26th Meeting of the General planning Managers of the Southeast and Northeast ASIAN Electric Utilities

Taipower's Current Development in Renewable Energy

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Ⅰ、Introduction of Taiwan Power Company

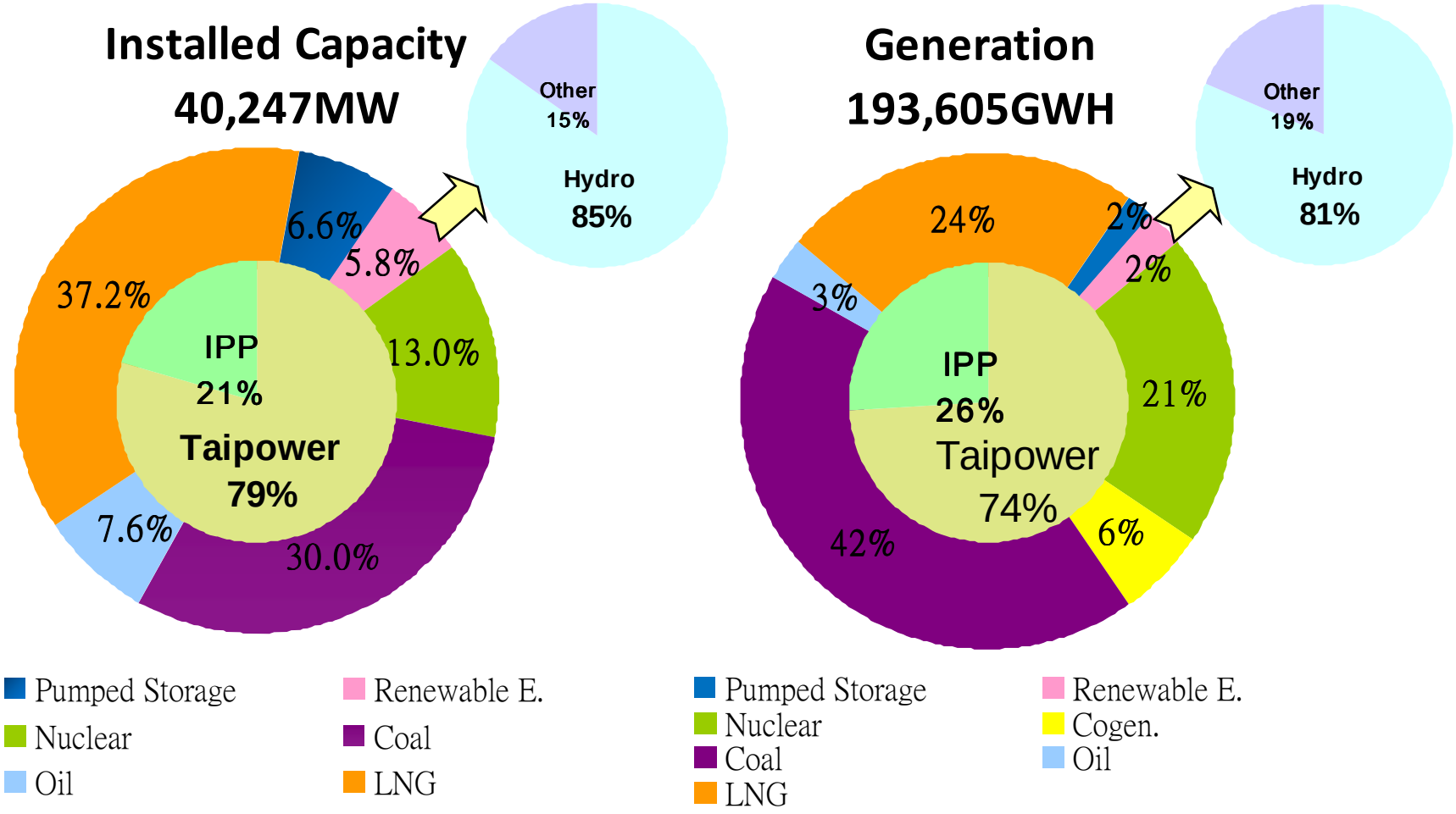
Introduction of Taiwan Power Company

- Date of Establishment：May 1 ,1946
- Total Assets：NT$ 1,587.9 billion
- Capital Stock：NT$ 330 billion
- Stocks：Government 97% , Public 3%
- Number of Employees：26,921
- Customers：12,415 (Thousand)
- Installed Capacity：40,247MW

