



經濟部能源局

Bureau of Energy,  
Ministry of Economic Affairs



# 12 key Strategies for Taiwan's 2050 Net Zero Transition (Draft)

## Power Systems & Energy Storage



# Outline

## 1 Background

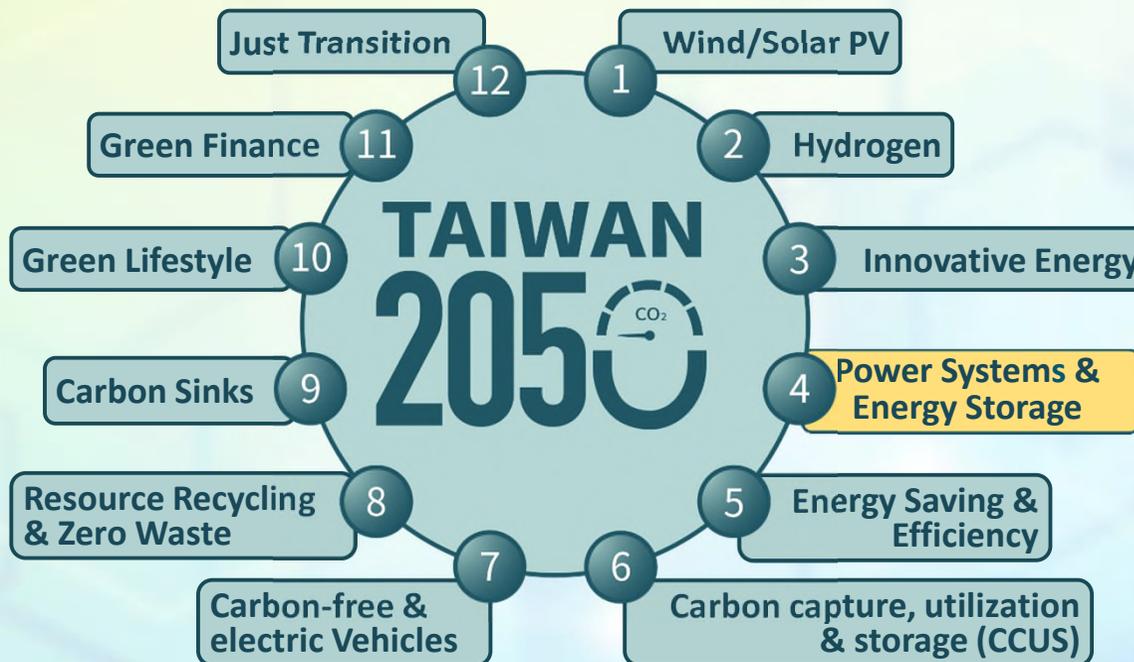
- 1. Introduction
- 2. Energy Transition Challenges

## 2 Promotion Strategies & Measurements

## 3 Budgets & Benefits

# 1. Introduction

National Development Council officially published “Taiwan’s Pathway to Net-Zero Emissions in 2050” on March 30, 2022. It aims to achieve Net-Zero Transition goals with “12 Key Strategies”, and the “Power Systems & Energy Storage” is one of the Strategies.



Promote distribution grid & Enhance grid resilience



Promote digitization and operational performance of grid to improve the resilience and facilitate IoT-tech to system integration.



Expand flexible resource planning such as energy storage requirements to respond to variety in renewable energy.

Taiwan  
2050

Net-Zero Transition

12 key Strategies



## 2. Energy Transition Challenges-Grid Integration

The suitable climate areas for setting up renewable energy (RE) are excessive concentration , and it causes the difficulties in connecting the fields to the grid.

**Grid-connected capacity insufficient  
in RE hot spot**

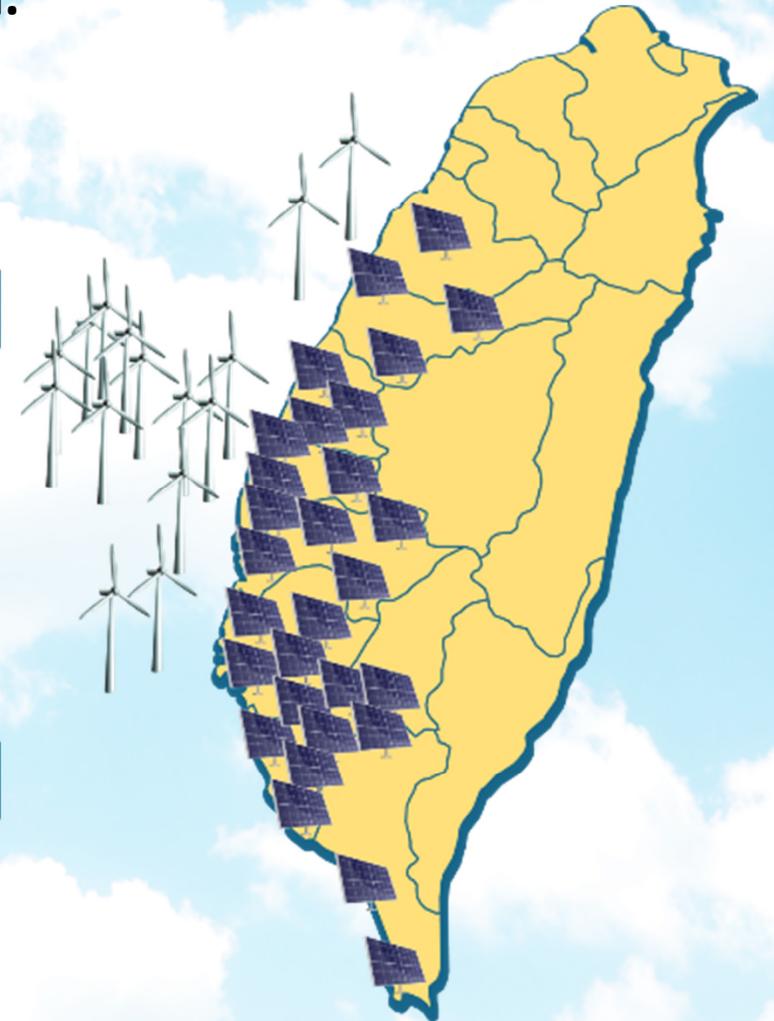
e.g. without water  
supply line to transmit  
water



