

Development of Smart Grid in Taiwan

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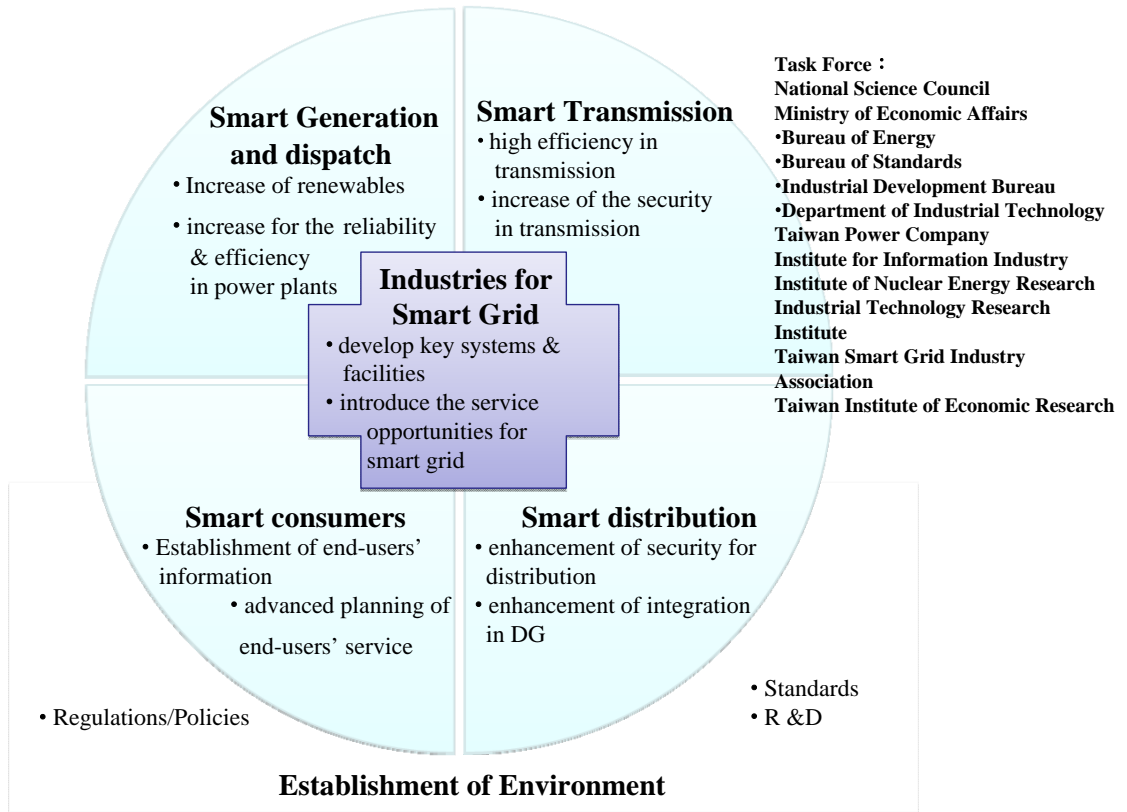
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Outline

- **Master Plan of Smart Grid in Taiwan**
- **Smart Grid Roadmap of Taipower**
- **National Energy Project – Smart Grid and AMI, National Science Council**
- **Taiwan Smart Grid Industrial Association**

Master Plan of Smart Grid in Taiwan



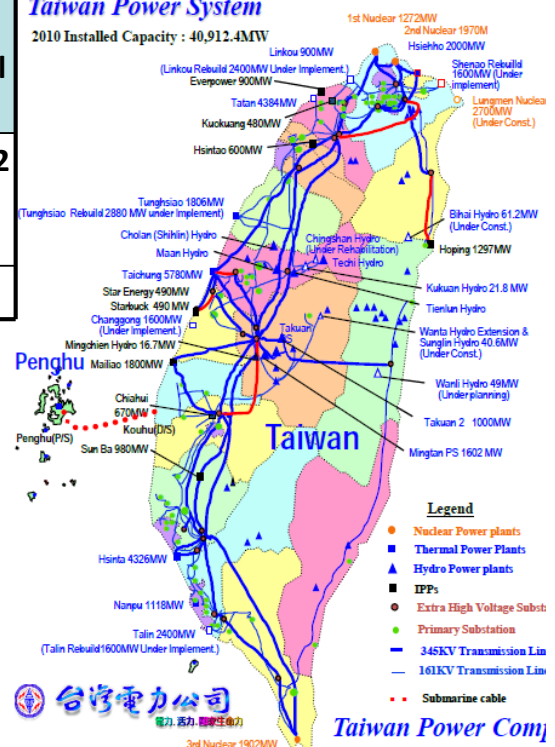
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Introduction of Taiwan power system

Item	Nuclear	Thermal	Hydro	Wind Power	Solar Energy	Total
Installed Capacity (MW)	5,144	30,717	4,579	471	1	40,912
%	12.6	75.1	11.2	1.1	0.0	100

