2017 German & Taiwan Smart GridSymposium

Taiwan's Energy Development Perspective

Taiwan Smart Grid Industry Association

2nd, March, 2017

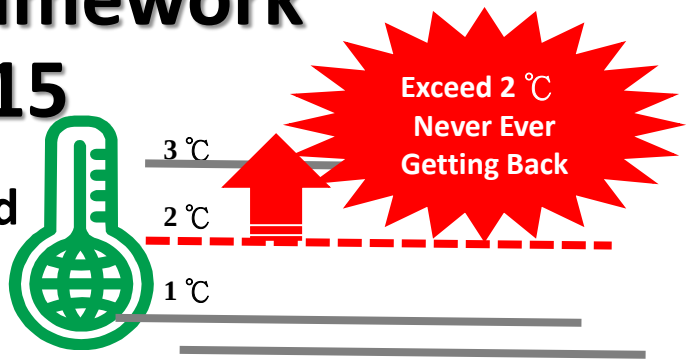
台灣經濟研究院
Taiwan Institute of Economic Research

Agenda

1. The Global Energy Supply and GHGs Reduction Trend
2. Taiwan's New Energy Policy & Implementation Plan
3. Shaun Green Energy Science City

I. The Global Energy Supply and GHGs Reduction Trend

The 21h Conference of United Nations Framework Convention on Climate Change, 2015



- The agreement sets out a global action plan to put the world on track to avoid dangerous climate change by limiting global warming to **well below 2˚C.**
- **The Paris Climate Change Agreement entered into force on 4th Nov. 2016.**

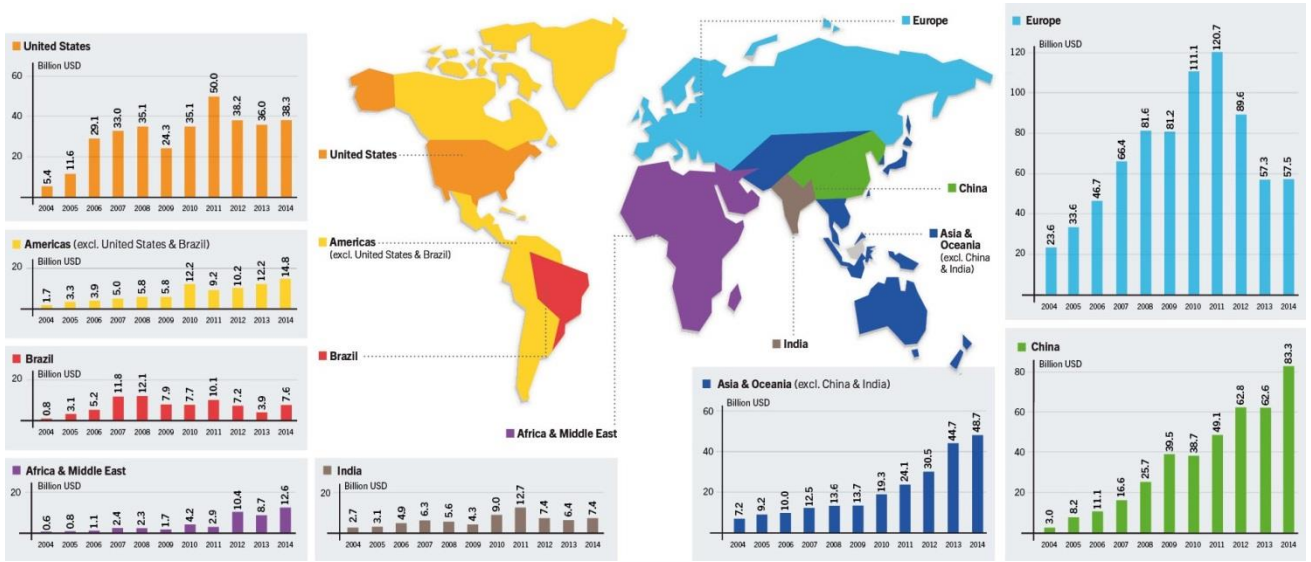
	Content
Long-term Goal	■ The target of keeping the rise in temperature is **below 2˚C** and should **aim for 1.5˚C**。 ■ Emissions should **peak** as soon as possible and the countries will aim to achieve carbon neutrality in the second half of the century.
Review Mechanism	■ In 2018, Parties will collectively **take stock of countries' emissions** reductions, and then update their NDCs or submit new ones by 2020. ■ After 2020, a **regular "Global Stocktake"** will take place every five years starting in 2023 to review all aspects of Agreement implementation, including mitigation, adaptation, finance and support. ■ Parties will then **submit new NDCs every five years**, informed by these Global Stocktakes.

