

# **The Development of Energy Management in Chinese Taipei**

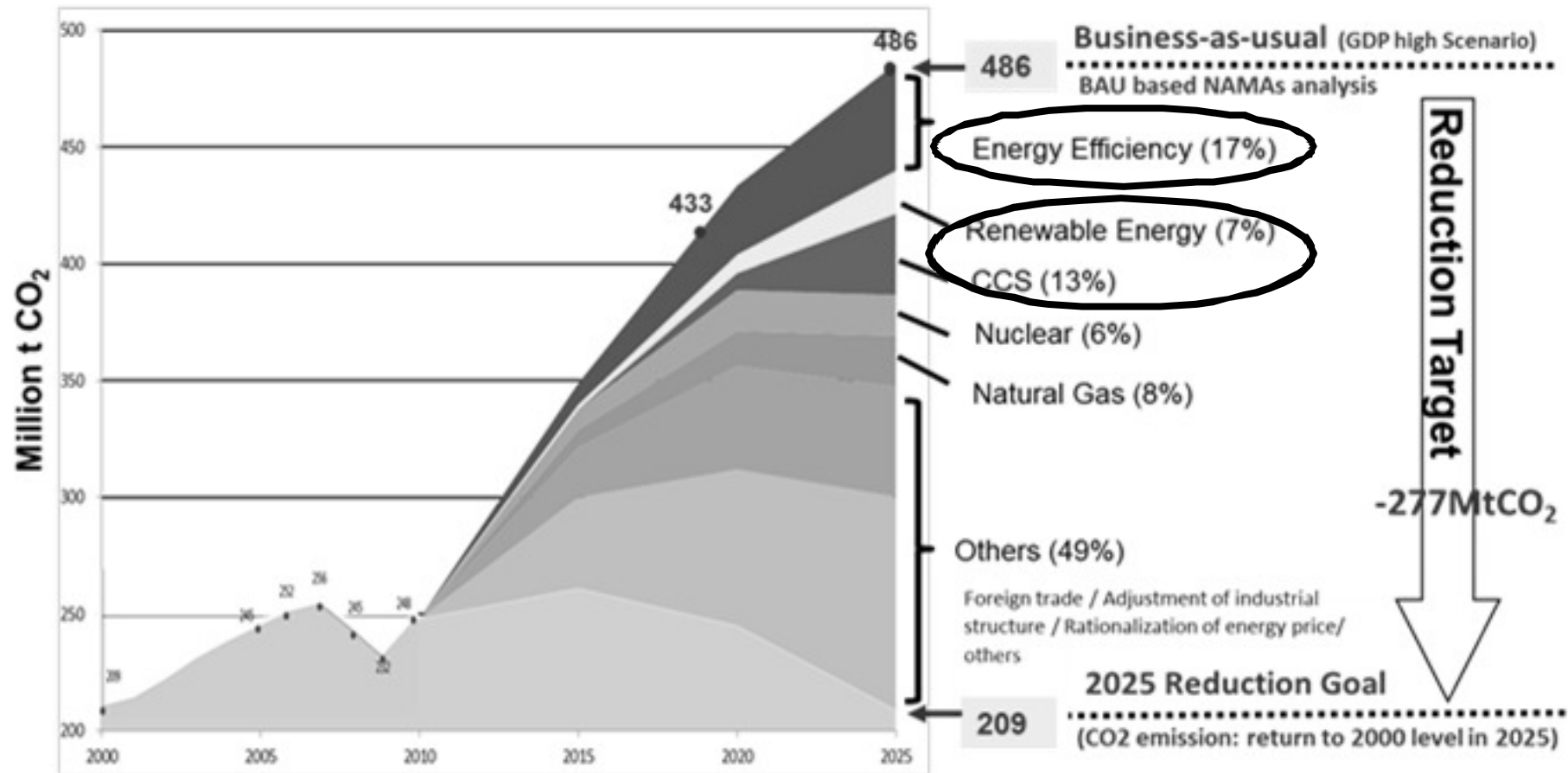
**April 10, 2014**

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# Mitigation Actions in Chinese Taipei

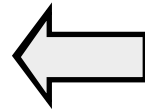
- ❑ 277 Mt CO<sub>2</sub> reduction is required to reach reduction goal in 2025 as compared to BAU scenario.
- ❑ Energy efficiency can account for 17% of CO<sub>2</sub> reduction based on ITRI's bottom-up (MACC) approach.



