Second Meeting for Smart Grid Promotion in Taipei City

Suggestions for Smart Grid Promotion in Taipei City

(Rough Draft)

Taiwan Smart Grid Industry Association

2015.7.8

Outline

1. Trends in the Promotion Policies of Renewable Energy & Smart Grid in Taiwan
2. The Development Trend of Smart Low-carbon City
3. The Opportunity and Condition of the Smart Grid Promotion in Taipei
4. Suggestions for Smart Grid Promotion in Taipei City

1. Trends in the Promotion Policies of Renewable Energy & Smart Grid in Taiwan

The Total Target Installed Capacity of the Renewable Energy Expansion

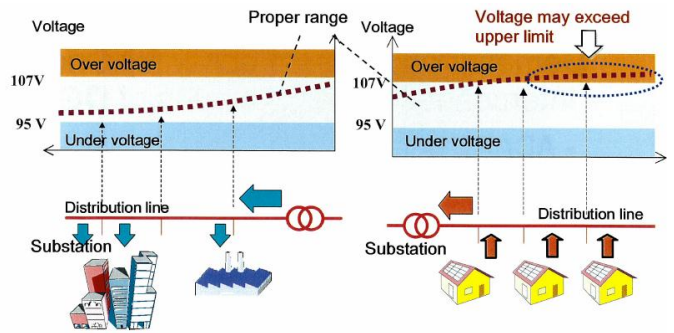
■ Taiwan's Policy on the Total Target Installed Capacity of the Renewable Energy Expansion

In response to the international pressure on carbon reduction and anti-nuclear, the Ministry of Economic Affairs planned "New Energy Policy" and "Three Renewables", which expand the PV installation, prioritize the promotion of offshore wind farm and accelerate the commercialization of geothermal energy.

- This year, the total target installed capacity has been modified and expand to 17.25 million kW, which is 1.5 times more than the original plan (10.858million kW by 2030, which will covers 30% of Taipower's power system). There's a large increase in PV, by 2030, the target amount has changed form 6.2 million kW to 8.7 million kW.
- Due to the low cost of PV, Ministry of Economic Affairs has increase the target promotion amount of the PV equipment each year, from 270MW to 500 MW. The project of "Million Solar Roof" has planned the goal of 6200MW by 2030, it is now expected to complete by 2025.

■ The Impact on Power Quality

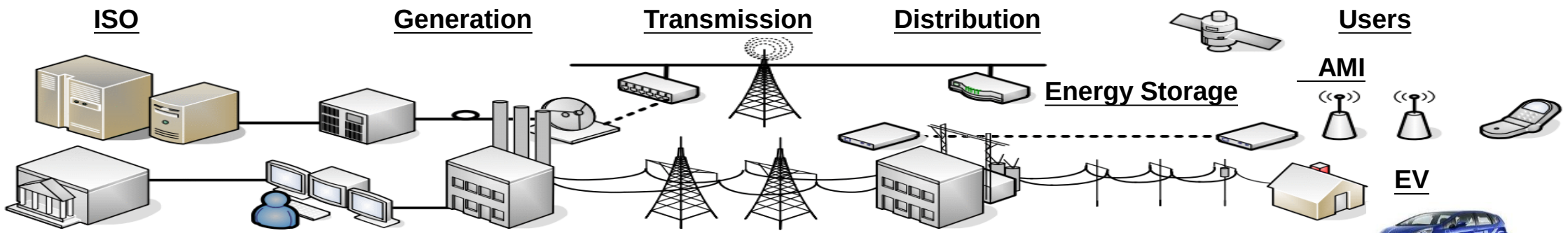
- When large amount of PV generation system connect to distribution system, especially the end of the feeder, this may cause an increase in voltage which will exceed the voltage limit of the operation.



Source：Ministry of Economic Affairs , NEPI- Smart Grid and Advanced Metering Infrastructure General Project NSC 102-3113-P-008-010

Smart Grid Master Plan

- Smart grid technology uses information, communication, and automation technology to deploy an integrated power grid with smart power generation, transmission, distribution and users. Smart grid emphasizes automation, safety, and the close cooperation between the users and suppliers to improve the operating efficiency of power system, to enhance power quality and to solidify grid reliability. The use of smart grid technology is also aligned with the policy goals of expanding the application of renewable energy, energy conservation, and carbon reduction.
- In 2012, the Executive Yuan of Taiwan approved the inclusion of "Smart Grid Master Plan" as a benchmark project in the "Master Plan of Energy Conservation and Carbon Reduction". The Ministry of Economic Affairs (MOEA), the National Science Council (NSC), the Atomic Energy Council (AEC), the National Development Council (NDC), the Board of Science and Technology (BOST), the Department of Economics, Energy and Agriculture (DEEA), the Taiwan Power Company (Taipower) and the subordinate agencies of the MOEA subsequently established "Smart Grid Task Force" to promote the development of smart grid technology.