	Content
Support	■ The developed countries will continue to support climate action to reduce emissions and build resilience to climate change impacts in developing countries. ■ Developed countries intend to continue their existing collective goal to mobilise **USD 100 billion per year by 2020** and extend this until 2025.
Mechanism for Loss and Damage	Decides on the continuation of the Warsaw International Mechanism for Loss and Damage associated with **Climate Change Impacts**, following the review in 2016;

資料來源：United Nations FCCC/CP/2015/L.9 (2015)；台經院整理

The Global Development of Renewable Energy

- To every investor's astonishment, in 2014 , **half of the global new installed capacities went to renewable energy.** Renewable energy has become a mainstream energy.
- Due to the strong carbon reduction policies in international community, it is projected that, from 2015 to 2040, 60% of the electricity investment will directly link to the renewable energy. The leading countries will be China, the EU, the US and India. **Renewable energy will continuously take the dominant position.**



		START 2004	2013	2014
INVESTMENT				
New investment (annual) in renewable power and fuels	billion USD	45	232	**270**
POWER				
Renewable power capacity (total, not including hydro)	GW	85	560	**657**
Renewable power capacity (total, including hydro)	GW	800	1,578	**1,712**
Hydropower capacity (total)	GW	715	1,018	**1,055**
Bio-power capacity	GW	<36	88	**93**
Bio-power generation	TWh	227	396	**433**
Geothermal power capacity	GW	8.9	12.1	**12.8**
Solar PV capacity (total)	GW	2.6	138	**177**
Concentrating solar thermal power (total)	GW	0.4	3.4	**4.4**
Wind power capacity (total)	GW	48	319	**370**
HEAT				
Solar hot water capacity (total)	GW_{th}	86	373	**406**
TRANSPORT				
Ethanol production (annual)	billion litres	28.5	87.8	**94**
Biodiesel production (annual)	billion litres	2.4	26.3	**29.7**

Source: 2015 world energy outlook,IEA, REN21 2015

The Global Energy Transition is Ongoing

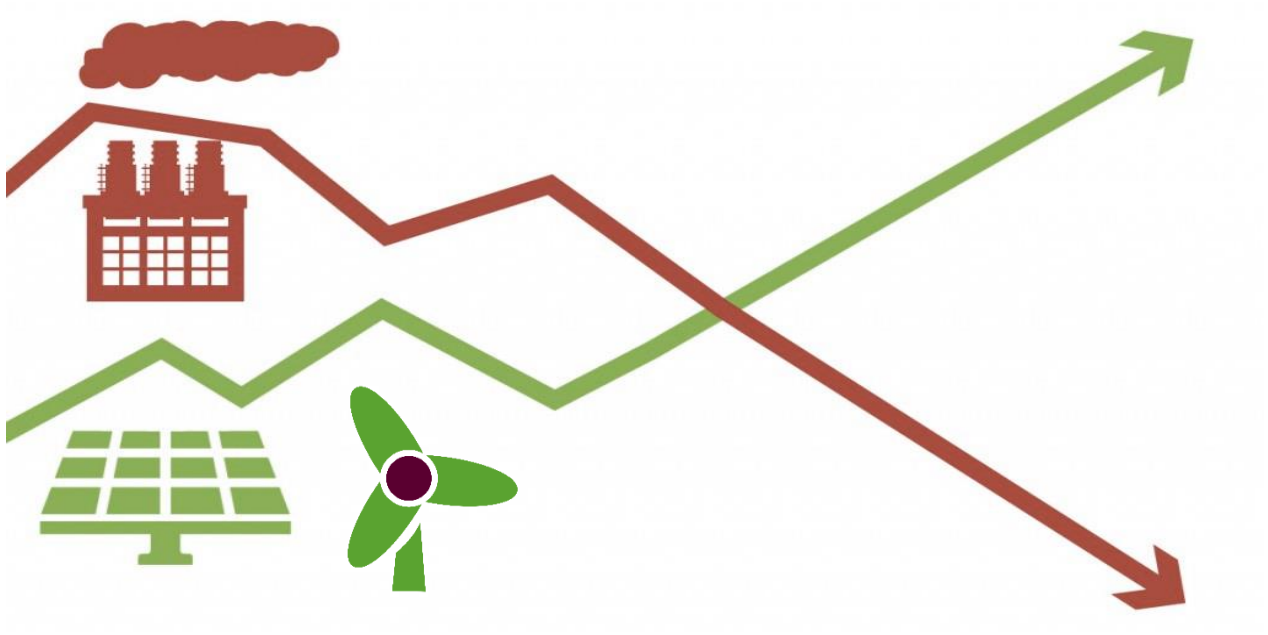
- Due to the **carbon reduction policies** eagerly adopted among international communities, together with the trend that the **decline of costs in renewable energy**, mainly Solar PV and Wind Power, **the global energy transition is ongoing**.
- To increase the share of renewable energy, each country expects the reinforcement of the application among **demand side management**, **renewable energy**, **storage and smart grid**, as well as establishes the **regional system** of smart **energy management and supply**.
- It is every country's common will to **promote the necessary technology of the energy transition both pragmatically and economically**, to reach final goal.

Source: Gou-Chung Chi, Yenhaw Chen, The Role of Smart Grid to Constructing Green Energy Supply System in Taiwan, TIER, 2017

II. Taiwan's New Energy Policy & Implementation Plan

2025 Energy Policy Target

- To reach the balance among energy security, environmental sustainability and green economy，while constructing an energy demand and supply system with security, stability, efficiency, and tidiness as well as initiating the value of sustainability in order to go towards to **nuclear free homeland by 2025**.
- The policy goal of nuclear free homeland **by 2025 that the energy mix** will **be 30% by coal, 50% by gas and 20% by renewables.**



2025		51.5(TWh)
Solar PV	**Wind**	**Other green enery**
25 (TWh)	**14** (TWh)	**12.5** (TWh)

(1 TWh=10億度)

