The Taiwan Net-Zero pathway Hanoi conference

Chel Wang, Taiwan Green Energy Association

Chel Wang

Current Position

ITS Director Transport & Infrastructure WSP

Kiwi-Smart Solutions CEO & Founder

Taiwan Green Energy Association Vice Chairman

Experience

ASYS Corporation IoT & Smart Solution Business Division General Manager

Asia Pulp & Paper (Sinar Mas Group) Head of Global Marketing & Customer Service

C-media (IC Design House) Product Development Manager

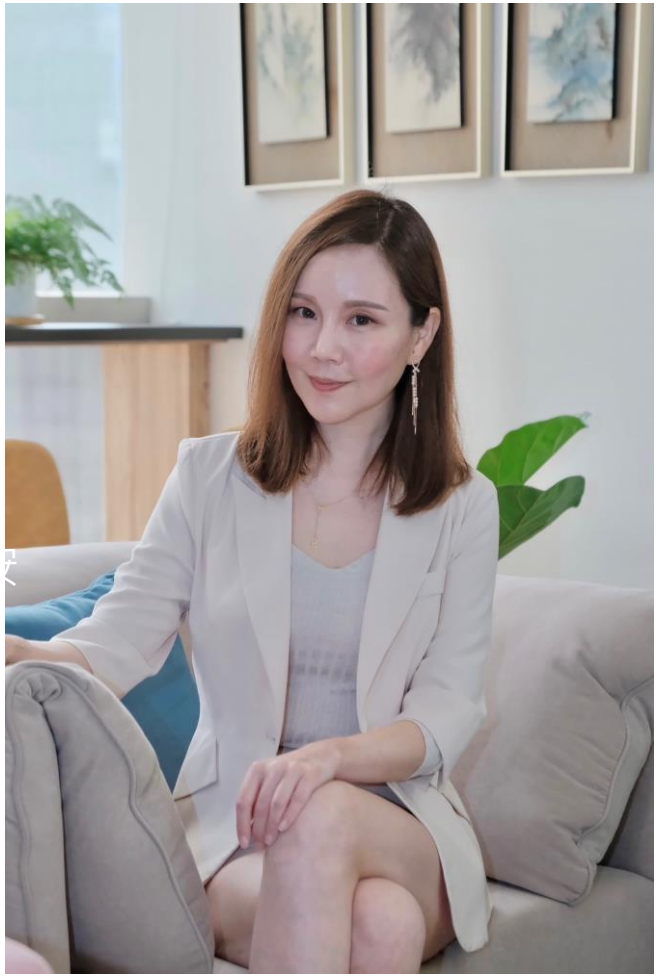
Educational Experience

National Chengchi University EMBA

University of Canterbury

Bachelor of Engineering with honours in Electrical & Electronic Engineering

Bachelor of Commerce in Corporate Finance



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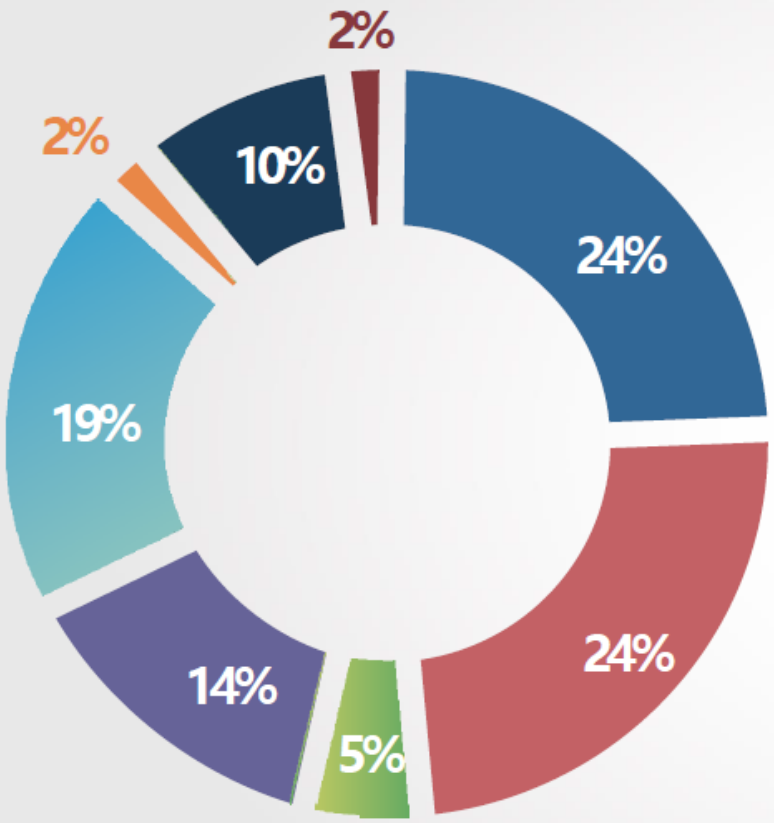
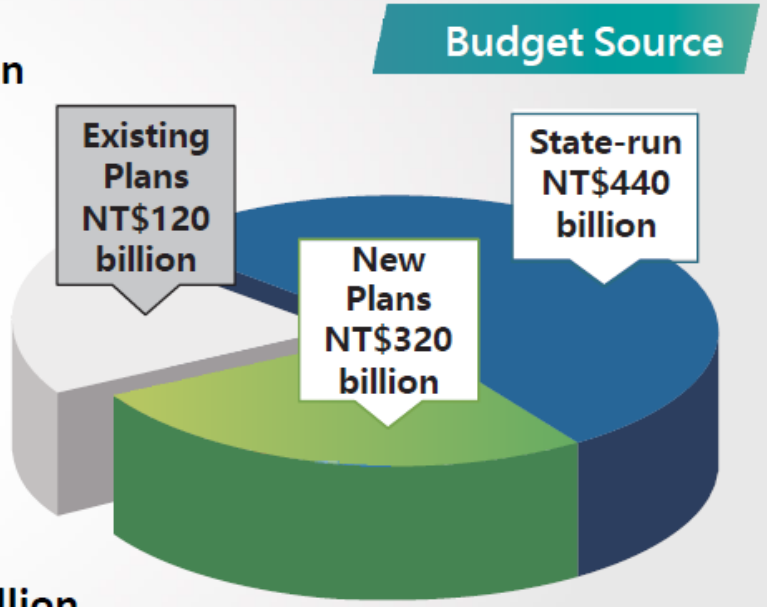
Taiwan's 2050 Net-Zero Transition