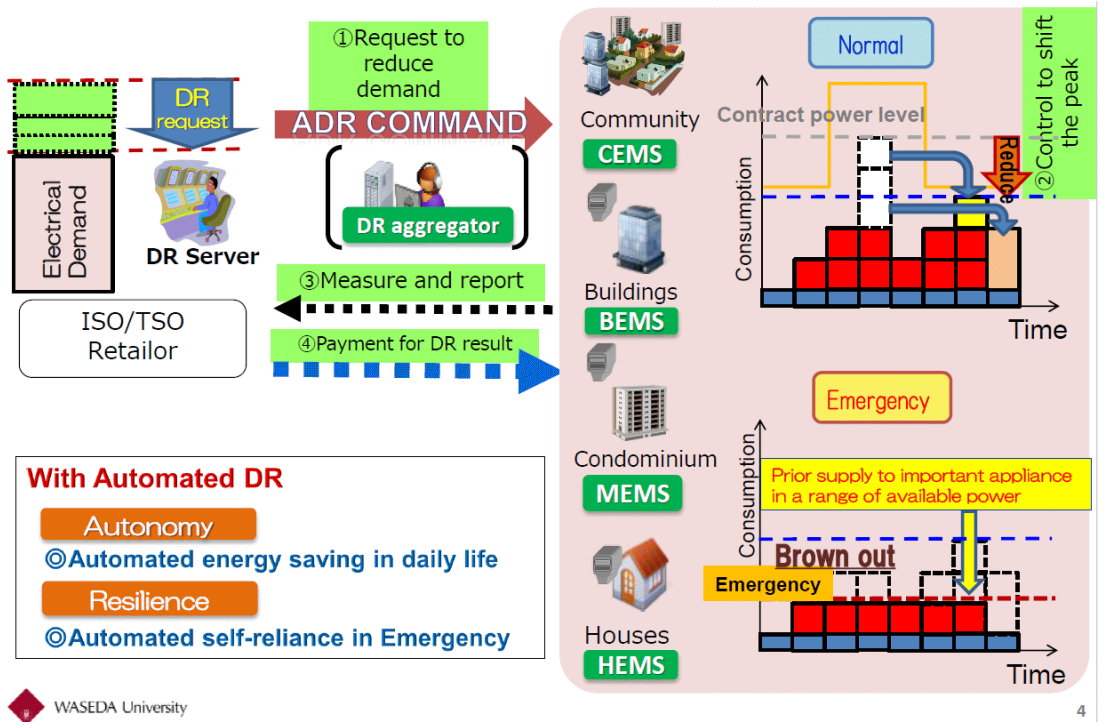


Source：Ministry of Economic Affairs , Smart Grid Master Plan, 2012.

AMI and Demand Bidding 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. According to the project, Taipower will complete the implementation of 100 thousands low voltage AMI by 2017.

- 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 Side 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.

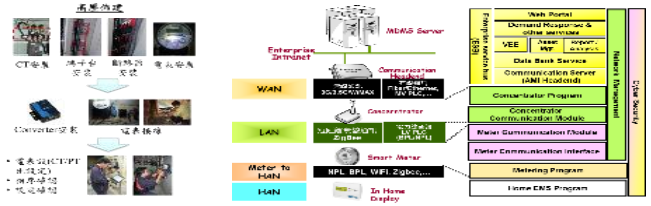


Source：Hideo Ishii, WASEDA University, 2015

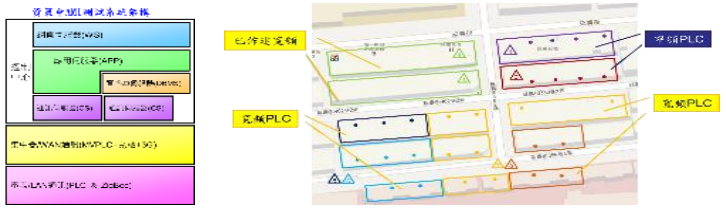
Source：Bureau of Energy, Ministry of Economic Affairs , Taipower Company, 2015.05

Smart Grid Demo Sites in Taiwan-1

Lead by National Science Council's Smart Grid and AMI General Project I, Ministry of Economic Affairs' Development of Energy Information Communication Technology and the Smart Grid industry in Taiwan, there are currently 18 Smart Grid Demonstration Sites in Taiwan.

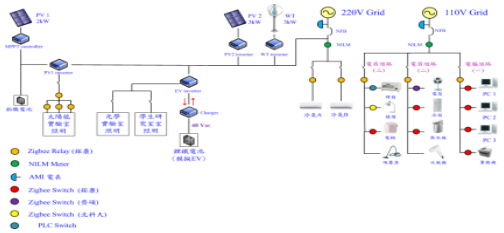


Smart Meter Reading & Demand Response System

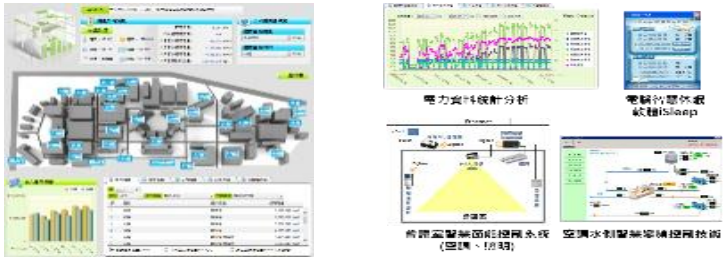


Demonstration of Smart Meter Reading in a Metropolitan Setting

Smart Meter System and Home Energy Management System Demonstration Area



Smart Home (Building) Energy Management System

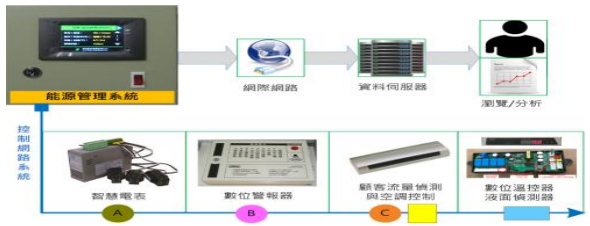


Smart Building Energy Conservation Demonstration Area

Smart Grid Control Center and Smart Home Demo Room

Wastewater Treatment Plant Power Equipment Monitoring and Energy Conservation Management System

