Asia-Pacific Economic Cooperation

Expert Group on Energy Efficiency and Conservation

APEC EGEEC 64 Meeting

Integrated District Energy System （IDES）

-- Transition from individual to system efficiency

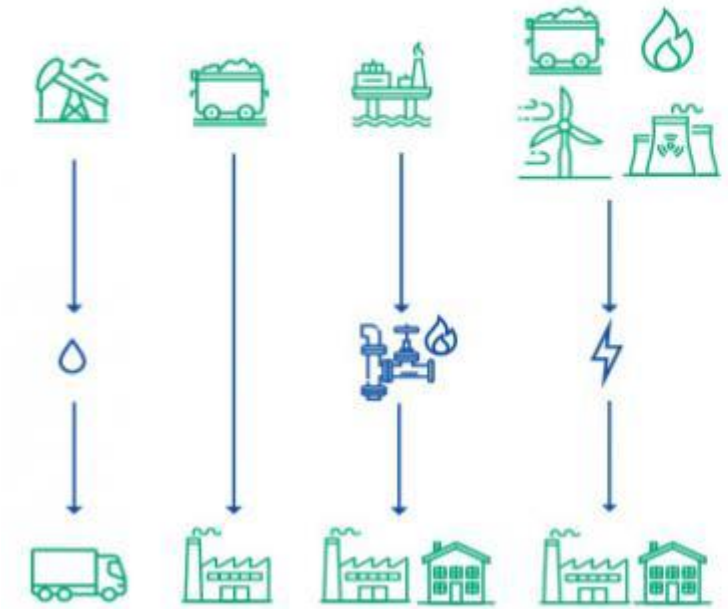
Dr. LIU Meng

Hong Kong, China

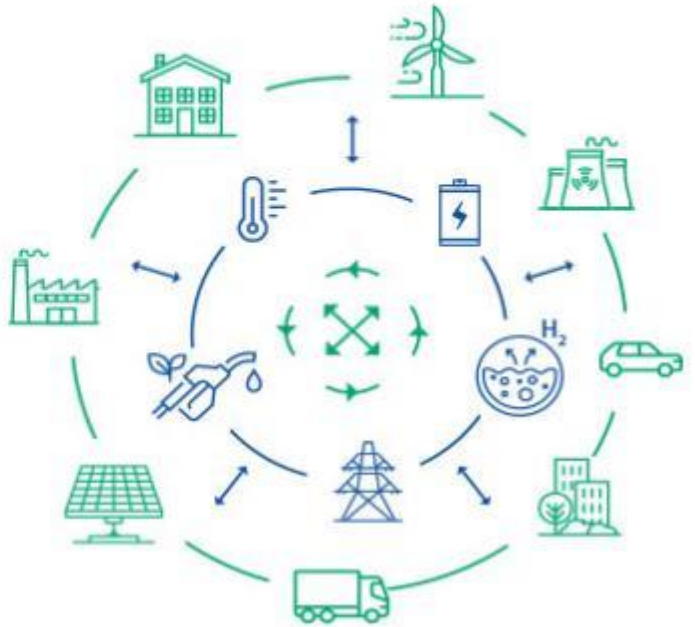
April 10, 2025

Why IDES?

The energy system today :
linear and wasteful flows of energy, in one direction only