The Goal of Renewable Energy Policy

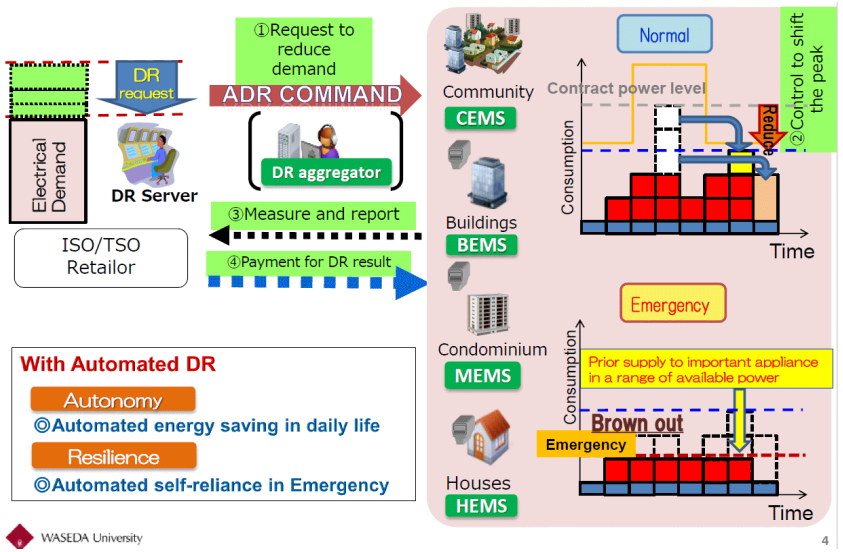
- **Strategic Directions: To achieve nuclear-free homeland and greenhouse gas reduction targets, the new government will increase the installation of the renewable energy, especially solar photovoltaic energy and offshore wind power . Additionally, it will accelerate the deployment of the smart grid and the AMI.**
- **Objectives: To promote solar PV 20GW (roof 3GW / ground type 17GW), wind power 4.2GW (onshore 1.2GW, offshore 3GW), till 2025 renewable energy will achieve 53.1% of generation capacity, 18.5% of the total generatin g capacity. And 8 million livelihood users build link to smart grid and smart meters.**

	2015		2020		2025	
	Installed Capacity (MW)	Power Generation (100 GWh)	Installed Capacity (MW)	Power Generation (100 GWh)	Installed Capacity (MW)	power Generation (100 GWh)
PV	842	11	8776	110	20000	250
Onshore Wind	647	16	1200	29	1200	29
Offshore Wind	0	0	520	19	3000	111
Geothermal	0	0	150	10	200	13
Biomass	741	54	768	56	813	59
Hydro	2089	46	2100	47	2150	48
Hydrogen	0	0	22.5	2	60	5
Ocean	0	0	0	0	0	0
Total	4319	127	13537	273	27423	515

Data Source:New energy policy, New Frontier Foundation, March 11th 2015.

AMI ,Demand Bidding & Aggregator Mechanism

- In 2010, the Executive Yuan began the “AMI Promotion Project”, the project has completed over 24,123 high voltage AMI systems and 10,000 low voltage AMI, which controls 60% of Taiwan’s power consumption. **Taipower will start the installation of 200 thousands low voltage AMI in 2017, 800 thousands in 2018, by 2020 finish 1 Million , by 2024 3 Million, low voltage AM installation.**
- Due to the tight power supply, in order to lower the peak load and ensure the reliability of power supply, Taipower has introduced the “**Demand Bidding Schema**” in May, 2015. The target audiences are the high voltage users who’s contract capacity is 100MW and above, and the lowest bidding price is 50kW power usage, which are government agencies, commercial buildings, hypermarkets and etc. Taipower asked the participants to save power **over 50kW** or above each hour, and will have an incentive of **NTD$10 per kWh**.
- In 2017, Taipower introduce the **Aggregator Mechanism for peak load clipping**. Each year, it could provide 200MW power usage reduction for 100 hours during the peak hours and increase 0.5% of Percent Operating Reserve.