(note：Figures calculated up to December 2009)


Taipower headquarters

Taiwan Power 2009 System



Ⅱ 、Government Policy & National Targets for Renewable Energy

Renewable Energy Government Policy

- **To cope with the enforcement of Kyoto Protocol and to collaborate with international efforts to control greenhouse gas emission, the government set up the renewable energy development policy, which set the target to implement renewable energy with capacity accumulated of 8,450 MW (including conventional hydro) by 2025 .**

National Targets for Renewable Energy

■ **Renewable Energy shall contribute 15% in terms of installed capacity by 2025.**

Year / Renewables	2009		2015		2025	
	Installed Capacity (MW)	Ratio (%)	Installed Capacity (MW)	Ratio (%)	Installed Capacity (MW)	Ratio (%)
1.Hydropower	1936.9	4.9	2261	5.1	2500	4.4
2.Wind Power	316.9	0.8	1480	3.4	3000	5.3
3.Photovoltaics	6.5	0.0	320	0.7	1000	1.8
4.Geothermal	---	---	10	0.0	150	0.3
5.Biomass	814.5	2.0	850	1.9	1400	2.5
6.Fuel Cell	---	---	50	0.1	200	0.4
7.Marine Power	---	---	1	0.0	200	0.4
Total	**3074.8**	**7.7**	**4972**	**11.2**	**8450**	**15.1**

＊Source：Bureau of Energy, MOEA

Ⅲ、 Renewable Energy Development Act

Renewable Energy Development Act

- **The renewable energy development act was promulgated on 8th July 2009 in Taiwan.**
- **The R.E. promotion goal will be 6,500 MW to 10,000MW .**
- **Grid utilities should supply grid connection for IPP with a fixed tariff purchase of 20 years but reviewed every year.**
- **Utilities will be obliged to render payment for an established fund and the levy can be reflected by the electricity fare.**
- **Utilities purchase R.E. electricity supplement could be applied to the fund.**

Tariff for Renewable Energy in Taiwan (2010)

Type of Renewable Energy	Feed-in Tariff (NTD/kWh)
Photovoltaic: 1~10 KW*	11.1883
Photovoltaic: 10~500 KW	12.9722
Photovoltaic: over 500 KW	11.1190
On-shore Wind Power:1~10 KW	7.2714
On-shore Wind Power :> 10 KW	2.3834
Off-shore Wind Power System	4.1982
Run-of-river Hydro-power	2.0615
Geothermal Power	5.1838
Biomass Power	2.0615
Wastage Power	2.0879
Others	2.0615
* Subsidies NT$50,000/KW for 1~10 KW Photovoltaic Systems	

Ⅳ、Wind Power Development of Taipower

Wind Potential and Exploitable Capacity of Taiwan

- **Theoretical potential: 13,600MW**

  1.Onshore：4,600MW

  Wind speed ＞ 4.5 m/s (50m height)