Taiwan Power System

2010 Installed Capacity : 40,912.4MW

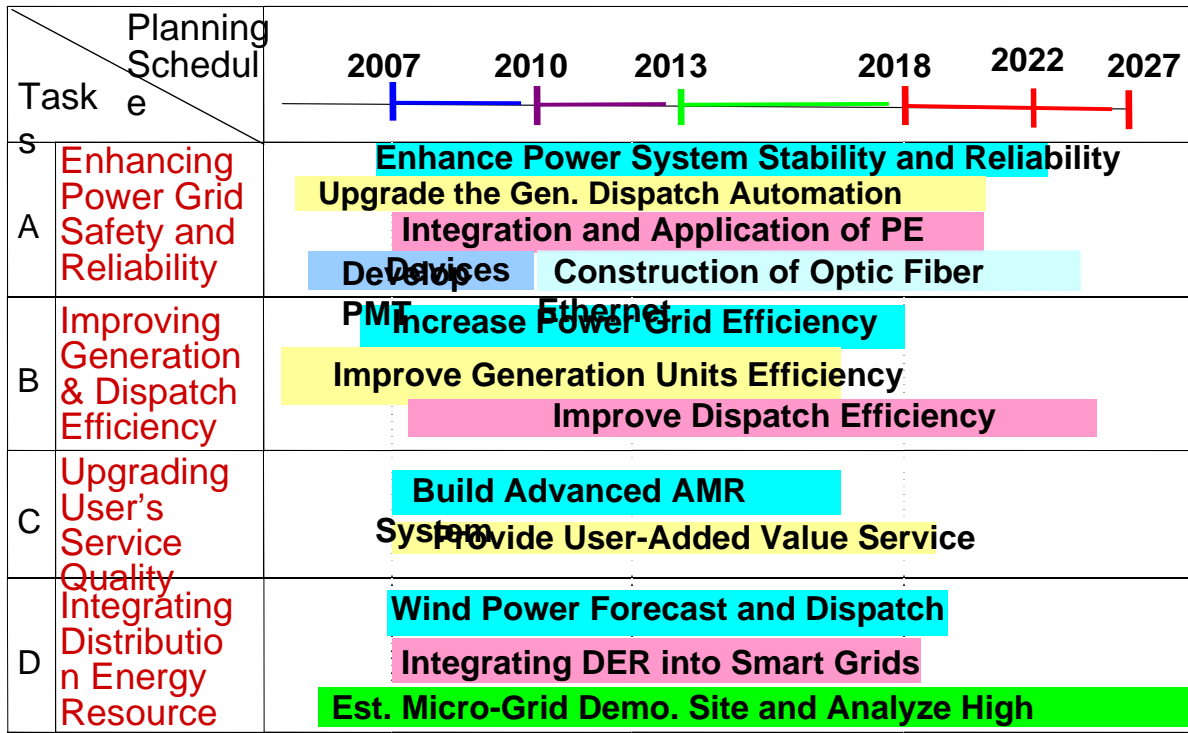


Up to year 2010:

- Peak Load: 33 GW
- Customers: 12.6 million
- Total Generated Electricity (+IPP): 207.4 billion KWh
- Sale Electricity: 193.3 billion KWh

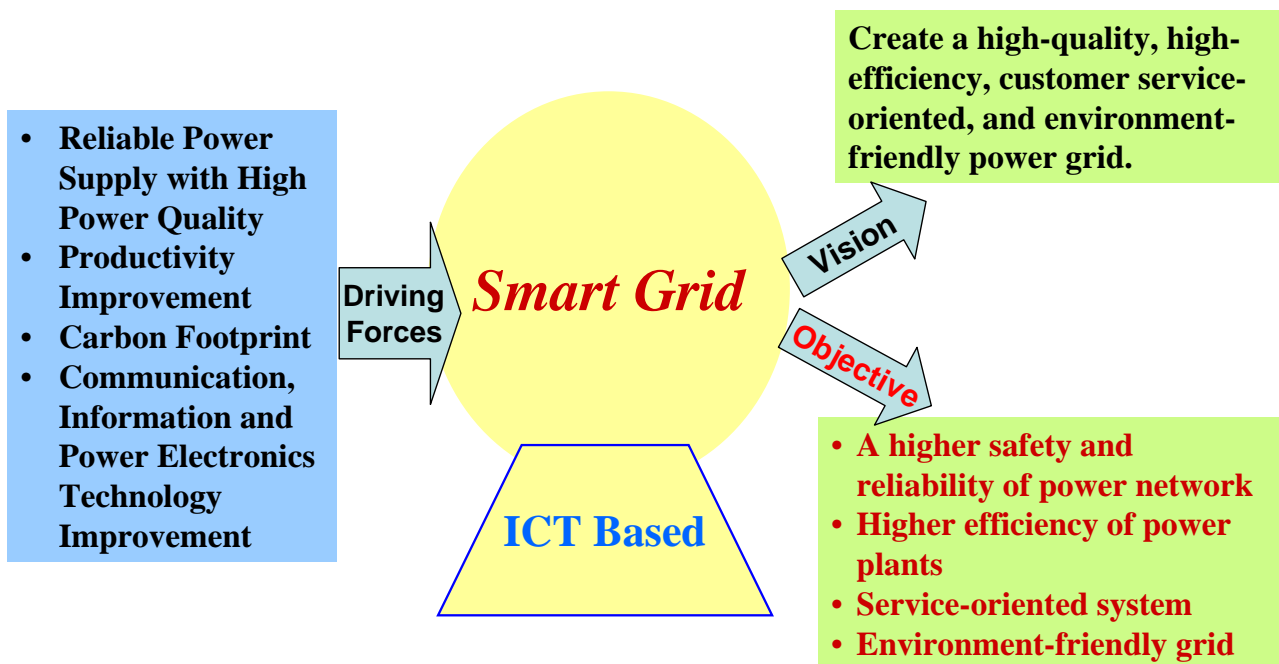
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Taipower's Roadmap on Smart Grid