Source：Hideo Ishii, WASEDA University, 2015

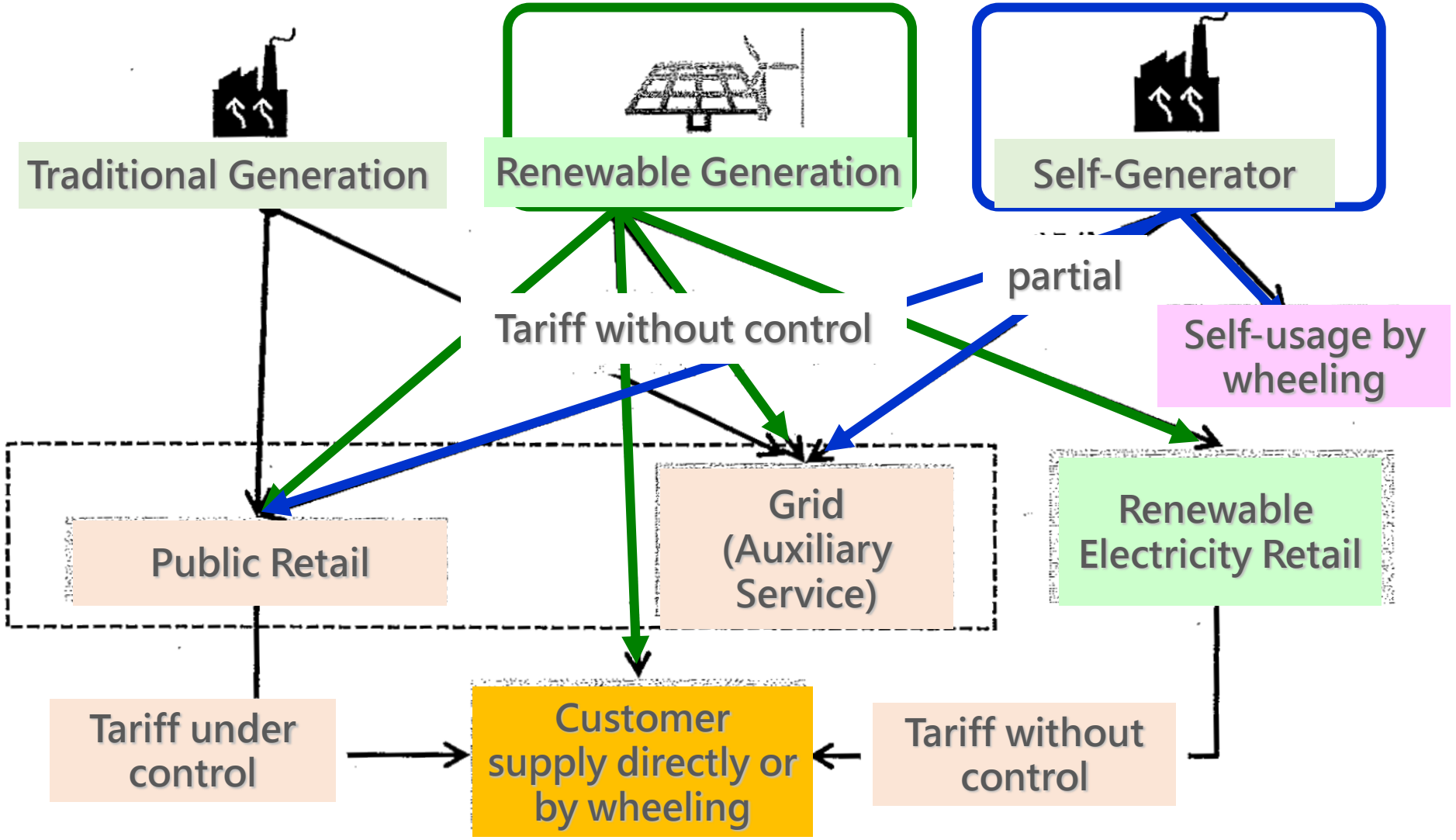
Source：Bureau of Energy, Ministry of Economic Affairs , Taipower Company, 2015.05

Amendment to Electricity Act

- **Amendments to the Electricity Act** passed their third and final reading in the legislature **on 11th Jan 2017**.
- The Electricity Act have been held up for 20 years, and their passage marks a **significant milestone** in Taiwan's development of **green energy sources**.
  - Set a goal to **make Taiwan nuclear-free by 2025**
  - **Prioritize the development of green energy**, with an eye to expanding renewable energy and creating a **green, eco-friendly country.**

Source: Legislature passes **amendments to reform energy market** and fund long-term care, Executive Yuan, 2017-01-12

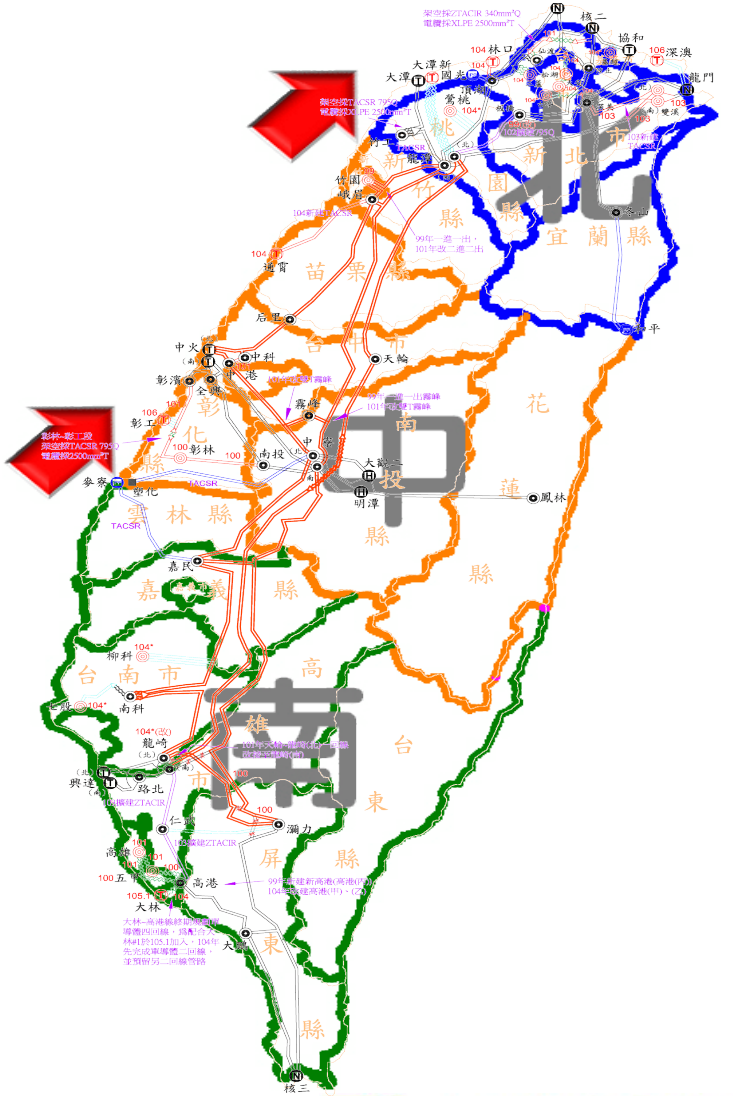
Amendments to the Electricity Act – Market Structure