**Transmission Congestion**

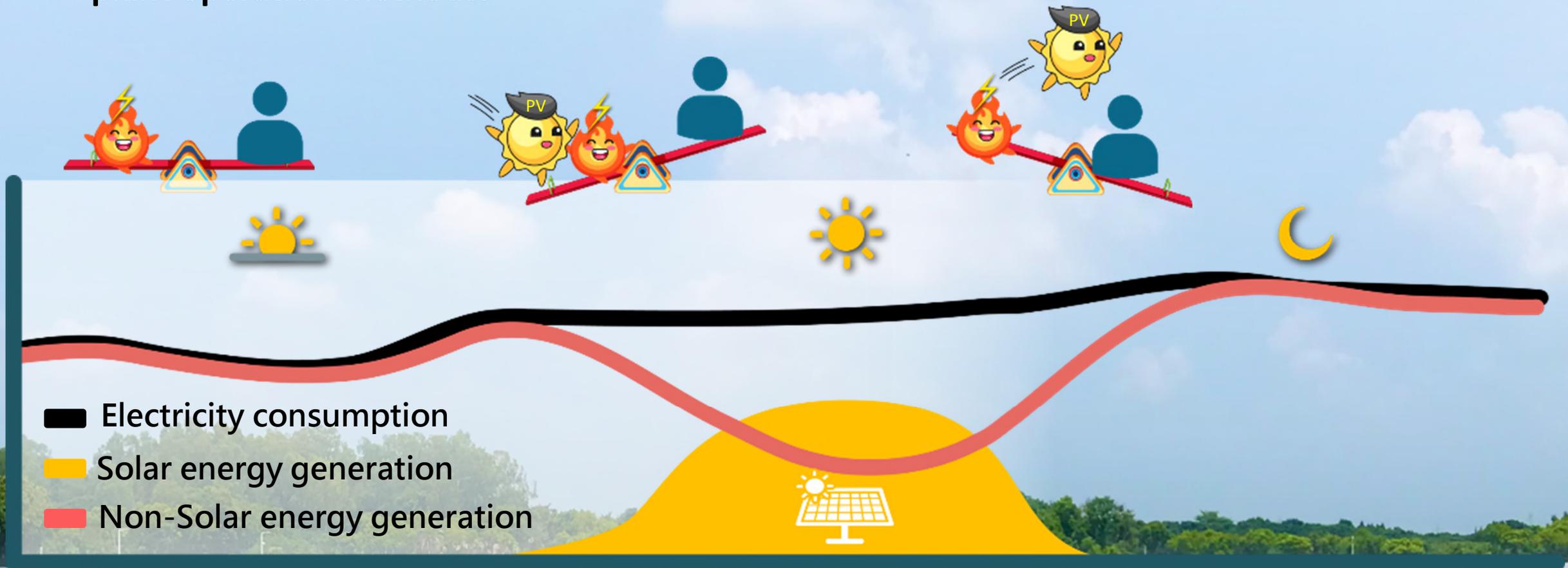


e.g. Strong water flow with small water pipes



## 2. Energy Transition Challenges- Supply-Demand Balance

The intermittency and uncertainty of RE causes the difficulties in conventional power plant operation methods.



# Outline

**1** Background

**2** Promotion Strategies  
& Measurements

**3** Budgets & Benefits

- 1. Goals & Core Strategies
- 2. Promote Measures (2030)
- 3. Just Transition

# 1. Goals and Core Strategies

Strategic Goals : Towards high proportion of renewable energy, while ensuring power balance and enhancing system resilience

**Solve** Promote grid digitization to facilitate the optimal operation **Solve**

## Grid Integration Challenges

- Grid-connected Capacity Insufficient
- Transmission Congestion

## Supply-Demand Balance Challenges

- Large amounts of electricity ramp rate
- Large amounts of load shedding
- Changes are frequently and rapidly

## Power Systems & Energy Storage Strategic Planning

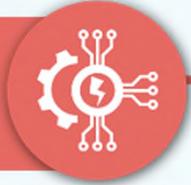
**Solve** Enhance grid infrastructure to enhance grid resilience

Improve resources-control ability for increasing the power supply flexibility **Solve**



## 2. Promotion Measures (2030)

### Enhance Grid Infrastructure



1. RE Enhanced Grid Project
2. Reduce Transmission **Issues** between Regional Grids
3. **Introduce** Power Quality Control facility to Strengthen **Power** System Stability

### Increase Flexibility of System Supply



4. Upgrade responsiveness of traditional power plants
5. Utilize of Energy Storage System (ESS)
6. **Take the Lead on RE generation**
7. **Refine Demand Response Management Measures**
8. Expand Electricity Market