PE: Power Electronics PMT: Preventive Maintenance Technology
 Supporting platforms: Communication Protocol Guideline and Knowledge Base

Taipower's Vision on Smart Grid



Objectives of Taipower's Smart Grid Action Plan

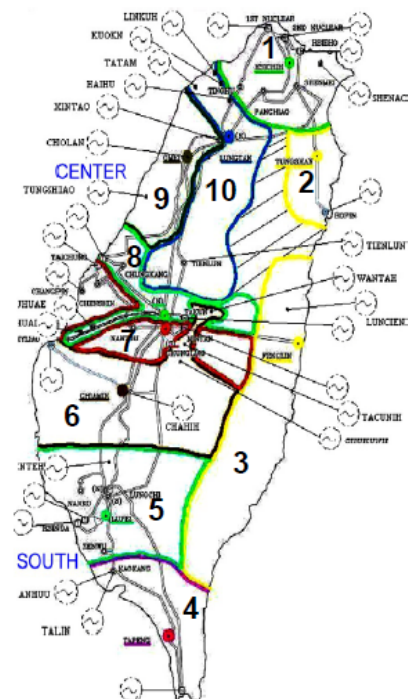
(preliminary)

Benefit	Objective	2010	2020	Remark
Security & Reliability in power Grid	System average interruption duration index (SAIDI)	22min/ customer · year	17.6min/ customer · year	↑ 20%
Energy efficiency	Efficiency in thermal plants	42.52%	43.58%	↑ 2.5%
Renewable	Percentage of installed capacities	4.7%	15%	
Energy conservation & Carbon reduction	Green gas emission	81 million tons	80 million tons (reduce to meet the standard in 2005)	

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Extension the Renewable and its Penetration Capability

- Renewable in Taipower focus on PV and Wind
- Divide Taipower's grid to 10 Renewable Deployment Regions (RDR) for Renewable expansion purpose.
- Investment evaluation of each project on RDR basis
 - Investigate Potential Renewable resources of each RDR
 - Examine Effective Load Carrying Capability
 - Carry out Cost/Benefit analysis of each investment
 - Example: Implement Submarine cable between Taiwan and the Poun-Hu archipelago wind farm



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National Energy Project – Smart Grid and AMI, NSC

Vision

Develop the smart grid and AMI industry in Taiwan to establish high quality, high efficiency, user-oriented and environment-friendly power system to reduce CO2 emission, increase energy efficiency and enhance energy security.

Strategy

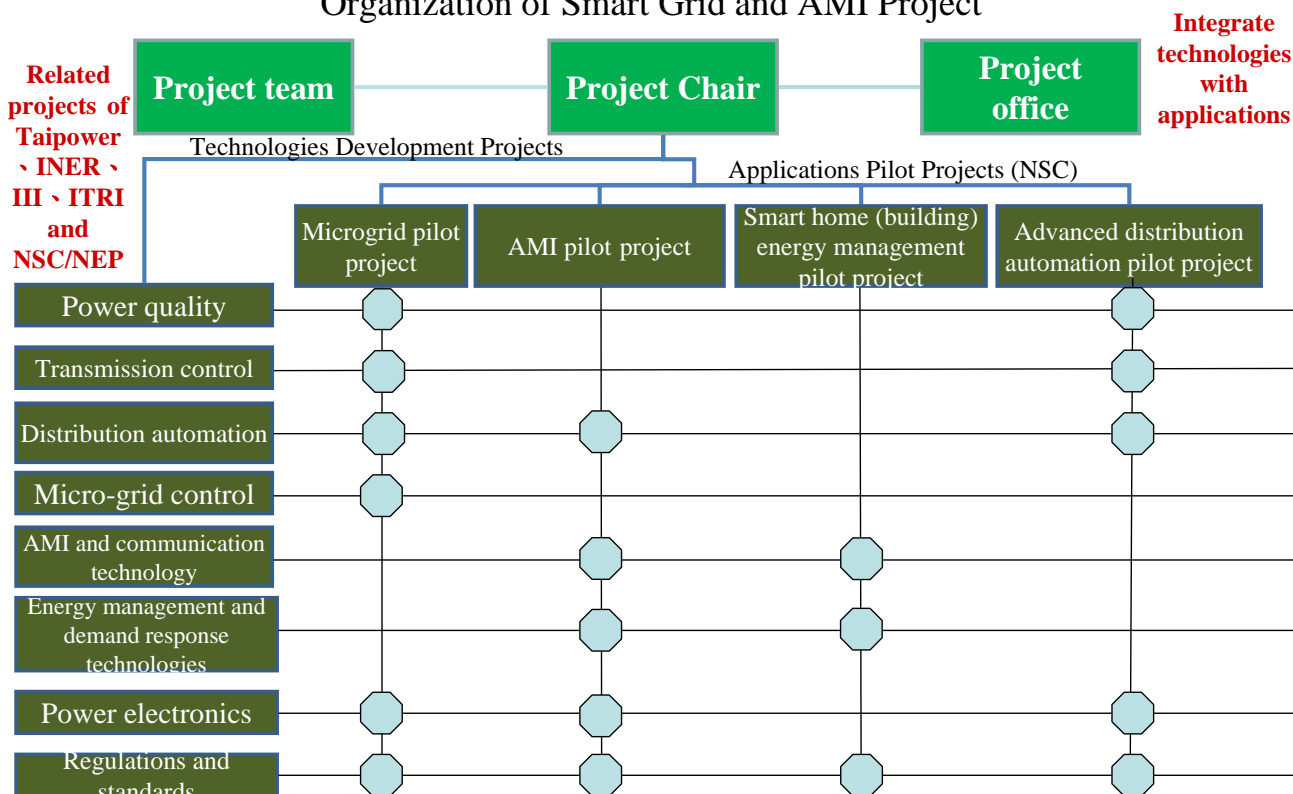
Tying in closely with the smart grid developing schedule of Taiwan Power Company, integrate the research abilities of industry and academia to establish smart grid and support the power facilities industry in Taiwan.