Hypermarket Energy Conservation Management System



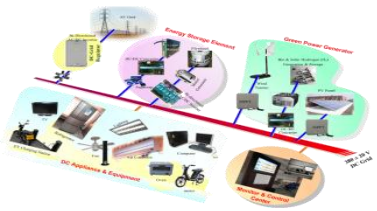
Convenience Store Energy Conservation Management System

Source：Faa-Jeng, Lin, NEPI- Smart Grid and Advanced Metering Infrastructure General Project NSC 100-3113-P-008 -001 -PO

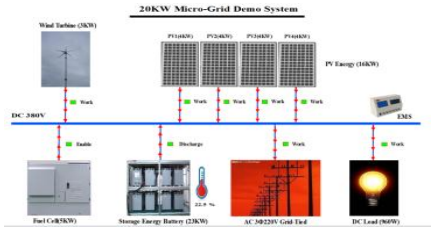
Smart Grid Demo Sites in Taiwan-2

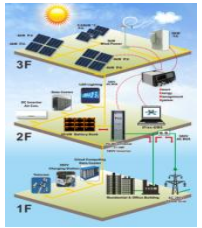

Advanced Distribution Automation Demo System

100 kW Autonomous Micro-grid Demonstration System

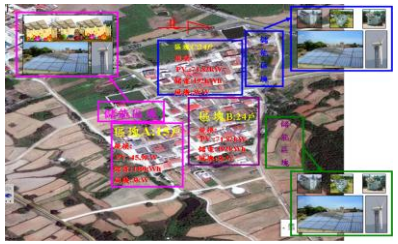
Smart DC Power System Educational Demonstration House



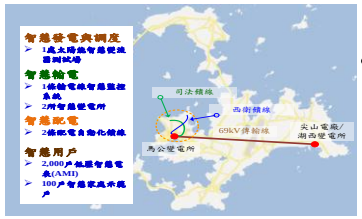


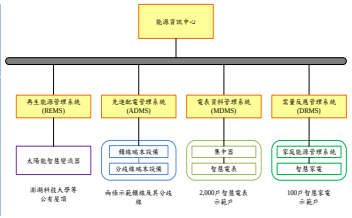
Smart AC/DC Hybrid Micro-Grid Demonstration System