### Promote Grid Digitization

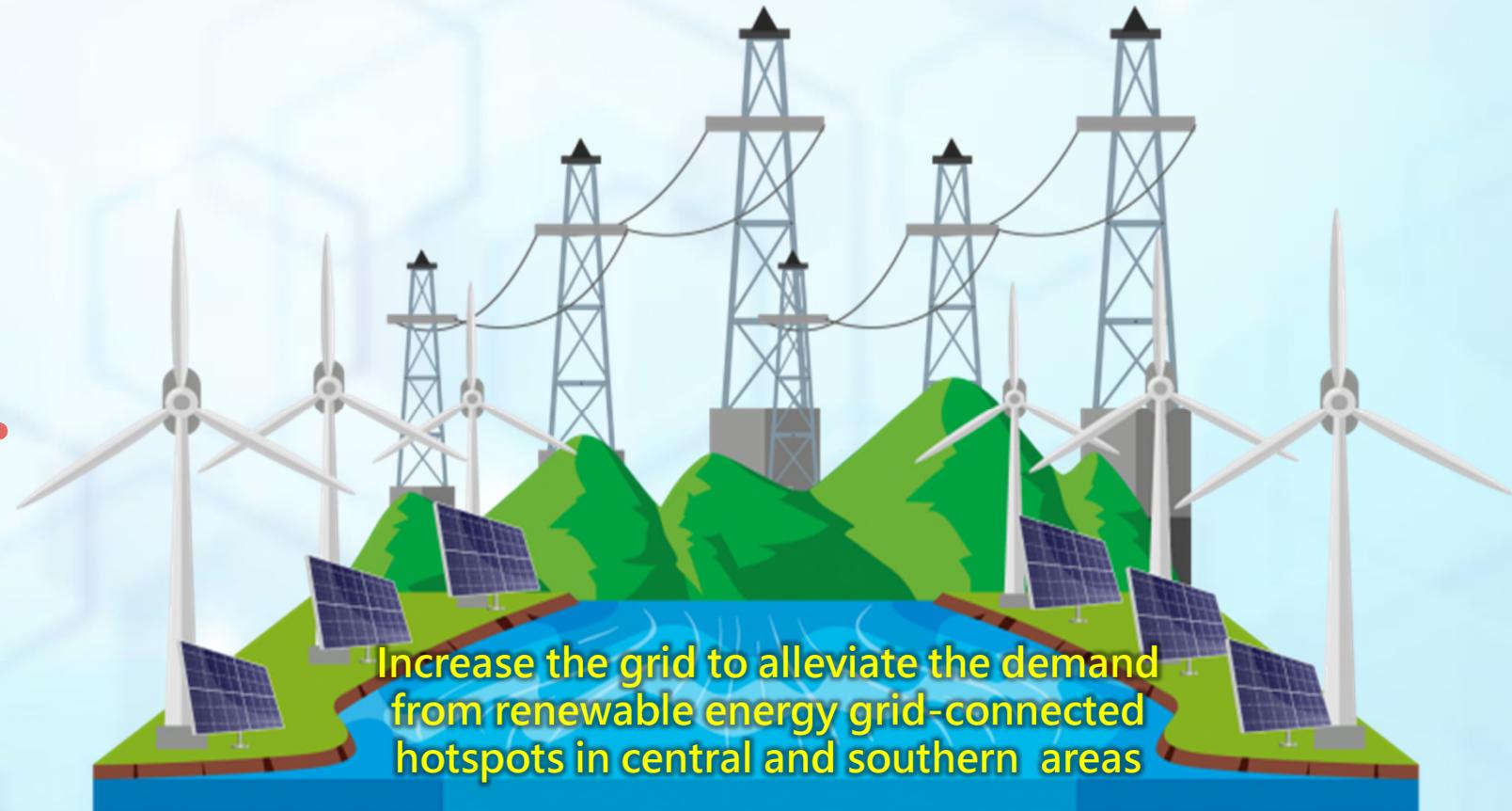


9. Promote **grid ICT** integration
10. **Refine Regional Dispatching**
11. Formulate/Revise National Standards for Smart Grids

## 1) Grid Enhancement for RE

RE development is usually concentrated in the central and southern of Taiwan due to the geographical location and climate, resulting in no suitable connection points or insufficient connection capacity. By strengthening the grid, renewable energy can be smoothly connected.

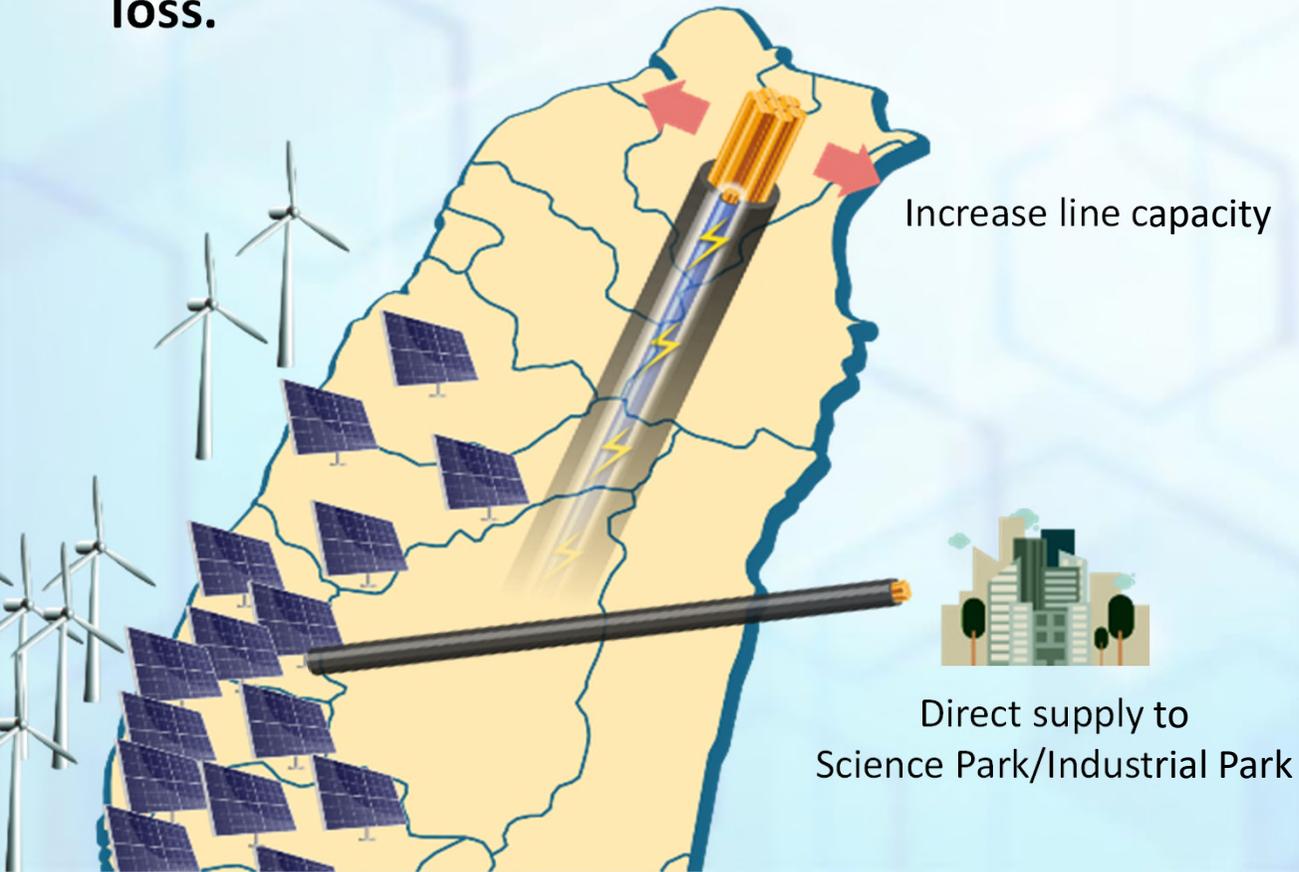
- **Wind Energy** : 7 stations  
7 routes strengthening  
project to increase 11GW  
connected-capacity
- **PV Energy** : 9 stations 10  
routes strengthening  
project to increase 6.5  
GW connected-capacity