Manner

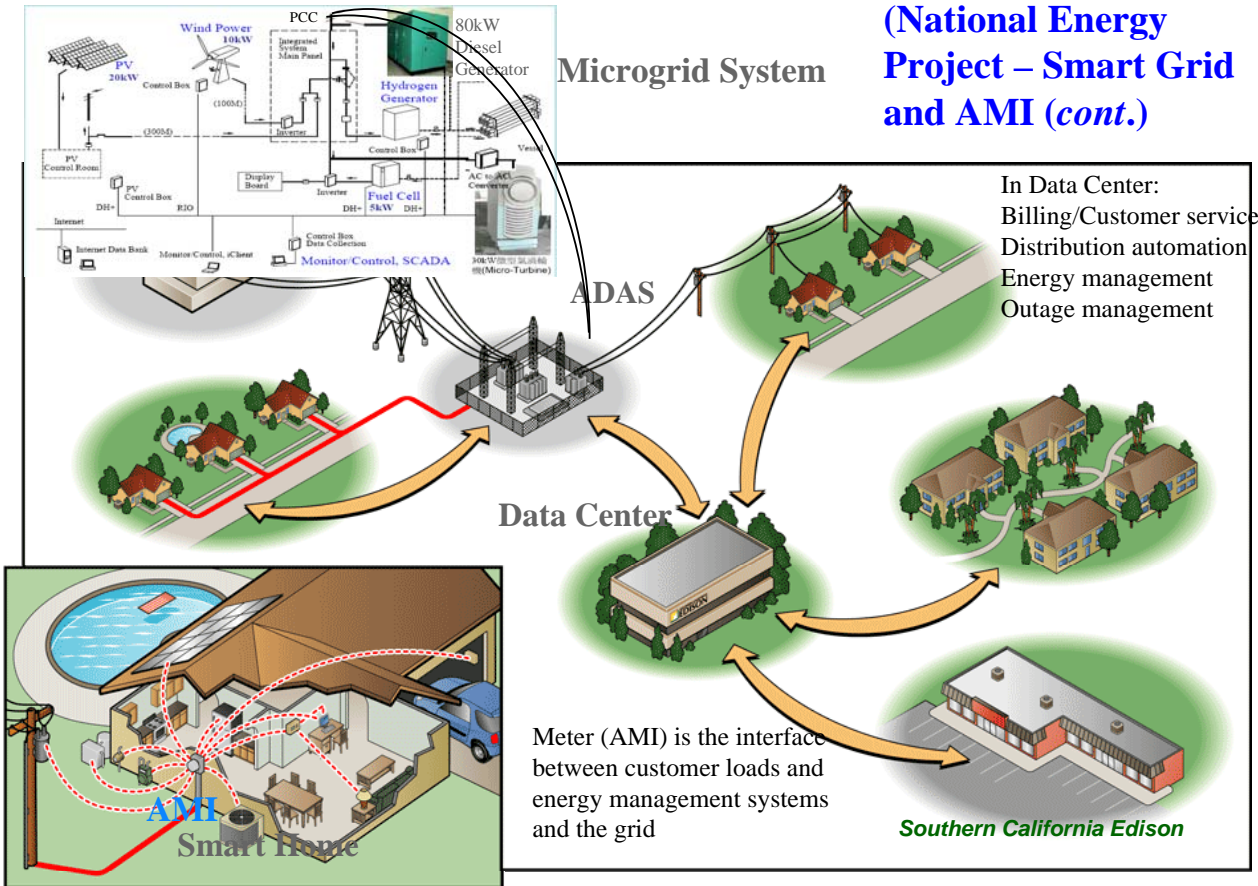
Promote AMI, microgrid, smart home (building) energy management system, advanced distribution automation four pilot projects by NSC to develop key technologies of smart grid and AMI and ensure the merging of the developed technologies into the power system in Taiwan will be reliable and feasible.

National Energy Project – Smart Grid and AMI (cont.)

Organization of Smart Grid and AMI Project



(National Energy Project – Smart Grid and AMI (cont.))