資料來源：台電公司企劃處整理

Regional Power Usage Character and Renewable Resource

- **North Taiwan**
  Power transmits from South to North during the peak time. North area is large power demand center. Demand management could create North VPP and become system dispatch resource.
- **Centre Taiwan**
  Full of onshore and offshore wind resource which is suitable to develop wind power and integrate as Centre VPP.
- **South Taiwan**
  70% PVs are installed in south area, combined with storage system could be South VPP。
- **East Taiwan**
  Full of geothermal and Ocean Current, could become local power resource and avoid the power transmit issue from West to East .

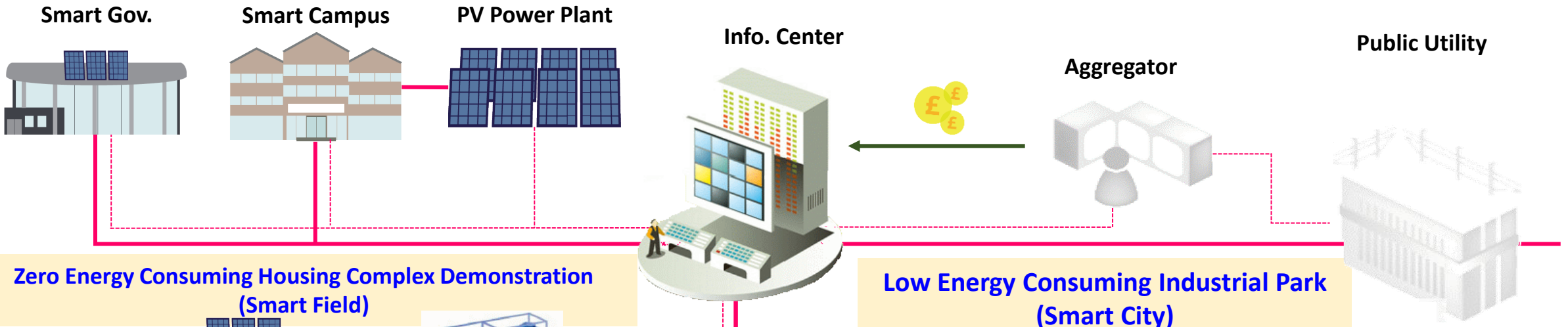


Promotion Structure for Smart Grid

Power creating public facilities and Zero Energy Consuming Buildings Demonstration (Smart Government)

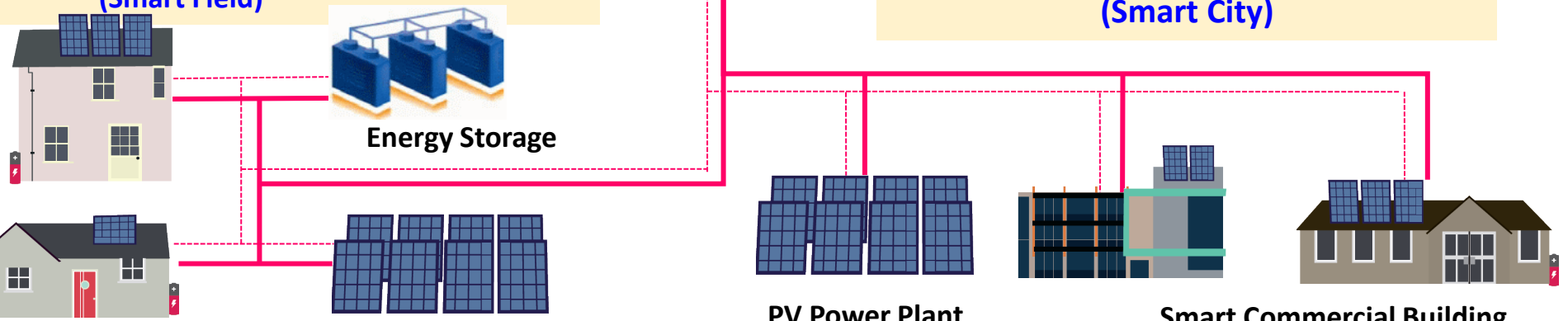
Energy Information Cloud Center (Smart Service)

Power Consumption & Creation Big DATA Aggregator Business Model (Smart Economy)



Zero Energy Consuming Housing Complex Demonstration (Smart Field)

Low Energy Consuming Industrial Park (Smart City)



III. Shalun Green Energy Science City

Green Energy Development Strategy

Green Energy Industry Strategy

Energy independence，Development of Green Industry

Industry Outlook

New energy saving activity	SOFC fuel cell	Wind power、solar power	Smart Meter、micro-grid
Energy Saving	Energy Storage	Power generation	System Integration

Improve R&D

Green energy technology industry development of the four major topics

Shalun Green Energy Science City
（Green energy Research center＋ Demonstration area）

Development Project

- 2-year Solar power project
- 4-year wind power project

資料來源：科技部陳宗權司長，綠能科技產業創新推動方案， 105年10月27日

Shalun Green Energy Science City Development

4 major topics

Power generation

Solar power
Offshore wind
Biomass power generation

Energy Storage

Lithium battery
Fuel cell
Utility-scale of Storage system

System Integration

Energy Saving

Technology upgrade
Improve energy saving
Smart green building
Electric vehicle

Shalun

Green Energy Science City

1. Activate the existing Green Energy industry
2. Innovate green energy industry
3. Connect industry and academia resources and build green energy environment.