Micro-grid and Electric Vehicle Demonstration Site

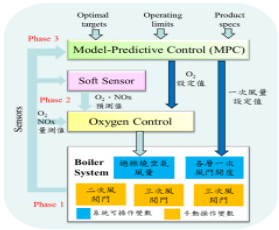



Dongkeng Smart Grid Demonstration Project

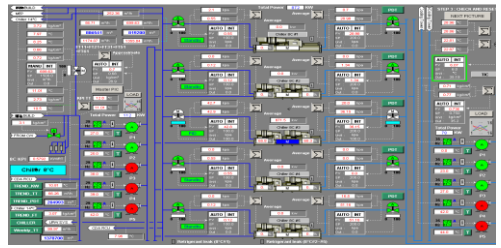




Penghu Smart Grid Demonstration Site

Furnace Optimized Operation Demonstration System

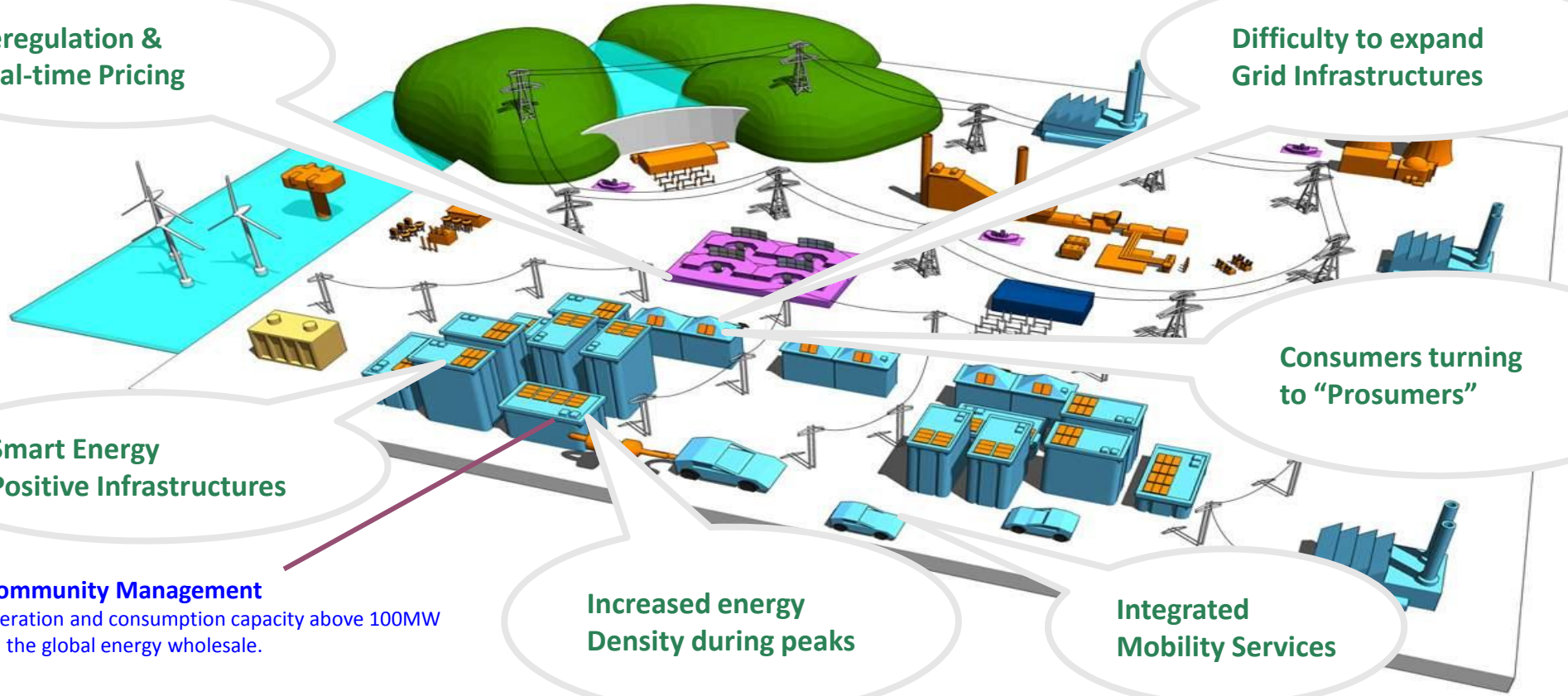


Optimizing Control System for a High-tech Plant Ice Water System

Source：Faa-Jeng, Lin, NEPI- Smart Grid and Advanced Metering Infrastructure General Project NSC 100-3113-P-008 -001 -PO

2. The Development Trend of Smart Low-carbon City

Growing constraints in city energy infrastructures



Emergence of new Virtual Power Plant concepts

Source：Alstom SmartGrids stategy, March, 2012

Smart Low-carbon City

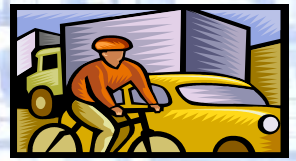
- UN Human Settlements Programme has named 21st century as the “Modernized Century”.
- Due to the effects of greenhouse gas emissions, subjects such as global warming and drastic climate change have attracted unprecedented attention.
- Therefore urban planning and the development of environmental sustainability (harmony) are taken more seriously.

Development Model

- **New City Development**
- **Implementation of Renewable Energies**
- **Satisfaction of Growth Needs**
- **Strengthen Supply Trustworthiness**

Smart Low-carbon City：Set environment harmony as goal, utilize green energy, smart grid and other newest technology to construct low-carbon and high quality second generation city, the design will expand from focusing on electricity and water resource to transportation, public logistics service and etc.


