022, Viet Nam generated approximately 268 terawatt hours (TWh) of electricity, an increase of 4.9% from the previous year. Fossil fuel-based power generation (coal, oil, and gas) accounted for half of the total generation mix, followed by hydro (36%). Renewable generation and others constituted 14% of the total generation mix (EGEDA, 2024).

Viet Nam's power sector is still reliant on coal. Approximately 39% of the electricity production was generated from coal in 2022, representing an increase of nearly 13% per annum from 2010 to 2022 (EGEDA, 2024).

Before 2018, only a small amount of solar and wind capacity was installed in Viet Nam. Thanks to the FiT mechanism, solar installed capacity has increased substantially since 2017. Up to the end of 2023, renewable energy capacity reached 21 664 MW, accounting for 27% of the total installed generation capacity (EVN, 2023).

Figure 8: Viet Nam’s electricity generation by fuel, 2000 to 2022



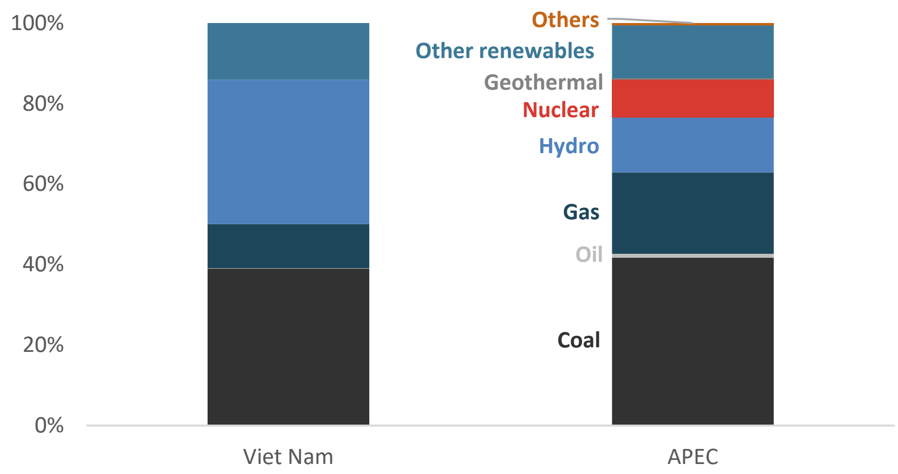
Source: EGEDA (2024)

The Vietnamese government issued a new PDP8 in May 2023, considering the 2050 net zero carbon emission target. According to the PDP8, Viet Nam plans to gradually phase down coal power generation and ramp up renewable, biomass, and hydropower generation as well as energy storage.

Viet Nam's electricity share from coal in 2022 was 2.8% lower than that of the APEC region (Figure 9). Viet Nam's share of gas in electricity generation was around half of APEC’s gas share.

In 2022, hydropower constituted the second-largest portion of Viet Nam's electricity generation mix, accounting for approximately 36%. This figure is more than double the hydropower share in the APEC region as a whole. Additionally, electricity generation from other renewable sources in Viet Nam was slightly higher than the average for the APEC region.

Figure 9: Electricity generation fuel share, Viet Nam and APEC, 2022



Source: EGEDA (2024)

Energy Transition

Since COP26, the government has updated and issued many new policies related to energy and climate change. These policies are: the National Climate Change Strategy to 2050 (2022); the Ministry of Foreign Affairs' Climate Diplomacy Action Plan, which aims to implement Viet Nam's commitments at COP26 in the period 2022-25 (2022); the Action Plan of the Construction Sector in Climate Change Response for the period 2022-30, with a vision to 2050 in order to implement Viet Nam's commitments at COP26 (2022); the Action Plan of the Ministry of Industry and Trade to implement Viet Nam's commitments at COP26 (2022); the Scheme on Tasks and Solutions to Implement the Results of COP26 (2021); the Action Program on Green Energy Transition and Reduction of Carbon and Methane Emissions of the Transportation Sector (2022); the Methane Emission Reduction Action Plan to 2030 (2022); the National Power Development Plan for 2021-2030, with a vision to 2050 (2023); the Energy Master Plan for the 2021-2030 period, with a vision to 2050 (2023); the Implementation Plan for PDP8 (2024); and the revised Electricity Law (2024).

