

Commercial Building Envelope Compliance in Singapore

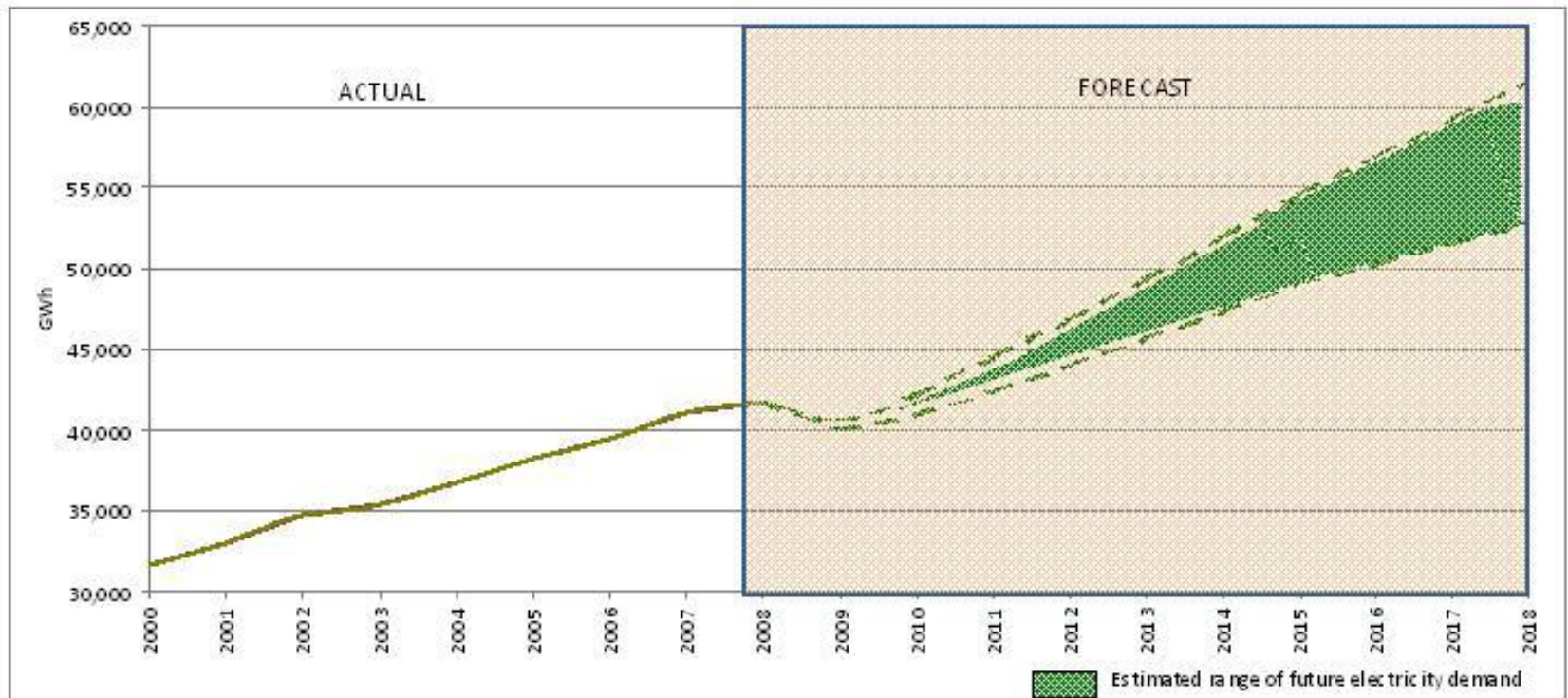
APEC 38EGEE&C

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Brief Introduction

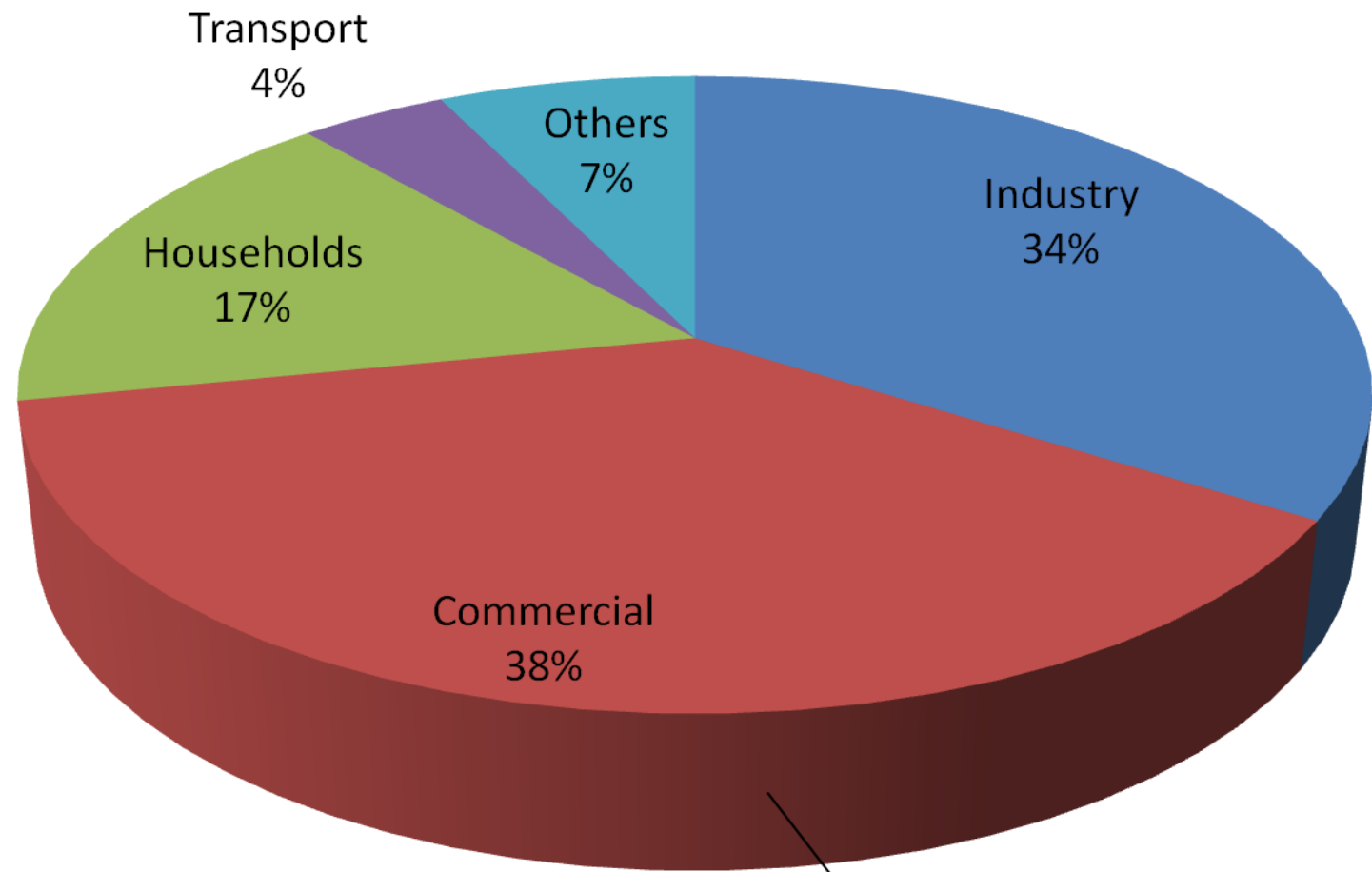
- Singapore is almost entirely dependent on imported energy & is also “alternative-energy disadvantaged”;
- However energy demand, as an economic growth enabler, is expected to increase at 2.5 - 3% p a over the next 10 years;
- Sustainability Blueprint set a target of improving energy efficiency by **35% by 2030**