12 Key Strategies

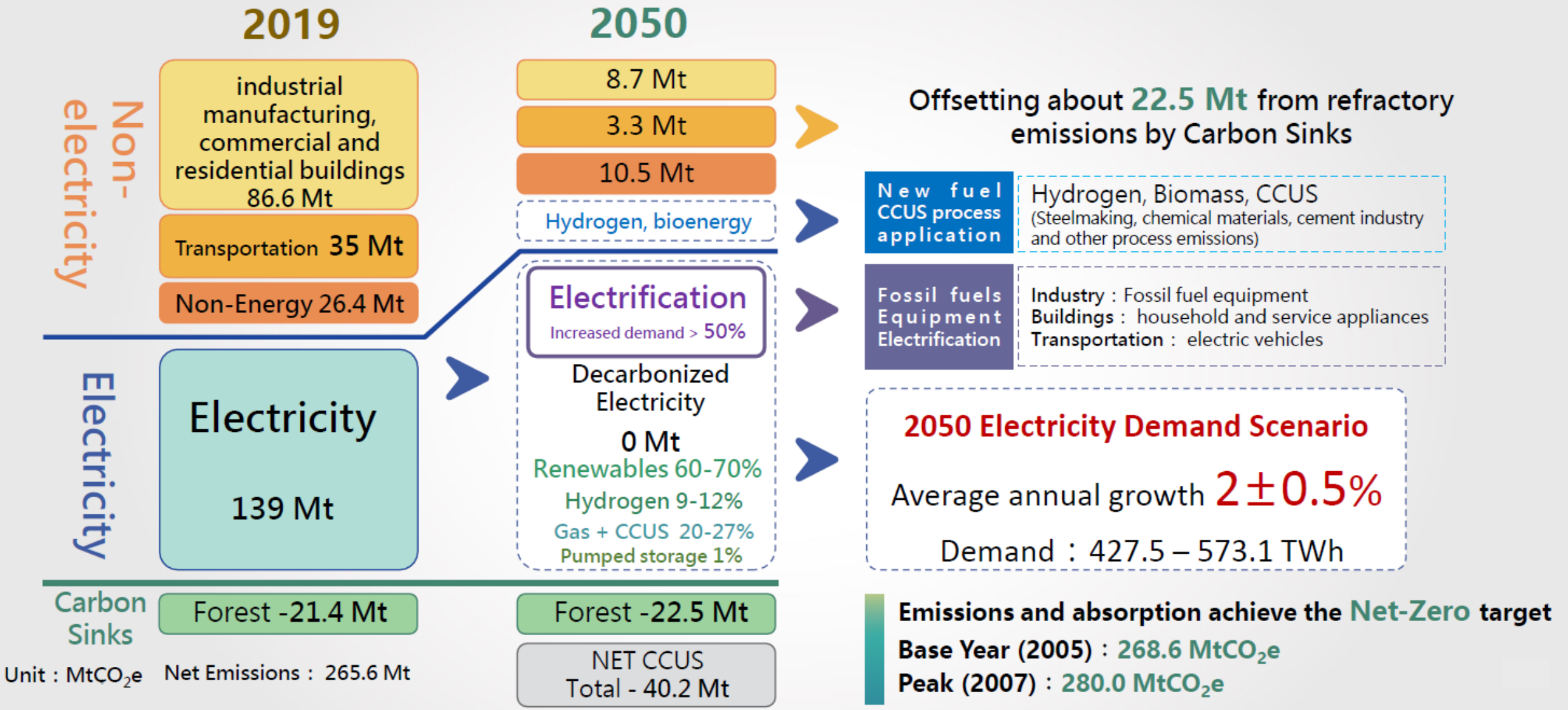
A Budget of Nearly NT$900 billions by 2030 for Major Plans of 2050 Net-zero Transition



- Renewables and hydrogen: NT$210.7 billion
- Grid and energy storage: NT$207.8 billion
- Low carbon and negative carbon technology: NT$41.5 billion
- Energy saving and boiler replacement: NT$128 billion
- Electrification of transport vehicles: NT$168.3 billion
- Resource circulation: NT$21.7 billion
- Forest carbon sinks: NT$84.7 billion
- Net-zero living: NT$21 billion



2050 Net-Zero Emissions Plan



2050 Net-Zero Pathway (Key Milestones)

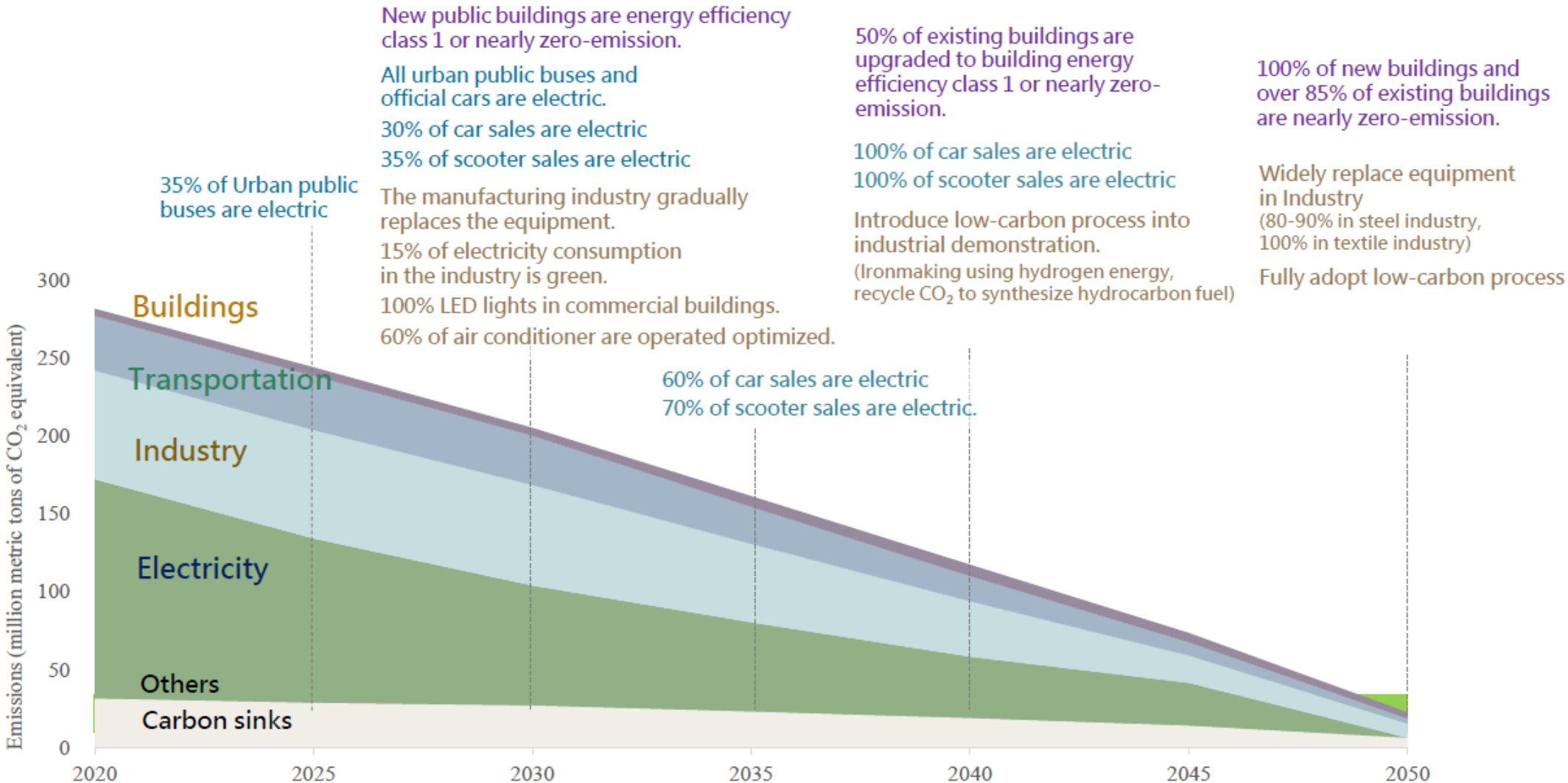
Buildings
Improving in exterior design, energy efficiency and appliance energy efficiency standards.