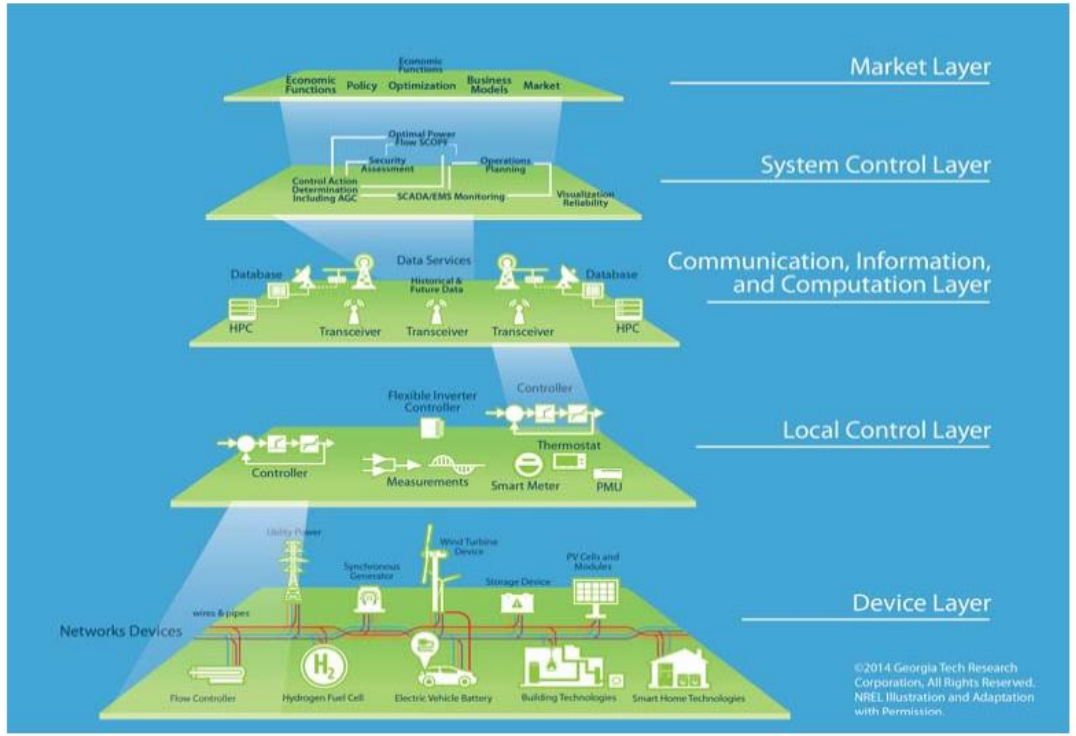


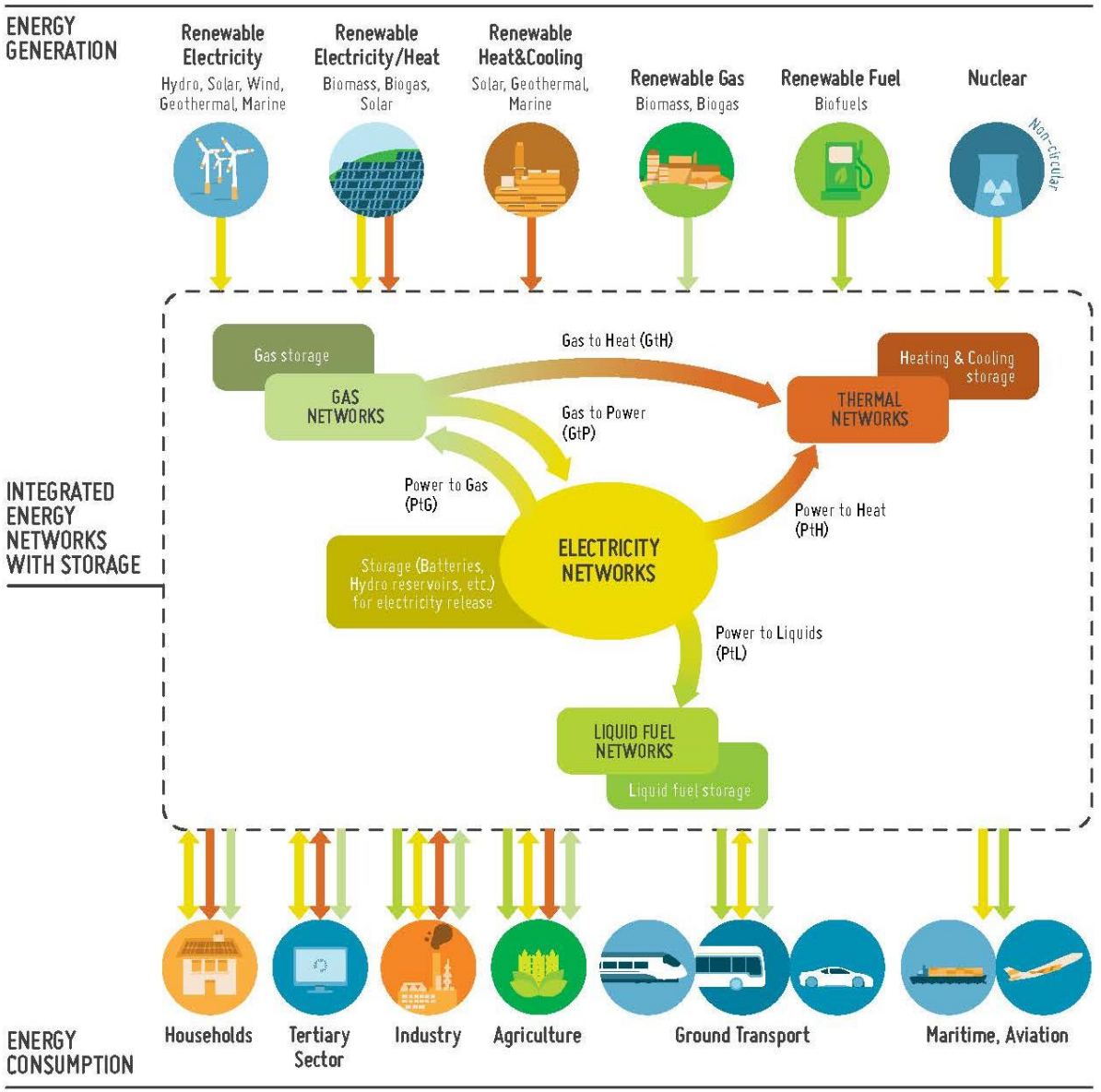
Future EU integrated energy system :
energy flows between users and producers, reducing wasted resources and money



Source: EU strategy on energy system integration

What is IDES?