Commercial Buildings

Building Energy Consumption Mix

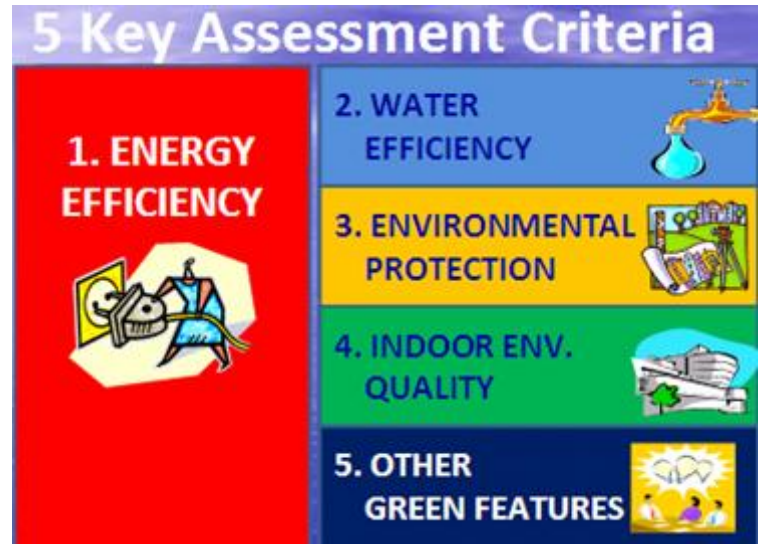


30-50%
Air-conditioning



Commercial Building Sector Target

- Target to green 80% of all buildings by 2030, current challenge is to green existing stock of buildings;
- Buildings would need to achieve the Minimum Green Mark Standard – a green building rating system launched in 2005 to evaluate building for its environmental impact & performance;
- Energy efficiency accounts for 50% of the GM rating system



Green Mark	Try Again	Certified	Gold	Gold ^{Plus}	Platinum					
Score	0	49	50	74	75	84	85	89	90	100

Regulations for Building Envelope - Major Milestones

- **1979: OTTV and prescriptive standards incorporated in the Building Control Regulations**
- 1982,1983 (revised 1999): Launch of CP 24 (Energy Efficiency Standard Building Services and Equipment)
- 1999: Compliance of CPs 13 (Mechanical Ventilation and Air Conditioning in Bldgs) , 24 and 38 (Artificial Lightings in Bldgs)
- **2004: Launch of Envelope Thermal Transfer Value (ETTV)**
- 2005: Launch of Green Mark Incentive Scheme
- 2006-2008: Launch of SS531 part 1 to 3: Lighting (replace CP38)
- **2008: Launch of Code on Envelope Thermal Performance for Buildings (formally ETTV)**
- 2009: Launch of SS553:Mechanical Ventilation and Air Conditioning (replace CP 13)



ETTV FORMULA

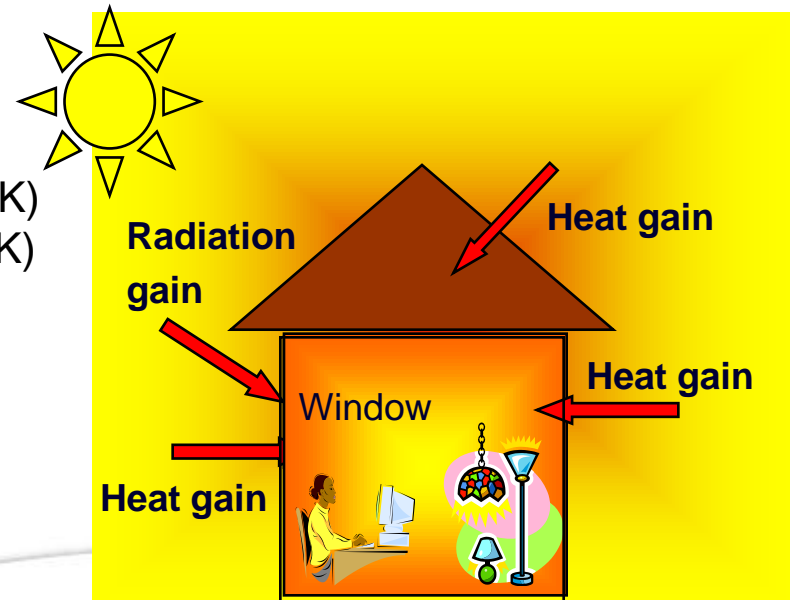
For minimum building rating the ETTV should not exceed 50W/m^2

$$\text{ETTV} = \text{Heat conduction}_{\text{wall}} + \text{Heat conduction}_{\text{glass}} + \text{Solar radiation}_{\text{glass}}$$