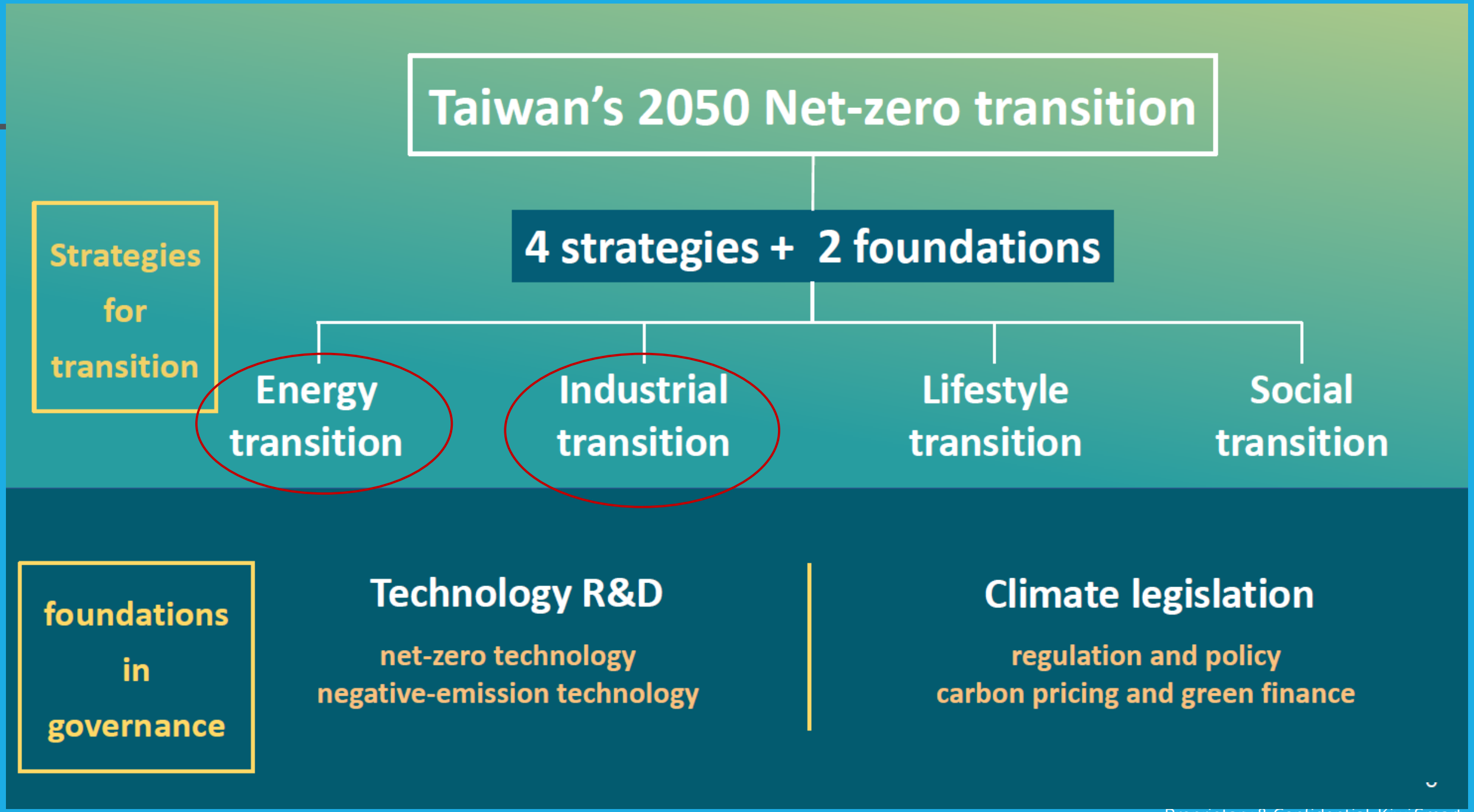
Transportation
Changing in travel behavior, reducing demand for transportation, and electro-mobility.

Industry
Improving in energy efficiency, fuel switching, circular economy, and innovative technologies.

Electricity
Scaling up renewable energy, developing new energy technologies, energy storage, and power grid upgrade.

Negative emissions technologies
Demonstration by 2030.
At scale by 2050.





Industrial Transition

Manufacturing Sector

3 aspects - 11 measures

Process Improvement

- Replacement of old appliances
- Energy saving (Digitalization)
- Development of hydrogen technology
- Reduction of F-gases

Fuel Switching

- Expanding usage of natural gas
- Expanding usage of bioenergy
- Adopting clean energy/hydrogen

Circular Economy

- Raw material replacement
- Refuse Derived Fuel (RDF)
- Energy Resources Integration
- CCU technology

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Industrial Transition

Commercial Sector

4 aspects - 4 measures

Improvements in Equipments or Operational Behavior	Low-carbon Energy	Business model with low-carbon transition	Green Buildings
• Energy efficiency of air conditioning and refrigeration (to gradually achieve level 1 for all) • Air conditioning system optimization • Adopt LED lights and high-efficiency lamps	• Conversion to gas and high efficiency boilers • Green electricity for large energy consumption • Electrification of commercial vehicles	• Gradually import intelligent management system • Reduce electricity and energy consumption	• New buildings to be enveloped with thermal insulation • Improvement in thermal insulation in existing buildings

Industrial Transition

Building sector

By 2050, 100% of new buildings and more than 85% of existing buildings will be nearly zero carbon buildings.

Multiple-Stage Policies

1 New buildings

- Establish energy efficiency evaluation systems
- Strengthen building energy efficiency regulations

2 Existing buildings

- Improve energy efficiency of existing public and private buildings

3 Home appliances

- Raise the energy efficiency benchmark for home appliances
- Reserve power-charging parking spaces

4 Technologies and construction methods

- Energy-saving technologies for buildings
- Research and development of low-carbon construction methods

Cross-sector Integration

Renewable energy + Building energy efficiency + Appliance energy efficiency

Promote the popularization of policy

Public buildings lead the low-carbon transition of private buildings.

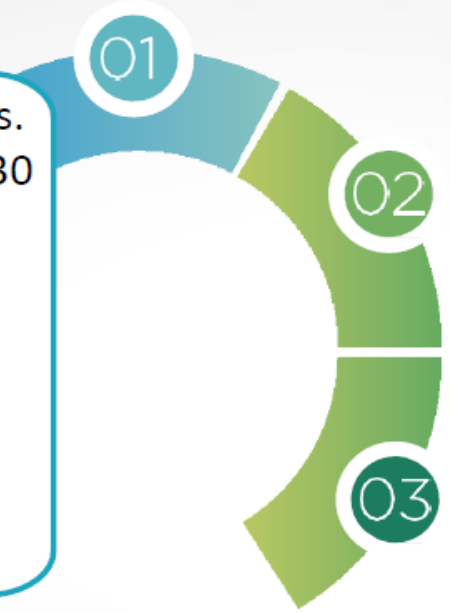
Industrial Transition

Transportation Sector

By 2040, 100% of cars and scooters are to be electric.