These new policies focus on potential solutions and measures to reduce CO_2 emissions while maintaining energy security, reliability and affordability, particularly in the high GHG emissions sectors.

Emissions

As a developing economy that has recently begun the process of industrialisation and modernisation, which is expected to last several decades, CO_2 emissions from energy-related sectors have increased approximately six-fold over the past 22 years. In 2022, emissions reached 260 million tonnes, up from 45 million tonnes in 2000 (Figure 10). The primary sources of these emissions were the power, industrial, and transport sectors. The power sector was the largest contributor, accounting for over half of the total energy-related CO_2 emissions, followed by the industrial sector and then the transport sector. Despite the implementation of various policies aimed at reducing CO_2 emissions, levels have continued to rise rapidly due to increased energy consumption related to economic and population growth. Additionally, the heavy reliance on fossil fuels in both the power and industrial sectors poses a challenge to achieving net zero emissions.

In recent years, Viet Nam has implemented measures to reduce GHG in various sectors, especially the energy production and industry consumption sectors.

In the energy sector, accelerating renewable energy share, energy saving and improving energy efficiency, and reducing transmission loss have been major measures for GHG emission reduction, contributing to a reduction of 68 $MtCO_2eq$ in 2020 compared to the baseline year of

2014.

In the industrial sector, two key strategies for reducing carbon emissions are replacing clinker in cement production and implementing advanced technology in the chemical and steel industries. In 2020, the mining, construction, and chemical industries collectively achieved a reduction of 4 million tonnes of CO_2 equivalent ($MtCO_2eq$) (NDC, 2022).

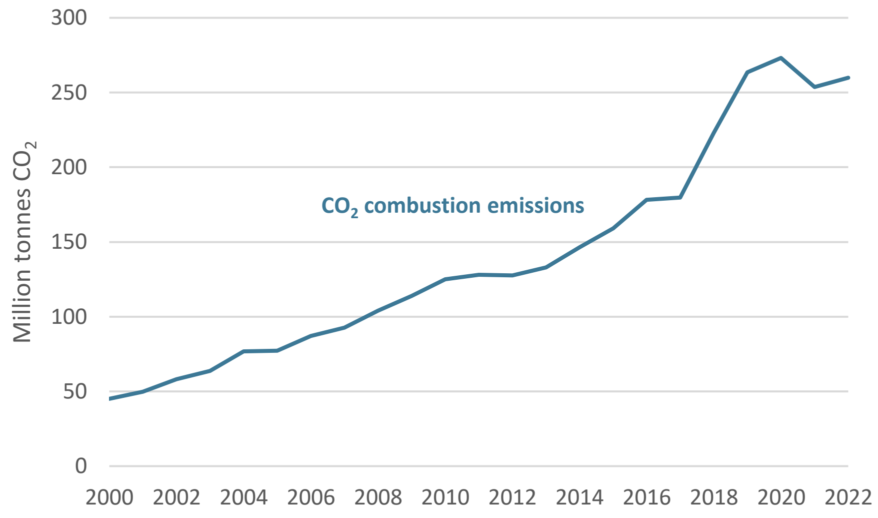
Viet Nam first submitted its Intended Nationally Determined Contribution (INDC) in 2015 and signed and approved the Paris Agreement in 2016. After the Paris Agreement came into force in November 2016, the INDC became a Nationally Determined Contribution (NDC). Viet Nam updated its NDC in 2020 and 2022. In the 2022 version, Viet Nam committed to reducing greenhouse gas emissions by 16% below 2005 levels by 2030 by using domestic resources. This is a significant increase compared to the previous commitment in 2020. With financial support from international organisations, the GHG emission reduction target will increase from 16% to 44%.

In December 2022, Viet Nam and its international partners announced a USD 16 billion package through the Just Energy Transition Partnership (JETP) program, designed to accelerate the reduction of carbon emissions and increase the uptake of renewable energy.

In December 2023, a Resource Mobilisation Plan (RMP) of the JETP initiative for Viet Nam was announced to the world at COP28 in Dubai.

Using the budget package from JETP and domestic resources, Viet Nam aims to reduce CO_2 emissions from the power sector, reduce the number of existing coal-fired power plants, and develop more renewable generation capacity in association with an expanded transmission grid and more effective energy infrastructure.