## 2) Reduce Transmission Issues between Regional Grids

Improve the power transmission capacity of the ultra-high voltage main line to expand the transmission capacity of the regional power grid. RE concentrated in the central and southern regions can be supplied to nearby science parks and industrial parks, freeing up power transmission for the ultra-high voltage main line and reducing the load on the grid and power loss.



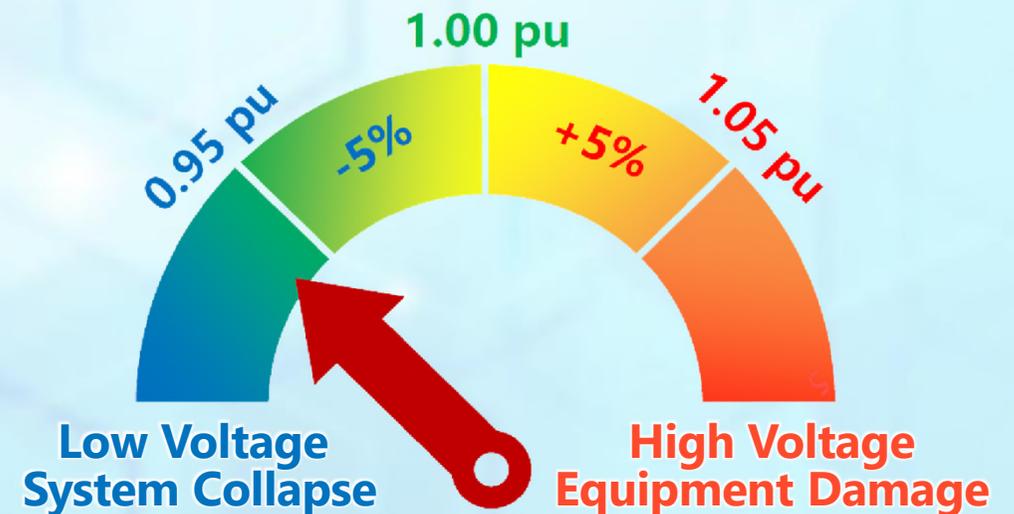
- **Improve power transmission capacity:** Expand The first ultra-high voltage transmission line capacity , from 1,000MW to 3,000MW ; the second and the third lines from 2,000MW to 3,000MW .
- **Supply power directly to Tainan Science Park:** Gathering the power supply from Southwest Coast photoelectric hotspots and directly supplying it to Tainan Science Park(Qigu- the Park)

### 3) **Introduce** Power Quality Control Facilities to Strengthen Stability of **Power System**

Importing power quality control facility can effectively reduce various system voltage instability when the proportion of renewable energy increases.



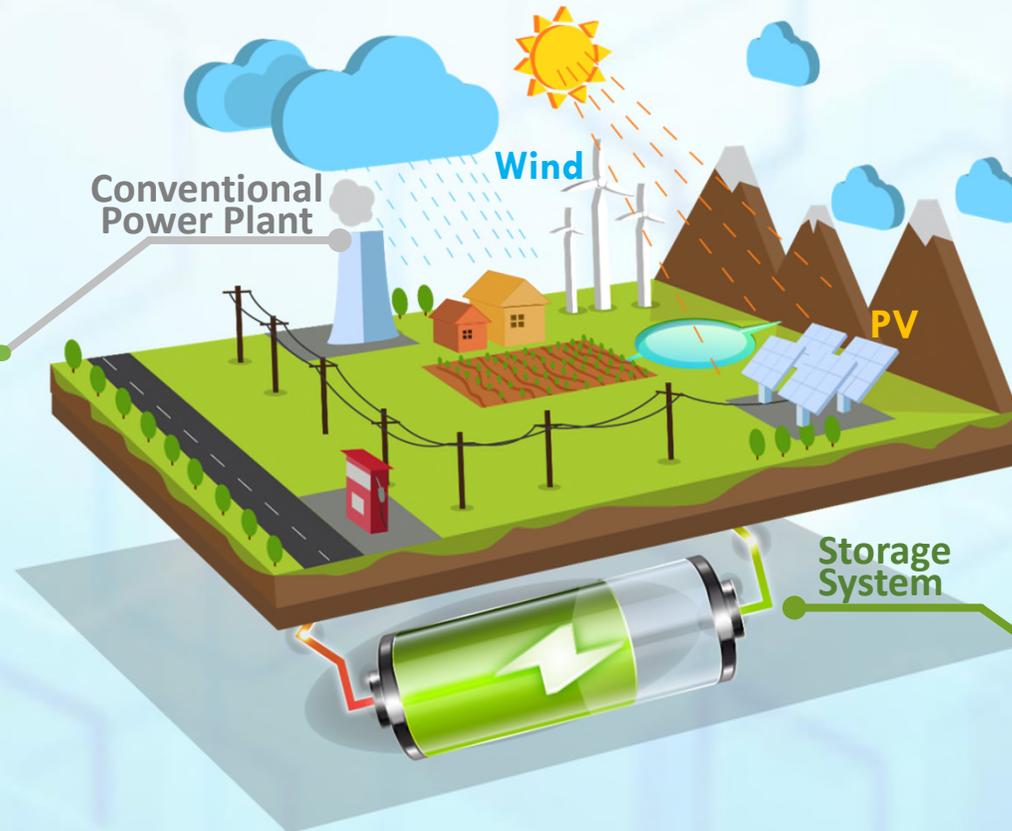
Chang Gong step-up substation, Yongxing Switching Station, Tainan Science Park Substation and Zhuyuan Substation adds  $\pm 200$  MVAR Static Synchronous Compensators (STATCOM) for each, effectively improving voltage stability and maintaining power supply quality.