Vehicle electrification

- Increase the market share of electric vehicles.
  - All urban public buses to be electric by 2030
  - All passenger car and scooter sales to be electric by 2040
- Create domestic market demand
- Localize Manufacturing
- Complete Infrastructure
- Strengthen vehicle carbon emission management



- Promote public transportation
- Complete sidewalks
- Complete bicycle paths

People-oriented green transportation

Private car and scooter management

- Private vehicle usage management
- Promote car and scooter sharing

Auxiliary measures

1. Strengthen urban planning

- Transit-oriented Land Use Planning

2. Green transport lifestyle

- Reduce unnecessary travel
- Online meetings • remote education

Energy Transition

3 aspects - 9 measures

Building a zero-carbon energy system

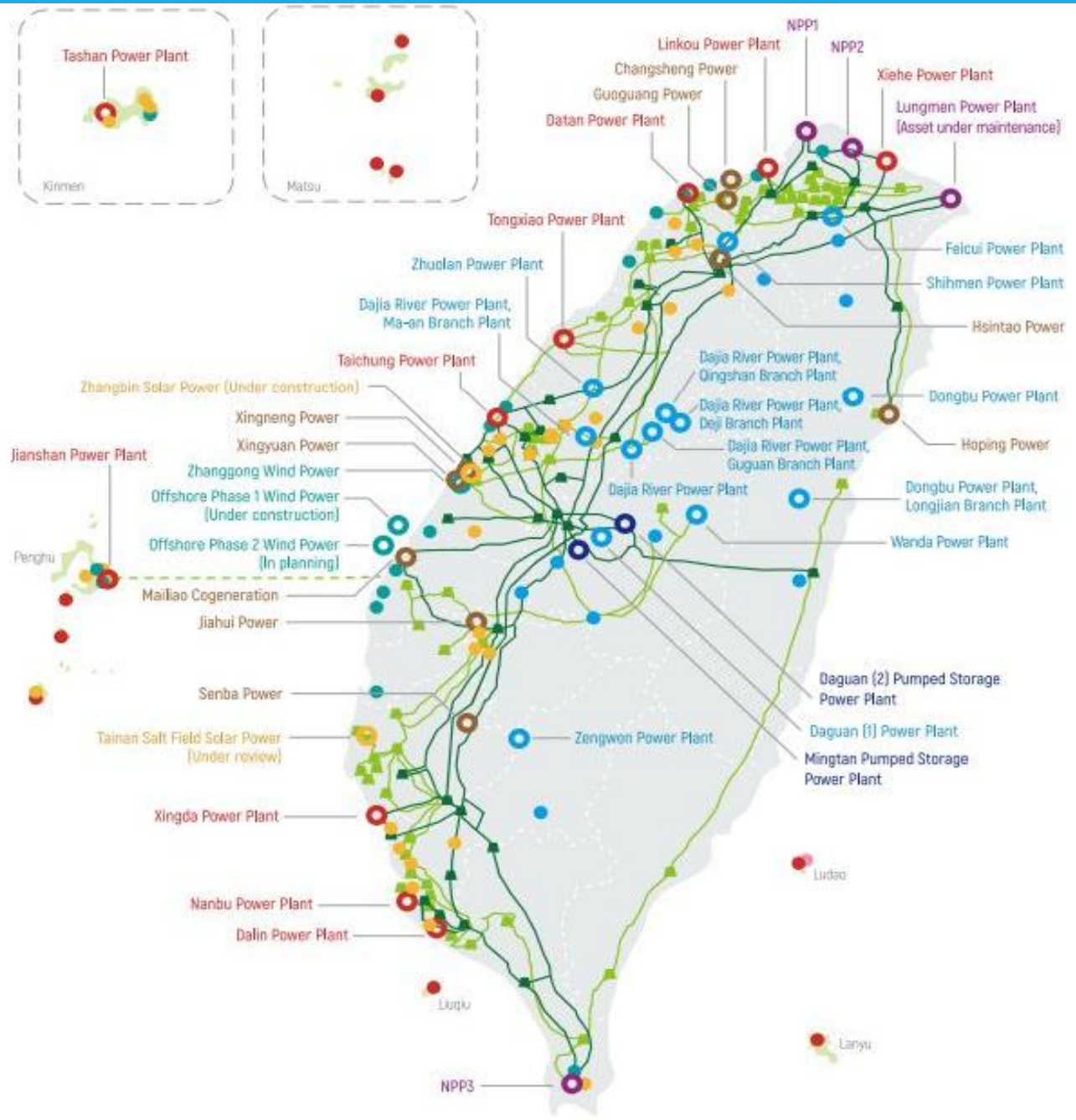
- **Maximizing renewable energy:** Expanding mature wind and solar PV deployment, with cutting-edge geothermal and ocean energy
- **Decarbonizing Thermal Power Development:** Hydrogen and Gas-fired Power plant with CCS
- **Phasing out of coal:** co-burning with ammonia in the short-term, converted to safe backup in the long-term
- **Building a zero-carbon fuel supply system:** Providing hydrogen, ammonia and biomass fuel for industry and transportation
- **Introducing advanced technologies in a timely manner to increase the space for zero-carbon energy utilization**

Improving energy system resilience

- **Prioritizing the expansion of renewable energy grid infrastructure**
- **Expand energy-storage facilities for renewable energy**

Creating green growth

- **Creating a green energy industry ecosystem:** Port Wind Power Zone, Green Energy Innovation Industry
- **Promoting decarbonization investment and international cooperation:** promoting green energy investment in public and private sector, establish international partnerships to introduce key technologies, and creating opportunities for exporting Taiwan's advantageous decarbonization technologies