Energy


Transportation


Industry


Social Benefit


Environmental Friendly


Wind Energy


PV


Energy Storage


EV


Smart Grid


Low-carbon Energy Equipment


Grid Equipment


Electricity Network Renewal

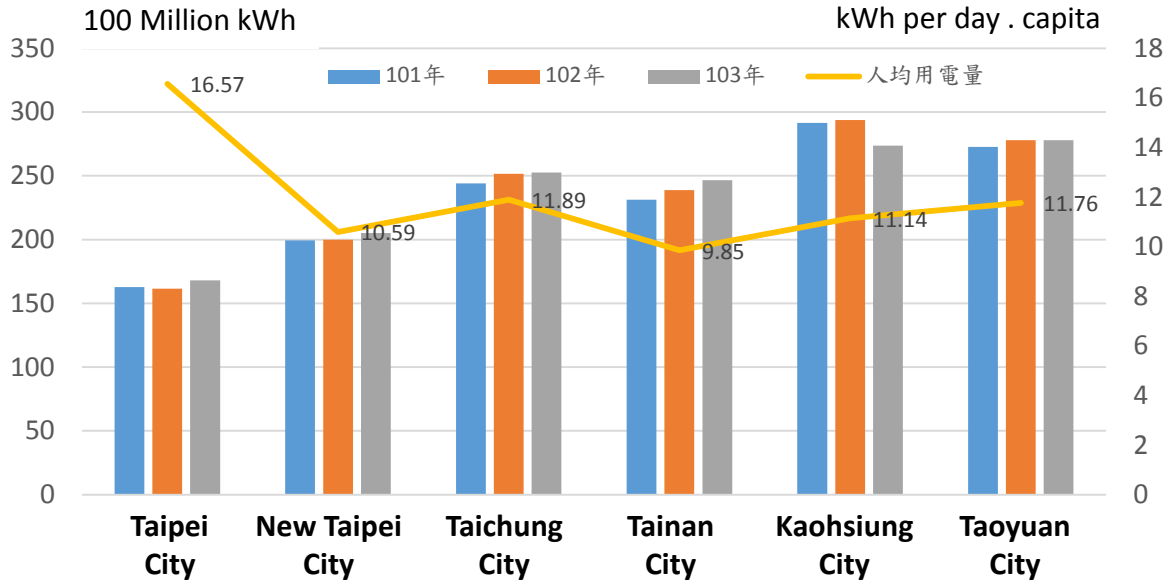

Blackout Monitoring, Error Response

3. The Opportunity and Condition of the Smart Grid Promotion in Taipei

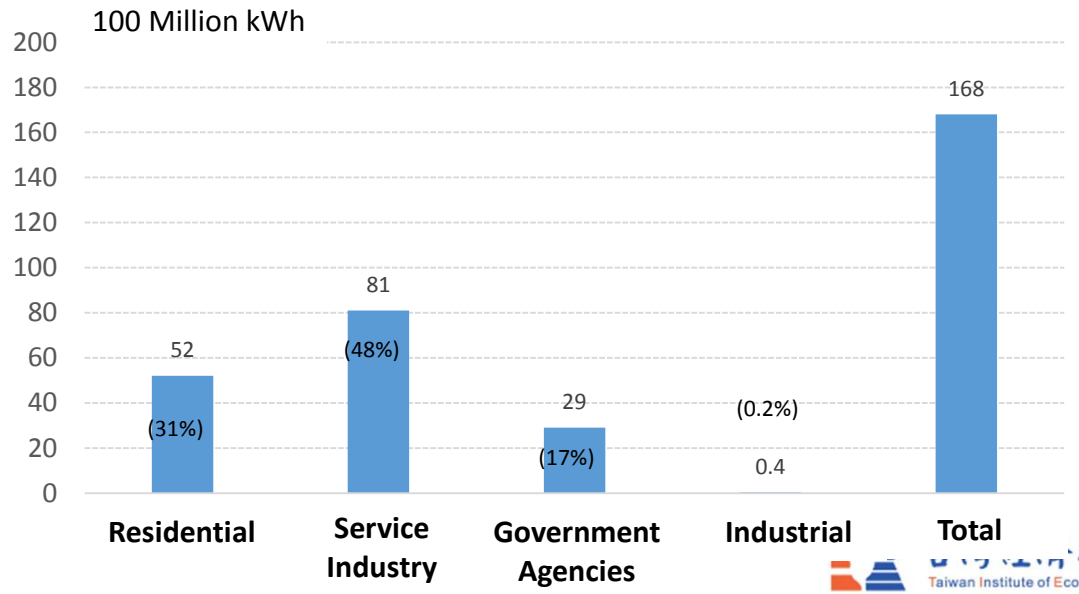
The Status of Power Consumption in Taipei

- The total power customers in Taipei is approx. 2.1 million, 2.09 million high voltage customers and 36,000 low voltage customers.
- **The total energy consumption in Taipei covers 8.35% of the total enegry consumption in Taiwan, 16.8 billion kWh in 2014, which is 4% higher than 2013.**
- The main power users are service industry (48%), residential users (31%), government agencies (17%), and industrial users (0.24%).
- The electricity consumption per capita in Taipei is 16.57 kWh per day, and 11.19 kWh per day in Taiwan.

6 main cities' total enegry consumption and energy consumption per capita comparison (Source: Taipower)

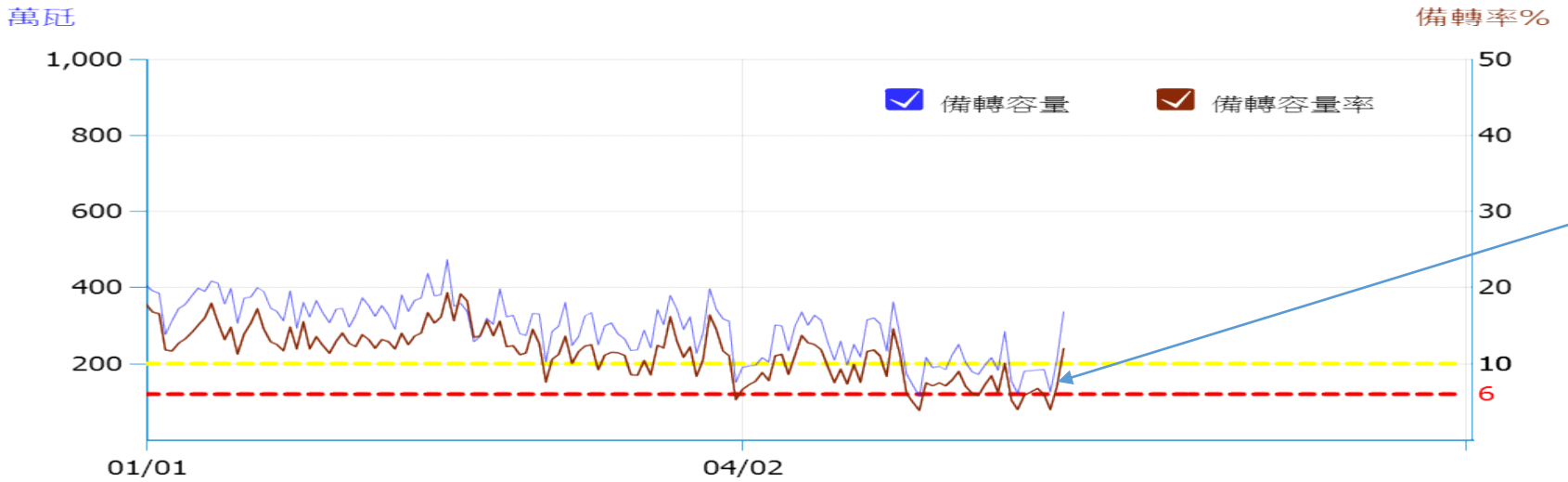


Different cases of energy consumption in taipei (Source: Taipower)



The Future Power Supply Environment in Taiwan

- Estimation based on analysis of overall power supply and demand shows that under the circumstances of Nuke 4 came to a halt, Nuke 1, 2 and 3 will retire on schedule, the newly planned coal-fired and natural gas power generation will complete on schedule, and the outdated facilities will be eliminated on schedule:
  - Calculation based on normal power consumption scenario (power consumption growth rate is 2%), **starting from 2018, Taiwan will face the risk of power shortage**, citizens will have to participate in power saving activities.
  - If the renewed coal-fired and natural gas power generation facilities are inoperable due to any reasons, **Taiwan will face the risk of power shortage in 2016** the earliest.
  - **The risk of power shortage is a serious and unavoidable subject that all the citizens will face.**