  Energy Density ＞150 W/m^2

  Full load operation ＞1,800 Hr/Yr

  2.Offshore：9,000MW

  Water depth：5~20 m

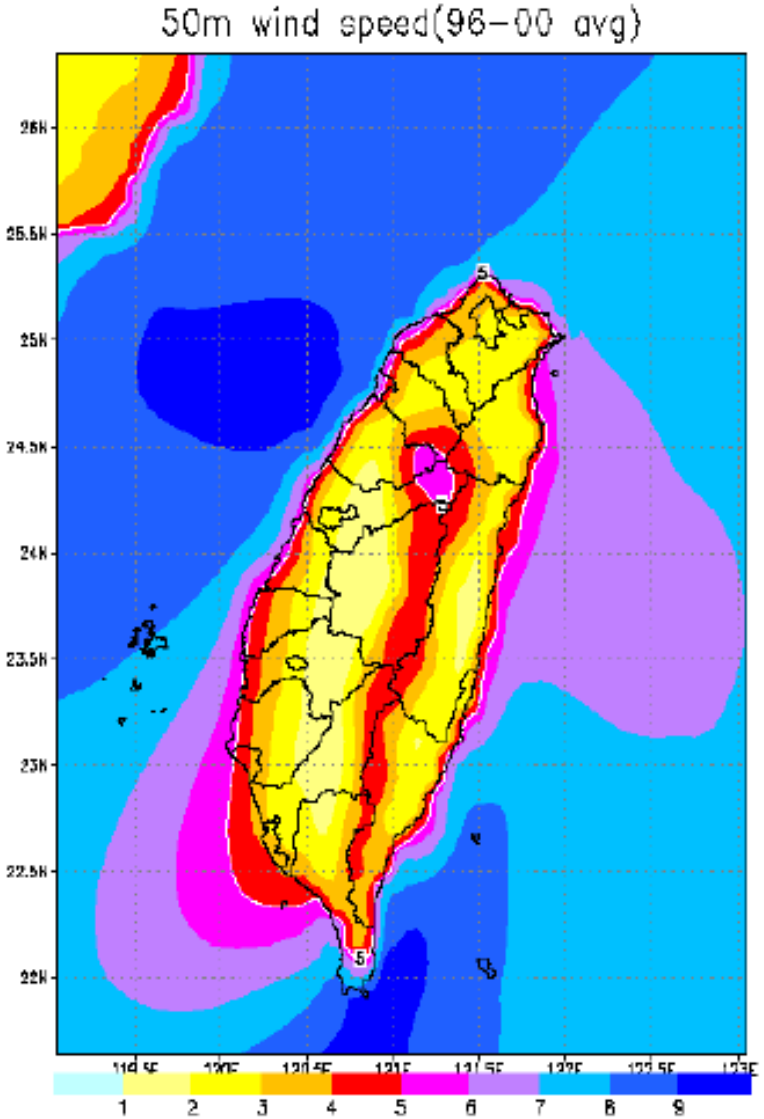
  Wind speed ＞ 6 m/s (50m height)

- **Exploitable Capacity : 2,200MW**

  The estimation is based on the above figure but excluding those areas of military and aviation restriction, environmental protection, fault and navigation.

  1.Onshore：1,000MW

  2.Offshore：1,200MW



＊Source：Bureau of Energy, MOEA

Taipower's Strategies for Wind Power Development

- **To aggressively develop superior onshore wind farms with a preference for public lands.**
- **Turnkey and joint procurement of wind turbines for several sites.**
- **Nobody-on-site operation with remote supervision.**
- **To sign contracts for accessory supply of wind turbines and establishing self-maintaining ability.**
- **To purchase IPP wind power in compliance with the government policy.**
- **To develop offshore wind farms cautiously.**

The Wind Power Projects in Taipower

- **Taipower initiated a Ten-year Wind Power Development Program in 2001, setting a target of installing 200 wind turbines or 300MW in capacity.**
  - **The first-phase project**
    60 units with a total capacity of 98.96MW has been completed by Dec. 2008.
  - **The second-phase project**
    58 units with a total capacity of 116MW will be implemented from 2005 to 2011.
  - **The third-phase project**
    28 units with a total capacity of 59.6MW will be implemented from 2007 to 2011.