Land area 35,808 Km²

Population 24million

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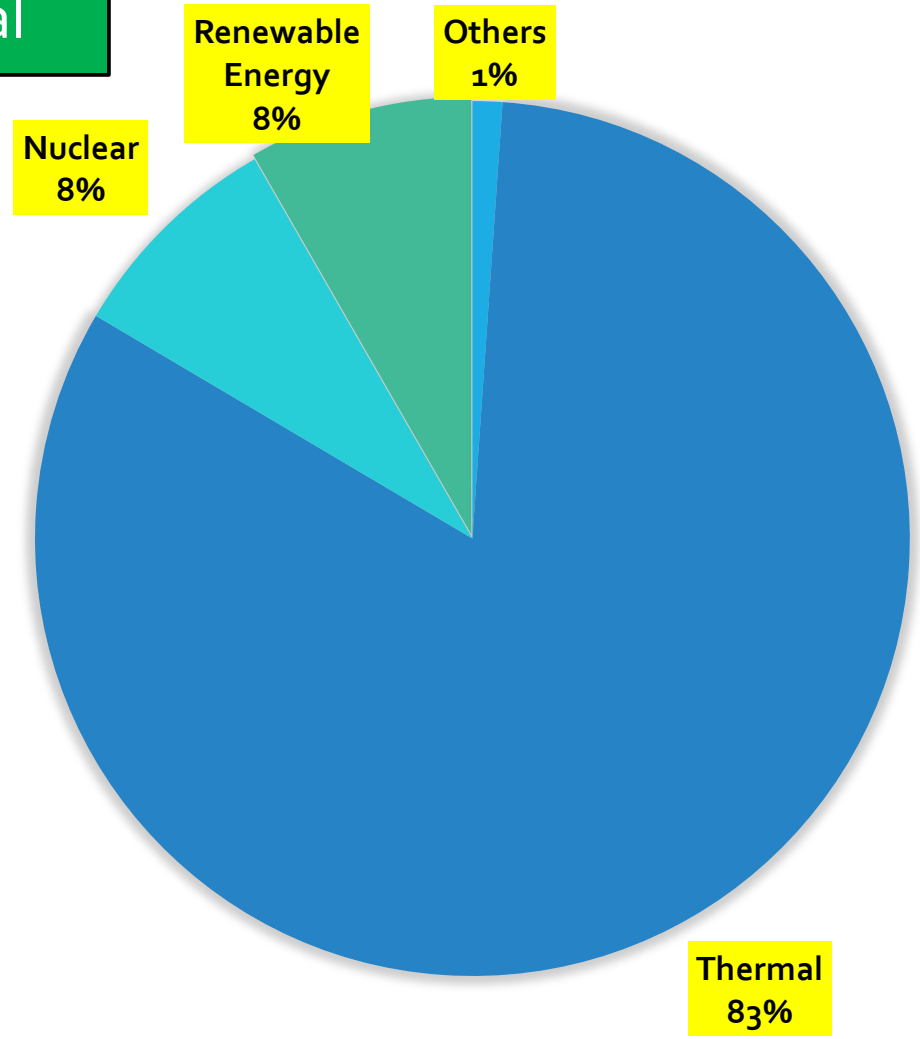
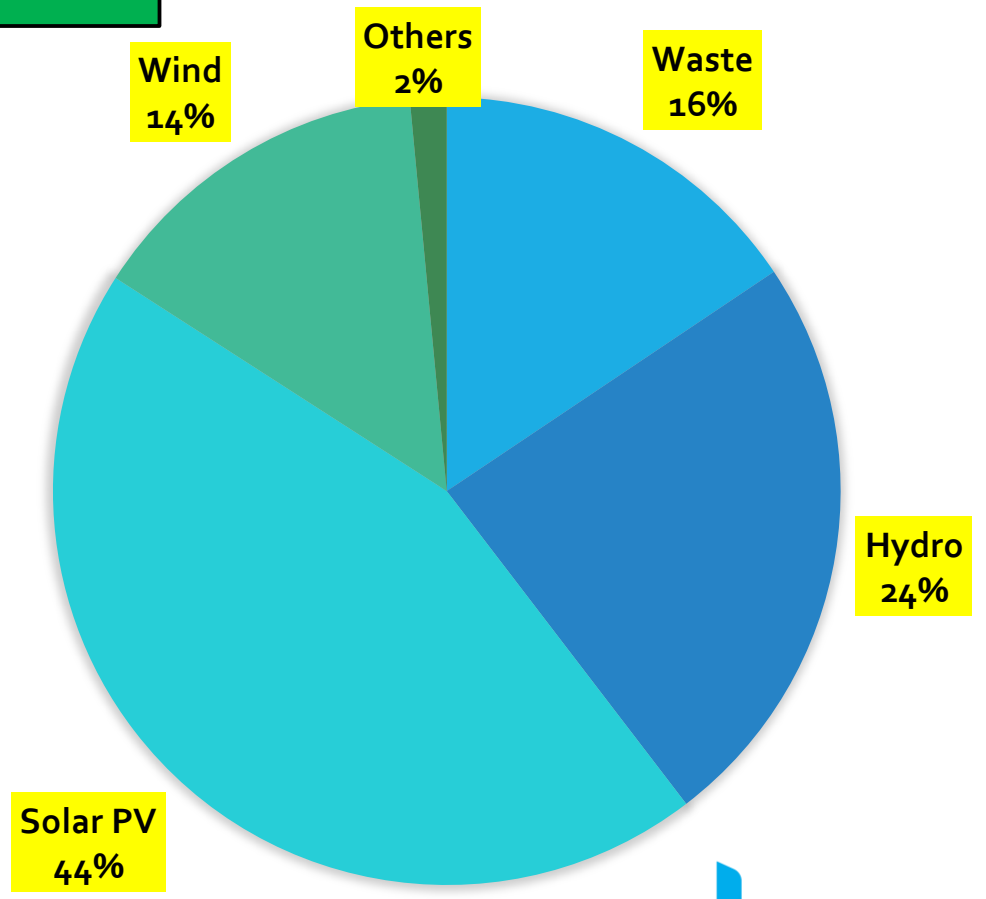
Electricity Consumption in Taiwan from 2012~2030

Taiwan Power Generation 2022

Total



Renewable



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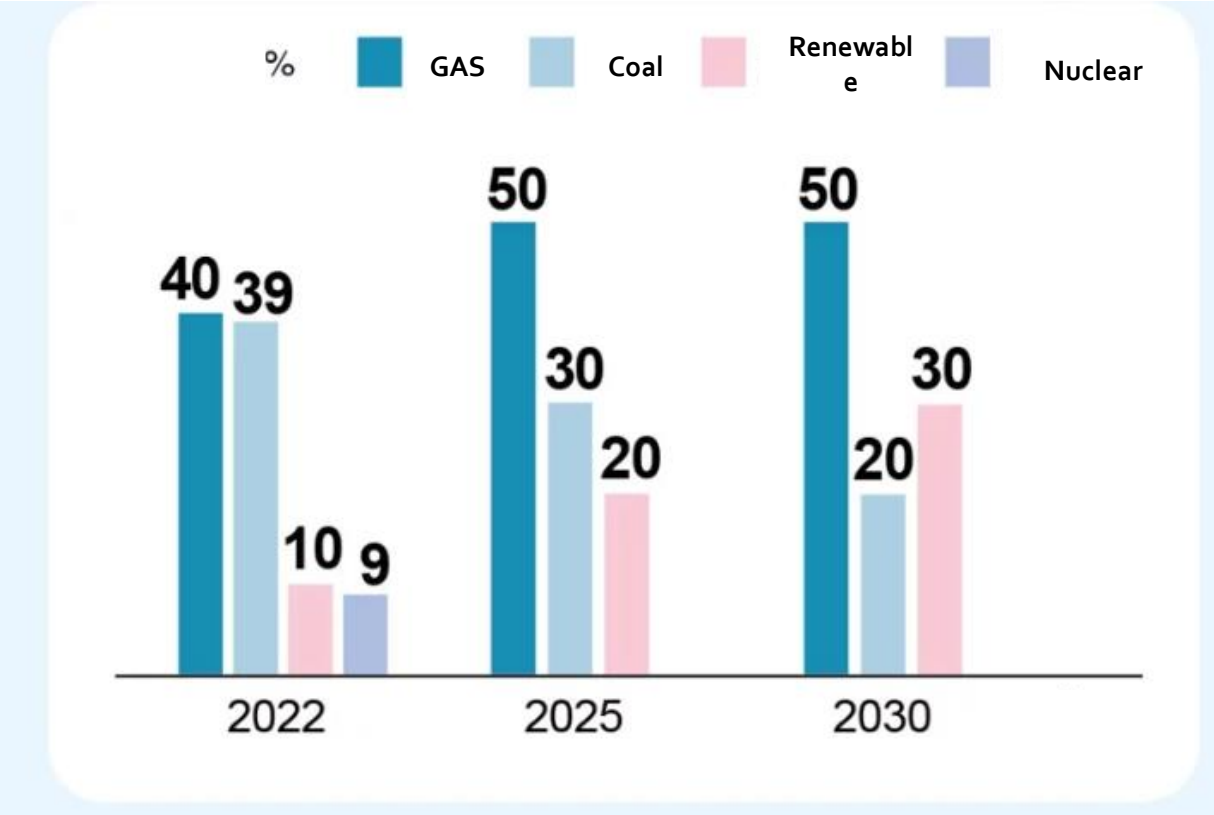