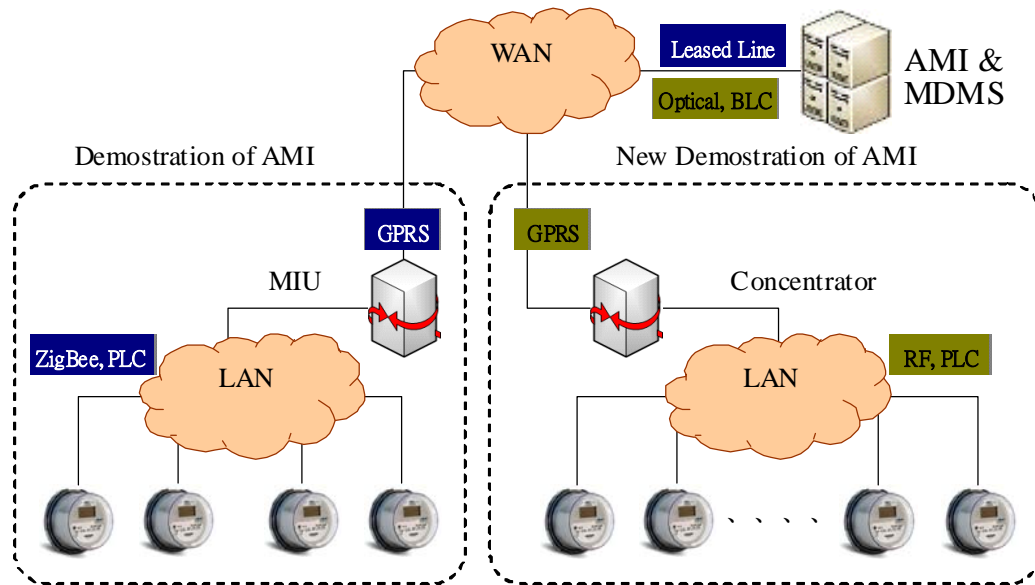


Research Budget of National Energy Project – Smart Grid and AMI, National Science Council

Year	Budget (thousand, NTD)
2010	126,140.00
2011	313,316.41
2012	349,028.41
2013	349,028.41
2014	-----

AMI System Structure

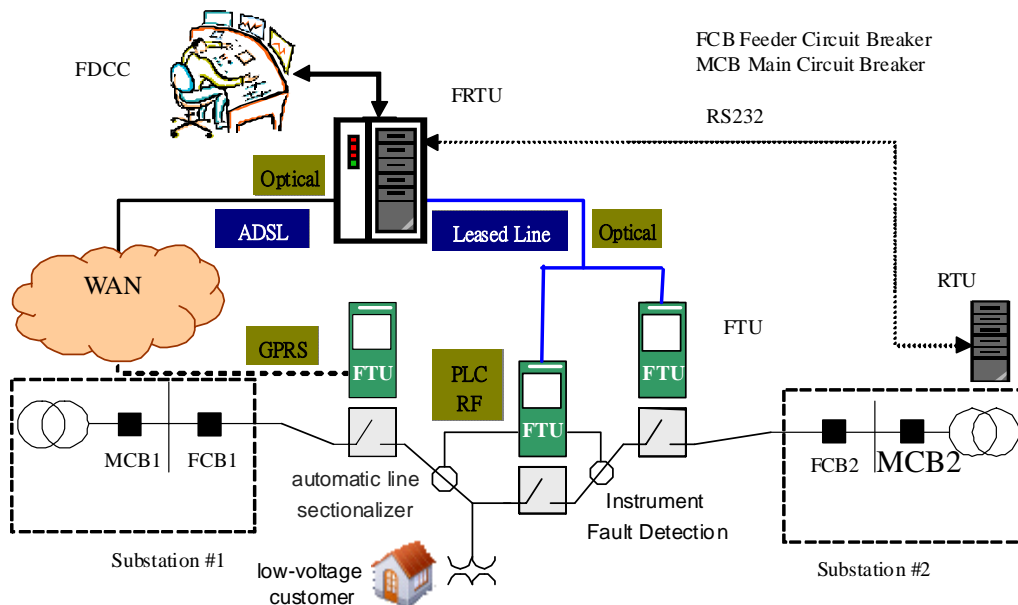
- AMI includes the smart meter, network of communication and meter of control center.
- Smart meter is composed by meter and Concentrator or Meter Interface Unit.



資料來源：能源國家型科技計畫－智慧電網與先進讀表主軸專案計畫總計畫 NSC 100-3113-P-008 -001 -PO

Distribution Feeder Automation System

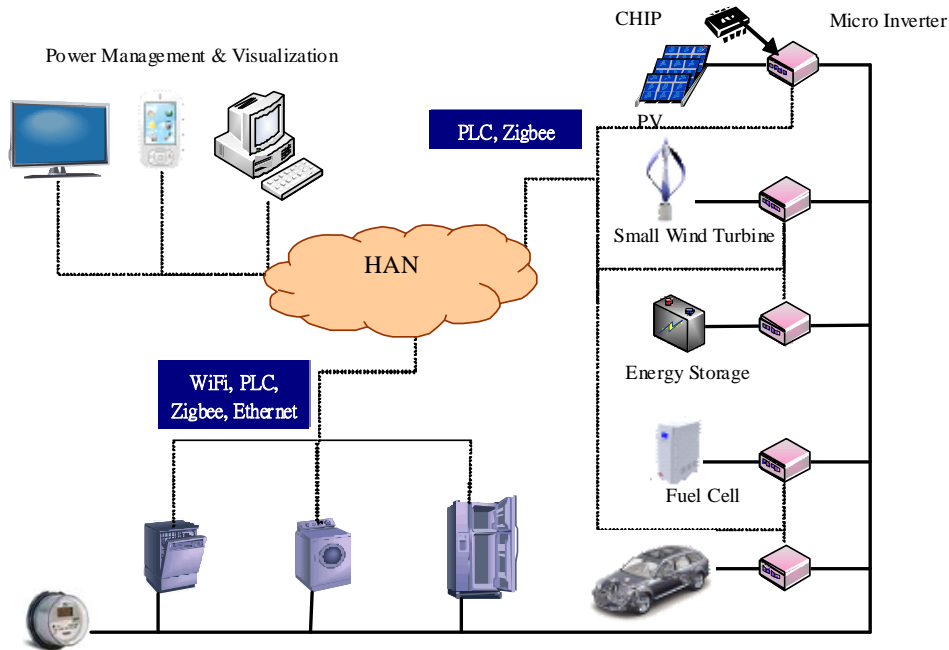
- Distribution Feeder Automation System includes Feeder Dispatch and Control Center (FDCC), Feeder Remote Terminal Unit (FRTU), Feeder Terminal Unit (FTU). FRTU is the concentrator in Substation.
- Distribution Feeder Automation System has the function of monitoring, control, SCADA and FDIR (Fault, Detection, Isolation and Restoration).