## 4) Upgrade responsiveness of traditional power plants

The speed of the response ability of the generator set in a conventional power plant is related to the performance of the power dispatching of the generator set, and directly affects the stability and safety of entire power system.

Strengthen the response capability of combined-cycle gas turbines ( Datan No. 7, No. 8 and No. 9 units, Xingda, Taichung, Hsieh-ho, Tungxiao Phase II and Dalin combined-cycle gas turbines ).



## 5) Application of energy storage system

- **Energy storage equipment at the grid side:** Strengthen the resilience and flexibility of the grid.
- **Energy storage equipment at the power generation side:** Combined with renewable energy to supply peak time at night and stabilize the power grid.

	2025	2030 (rolling review)
Grid End	1,000	3,000
Generation End	500	2,500

## 5) Application of Energy Storage System- Grid Side Planning

- ◆ Provide power grid functions such as frequency adjustment, quick response, and peak cut.
- ◆ Promote Goals and Methods :
  - ✓ Reach 1,000MW by 2025: adopt TPC's self-built equipment of 160MW and procurement of auxiliary services of 840MW.
  - ✓ Reach 3,000MW capacity goal by 2030 and proceed the rolling review.



## 5) Application of ESS- Generation Side Planning

The combination of PV energy and ESS promotes the effective use of feeders, expands the installation of photoelectricity, and provides power consumption during peak hours at night. In the short term, it will reach 500MW goal in 2025, expand to 2,500MW in 2030, and continue the rolling reviews.

### Combination of PV Energy and Energy Storage System

**Benefits:** Promote the effective use of feeders, expand PV system installations, and provide peak time power at night.

**Planning Methods:** Announced "ESS Combined with Photovoltaic Power Generation Equipment 2022 Bidding and Capacity Allocation Regulation" on 6/28.

- The **First Type** of project with **1MW** or more should be completed and grid-connected **within one year**.
- The energy storage is charged during the allowed time and discharged during the **night designated time period** announced by TPC.
- **Night Feed-in Tariffs** : Distinguish **electric energy rate** and **battery capacity rate**. The battery capacity rate will be proceeded by bidding.

### Combination of Wind Energy and ESS

Domestic ESS will be built in step-up substation by **bonus mechanism** after 2026

## 6) Take the Lead on RE generation

- By strengthening the forecasting ability of renewable energy and increasing the real-time monitoring information of RE.
- Keep reviewing the regulations of grid-connection technology of RE, and make rules for the rate of RE output change and the supporting system frequency/voltage, making the power system more stable.



- **Improve the forecast accuracy of RE generation :**  
**Wind power generation:** day-ahead forecast error is within 8% and hour-ahead forecast error is within 4%.  
**PV power generation:** day-ahead forecast error is within 10% and hour-ahead forecast error is within 5%.



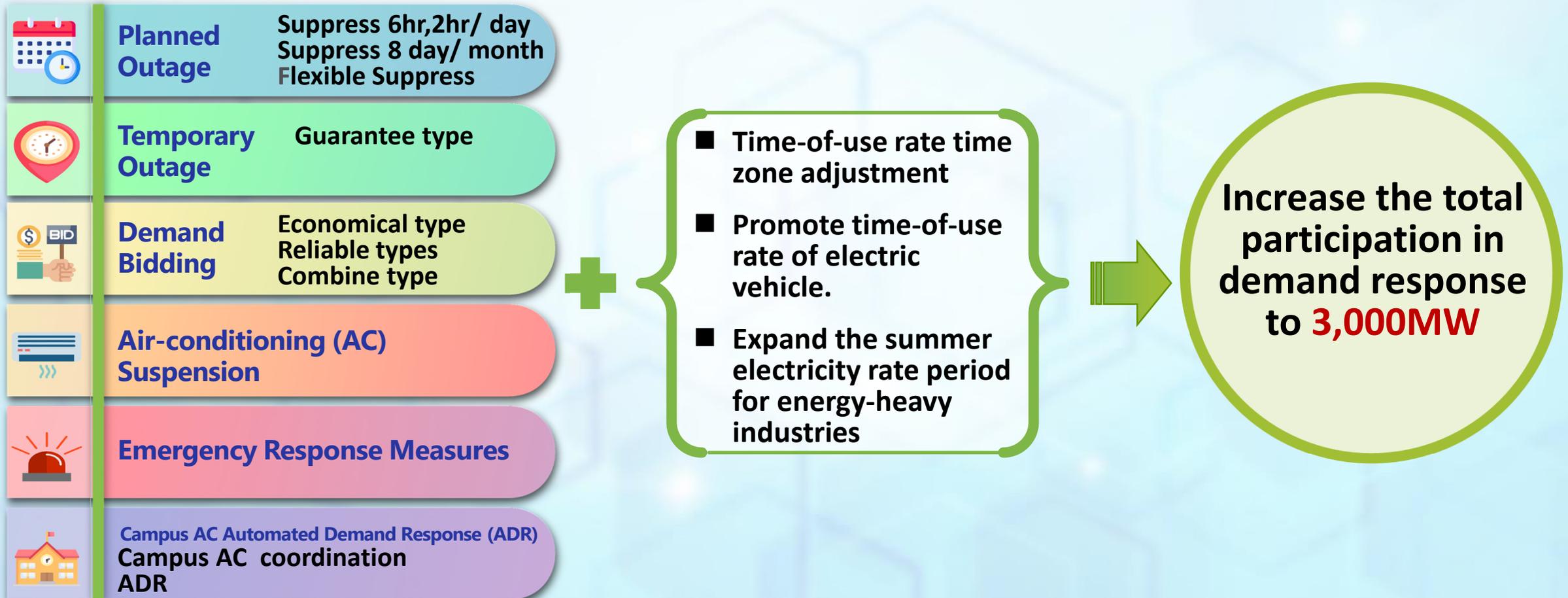
- **RE forecasting increases the amount of real-time monitoring data:**  
The capacity of RE real-time monitoring data reached 28GW, and more than half of situation would be watched.