Prospect：
Construction of Shalun Green Energy Science City Innovate Green Energy Industry Ecosystem.

The reason of setting in Shalun

1. No concert about eminent domain
2. Convenient transport
3. Nearby University
4. Tainan City is aggressively developing in renewable energy.

資料來源：科技部陳宗權司長，綠能科技產業創新推動方案， 105年10月27日

Drive Central、State owned businesses、Corporation、University and local connected

Connect local
Combine with Central、local、State owned businesses、Corporation、University resource.

Sustainable Development
By scientific verification to solve the industrial development of environmental issue.

International Connected Using international cooperation projects to attract domestic and foreign manufacturers investment.

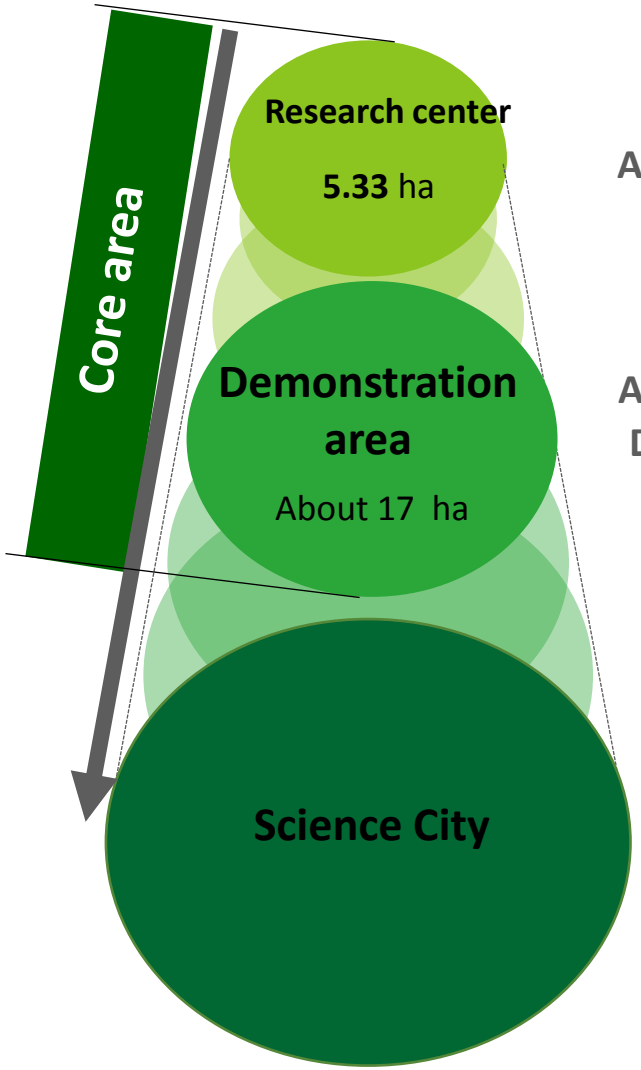
Connect future
Disruptive innovation. Develop the next generation of emerging green energy industry technology