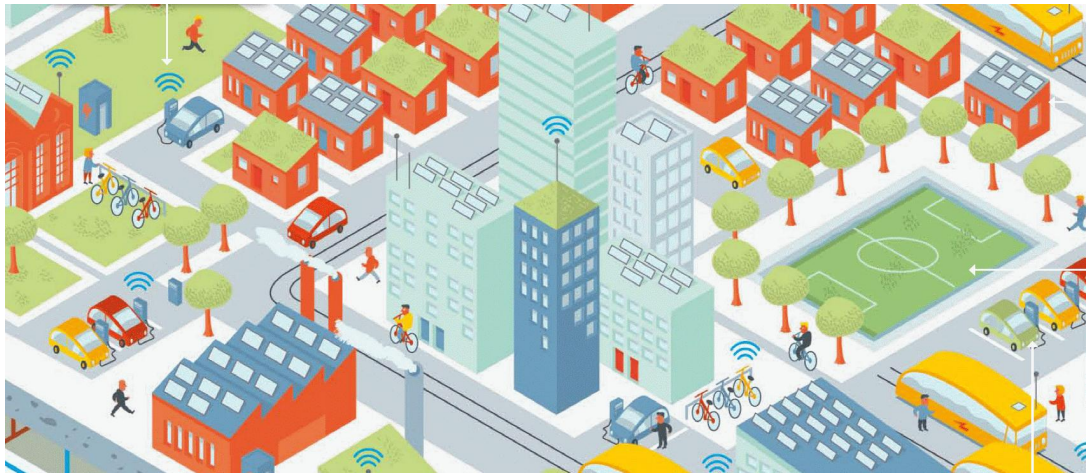


When Electricity reserve rate is lower than 15%, the chance of electricity rationing will increase, it has happened to be lower than 10% multiple times in 2015, and it was 3.88% on April 29th.

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

The Direction of Taipei Smart City Promotion

- **Taipei should become an “Open Data City”, allows the citizen to sense the city fluctuation.**
  Taipei Smart City is formed by four aspects: Smart Government, Smart City, Smart Service and Smart Field.
- **Intelligentization of Government Service**
  Government operates intelligently, the citizens becomes the owners of the city, government provides smart services; and the smart city project needs to have an overall combat-type field.
- **Intelligent New Economy**
  Intelligent city with new economy, allows new technology to lead the new industry, opens the hardware and software infrastructure, build a smart city, allows the citizens to show their intelligence.



Source：Charles Lin, Vice-mayor of Taipei City Government　Figure Source：Jens-Andreas Dolberg Elkjær, ccj_issue_2

The Opportunity and Condition of the Smart Grid Promotion in Taipei

- **Conditions**
  - Energy consumption per capita is 16.57kWh, **must face the risk of power shortage in the future.**
  - Taipei city government has a **clear vision, uses smart technology as core and bring changes to citizen's daily life.**
  - Taipei has a healthy financial status and have citizens with civil literacy.
  - Build new public housing and Beito-Shilin Tech. Park to demonstrate smart energy technologies.
- **Opportunities**
  - The new promotion policy for PV enables Taipei to use PV as the new investment incentive.
  - The smart grid promotion policy and big data technology create new business opportunities for saving and creating energy.
  - Taiwan's smart grid industry has a complete technology, which is able to fulfill any types of innovative application and business services.

4. Suggestions for Smart Grid Promotion in Taipei City

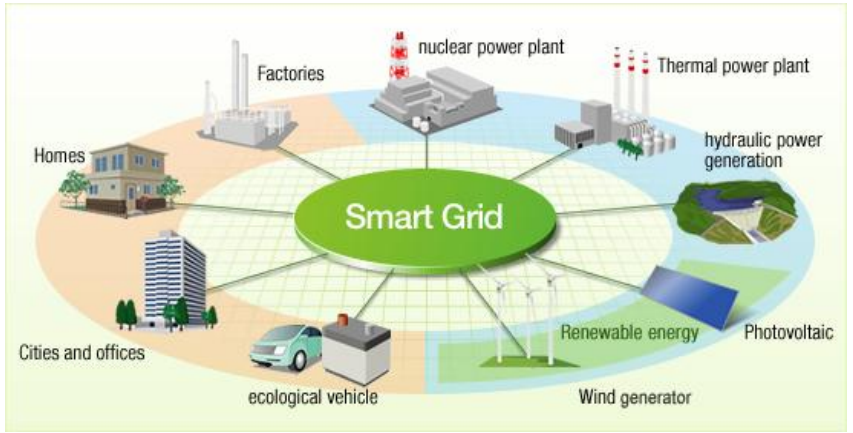
The Vision of Smart Grid Promotion in Taipei City

Setting **Smart City, Smart Government, Smart Service and Smart Field** as core, integrate city government's current promotion policies on power saving, power creating and industry, expand the utilization of green energy, enhance power usage efficiency and the willingness to save power, lower the risk of power shortage, invigorate **smart economy**, build the **future energy planning benchmark for the city**.