GOALS FOR POWER GENERATOR

Goals of Renewable Energy Installations

Taiwan Energy Bureau

(unit: MW)

	2020	2025
Solar photoelectric	6,500	20,000
Onshore wind power	814	1,200
Offshore wind power	520	3,000
Geothermal Energy	150	200
Biomass and waste	768	813
Conventional hydroelectric power	2,100	2,150
The fuel cell	22.5	60
Total	**10,875**	**27,423**

252% Growth

Digitalization

Traditional Generator

- Large centralized power generation
- One-way output

Stable Renewable Energy Supply

- Large, centered power generator

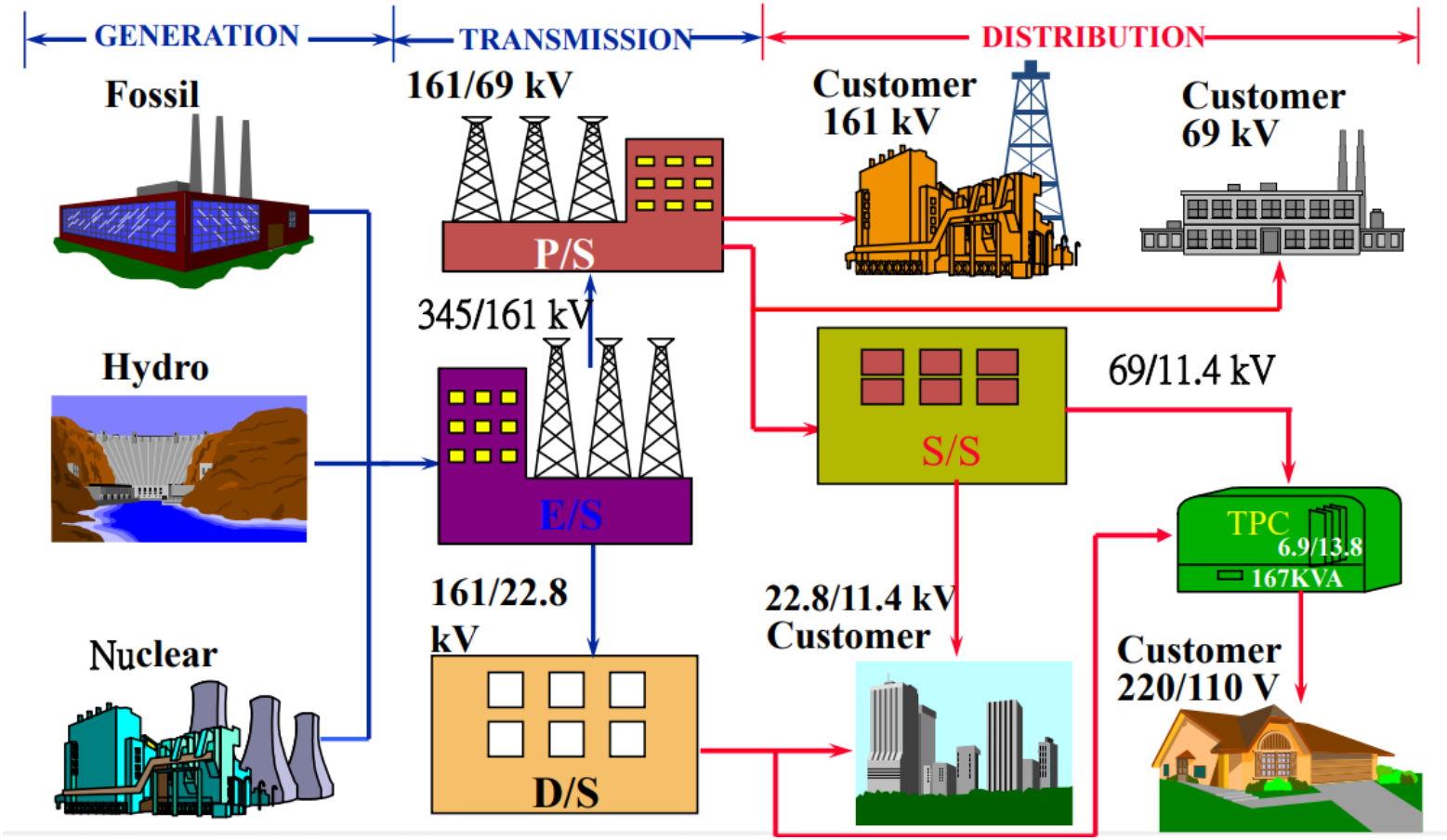
Instant and Multi Data Resources

Integrated Demand and Supply

Smart Power

- Use 5G、AIoT to develop green energy applications
- Digitally integrated power resources
- Build a digital energy internet with smart grid

Overview of Taipower's System



Why Smart Grid

- Upgrading the Reliability and Power Quality
- Customer Participation
- Carbon Footprint
- Integration of Renewable Generation
- Improvement of Communication, Information, and Power Electronics Technology