Source:

- NREL: Energy Systems Integration
- Vision 2050 Integrating Smart Networks for the Energy Transitions: Serving Society and Protecting the Environment

Global relevance and practices (1)

- The traditional district energy system was first commercially introduced in cities in US in the 1870s.
- The 45 champion cities around the world– including Dubai, London, Munich and Paris – with many cities attracting over US$150 million of investment in their respective district energy systems between 2009 and 2013. The 45 champion cities collectively have installed:

  — more than 36 gigawatts (GW) of district heating capacity (equivalent to approximately 3.6 million households),
  — 6 GW of district cooling capacity (equivalent to approximately 600,000 households) ,
  — and 12,000 kilometres of district energy networks.

Source: *District energy in cities, unlocking the potential of energy efficiency and renewable energy* by UNEP, etc. 2015

Global relevance and practices (2)

CHRISTCHURCH

PORT LOUIS

HONG KONG

Łódź, Poland has a vast district heating network, which in 2011 supplied approximately 60 per cent of the city's heating demand (top).

A portion of Milan's district heating network, connected to the Canavese CHP plant. Milan's segregated networks are undergoing interconnection and expansion to form three large heat networks by 2016, which will then be interconnected via a ring around the city.

In **TORONTO**, a unique business model served as the catalyst for finally implementing the city's deep-lake-water cooling system, conceptualized since the early 1980s. Too much silt in drinking water extracted from the lake meant that the city needed to develop a deeper, longer pipe to reduce filtering costs. This was exactly the pipe needed for the deep-water cooling system, creating the opportunity for the city to partner with the company Enwave to provide cooling to the city.

Access to energy resources was a catalyst for district heating in **HELSINKI**, where reliance on wood, oil and coal became a concern already in the 1940s. District energy helped to improve energy security as well as reduce local air pollution caused by the combustion and transport of imported fossil fuels. More recently, Helsinki has been implementing a district cooling system that relies on absorption chillers to use waste heat from cogeneration plants that was previously underutilized during the summer months.

In **BOTOSANI**, high levels of heat loss, network breakdowns, heat subsidies and electricity consumption meant that the city required finance to rehabilitate its ageing district heating networks. The availability of finance from the International Finance Corporation and the EU Structural Funds provided the catalyst for modernization of Botosani's district energy systems.

In **DUBAI**, the rapid pace of urban development as well as rising energy costs have encouraged building developers to incorporate district energy systems into new infrastructure projects as a means to provide a new service (cooling) to customers and to generate an additional income stream.

In **VANCOUVER** and **LONDON**, the Olympic Games of 2010 and 2012, respectively, were a key driver for new infrastructure development, and district energy provided a solution to meet a variety of goals, including reducing emissions and taking advantage of local fuel sources.

In Japan, the 2011 Fukushima nuclear accident was a major catalyst for focusing on energy efficiency and district energy. The event prompted **TOKYO** to develop a cogeneration facility with an independent transmission network, making it possible to supply power to affected areas in times of natural disasters or other emergencies.

In **CHRISTCHURCH**, as part of the major rebuilding process under way following the 2011 earthquake, district energy has been included in city construction planning and development, helping to minimize costs and local impacts.

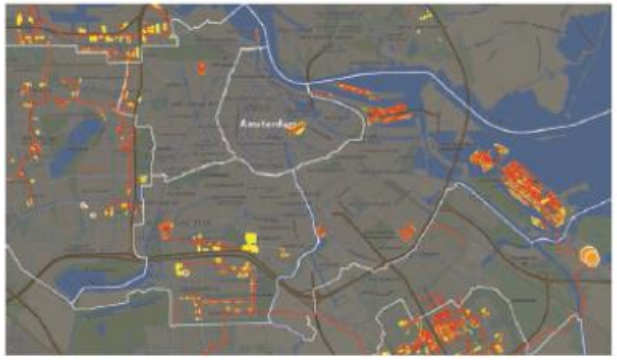
In **ROTTERDAM**, district energy was introduced into city planning during World War II. When the war ended, the Minister of Public Works and Reconstruction, Johan Ringers, oversaw the rebuilding of the city and the simultaneous placement of a district heating pipeline. In 1949, Hotel Pax became the first building to be fully heated by the new system.

ANSHAN has commenced significant renovation of its isolated, inefficient district heating networks into a modern system that captures waste heat from industry and new CHP plants. The catalyst was national regulation in China that required a solution to the city's poor air quality, caused primarily by the use of coal to provide baseload heat to local heating networks.