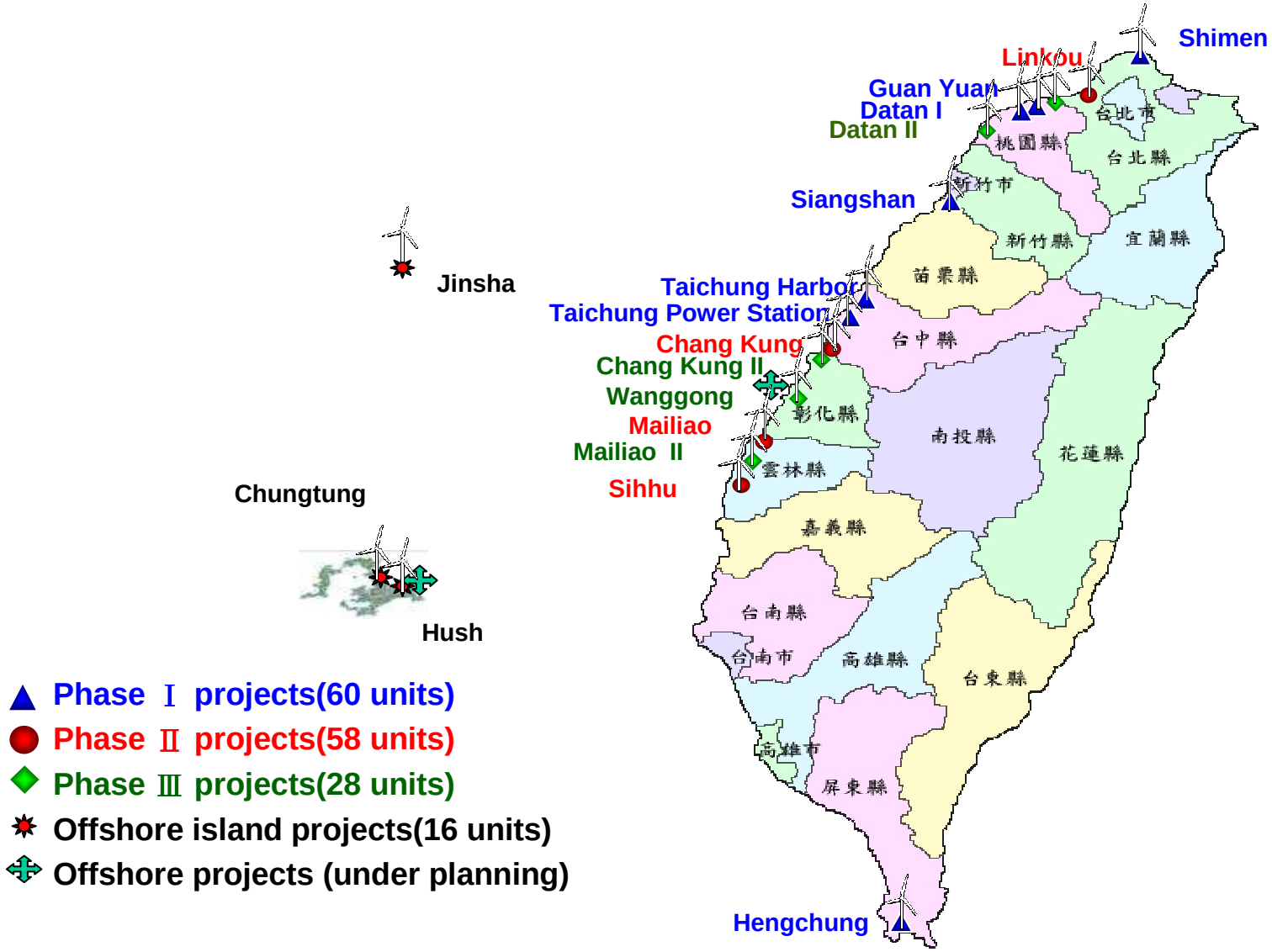
The accumulation will be 162 units with 289 MW at the end of 2011.