Driving Factors

Smart Grid

ICT Based

Vision

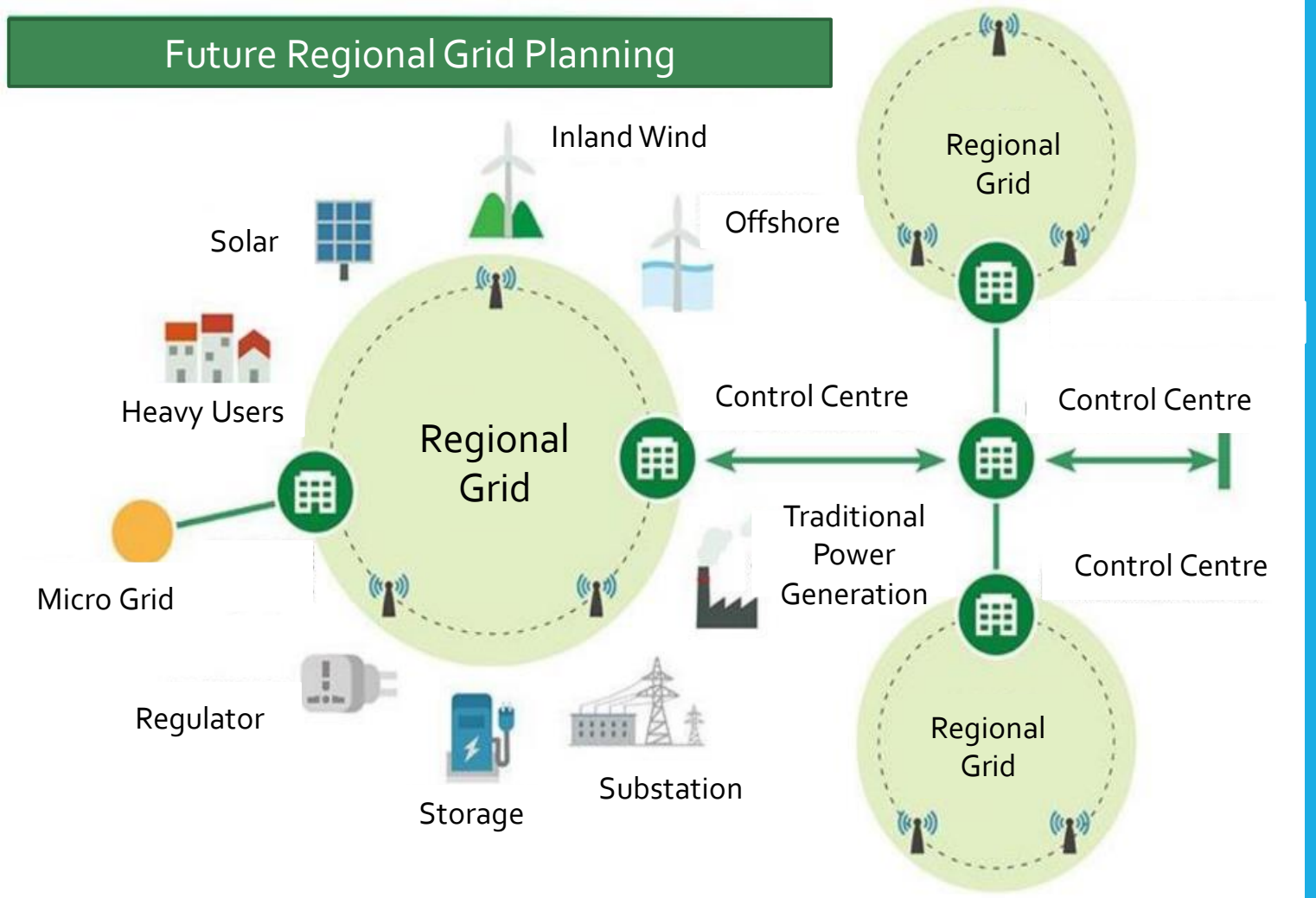
- To establish a high quality, high efficiency and environmentally friendly smart grid.
- To promote the realization of a low-carbon society and sustainable development.

Objective

- To ensure high reliability.
- To encourage conservation and CO_2 emissions reduction.
- To enhance the use of green energy.
- To develop a low-carbon smart grid industry.

Distributed Energy Grid

- **Build local distributed grid and expand grid capacity for renewable energy**
- **Use smart technology to plan regional grid**
- **Integration of multi power generation resources to enable effective and flexible power dispatch**



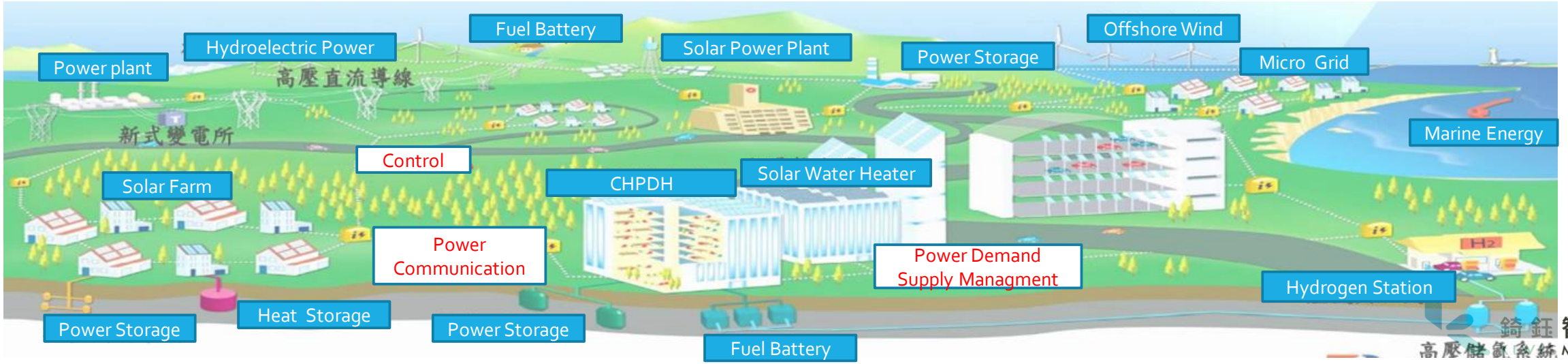
Green Energy Development Trend

- **Distributed Generation and Power Storage**

Enables the collection of energy from many sources and may lower environmental impacts and improve the security of supply.

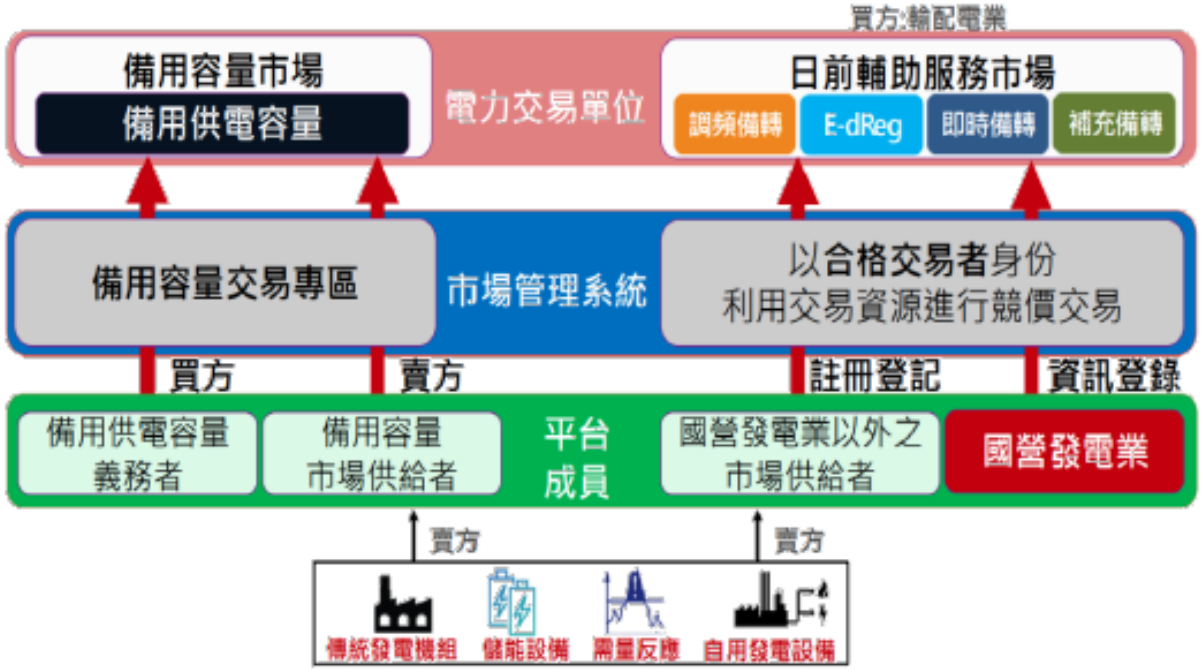
- **Smart Energy Integration**

The combination of smart sensors, big data, cloud calculation and AIOT solutions create the possibility to linkage the digitalized energy system with the service platform. This will lead to new supply chains of traditional and new power generations.