Figure 10: Viet Nam's CO_2 combustion emissions (million tonnes), 2000 to 2022



Source: EGEDA (2024)

Energy Security

Viet Nam became a net energy importer in 2015, and its reliance on energy imports is projected to increase further over the next decade, potentially reaching 53-60% of total primary fuel consumption by 2030. Currently, Viet Nam imports coal, crude oil, petroleum products, and liquefied natural gas (LNG). As a result, energy security is one of the top priorities for the Vietnamese government.

Due to high fuel prices and dependence on imported energy, the Viet Nam Government planned to dramatically reduce new LNG-fired and coal-fired power capacities in the final version of the PDP8, issued in May 2023. This action showed that the Vietnamese government is working to ensure energy security to avoid global supply chain disruption due to geopolitical and extreme weather issues.

Energy import dependency is affected by global energy prices. By reducing the amount of imported energy, Viet Nam's energy system will face less risk due to price volatility. Therefore, diversification of domestic energy sources would also avoid the risk of global supply disruption.

According to the new PDP8, renewables (excluding hydropower and storage) are expected to be a major focus and will account for almost 29% of Viet Nam's total installed capacity by 2030 and over 63% by 2050 from 19% in 2021. The installed capacity of offshore wind power is expected to rise tremendously to 6 GW by 2030 and 92 GW by 2050. Viet Nam will maximise the technical capacity of offshore wind power to produce electricity and new energy. PDP8 calls for the use of renewables to generate new energy (hydro, green ammonia), which will become a ‘new economic sector’ for Viet Nam for both domestic and export demand (PDP8, 2023).

Nevertheless, renewable generation sources are variable. They need other generation sources to assist during the night, cloudy days and periods of little wind. These sources include hydropower, battery storage and thermal power (coal-fired and natural gas-fired power plants). As mentioned above, accelerating domestic coal and natural gas production is significant during the transitional period to avoid energy supply disruptions in Viet Nam.

In October 2023, at a ceremony attended by the Economy Leader, Petrovietnam and its partners signed an agreement to launch the Block B-O Mon gas-to-power value chain project after more than 20 years of negotiations. Accordingly, a nearly USD 12 billion project in southwest Viet Nam will provide power plants with about 5.1 bcm of gas annually to supply natural gas to gas-fired power plants with a total installed capacity of 3800 MW. Its component projects are also expected to help upgrade infrastructure, generate thousands of jobs, and promote economic restructuring in many localities (Vietnam Energy, 2023).

APEC Energy Goals

There are two energy-related objectives that APEC member economies have agreed to meet as a collective: to reduce energy intensity and double the share of modern renewables.

Energy Intensity Goal

In 2011, APEC member economies agreed to increase their ambition to reduce energy intensity by 45% in 2035, relative to a 2005 baseline. The original goal was a 25% improvement by 2030, relative to a 2005 baseline.

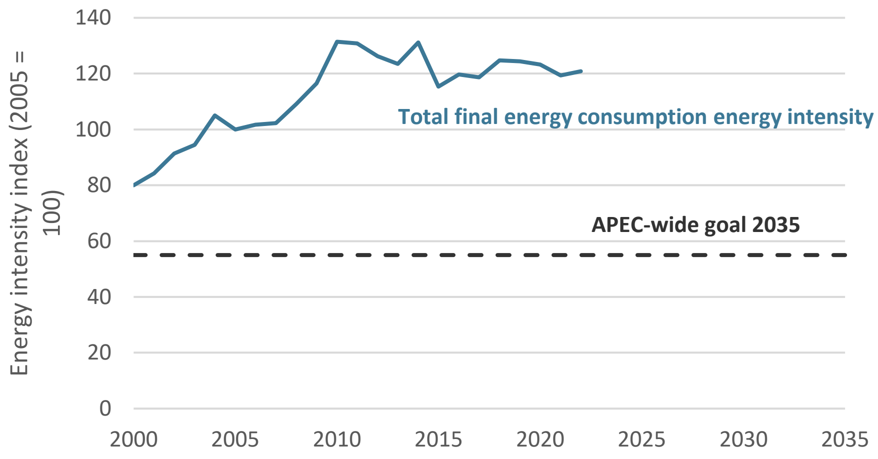
APEC is on track to achieve this energy intensity improvement. The goal does not impose individual economy targets, but it is possible to track the progress of individual APEC economies relative to the overarching proportional improvement.