Smart City

Smart Energy Economy

Smart Grid



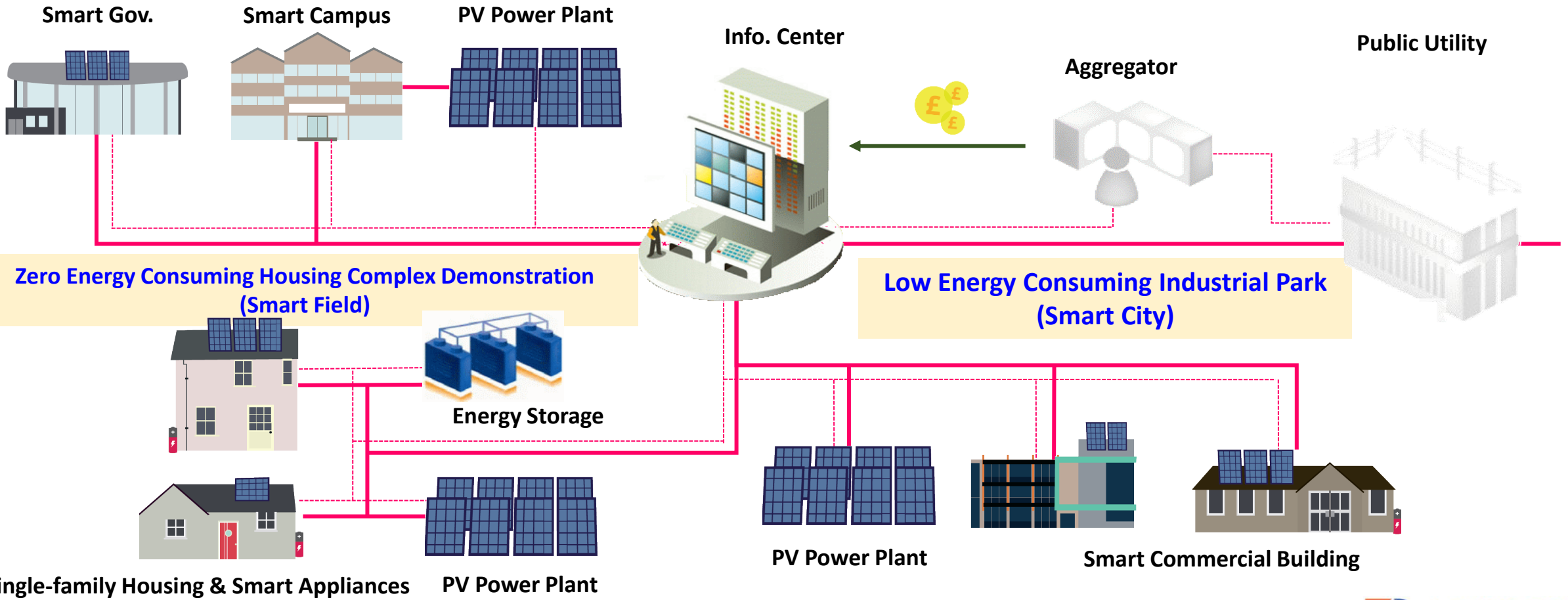
Big Data & Cloud

Promotion Structure for Smart Grid

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

Energy Information Cloud Center (Smart Service)

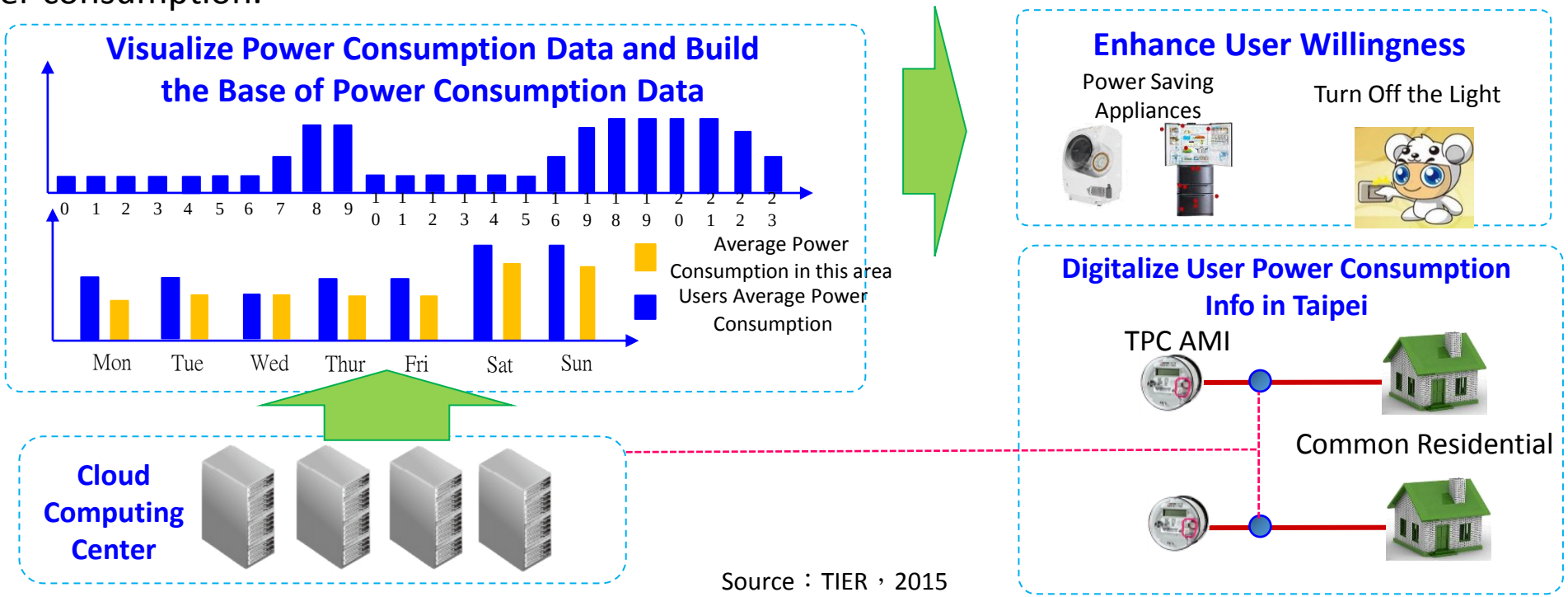
Power Consumption & Creation Big DATA Aggregator Business Model (Smart Economy)



Residential Power Consumption Cloud Service in Taipei

Build cloud service for residential power consumption, visualize power consumption and provide data, enhance the willingness to save power.