資料來源：能源國家型科技計畫－智慧電網與先進讀表主軸專案計畫總計畫 NSC 100-3113-P-008 -001 -PO

Smart Home and Building System

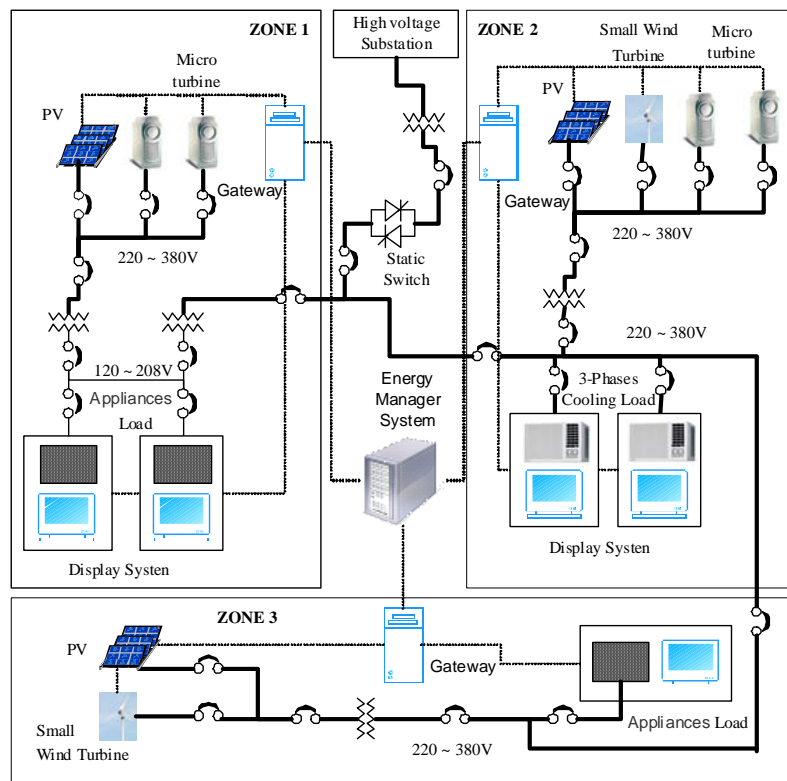
- Equipment associated with smart home energy system includes intelligent home appliances, slow chargers for electric vehicles, power management chips, energy management system, home gateway, human-machine interface control, load type of control interface, wireless sensors, wired sensors, and communications module.



資料來源：能源國家型科技計畫－智慧電網與先進讀表主軸專案計畫總計畫 NSC 100-3113-P-008 -001 -PO

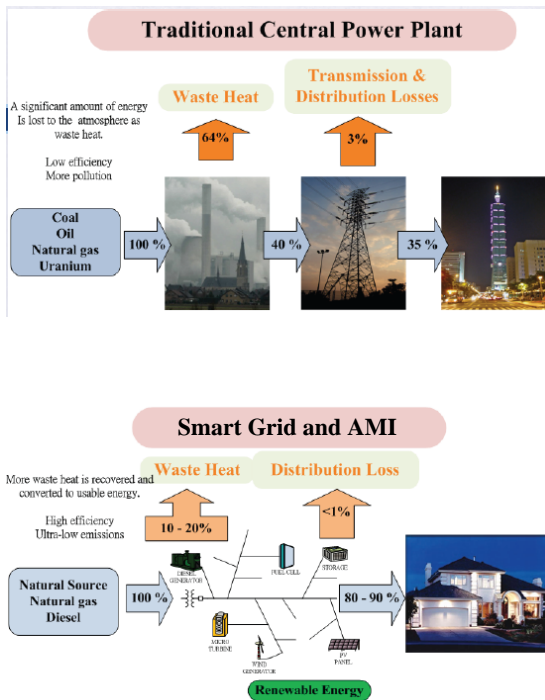
Microgrid and Distributed Generation System

- The general idea of Microgrid is to integrate a series of power loads with micro sources. The integrated system so called Microgrid is controllable and would provide users with high quality electric power and thermal energy.
- The concept of Multi-Microgrid is that arbitrary Microgrid could be integrated or separated and become a new grid. This concept could support the development of Cellular Smart Grid.