Viet Nam deployed the National Energy Efficiency Program and the Law on Energy Efficiency and Conservation in 2006 and 2010, respectively (NAVN, 2010; PMVN, 2006). However, its final energy consumption intensity is still high compared to other economies.

Viet Nam's total final energy consumption intensity improved by approximately 1% over the 2011-22 period.

Viet Nam has approved the National Program on Energy Efficiency and Conservation for the period of 2019 to 2030. The program aims to achieve an energy consumption reduction of 8-10% across the economy and to ensure that electricity losses remain below 6% (PMVN, 2019). This initiative will also contribute to APEC's aspirational goal of reducing energy intensity.

Figure 11: Viet Nam's total final energy consumption intensity index, 2000 to 2022 (2005 = 100)



Source: EGEDA (2024)

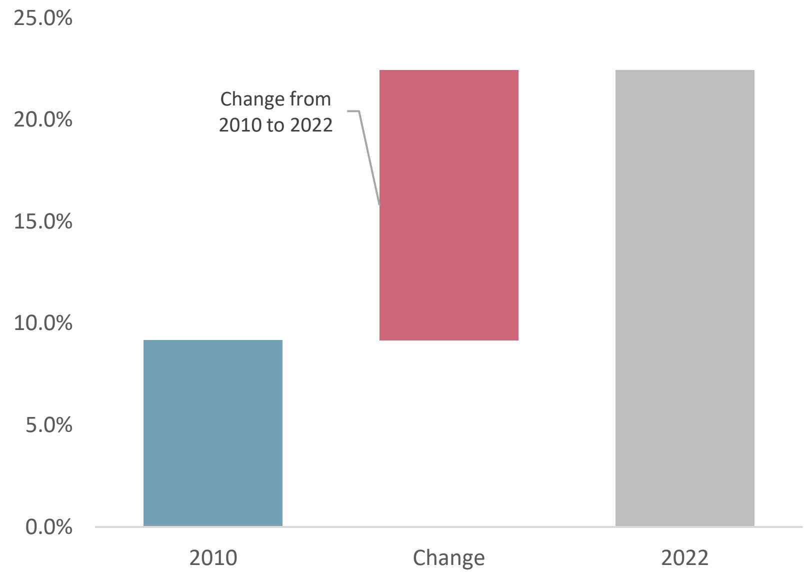
Doubling of Renewables

The second energy goal involves doubling the share of modern renewables in the APEC energy mix for the period 2010 to 2030. There is no economy-level goal for individual member economies, but improvements by individual economies will contribute to the doubling goal.

Viet Nam is starting from a higher renewable base than the APEC region, as its renewable share in 2010 was 9.2% (Figure 12), while APEC's was 6%. In 2022, the proportional share reached approximately 22%, 2.4 times greater than in 2010.

According to the NEMP, renewable energy is expected to account for 15% to 20% of TPES by 2030 and 80% to 85% by 2050. This growth will contribute to APEC meeting its goal of doubling its renewables share by 2030.

Figure 12: Viet Nam's modern renewable energy share, 2010 and 2022



Source: EGEDA (2024)

Note: Biomass used in the residential and commercial sectors is assumed to be traditional biomass and is not included in the definition of modern renewables. All other renewables (biomass used by industry, hydro, geothermal, etc.) are considered modern renewables. Modern renewables also include the share of electricity that is generated from renewable sources.

Viet Nam has set a target to achieve net zero emissions by 2050 and aims to increase the use of renewable energy in the PDP8. The economy has significant potential for renewables and could achieve over 90% integration of domestic solar and wind power, along with pumped storage hydropower, into its electricity mix. However, the costs associated with this ambitious plan remain uncertain. Viet Nam can leverage its early successes in solar and onshore wind power development to establish itself as a leader in renewable energy in