- **The fourth-phase wind power project and the first offshore wind farm are under planning, expecting to add another 14.8MW onshore by 2015 and 108MW offshore by 2020 respectively.**

Offshore Wind Projects in Taipower

- **Taipower has chosen Changhua, Penghu and Yunlin coastal areas as the major offshore wind power sites, and will plan and develop the projects by stages.**
- **Changhua**：Around 232 units with a total capacity of 835MW can be installed at this site. Taipower plans to install 30 units with a total capacity of 108MW in the first stage according to the results of a feasibility study report.
- **Penghu**：Around 40 units with a total capacity of 120MW can be installed in the east coast of Penghue.In accordance with the submarine cable project to be constructed between Taiwan and Penghu, Taipower will perform a feasibility study for the site.
- **Yunlin**：more than 70 units with a total capacity of 252MW can be installed at this site. Taipower will develop this site after the Changhua and Penghu projects.

Taipower Wind Power Sites

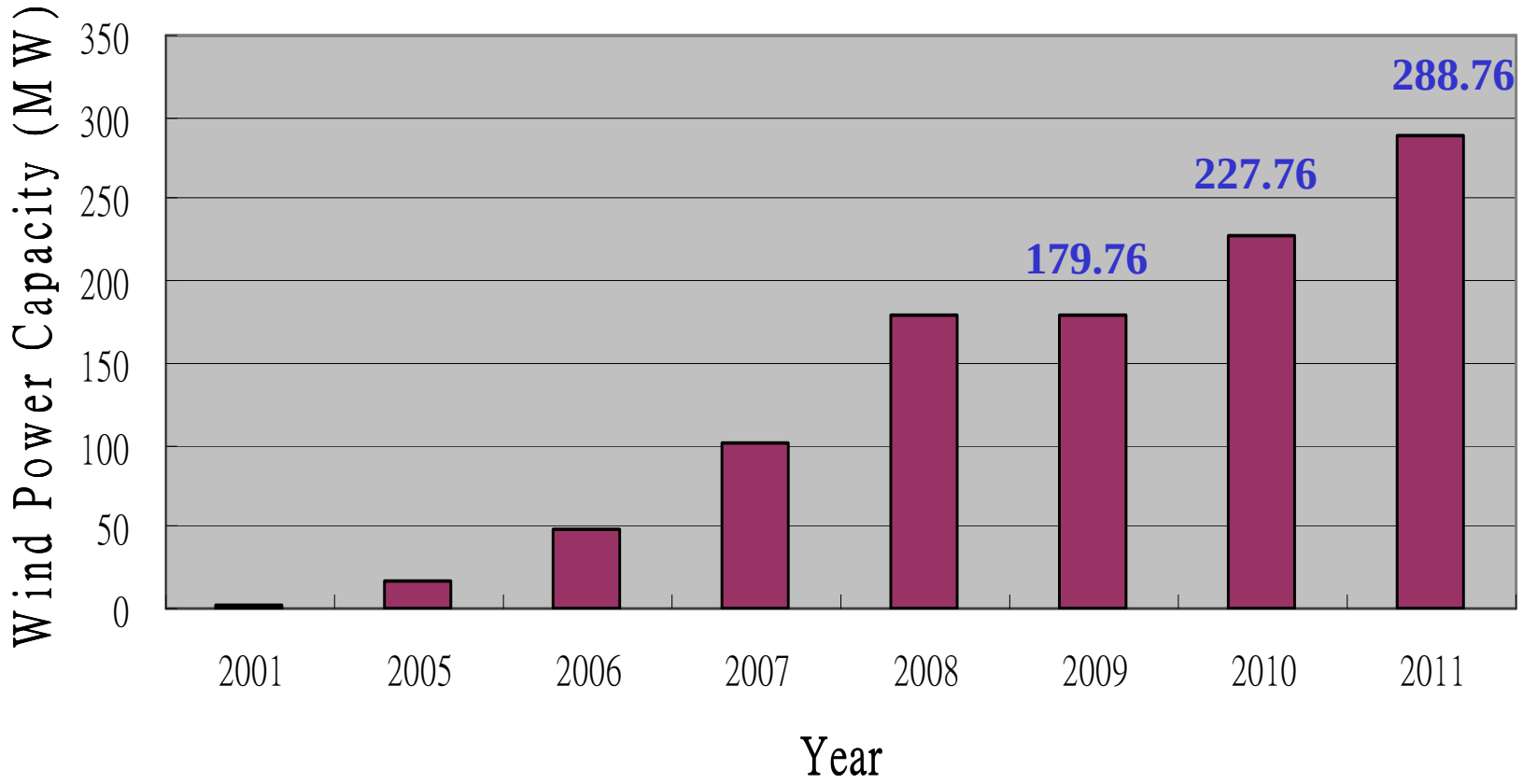


Wind Projects in Taipower