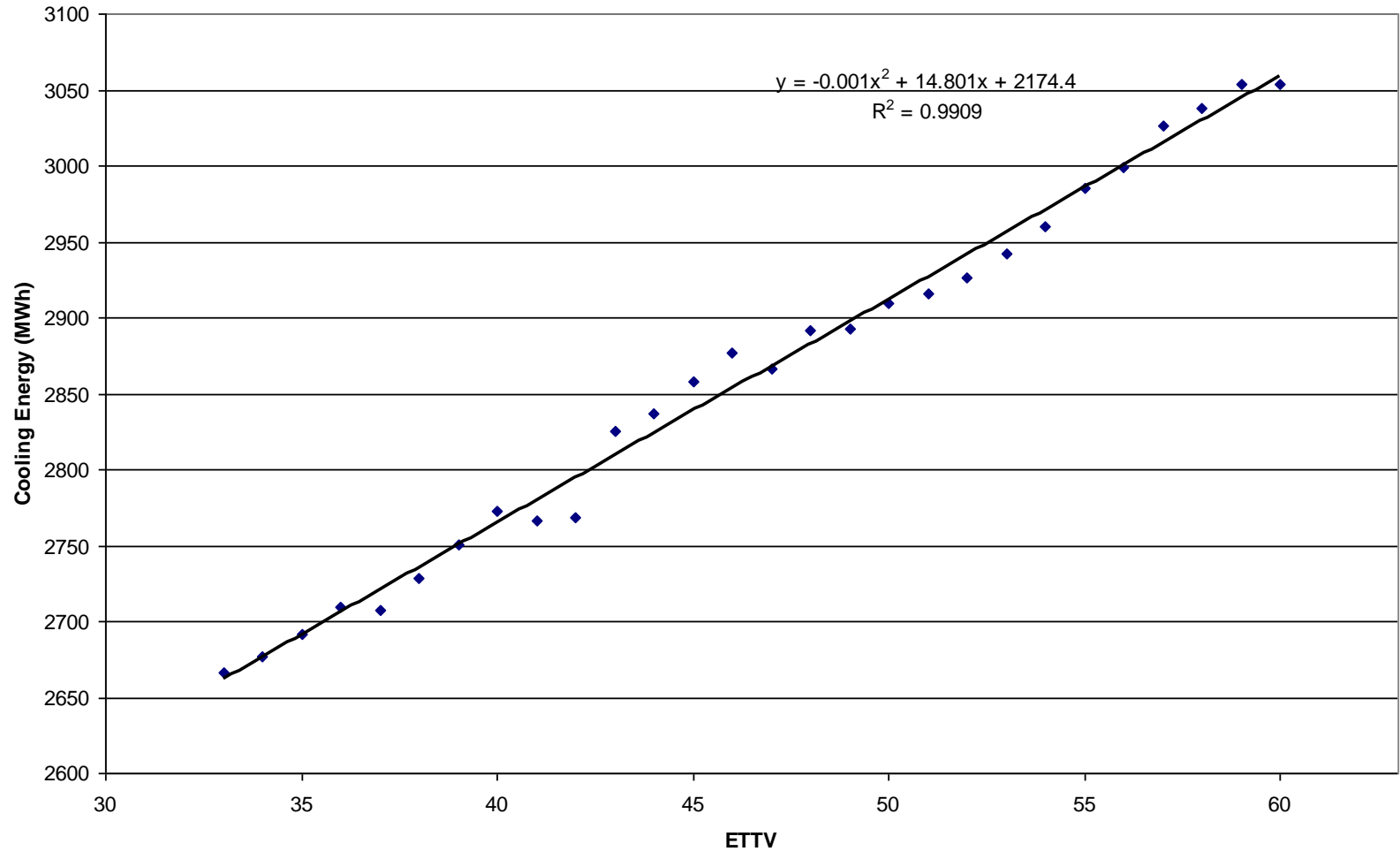
$$\text{ETTV} = 11.9(1-\text{WWR})U_w + 3.37(\text{WWR})U_f + 210.9(\text{WWR})(\text{CF})(\text{SC})$$

Where

- ETTV : envelope thermal transfer value (W/m^2)
- WWR : window-to-wall ratio
- U_w : thermal transmittance of opaque wall ($\text{W/m}^2 \text{K}$)
- U_f : thermal transmittance of fenestration ($\text{W/m}^2 \text{K}$)
- CF : Correction factor for solar heat gain through fenestration
- SC : shading coefficients of fenestration



Office ETTV vs Energy



Compliance to Building Envelope

- At building plan stage for buildings > 2,000m², the External Thermal Transfer Value (or ETTV calculations) would be submitted for approval;
- A Certificate of Statutory Completion will be issued after inspectors conduct a check to ensure that they have been completed in accordance with the approved plans;
- ETTV accounts for about 11% of total marks for GM Certificate ie 50-74

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Assistance to Building Owners

- Efficiency financing scheme is available to building owners planning to retrofit their buildings;
- Certification training courses are available to equip facility managers & professionals with skill sets to implement sustainable measures in their buildings
- Grants are available for these courses.



THANK YOU