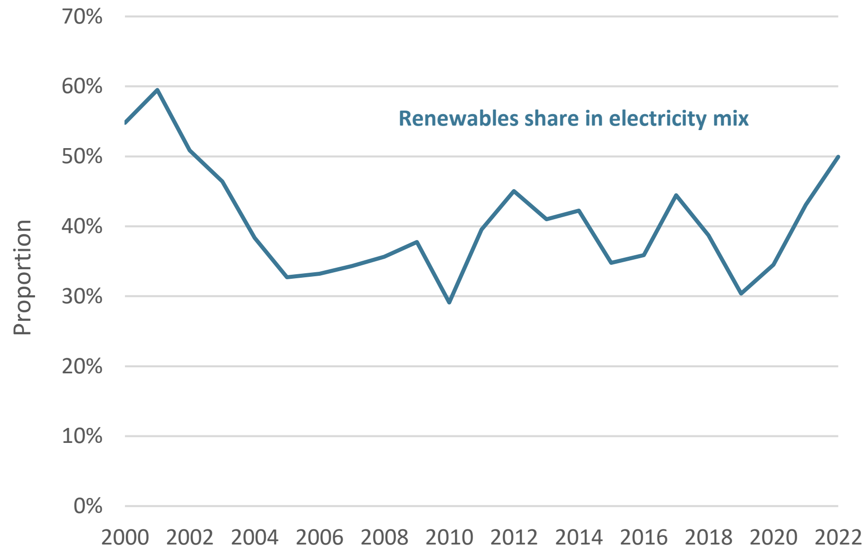
South-East Asia.

In Viet Nam, the share of electricity generated from renewables (including hydro) decreased significantly from 55% in 2000 to 29% in 2010, before rising again to 50% in 2022 (Figure 13).

The reductions were due to the small amount of undeveloped, large-scale hydropower generation potential remaining in Viet Nam and the growth in electricity demand exceeding the rate at which solar/wind capacity and required transmission lines were built.

Although solar and wind generation have been accelerating in recent years, they have not, to date, been growing as rapidly as electricity demand.

Figure 13: Viet Nam's renewable generation share, 2000 to 2022



Source: EGEDA (2024)

Energy Policy

Energy policy	Details	Reference
Politburo's Resolution No. 55 on Viet Nam's National Energy Development Strategy to 2030, with a vision to 2045	The resolution provides for the prioritisation of fast and sustainable energy development while fostering favourable conditions for all economic sectors, particularly the private sector, to participate in energy development.	Communist Party of Viet Nam
Nationally Determined Contribution (2022 version)	Viet Nam will reduce GHG emissions by 16% compared to Business As Usual by 2030 with domestic resources. However, this 16% contribution could be increased to 44% if international support is received through bilateral and multilateral cooperation.	United Nations Framework Convention on Climate Change
Law on Economical and Efficient Use of Energy	This law promotes economical and efficient use of energy, sets out the rights, obligations and responsibilities of organisations, households and individuals regarding the economical and efficient use of energy.	Viet Nam Government Portal
The 2022 Petroleum Law	The 2022 Petroleum Law aims to guarantee a more convenient and flexible legal framework for promoting the development of the oil and gas industry in conformity with international practices as well as the economy's realities. Taking effect from 1 July 2023, the 69-article law provides for basic oil and gas investigation and oil and gas activities within the mainland, islands and seas of Viet Nam. It applies to Vietnamese and foreign agencies, organisations and individuals involved in basic oil and gas investigation and oil and gas activities.	Viet Nam Law
Electricity Law (revised)	The National Assembly of Viet Nam officially adopted the Electricity Law (revised) in November 2024. This law will take effect next February. The new law introduces a comprehensive reform of the legal framework governing the power and energy sector, significantly impacting the development and financing of power projects, particularly those related to domestic gas, LNG-powered projects, and all renewable energy generation technologies.	Viet Nam Government Portal
Law on Environmental Protection	This law provides statutory provisions on environmental protection activities, measures and resources used for the purpose of environmental protection, rights, powers, duties, and obligations of regulatory bodies, agencies, organisations, households, and individuals who are tasked with environmental protection.	Ministry of Natural Resources Environment
National Program on Economical and Efficient Use of Energy for the Period 2019-2030	To promote the economical and efficient use of energy by means of government management duties and solutions, technical assistance, scientific and technological research, product development, market transformation, and human resource training and development.	Viet Nam Government Portal