Approved Project		Capacity(kW) × units	Construction period	Status		
				In operation	Under construction	Tender Process
First-Phase		660x6 1500x26 2000x28	2003~2008	660x6 1500x26 2000x28		
Second-Phase		2000x58	2005~2011	2000x52	2000x6	
Third-Phase		2000x16 2300x12	2007~2011	2000x8	2000x8 2300x12	
Penghu		600x8 900x6	1999~2004 2007~2011	600x8	900x6	
Kinmem		2000x2	2007~2010	2000x2		
Total	MW	288.76	—	227.76	61	0
	Units	162	—	130	32	0

Taipower Statistics — September 2010

Wind Power Development in Taipower



Taipower owned Wind Power Stations






Ⅴ、Photovoltaic Energy Development of Taipower

Photovoltaic Energy Potential of Taiwan

- **Theoretic Potential: 35,060 MW**
  - ✓ Total roof area of buildings is about 350,600,000 m^2
  - ✓ Assumed 100% installation, and 100% utilization of top floor
  - ✓ 10 m^2 needed per kW

- **Exploitable Capacity : 3,467 MW**
  - ✓ Vacant rate of buildings is 17.6%
  - ✓ Assumed 30% installation, and 40% utilization of top floor,
  - ✓ 10 m^2 needed per kW

Plate 9 *Energy-autonomous house at Woubrugge, The Netherlands (Ecofys) BOALsolar profile system*