- **Easy Access To Power Consumption Info:** 15 mins or an hours as base unit, provide residential power consumption info hourly, daily, quarterly and yearly.
- **Analyze Power Consumption Info:** use the cloud platform to analyze and demonstrate the status of residential power consumption.
- **Provide Power Saving Strategies Based On Types:** provide power saving strategies based on different types of residential power consumption.

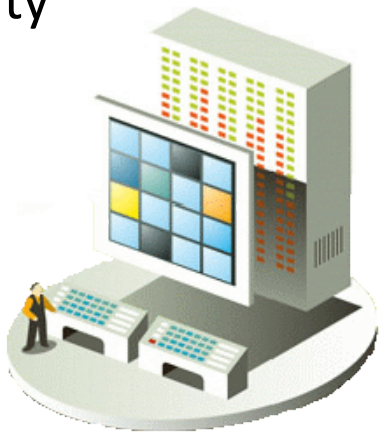


Source：TIER，2015

Regional Energy Information Cloud Center

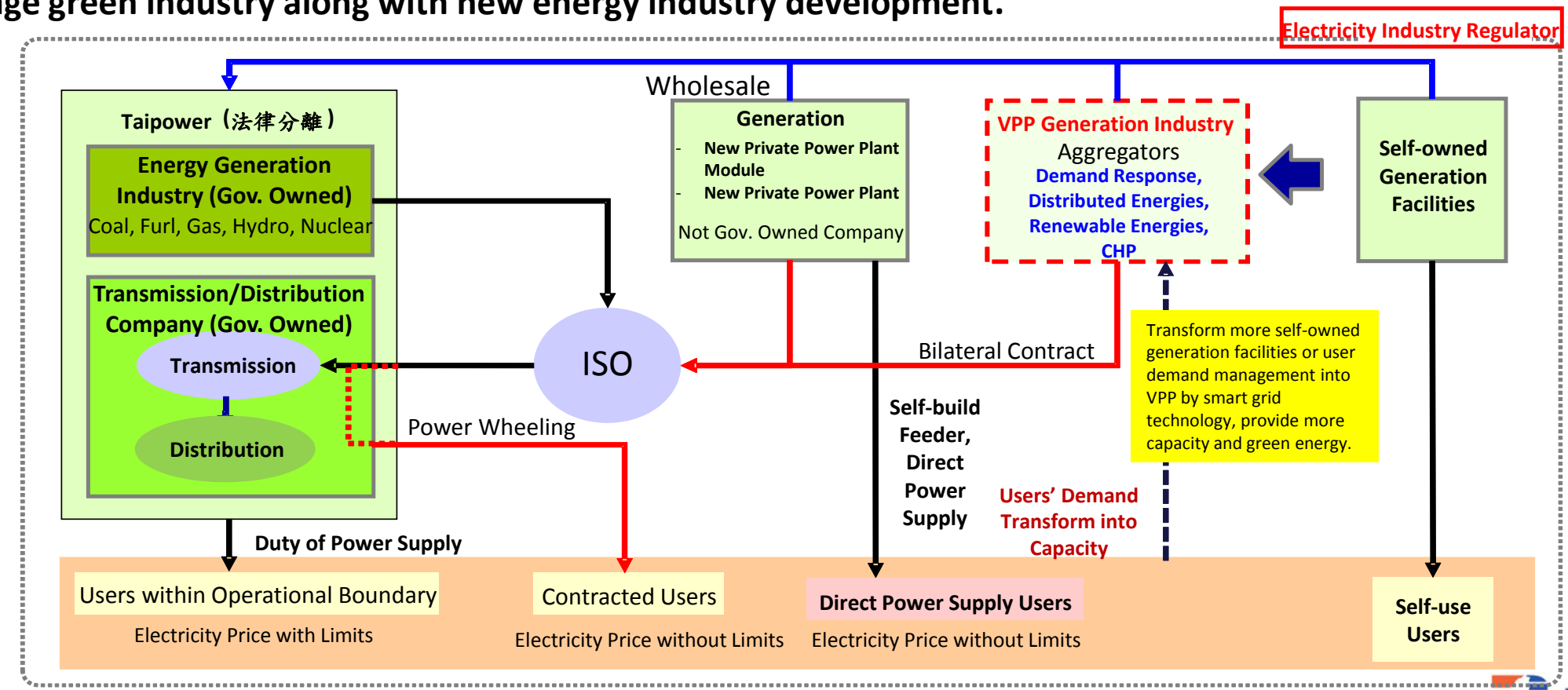
- Purpose:
  Link power management system of all kinds of homes and buildings. Collect power creation and consumption information of specific areas under householders' permission, and provide possible power saving suggestions to those who have special power using tendency.

- Measures:
  - First integrate the systems with the data from homes and buildings energy management system in Taipei smart grid demonstration sites and Taipei City government.
  - Utilize Taipei home energy cloud platform services to compile power using tendency and development information of various kinds of homes and buildings in Taipei city.
  - Promote transparency of regional power consumption information, and encourage citizens to save energy.



The Connection between Taiwan VPP Promotion and Energy Market

- The concept of VPP enables distributed energies, demand response and others with lower capacity to be part of energy market, despite the limitation of ISO financial model and real facility model.
- The VPP technology coordinating with energy market liberalization attract enterprises to integrate demand response, distributed energies such as solar energy, wind energy, power saving facilities, fuel cells, CHP, etc., to join energy generation industry, make up for the future capacity gap caused by steady decreasing nuclear power usage, and encourage green industry along with new energy industry development.



資料來源：陳彥豪、盧思穎、林法正，虛擬電廠概念與運作模式介紹，電力電子雙月刊,Vol.11, No.4, 46-53頁, 2013年7月。

Thank you!

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