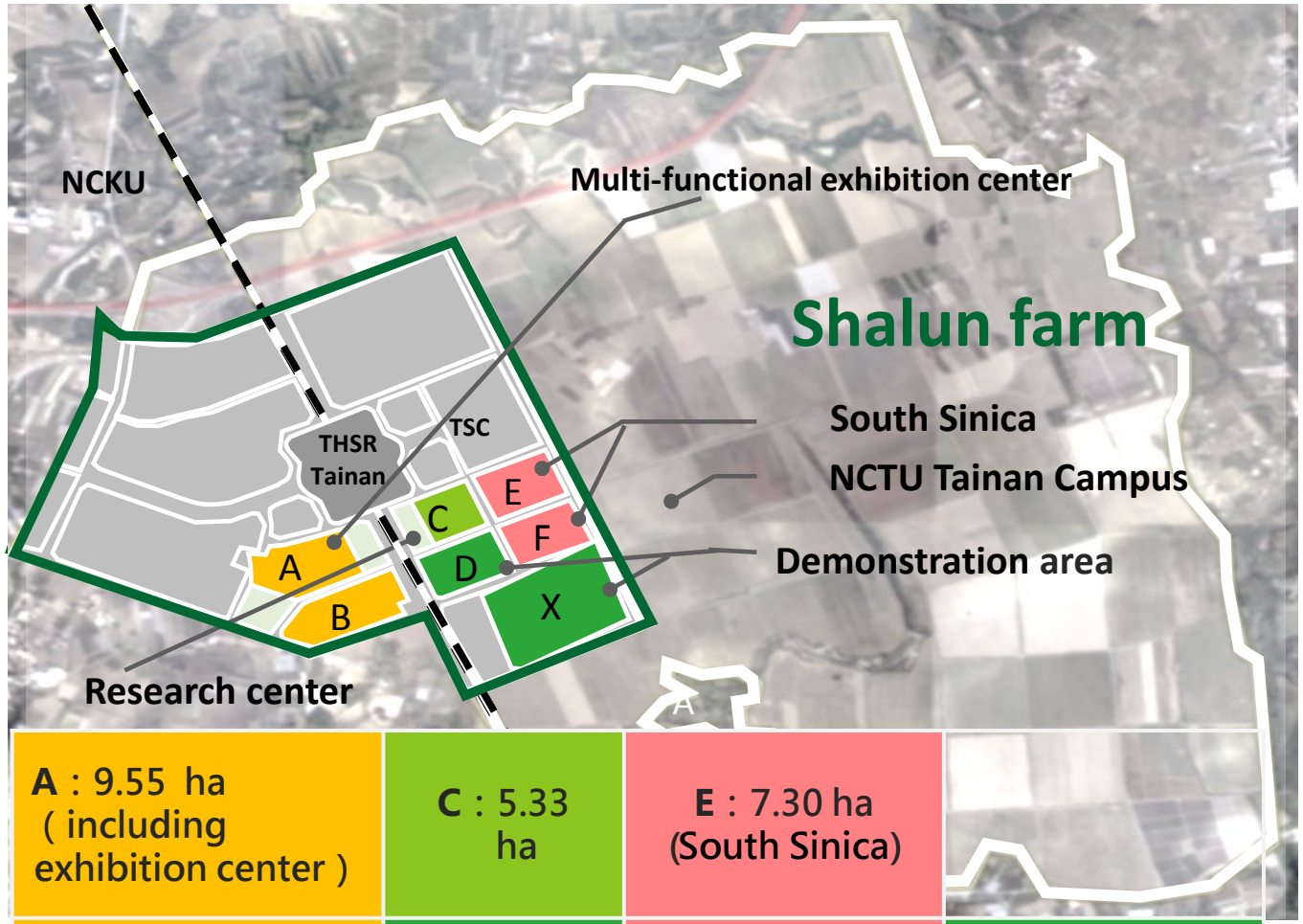
Construct green industry cluster

Combined with 30 parks to form cluster effect

資料來源：科技部陳宗權司長，綠能科技產業創新推動方案， 105年10月27日

Shalun Green Energy Science City Planning

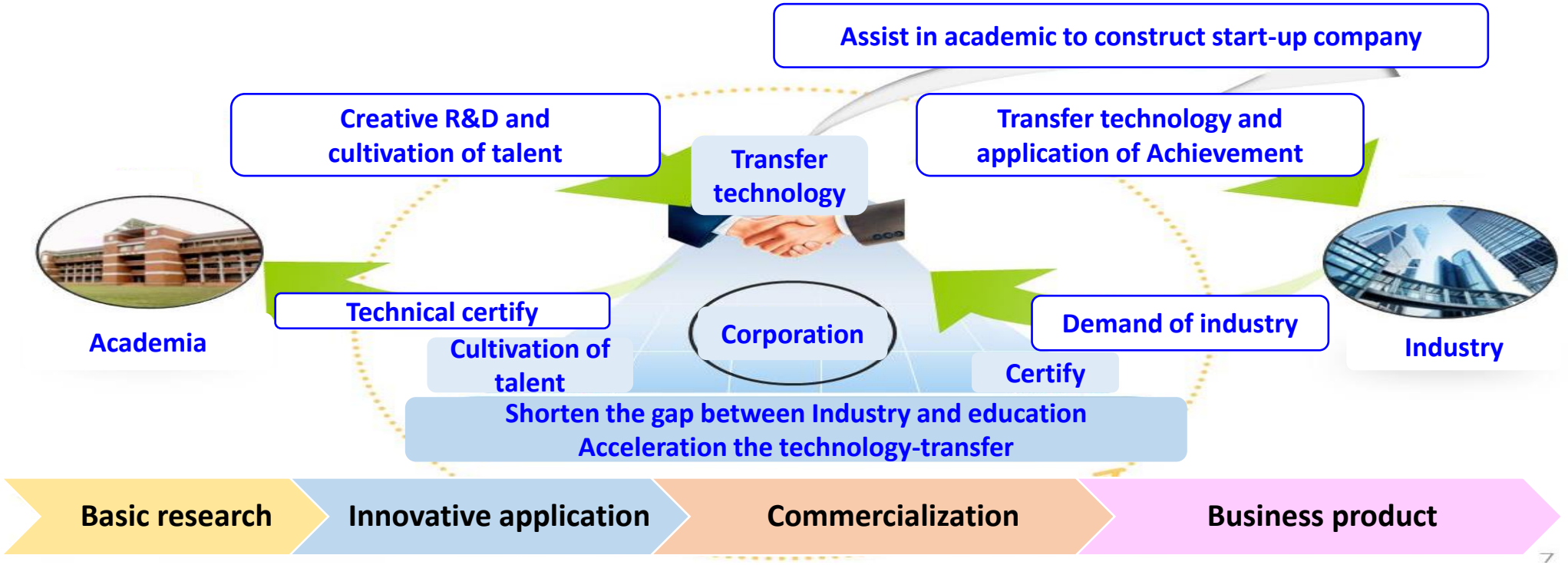




A : 9.55 ha (including exhibition center)	**C** : 5.33 ha	**E** : 7.30 ha (South Sinica)	
B : 9.73 ha	**D** : 7.44 ha	**F** : 7.77 ha (South Sinica)	X: 10 ha