TaiPower's Energy Trading Platform (ETP)

- **Number of Private Qualified Traders : 86**
  - Total Regulation Reserve : 745.4 MW
  - Total E-dReg Reserve : 207.9 MW
  - Total Spinning Reserve : 127.1 MW
  - Total Supplemental Reserve : 301.9 MW
- **State-Owned Electricity Generating Enterprise : 10**
  - Total Installed Capacity : 27,211.8 MW
  - Total Regulation Reserve : 1,447.5 MW
  - Total Spinning Reserve : 5,794.22 MW
  - Total Supplemental Reserve : 8,757.32 MW
- **AFC Participants : 5**
  - Total Capacity : 15 MW



Current Participants

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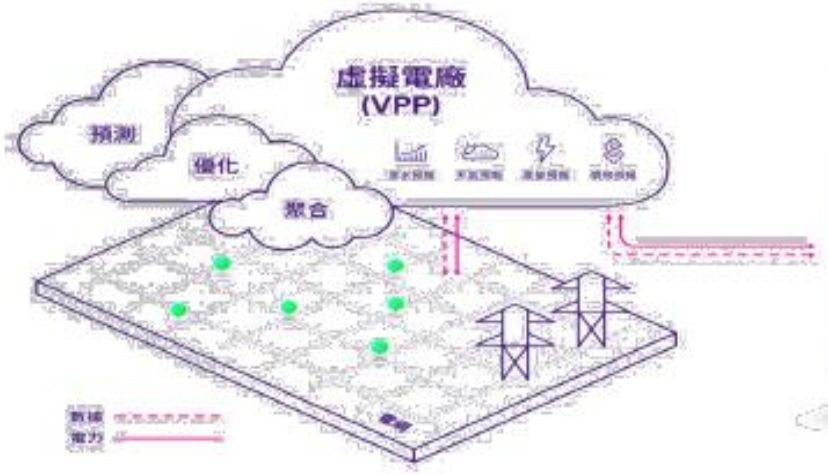


gogoro

安瑟樂威
Ancillary Power

表2 生態系成員電力救援

包括：能源IOT規劃＋機電整合設計
＋ 技術諮詢＋虛擬電廠服務平台

Business Models

Market Players

Market participants are differentiated by the type and size of aggregated DERs.

Customers to Prosumers

Prosumers equipped with DERs, can connect with VPP operators to trade surplus energy, enhancing grid efficiency and earning rewards.

Source : Moxa

Power Generation
Conventional • Renewables
MWs

Flexible Demand
Stationary Batteries • Power-to-X • V2G • B2G
kWs - MWs

Behind-the-Meter
Solar PV • Home Batteries • V2G • B2G
kWs

UTILITY VPP
Utilities pooling their generation assets and their own customer's loads and generation

MVV Energie | E.ON
BayWa r.e. | CNR

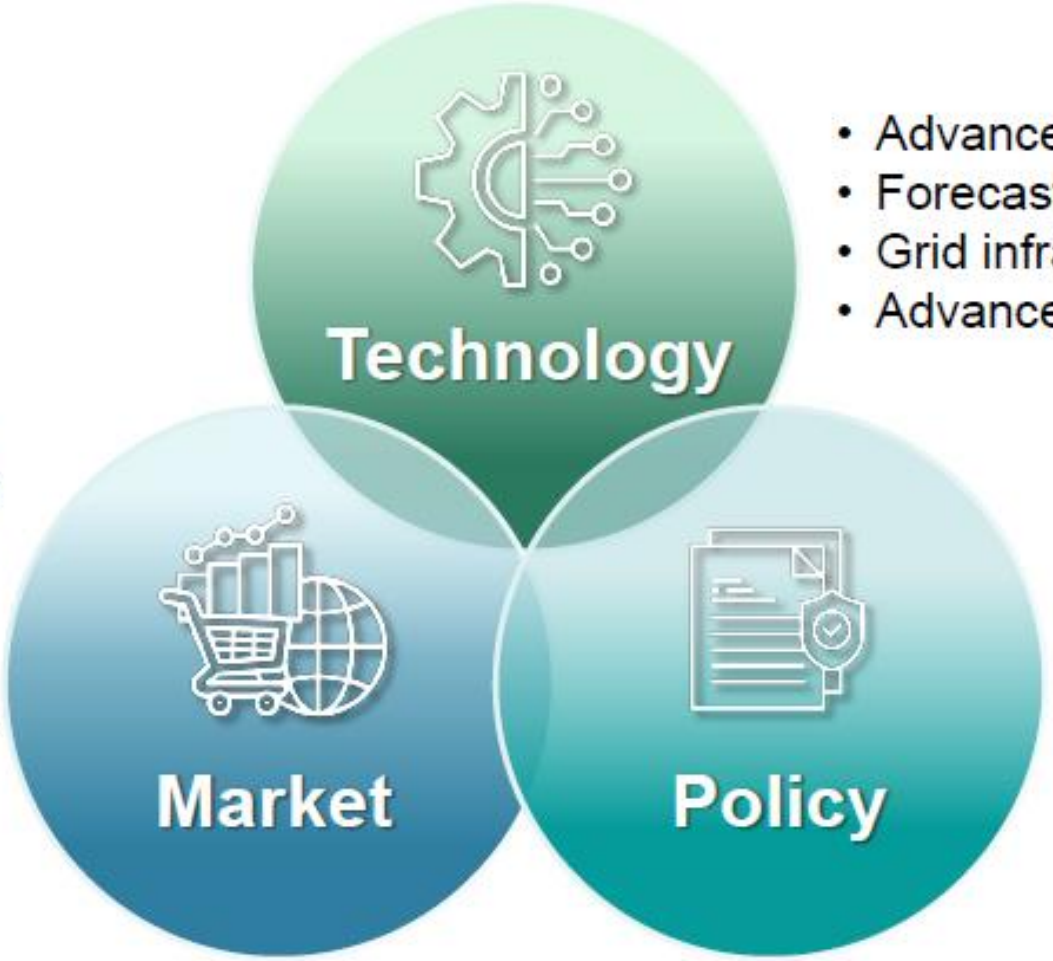
INDEPENDENT VPP
Small-scale "independent" energy producers looking for services

Next Kraftwerke GmbH | Statkraft | Energy2market
Stem | Enel X | Entelios
CPower | Agregio Solutions | GETEC ENERGIE GmbH

NICHE VPP
DER manufacturers aggregating their customer's energy assets

SunPower | Centrica | Tesla
Sonnen GmbH | OhmConnect
ShineHub | Moixa | Sunrun

Future Development



- Advance ICT and AI technologies
- Forecasting and optimization
- Grid infrastructure
- Advanced DER technologies

- Power balance markets
- Ancillary service markets
- Risk mitigation
- Innovative business models
- Investment opportunities

- Demo zones and feasibility study projects
- Supportive regulations
- DER incentives
- Interconnection processes
- Flexible VPP scopes

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THANK YOU

Q&A