PARIS developed district heating in 1927 to overcome local air quality issues and to address the challenge of delivering huge amounts of fuel to distributed users in the city centre. Today, large portions of the city are connected to district heating, including the Louvre museum, delivering the heat-demand equivalent of 460,000 households city-wide. Paris also developed the first district cooling network in Europe – Climespace – in 1991, part of which uses water from the Seine River for cooling.

Source: *District energy in cities, unlocking the potential of energy efficiency and renewable energy* by UNEP, etc. 2015

Global relevance and practices (3)



City of Amsterdam, Interactive Maps, 'Energy from waste incineration and waste heat'. Map showing the existing district heat network in Amsterdam (red) with connected load (yellow) and sources of waste heat (orange).

Helsinki's Katri Vala heat pump captures heat from the city's waste water.

A large solar thermal plant with heat storage connects to a district heating network in Brædstrup, Denmark.

Heizkraftwerk West CHP plant in Frankfurt, Germany.

Marina Bay, Singapore. Singapore piloted district cooling in Marina Bay by creating a 1.25 square kilometre zone with mandatory connection for commercial buildings.

A glass accumulator tower at Pimlico District Heating Undertaking in London stores excess heat from the network.

Middelgrunden offshore wind farm, 3.5 km from Copenhagen, Denmark. When built in 2000, it was the largest offshore wind farm in the world, at 40 MW. Wind generation will provide 50 per cent of Denmark's electricity by 2020. Such high shares of wind generation will be made possible, in part, by the country's extensive district heat networks.

Source: *District energy in cities, unlocking the potential of energy efficiency and renewable energy* by UNEP, etc. 2015

Significance of the issue

➢ Energy efficiency and Emission reduction:

The ability of modern IDES to combine energy efficiency improvements with renewable energy integration allows for a transition away from fossil fuel use and can result in a 30–50 percent reduction in primary energy consumption.

●*Denmark has seen a 20 percent reduction in national CO2 emissions since 1990 due to district heating.*

➢ Green economy transition:

The 45 champion cities around the world attracted over US$150 million of investment in their respective district energy systems between 2009 and 2013.

● *In Toronto, Canada, the extraction of lake water for district cooling reduces electricity use for cooling by 90%, and the city earned US$89 million.*

➢Sustainable development:

For most of the developing economies, IDES is playing an increasingly important role in providing the quickly-deployed, stable, sustainable and affordable energy supply, and the customized energy services, particularly considering the weak energy infrastructure and rich renewable energy resources.

The development of IDES is one of the least-cost and most-efficient solutions for reducing GHG emissions and primary energy demand.

Global initiatives on IDES

IEA	IEA Technology Collaboration Program on District Heating and Cooling (DHC) was established in 1983, now having 12 members from Asia and Europe. R&D as well as policy analysis and international co-operation to increase the market penetration of DHC.
UNEP	From 2013 to 2015, interviews, surveys and consultations were undertaken by UNEP from 65 cities around the world in order to gather stakeholder perspectives on the necessary parameters to ensure successful design, implementation and operations of modern DES.
G20	In 2016, G20 members identified DES as a key area of work on energy efficiency with the objective to encourage district cooling/district heating deployment. The task group of G20 EELP/DES is co-led by Kingdom of Saudi Arabia, China and Russia with close support of Singapore.
EU	In the EU Strategy for Energy System Integration, it is suggested to accelerate investment in smart, highly-efficient, renewables-based district heating and cooling networks.

Global initiatives on IDES

- International Organization for Standardization (ISO)

  ISO/TC301 “Energy Management and Energy Savings” established 2 groups for IDES

  - ISO/TC301/AHG13 “Integrated District Energy System (IDES)”
  - ISO/TC301/WG19 “Integrated District Energy System (IDES) Concepts and practices”

  And 2 international standards are being developed,

  - ISO/TR 25479 “Integrated district energy system (IDES) - Basic concepts and key initiatives”
  - ISO/TR 25480 “Integrated district energy system (IDES) - Case studies and principles for good practices in energy performance”

- Engagement of global stakeholders

  Experts from *China, Canada, Mexico, US, Germany, Italy, Demark, Ecuador, UNEP and UNIDO participating the standards development.*

Suggestions

- More activities from EGEEC on IDES related things,
  - ✓ APEC projects on IDES related things (smart energy, integrated energy system, energy prosumers…)
  - ✓ Workshops on IDES
  - ✓ ……
- Cross fora and organization cooperation on IDES.
  - ✓ ISO
  - ✓ UNEP
  - ✓ UNIDO
  - ✓ ……

Future is here,
IDES provides EGEE&C with the opportunity to improve the EE&C from the perspective of system of systems.

Let’s work together for a low-carbon tomorrow in APEC！

Thank you!

liumeng@cnis.ac.cn