- **Request RE to take responsibility for improving the system stability:**  
Review the regulations of grid-connection and make rules for the rate of output change and the frequency/voltage supporting .

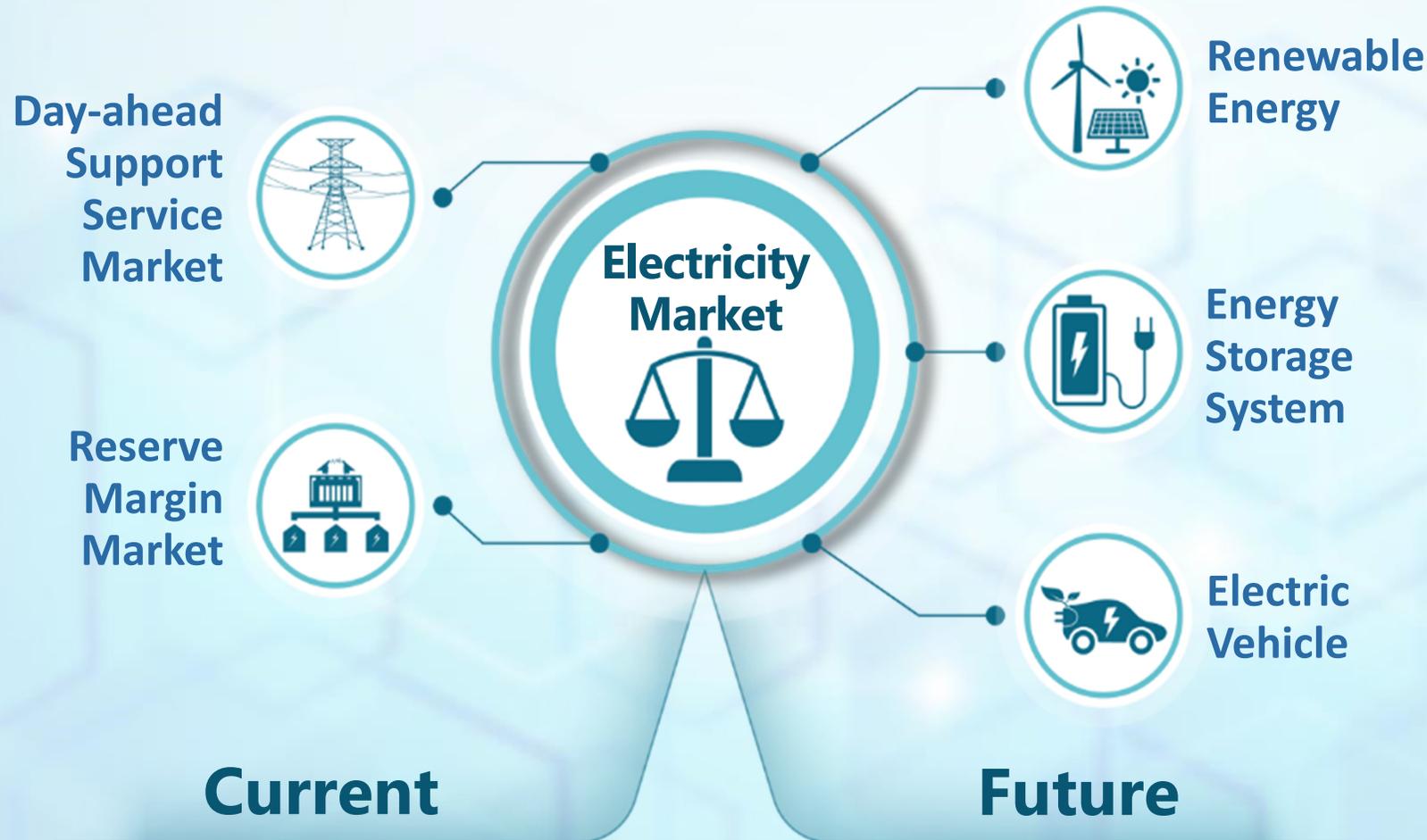
## 7) Refine Demand Response Management Measures

To Encourage customers and reduce electricity consumption and load during peak hours, through demand response management, and customers can pay a lower tariff or receive a tariff deduction according to the actually reducing or shifting their electricity load.



## 8) Expand Electricity Market

- Make emerging resources to efficiently participate in electricity market operation with the implement of energy storage, electric vehicles and demand response.



- Keep promoting the Electricity Trading Platform and improve the trading market.
- Promote the investment of emerging resources (such as energy storage/electric vehicles)

## 9) Promote **Grid ICT** integration

- To make the power grid operate safely and efficiently: integrate ICT technology on various devices for providing integrated functions and services.

- **Promotion of smart meters:** 6 million smart meters for low-voltage user were built.