資料來源：紀國鐘，國科會產學合作計畫－微電網技術規範及產業發展研究計畫(1/2) NSC 100-3113-E-009 -003 -CC2

The Past and The Future of Power System



The past

- Centralized power plant
- Low proportion of DG
- Few islanding operation
- From generation, transmission, distribution to user: overall energy efficiency 30~40%

Smart Grid and AMI Technologies Development

- Power quality
- Transmission control
- Distribution automation
- Micro-grid control
- AMI and communication technology
- Energy management and demand response technology
- Power electronics
- Regulations and standards

Smart Grid and AMI Pilot Projects

- Microgrid pilot projects
- AMI pilot project
- Smart home (building) energy management pilot project
- Advanced distribution automation system (ADAS) pilot project

The future

- High proportion of DG (including renewable energy)
- Using microgrid and ADAS technologies, distributed network can be connected to the grid or operated in islanding
- Using AMI with demand response (DR), time of usage (TOU) strategies, saving and generating electricity become a concern of public
- Significant improvement of overall efficiency due to regional power sources supply local loads

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Taiwan Smart Grid Industry Association (TSGIA)

■ Object

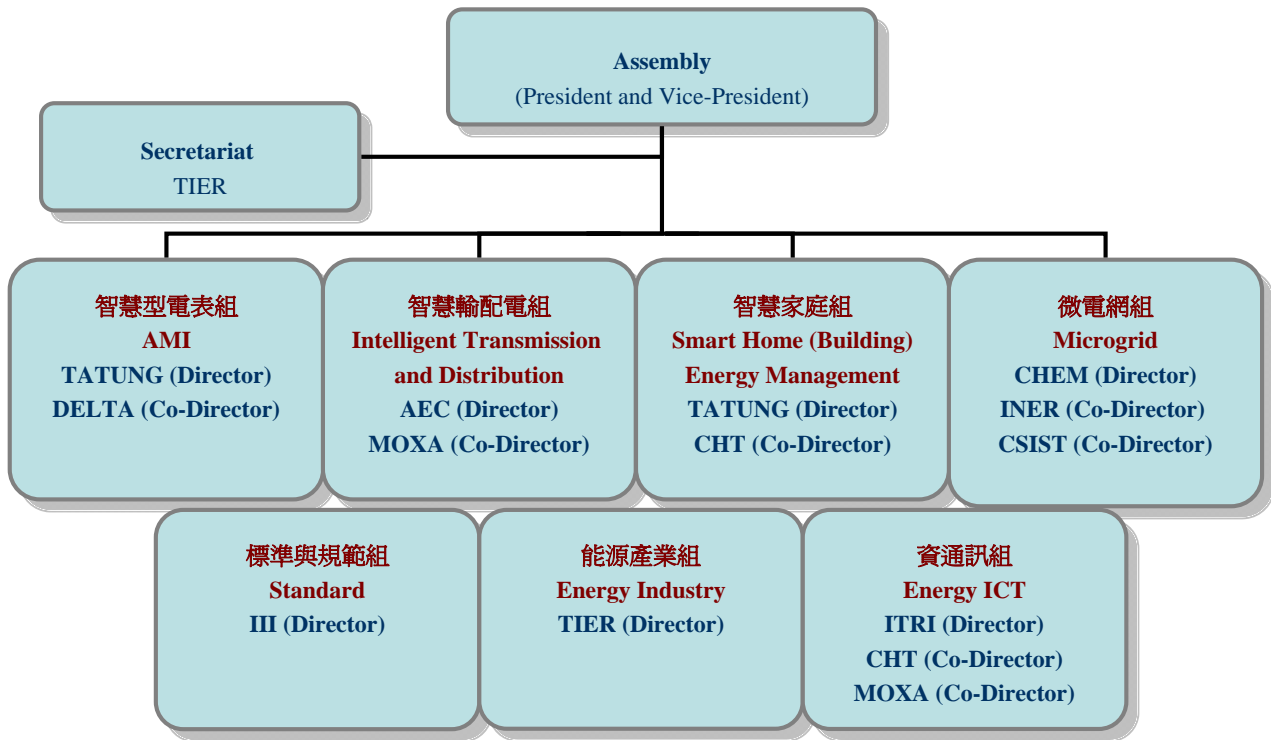
- ❑ To coordinate the development of power system, power electronics and ICT to develop the smart grid industry in Taiwan.

■ Mission

- ❑ Build up design and integration capabilities of smart grid.
- ❑ Establish a platform for integration and exchanging smart grid technology.
- ❑ Bridge the industry to the government to create an industry-friendly society and policy structure encouraging the development of smart grid industry.
- ❑ Assist Taiwan smart grid industry to reinforce the opportunities of international market shares.

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Structure of TSGIA

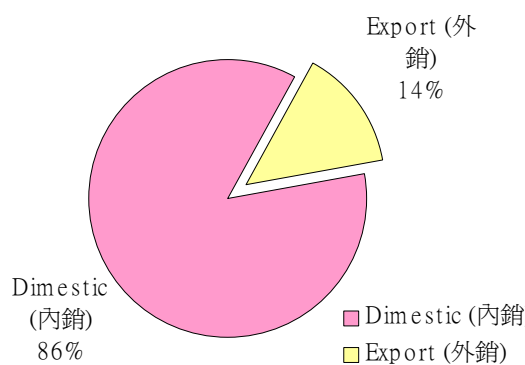


ALLIS ELECTRIC CO (AEC), Chung-Hsin Electric and Machinery Manufacturing Corp. (CHEM), Institute for Information industry (III), Industrial Technology Research Institute (ITRI), Institute of Nuclear Energy Research (INER), CHUNG-SHAN INSTITUTE OF SCIENCE & TECHNOLOGY (CSIST), Chunghwa Telecom(CHT)

Taiwan's Smart Grid Product Sales Amount

In 2010, Taiwan Smart Grid Product domestic sales amount is NT\$ 10.87 Billion (86%) and export sales amount NT\$ 1.73 Billion (14%).