National Climate Change Strategy to 2050	The strategy sets the overall targets to minimise the effects or damage caused by climate change, reaching net zero emissions by 2050.	Viet Nam Plus
National Green Growth Strategy for the period 2021-2030, with a vision by 2050	The strategy focuses on efforts to restructure the economy in conjunction with renewing the growth model, reducing the intensity of greenhouse gas emissions, and striving towards a green and carbon-neutral economy.	FAO
Viet Nam's Action Plan on Methane Emissions Reduction by 2030	The action plan targets methane emissions in cultivation, animal husbandry, solid waste management, wastewater treatment, oil and gas exploitation, coal mining and fossil fuel consumption. Total methane emission volume should not exceed 96 million tonnes of CO_2 equivalent in 2025, down 13% from 2020.	Viet Nam Plus
National Power Development Plan for 2021-2030, with a vision to 2050	On 15 May 2023, the Government of Viet Nam issued Decision 500/QD-TTg, approving a new National Power Development Plan (PDP8) for 2021-30, with a vision to 2050. The overall goal of PDP8 is to ensure domestic energy security and meet the requirements of socioeconomic development, industrialisation, and the modernisation of the economy. Commercial electricity consumption is projected to be approximately 335 TWh by 2025, around 505 TWh by 2030, and between 1114 to 1254 TWh by 2050. Electricity production and import is projected to be approximately 378 TWh by 2025, around 567 TWh by 2030, and between 1224 and 1378 TWh by 2050. Renewable energy generation is expected to reach approximately 31% to 39% by 2030 and could increase to between 68% and 72% by 2050.	Viet Nam Electricity
National Energy Master Plan for the 2021-2030 period, with a vision to 2050	In July 2023, the government approved the NEMP for the 2021-30 period, with a vision to 2050 via Decision No. 893/ QD-TTg. The NEMP sets out specific targets in the energy sector, including oil and gas, coal, electricity, and renewable energy. The NEMP estimates that Viet Nam's total final energy demand will hit 107 Mtoe by 2030 and 165 to 184 Mtoe by 2050. Viet Nam intends to ensure its energy supply exceeds these estimates, aiming to have a TPES equivalent to 155 Mtoe by 2030 and 294 to 311 Mtoe by 2050	Government News
Master Plan on Exploration, Exploitation, Processing and Use of Minerals in 2021-2030, with a vision to 2050	The government has approved the Master Plan on Exploration, Exploitation, Processing and Use of Minerals in 2021-30, with a vision to 2050 via Decision No. 866/QD-TTg. The plan sets out the overall objectives for mineral development as well as the objectives and requirements for exploration, exploitation and processing for specific minerals (such as bauxite, titanium, rare earths, gold, copper, nickel, tin, wolfram, antimony, lead, zinc, etc.).	Viet Nam Plus

The Development Strategy of the Coal Industry to 2030 with a vision to 2045	Coal output is expected to be between 45 and 50 million tonnes by 2030, and between 38 and 40 million tonnes in 2031-45. Under the strategy, the industry will focus on exploration for upgrading existing coal resources along with new coal mines. A goal set by the strategy is to start pilot exploitation in the Red River coal basin before 2040 and to proceed with industrial-scale mining before 2050 if the trial is successful.	Viet Nam News
Viet Nam's National Energy Development Strategy by 2030 with a vision towards 2045	On 1 March 2024, the Prime Minister issued Decision No. 215/QĐ-TTg approving the National Energy Development Strategy of Viet Nam until 2030, with a vision to 2045. This decision is to implement the Politburo of the Communist Party of Viet Nam's Resolution No. 55- NQ/TW dated 11 February 2020 on orientation of the National Energy Development Strategy of Viet Nam to 2030, with a vision to 2045. This strategy aims at (i) ensuring energy security for socio-economic development, (ii) prioritising fast and sustainable energy development, (iii) adapting to climate change and aligning with the net zero emissions target by 2050; and (iv) using energy efficiently, and environmentally friendly which deemed as an important national policy and the responsibility of the whole society.	LawNet
Viet Nam's Hydrogen Energy Development Strategy to 2030 and Vision to 2050	The Hydrogen Energy Strategy was developed based on the National Energy Development Master Plan, which lays out the foundation for the Vietnamese energy sector, including oil and gas, coal, electricity, and renewable energy, for the period from 2021 to 2030, with a vision to 2050. The overarching goal of the Hydrogen Energy Strategy is to develop the various stages of Viet Nam's hydrogen energy ecosystem, including production, storage, transportation, distribution, domestic use, and export. This development aims to help ensure energy security, achieve national goals on climate change and green growth, and achieve Viet Nam's 2050 net zero emissions target.	Vietnam Briefting