- **Smart substation setup:** Complete the construction of 185 smart substations

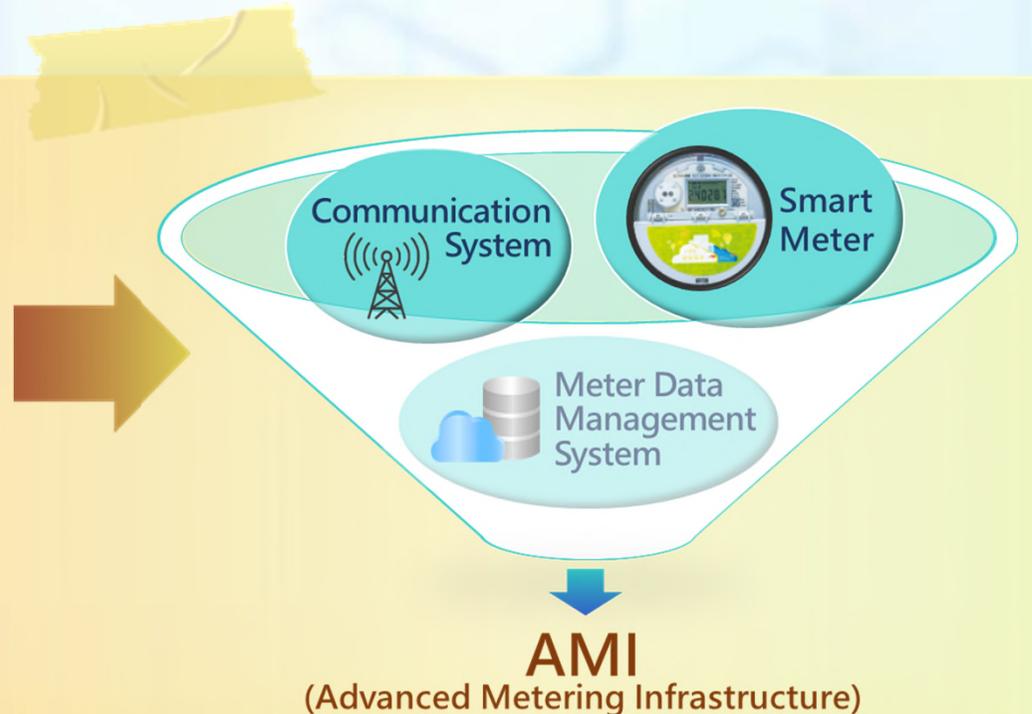
(including the introduction of IEC 61850 in s/s and the replacement of IEC 61850 automation equipment in substations or the replacement of transmission-level digital protection relays).

**IEC 61850**  
Information  
Integration



### Traditional Mechanical Meter

- Mechanical rotation metering
- Manual meter reading
- Electricity bill display



## 10) Refine Regional Dispatching

- In response to the increasing amount of RE :
  - ✓ The dispatching capability of the regional grid will be improved and ADCC could assist the CDCC in the power dispatching.
  - ✓ The capability of the dispatching center will be strengthened simultaneously in transferring capacity, speeding up the power recovery time and improving system stability.

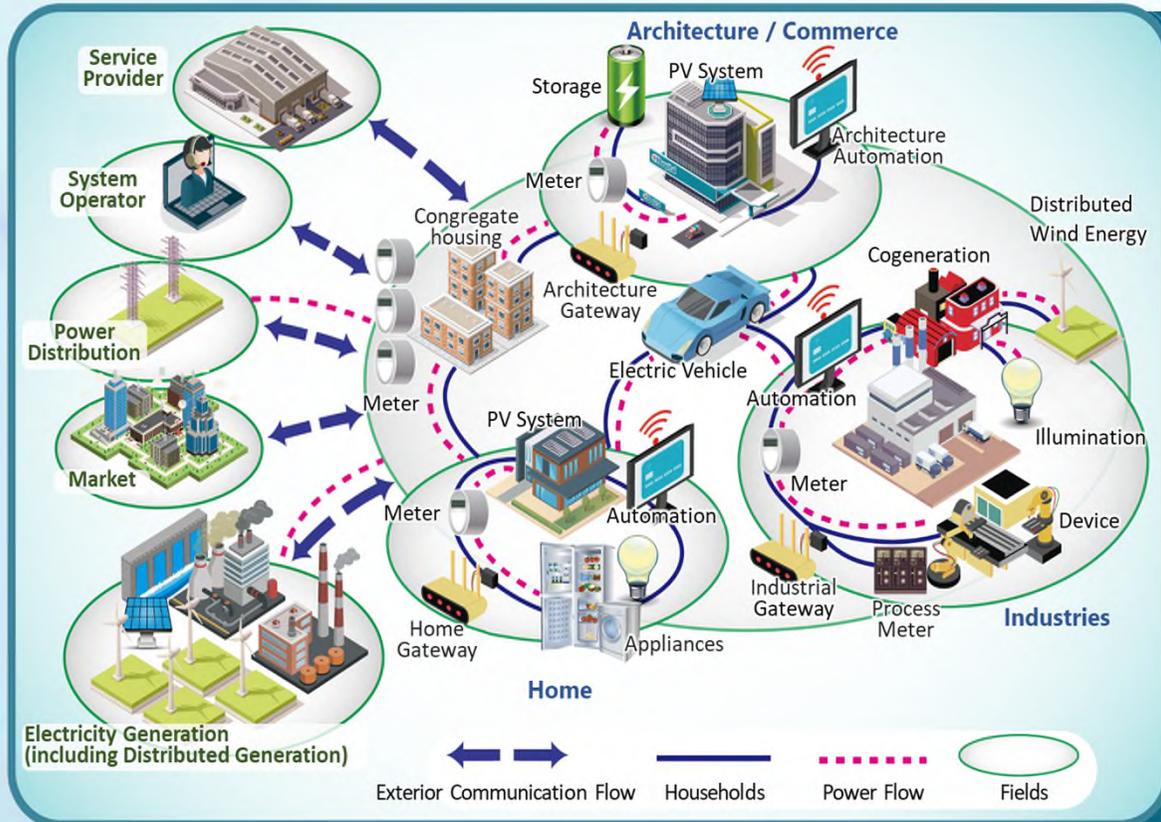
■ **Area Dispatch Control Center (ADCC) enhancement** : Complete additional electric energy management systems (EMS) in 7 ADCCs for decentralization and regionalization of future grid and enhancing the ability to monitor power plants and a large amount of renewable energy under jurisdiction.

■ **Distribution Dispatch Control Center (DDCC) enhancement** : Complete Advanced Distribution Management System(ADMS) in 21 DDCCs to monitor the data of distribution system load, renewable energy and energy storage.



# 11) Formulate/Revise National Standards for Smart Grids

Formulate and revise national standards regarding Smart Grid (distribution management system, smart meters, information security, etc.) to facilitate interoperability between devices and systems, and to promote the development of relevant industries.