Taiwan's Smart Grid Products rely on domestic market.



	Stock Listed	Stock Unlisted	Total
Domestic sales	10.7	0.15	10.8
Export Sales	1.14	0.52	1.67
Total	11.87	0.67	12.55

Unit: Billion NT\$

資料來源：紀國鐘，國科會產學合作計畫－微電網技術規範及產業發展研究計畫(1/2) NSC 100-3113-E-009-003-CC2

資料來源：台灣智慧型電網產業協會整理

*Thank You for Your
Listening!*

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Taiwan AMI Components Provider

- The high voltage AMI System of Taiwan Power Company is constructed by Tatung (with Institute for Information Industry). MIU is provided by Tatung and CHEM
- The scale of low voltage AMI is about 6 million smart meters.

Component	Provider in Taiwan
Smart Meter	TATUNG, CHEM, SHIHLIN(Arch), DELTA, AcBel, Itron, Danielgroup, Schneider Taiwan
Communications Module	AcBel, DELTA Networks, Billion Electric, TATUNG , Arch, MOXA, SensingTEK, Itron, ITRI
Concentrator or MIU	MOXA, AcBel, DELTA Networks, ZyXEL, Itron, ITRI
AMI Sytem	III, TATUNG, DELTA, Chunghwa Telecom, Ladis+Gyr 、 Itron, Altos , ITRI
Meter Data Management System(MDMS)	TATUNG , III,Chunghwa Telecom, eMeter, Oracle, Ladis+Gyr, Itron, Altos

Taiwan DAS Equipments Provider

Sort	Equipment	Provider
Power Distribution Equipment)	Transformer Oil Gas Analyzer	CHEM, Fortune, SHIHLIN, TATUNG, PIC(G.E)
	Pad- & Pole-Mounted Transformers	TATUNG, SHIHLIN, Fortune, ALLIS
	Recloser	Fortune, SHIHLIN
	Automatic Line Switches	CHEM, Fortune, ALLIS, SHIHLIN, TECO, TATUNG, Schneider Taiwan
Distribution Feeder Automation System	RTU, FRTU, FTU	CHEM, Connet, HCE , TATUNG
	SCADA System	CHEM, Connet, HCE , TATUNG , Chunghwa Telecom, Siemens 、 ACS 、 SNC
	SCADA Server	ADVANTECH, HP
	GPRS/Fiber MODEM	Korenix, MOXA, EDIMAX
	Switch, Router	Connet, Wallnet, TATUNG, MOXA, Cisco, Altran

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Taiwan Smart Home and Building Equipment Provider

Equipment	Provider
Intelligent home appliances	EHome : Cheng Xiang Control4 EMS : Justyle, ITRI
Electric vehicles charger	DELTA, ALLIS, LITEON, Fortune, Schneider Taiwan, ITRI
Power management chips	VIA
Energy management system (Interface)	Panasonic Taiwan, Chunghwa Telecom, INTEC, Tung-Chou, ITRI, Schneider Taiwan
Home Gateway	Panasonic Taiwan, Micortime Chunghwa Telecom, ITRI, Schneider Taiwan
Human-machine interface control	Panasonic Taiwan, Chunghwa Telecom, ITRI, Schneider Taiwan
Load type of control interface	Netvox, JosephTech
Wireless sensors	ZigBee : ICP DAS, Netvox
Wired sensors	Hom-thai, Winling
Communications Module	PLC : AcBel, Billion, ITRI ZigBee : ICP DAS, Netvox , ITRI Wi-Fi , Ethernet :MOXA

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Taiwan Microgrid and DG Equipment Provider

Equipment	Provider
DG – Stationary fuel cell	CHEM, ITRI
DG - PV	Unienergy, HELIUS, ALLIS, Lucky Power, JosephTech, MOTECH, GPI, DELTA, ITRI, TATUNG
DG – Small wind turbine	Hi-VAWT, PGC, Boltun, iWIND, STU, ITRI, TATUNG
DG – Micro turbine	AIDC
DG – Energy saving system	FEMTC, AcBel, ALLIS, Lucky Power, ITRI, CSISTDUP
Electric vehicle quick charger	ALLIS, DELTA, LITEON, Fortune, Schneider Taiwan, ITRI
Bi-directional dc-dc converter	CHEM, DELTA, AblereX, MOTECH, INER, ITRI, TATUNG
Micro Inverter	ALLIS, DELTA, Fortune, CHEM, Jubilee, Top Tower, GEOPROTEK, Schneider Taiwan, ITRI, TATUNG
Maximum Power Point Tracker	DELTA, INER, ITRI
Local SCADA	ALLIS, ADX, 榮成興業, CHEM, Chunghwa Telecom, ITRI, TATUNG
LVRT (AVR)	MOTECH
Distribution SVC	DELTA, TAIK
Distribution STATCOM	DELTA
AVR	DELTA, CHEM
Power controller / conditioner	INER
Loop Balance Controller (LBC)	NA
Static switch	榮成興業
Protective Relay	ALLIS, TAIK, Schneider Taiwan
Communication Equipment	MOXA

資料來源：紀國鐘，國科會產學合作計畫－微電網技術規範及產業發展研究計畫(1/2) NSC 100-3113-E-009-003-CC2