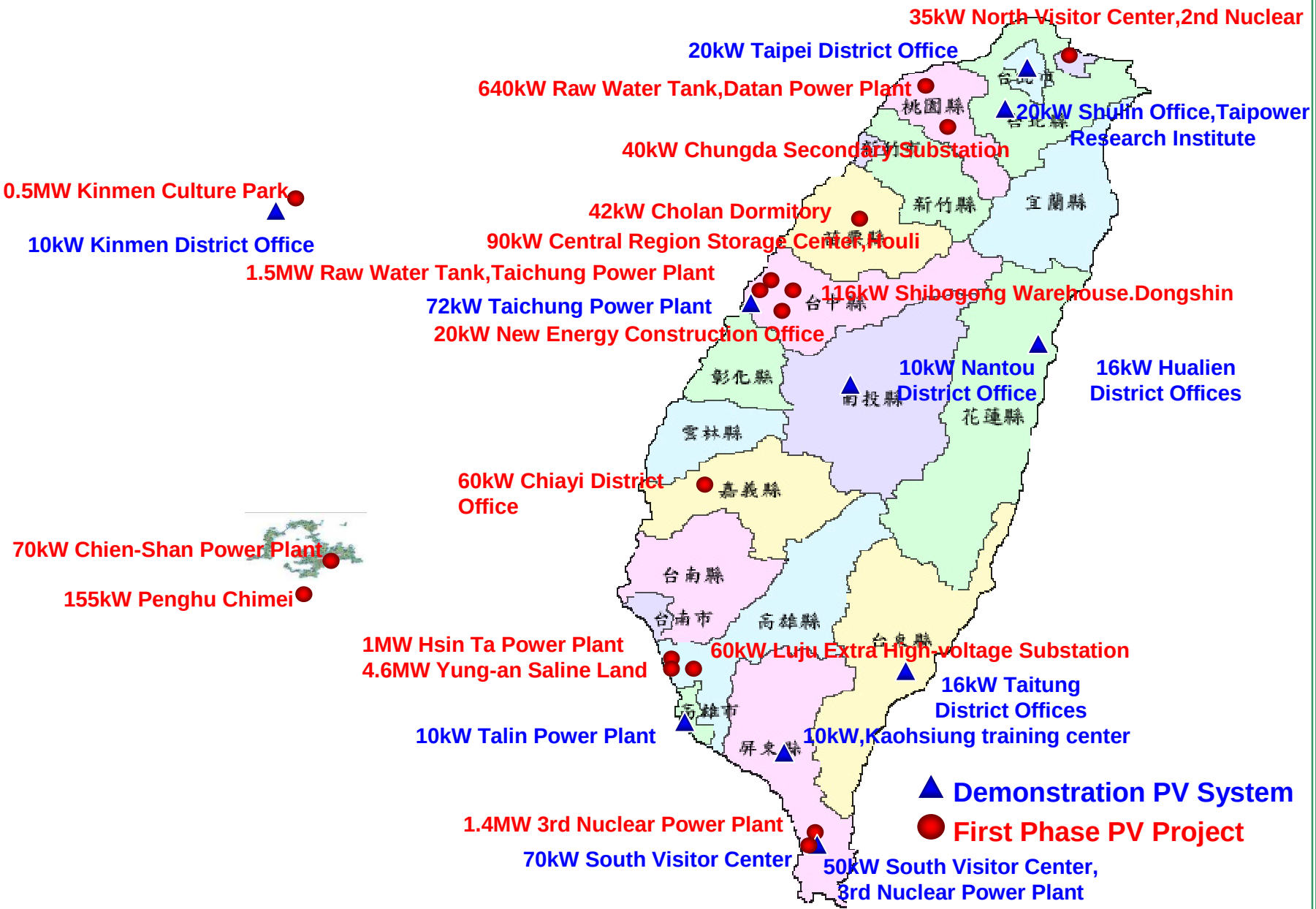
- **Annual Generation: 3,800 GWh**
  - ✓ 3 kWh per kW per day (Capacity factor=12.5%)

Taipower's Target and Strategies for Photovoltaic Energy Development

Target: to set up 10 MW Photovoltaic systems by the end of 2011

- To start by building different kinds of demonstration PV systems to accumulate experience.
- Turnkey and joint procurement of PV systems for several sites of the first-phase project.
- Taipower-owned land and building top are the first priority to set up PV systems .
- To cooperate with offices and schools to build PV systems on vacant land or building top.