## National Standard for Smart Grid

- IEC 61850** Electricity Automation
- IEC 62357** General Introduction to the Power System
- IEC 61968** Power Distribution Management System
- IEC 62056** Smart Meter
- IEC 62351** Grid Information Security
- IEC 62746** User Interface for PMS (Power Management System) and EMS (Energy Management System)
- IEC 61970** Energy Management System
- CNS 16014** Smart Home Device

# 3. Just Transition

- In response to the promotion of power systems and ESS, the rights and interests of landowners, neighboring households, industries and labor stakeholders should be taken into account of to achieve just transition.



Regional Development and Livelihood Consumption

Industrial Transformation and Employment

Economy	Assistance fund mechanism to improve the welfare of stakeholders: Improve the benefits of residents in the surrounding areas of the power grid facilities.
Life	Listen to the opinions from all sectors to create a win-win situation: Hold regional briefings to clarify the concerns of all parties and avoid sensitive locations.
Psycho.	Enhance the confidence of stakeholders by outreach and advocacy: Produce videos to publicize the added value and clarify the impact.
Industry	Industry counseling and promoting the development of emerging industries: Help industries to transfer conventional units or reconstruct the plant to activate related industries.
Labor	Infrastructure promotion and industrial transformation to expand the job market: Both the promotion and the operation of power grids require a large amount of talent investment to drive the market.

# Outline

**1** Background

**2** Promotion Strategies  
& Measurements

**3** Budgets & Benefits

- 1. Budgets Plan
- 2. Expected Benefits



# 1. Budgets Plan

It is estimated that **76.0777 billion NTD** will be invested in 2023 to 2024 to introduce a high proportion of renewable energy, while ensuring power supply balance and improving system resilience.

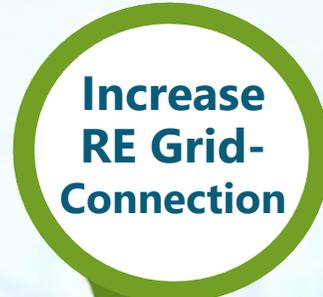
Executive Unit	Budget (billion)	Investment	
TPC <sup>1</sup>	68.303	<ul style="list-style-type: none"> <li>Power Grid Improvement Project for Offshore Wind Generation (Phase I)</li> <li>Power Grid Improvement Project for Offshore Wind Generation (Phase I Block Development)</li> <li>Grid-connected Solar Photovoltaic Project</li> <li>Tainan Science Park Extra-High Voltage Substation Expansion project (Only STATCOM)</li> <li>161 kV STATCOM Installation Project at Zhu-Yuan E/S</li> <li>Smart meter infrastructure AMI promotion scheme</li> <li>Feeder Automation Deployment</li> <li>Import IEC-61850 Standard into S/S</li> <li>IEC-61850 Automation Devices Replacement or Transmission Level Digital Relay Replacement for Substation</li> <li>Solar Photovoltaic Unit devices replacement plan - Tainan Salt Pans Solar Energy Storage Project</li> </ul>	<ul style="list-style-type: none"> <li>Financial procurement and installation of Zhang-Bin energy storage system</li> <li>Lu-Yuan D/S Transformer and Energy Storage Devices Installation Project</li> <li>Long-Tan E/S installation project for energy storage devices</li> <li>Dong-Shan E/S installation project for energy storage devices</li> <li>Budget for the Sporadic Expansion and improvement of Power Distribution Equipment</li> <li>Da-Chia River Guang-Ming Pumped Storage Hydropower Project</li> <li>Shi-Men Pumped Storage Hydropower Project</li> <li>Improve the Power Transmission Capacity of the Main Line</li> <li>ADMS for Distribution Dispatching Center</li> </ul>
BOE <sup>2</sup>	0.726	<ul style="list-style-type: none"> <li>Policy Promotion and Key Application Technology Development of Smart Grid Project</li> <li>Electricity Market Supervision Analysis and Promote Project</li> <li>Net zero emissions - MW level energy storage battery health detection and evaluation technology optimization</li> </ul>	<ul style="list-style-type: none"> <li>Net Zero Emission – The Technology Validation Program of Flow Battery Energy Storage System</li> <li>Research and development on new and renewable energy technologies (1. Energy storage module operation and maintenance technology applied to power grids with green energy, and 2. The Application and Verification Plan of Energy Storage Battery Systems)</li> </ul>
BOE/TPC	6.0617	<ul style="list-style-type: none"> <li>Public Construction Project on Power Grid Operation Flexibility Improvement</li> </ul>	<ul style="list-style-type: none"> <li>Energy Storage Project for Regional Grid</li> </ul>
BSMI <sup>3</sup>	0.537	<ul style="list-style-type: none"> <li>Project on Standards, Testing and Certification for Safety of Energy Storage Systems and Smart Grid</li> </ul>	<ul style="list-style-type: none"> <li>Project on Standards, Testing and Certification for Renewable Energy Infrastructure</li> </ul>
INER <sup>4</sup>	0.38	<ul style="list-style-type: none"> <li>Development of intelligent management and efficiency enhancement for distribution system with renewable energy</li> </ul>	<ul style="list-style-type: none"> <li>Net zero emissions – Power Grid Resilience Analysis Project</li> </ul>
IDB <sup>5</sup>	0.07	<ul style="list-style-type: none"> <li>Assistance Plan for Energy Storage System and Equipment Industry</li> </ul>	



## 2. Expected Benefits

The benefit of these implements is estimated to create over 30 billion in private investment, exceed 90 billion of output value and over 450 job opportunities.

- ① Reduced ancillary service capacity charges.
- ② Reduce costs for ancillary service initiation.



- ① Increase offshore wind energy to 11GW and PV to 6.5GW.
- ② Increase 1st and 2nd ultra-high voltage transmission lines to 3,000MW.
- ③ Southwest Coast photoelectric hotspots and directly supplying it to Tainan Science Park.



- ① Expand the electricity market and promote investment in energy storage/electric vehicles.
- ② Planning ESS to 5,500MW in 2030.



The 90 % of power restoration accidents in the downstream automated feeder could be solved within 5 minutes.



Improve TPC's ability to detect the loss of power supply lines and enhance the information security of smart grids.



**Thank you  
for your listening.**