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Grid Digitalisation

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Tackling Climate Change



2015 The Paris Agreement

- Limit global warming to well below 2, preferably to **1.5 degrees Celsius**, compared to pre-industrial levels.
- To achieve this long-term temperature goal, countries aim to reach global peaking of greenhouse gas emissions as soon as possible to achieve a **climate neutral world by mid-century**.

Charting Singapore's Low-Carbon Future

NCCS
NATIONAL CLIMATE CHANGE SECRETARIAT
SINGAPORE
STRATEGY GROUP
PRIME MINISTER'S
OFFICE

Enhanced 2030 Nationally Determined Contribution (NDC)

Peak emissions at
65 MtCO₂e
around **2030**

Based on current projections, this will allow us to achieve a 36% reduction in emissions intensity from 2005 levels by 2030.

MITIGATION

Transformations in Industry, Economy, Society

POWER GENERATION	INDUSTRY	TRANSPORT	BUILDINGS	HOUSEHOLDS	WASTE & WATER
- Energy efficiency - At least 2 GWp of solar energy by 2030 - Low-carbon technologies	- Energy efficiency - System-level solutions - Low-carbon technologies	- Zero private vehicle growth 9 in 10 peak period journeys on "Walk-Cycle-Ride" by 2040 - Cleaner vehicles by 2040	80% green buildings by 2030 - Super Low Energy Programme	- Mandatory Energy Labelling Scheme - Minimum Energy Performance Standards - Green Towns Programme	- Circular economy approach - Waste - Recycling - Energy efficiency of desalination and used water treatment

CARBON TAX Initial rate of **\$5\$/tCO₂e** → **\$10-\$15/tCO₂e** by 2030

Adoption of Advanced Low-Carbon Technologies
e.g. Carbon capture, utilisation and storage, use of low-carbon hydrogen

Effective International Collaboration
e.g. International climate action, regional power grids, market-based mechanisms

Long-Term Low-Emissions Development Strategy (LEDS)

Halve emissions from its peak to
33 MtCO₂e
by **2050 & net zero**
emissions as soon as viable in the second half of the century

ADAPTATION



Coastal Protection, Water Resources & Drainage
Protecting our coastline from sea level rise
Ensuring water resilience, holistic stormwater management, and flood protection



Biodiversity & Greenery
Strengthening resilience of our biodiversity and ecosystems



Buildings & Infrastructure
Keeping our buildings and infrastructure safe



Public Health & Food Security
Strengthening resilience in public health and our food supply



Network Infrastructure
Keeping our essential services, including transport and network infrastructure, running well



Urban Heat Island (UHI) Effect
Mitigating the UHI effect to strengthen our resilience in the face of rising temperatures

Towards a greener environment



- Peak emissions at 65 MtCO₂e around 2030;
- Halve emissions to 33 MtCO₂e by 2050; and
- Reach net-zero emissions as soon as viable in the second half of the century



Challenges to our Grid



Decarbonisation



Decentralisation

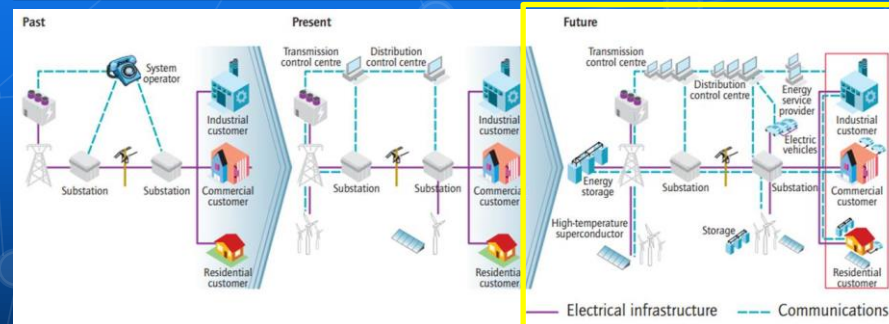
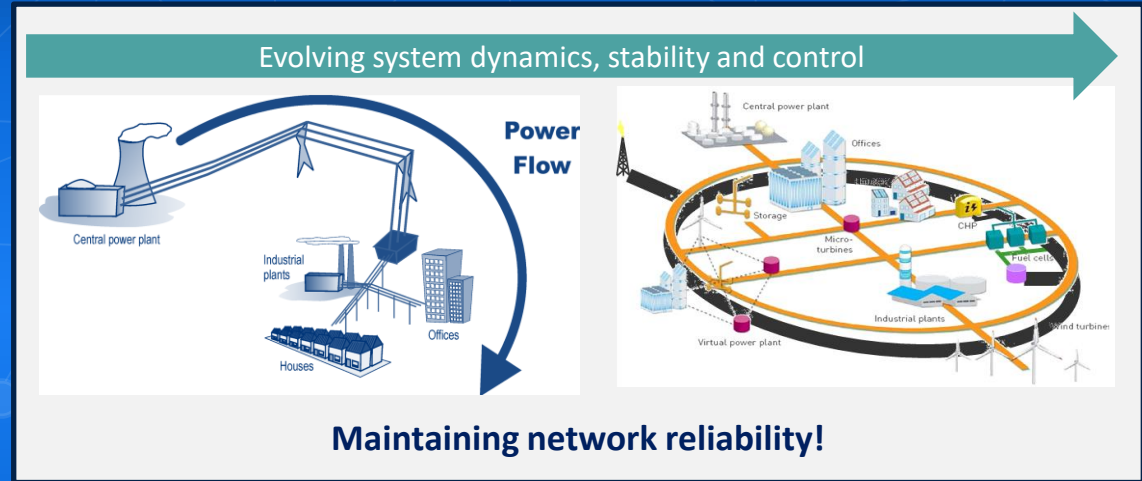


Electrification



Digitalisation

Greater decarbonisation,
decentralisation, digitalisation and
electrification for a greener world



Industry 4.0



Grid Digitalisation



Predicting the future



Intelligent Control & Mgmt

Data Driven

- Common Information Model
- Digital Twin

Sensing

- IoT
- Asset with integrated sensors

AI/Machine Learning

- Predictive maintenance for assets
- Forecasting network constraints

Comms Infrastructure

- 5G, whitespace
- Enterprise Integration

Edge Control

- Grid edge control & processing
- Edge-Centralised orchestration

Advanced Distribution Management

- Active Network Management
- DERs management

Digital Substation

- IED & Digital Relay
- Robotics

AR/VR & Computer Vision

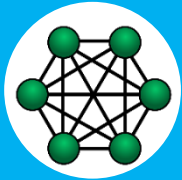
- Operation & Maintenance
- Training

The Digital Future



MORE INSTRUMENTED

Industrial internet of things (IIoT), Robotics, AR, VR



MORE INTERCONNECTED

Connection/integration among sensor, system and people; IT/OT integration



MORE INTELLIGENT

Machine learning and business intelligence

Cyber Secured



Digitalisation will bring on a more reliable & sustainable future



Thank you