Taipower Photovoltaic Power Sites



Photovoltaic Demonstration Systems

Taichung Power Plant
72kW

South Visitor Center
near the 3rd Nuclear Power Plant
50kW

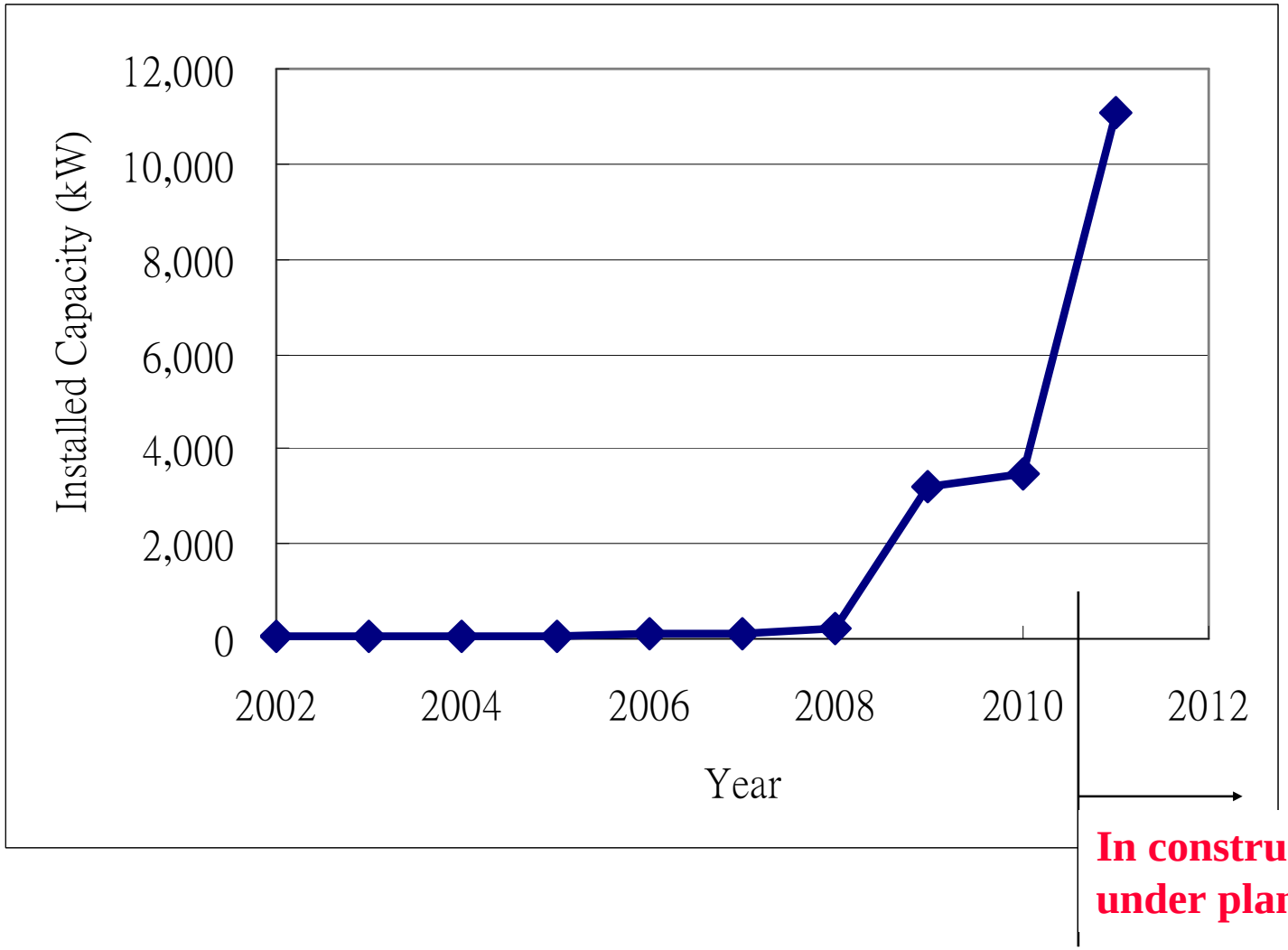
Photovoltaic Systems

Raw Water Tank,
Hsinta Power Plant
1.0MW

Raw Water Tank,
Taichung Power Plant
1.5MW

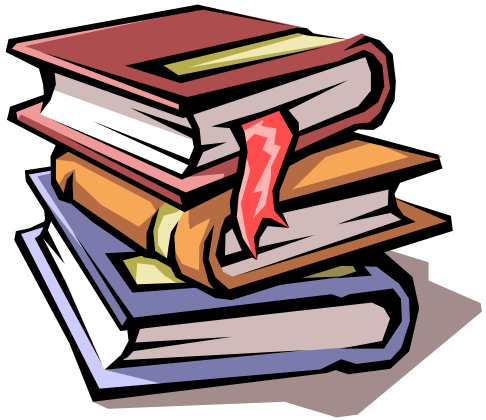
Yung-an Saline Land Photovoltaic Project Outline

Photovoltaic Development in Taipower



Ⅵ、 Conclusions

- **To ensure energy security, economic development and environmental protection, Taipower will continue to build traditional power plants and develop renewable energy to match with the government energy policy.**
- **Considering the maturity and cost of renewable energy currently, Taipower will mainly focus on the development of hydro and wind power, as well as the purchas of renewable energy generation from IPP to comply with government targets.**



THANK YOU FOR YOUR ATTENTION