Notable Energy Developments

Energy development	Details	Reference
Viet Nam announces resource mobilisation plan to implement JETP in Dubai	In December 2023, a Resource Mobilisation Plan for Viet Nam, a key tenet of the JETP initiative, was finally announced to the world at COP28 in Dubai. Using the budget package from JETP and domestic resources, Viet Nam aims to reduce CO_2 emissions from the power sector, reduce the number of existing coal-fired power plants, and develop more renewable generation capacity associated with the transmission grid, and a more effective energy infrastructure.	Government News

Viet Nam's renewable generation output exceeds the thermal power output	In 2022, total domestic plus imported renewable electricity was 268 billion kWh, of which hydropower output increased by 21% compared to 2021 due to high level of water in the lakes and the mobilisation of power generation in accordance with inter-lake regulation. The increased renewable energy enabled EVN to reduce the purchase of coal-fired power, which had become expensive due to high coal prices. In 2022, electricity output from renewable energy plants (including hydropower plants) exceeded thermal power.	Viet Nam Energy
Work starts on Viet Nam’s first green hydrogen plant in March 2023	Tra Vinh Green Hydrogen Company, a member of the Green Solutions Group, has started construction of Viet Nam's first and largest green hydrogen factory in the Mekong Delta province of Tra Vinh’s Duyen Hai district, with total investment of USD 341 million. Covering an area of 21 ha, the project is expected to become operational after two years, initially producing 24 000 tonnes of green hydrogen a year using electricity produced by wind turbines.	Viet Nam Plus
Viet Nam launches its first LNG terminal	Viet Nam began commercial operation of its first LNG terminal on 29 October 2023. The terminal has the capacity to store one million tons of LNG – equivalent to about 180 000 cubic metres of gas. The LNG terminal is located at Cai Mep Industrial Park in Tan Phuoc ward, Phu My township, southern Ba Ria-Vung Tau province. Construction on the USD 286 million project began in October 2019 on a surface area of about five hectares. It will supply LNG for domestic consumers, including Nhon Trach 3 and Nhon Trach 4 gas-fired power plants and other industrial plants.	Government News
Approving the Plan to implement the National Electricity Development Plan for the period 2021-30, with a vision to 2050.	The plan implements a strong energy transition from fossil fuels to new energy sources and renewable energy to reduce environmental pollution and greenhouse gas emissions, contributing towards the committed targets under the NDCs and the 2050 net zero target of Viet Nam.	Viet Nam Electricity
Start operating the largest and the world's second-largest waste-to-energy plant in Viet Nam	In November 2023, the Soc Son waste-to-energy plant, located in Ha noi City, was put into operation. It can handle 5000 tons of solid waste per day, approximately two-thirds of Ha noi's total daily solid waste. With a total power generation of 90MW, it is currently the second-largest waste-to-energy plant in the world, second only to Dubai's 185 MW facility.	Hanoi Times

Useful Links

Government of Viet Nam – http://chinhphu.vn/portal/page/portal/chinhphu/trangchu

Ministry of Industry and Trade – www.moit.gov.vn/

National Energy Efficiency Program (VNEEP) – http://vneec.gov.vn/

Electricity Regulatory Authority of Viet Nam (ERAV) – www.erav.vn/

National Load Dispatch Centre (NLDC) – https://www.nldc.evn.vn/

Viet Nam Electricity (EVN) – www.evn.com.vn

Energy Savings – https://tietkiemnangluong.evn.com.vn/

Viet Nam Energy – http://nangluongvietnam.vn

Viet Nam Oil and Gas Group (PVN) – www.pvn.com.vn

Viet Nam National Petroleum Group (Petrolimex) – https://petrolimex.com.vn/

Viet Nam National Coal and Mineral Industries Holding Corporation Ltd (Vinacomin) – www.vinacomin.vn/

Viet Nam Economic Times – https://vneconomy.vn/

Viet Nam News Agency – https://vietnamnews.vn/

General Statistics Office – https://www.gso.gov.vn/

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