資料來源：科技部陳宗權司長，綠能科技產業創新推動方案， 105年10月27日

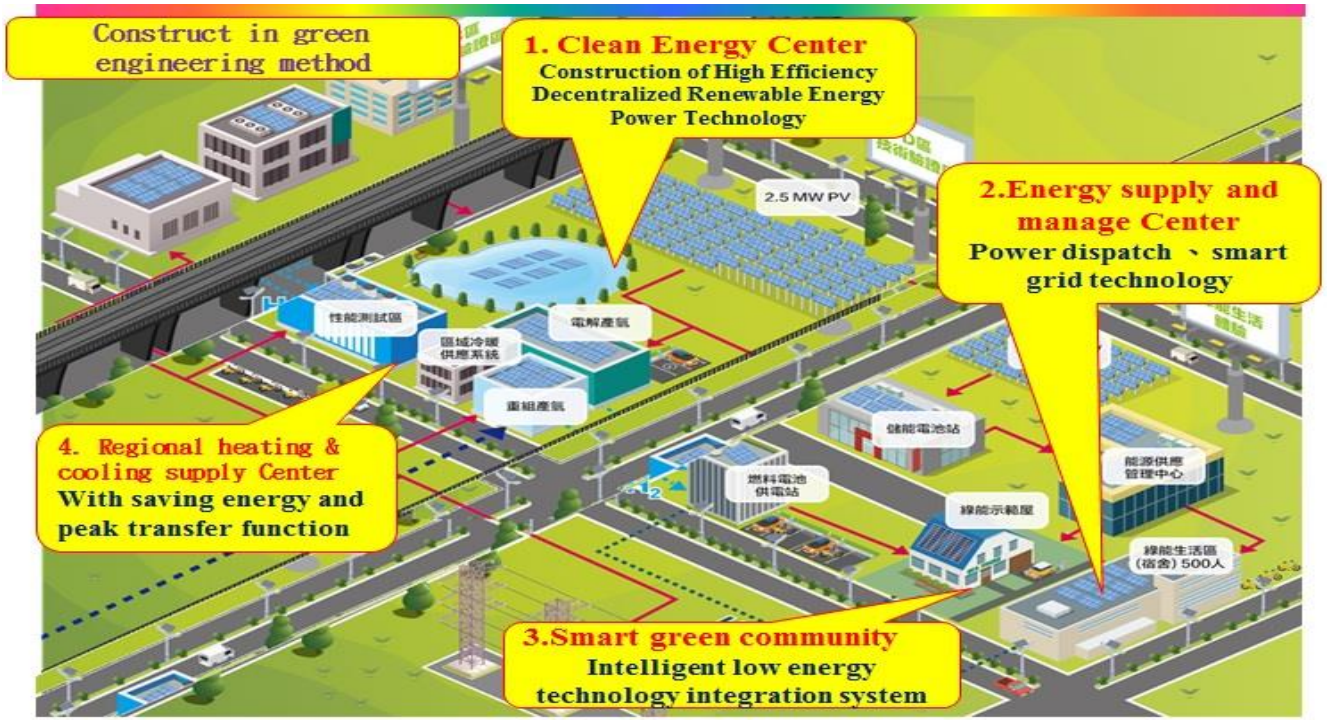
Green Energy Research Center



Main operation way：

1. Establish a green environment with international standards to study the open service environment and providing research ,development, industry innovative study .
2. Cooperate with academia to cultivate scientific and technological research and development or technical implementation talents which meet industry needs.
3. Through the construction of the research platform, and industry and academia cooperate with the planning or commission to develop industrial technology to promote technology transfer or patent licensing.

Demonstration Area



Energy supply	Storage & dispatch	Energy user
Demonstration Efficient decentralized renewable energy system ■ Solar power **Demonstration** ■ Fuel cell **Demonstration**	**Auxiliary multiple power dispatching Construction of CHP** ■ **Energy Storage Systems Demonstration** ■ **International level of renewable energy application validation field** ■ **Power dispatching and manage system**	**Intelligent low energy technology Demonstration** ■ **Zero energy building Demonstration** ■ **Regional energy supply Center** ■ **Smart green life environment**

資料來源：科技部陳宗權司長，綠能科技產業創新推動方案， 105年10月27日

Construct the intelligent of ecological city

1 **Uphold the concept of harmonious symbiosis planning community blueprint**
Become a symbiotic counterpart to nature, the concept of sustainable development by constructing the community to develop life system.

2 **Breeding ecological of biodiversity**
Maintain the environment and microclimate required for native flora and fauna, and enrich the diversity of local organisms.

3 **Use of green energy technology achievements and establish low-carbon saving energy communities.**
The application of green energy technology achievements, construction of smart grid and low-carbon transport systems, construct Infrastructure and use green-marked products.

4 **Application of smart technology to create a convenient living space**
Improve the residential and office community infrastructure, intelligent facilities, intelligent service system and establish a international-level smart city to attract domestic and foreign personnel to come.

5 **Improve the settlement measures**
Build a high quality of environment, improve the transport, establishment of international schools and set up the incentive settlement measures.

6 **Promote the concept of circular economy and energy recycling**
No mater what the life style, using the concept of circular economy plan construction and production.

資料來源：科技部陳宗權司長，綠能科技產業創新推動方案， 105年10月27日

Thank you!

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