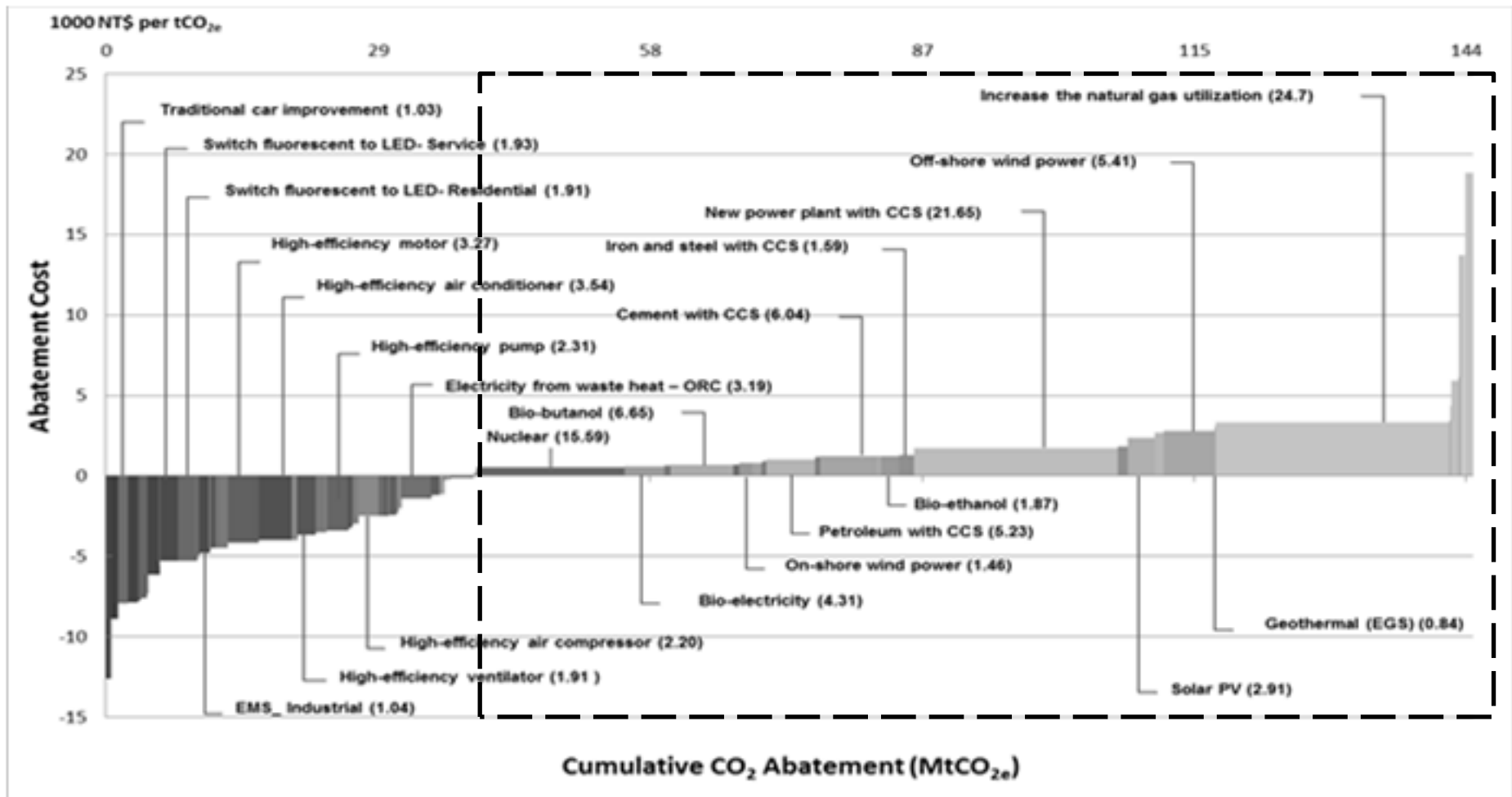
# Abatement Cost Curve in 2025 (144.1 MtCO<sub>2e</sub>)

Use of low-carbon technologies to fill the gap

Accelerate the implementation of mature technologies through regulation adjustment and incentive policies



- CCS will play an important role
- Accelerate R&D, reduce installation cost, increase capability of carbon reduction



# The Policy Tools of Energy Efficiency Management in Chinese Taipei

## ■ Mandatory Programs

- ✓ Minimum energy performance standard (MEPS)
- ✓ Energy efficiency ranking labeling
- ✓ Energy management and audit
- ✓ ESCO

## ■ Voluntary programs

- ✓ Energy conservation labeling
- ✓ Public awareness, education & promotion
- ✓ Incentives programs

# Minimum Energy Performance Standard (MEPS)

- Mandatory minimum energy performance standards (MEPS) is the main regulatory tool used for energy efficiency. Manufacturers and importers are obliged to apply in advance for compliance certification.
- In Chinese Taipei, MEPS was first introduced in 1980's, and have been updated over the years to cover a wide range of products, and increasing levels of stringency.

Effective Year	Categories	New Criteria Effective Date
1988	Engine for fishing boat	--
1987/.../2004	Automobile & motorcycle	Aug. 2009
2001	Fluorescent lamps	--
2003	Chiller for Air Conditioner System	--
2003	Boiler	--
1981/.../2007	Non-ductive Air-Conditioners	Stage1 : Jan. 1, 2011 Stage2 : Jan. 1, 2016
2002	1 & 3 phased Induction motors	--
1984/.../2003	Refrigerators	Jan. 1, 2011
2007	Self-ballasted fluorescent lamps	Jan. 1, 2010
2009	Ballast	Mar.1,2009
2010	Compact fluorescent lamps	Jan. 1, 2010
2011	Dehumidifiers	Mar.1,2011
2012	Incandescent bulb	Jan. 1, 2012
2014	LED bulb	Jul. 7, 2014
2015	Electric pots	Jan. 1, 2015

# Energy Efficiency Ranking Labeling

- To provide the consumers useful information when they choose among various models.
- To influence consumers' purchasing decisions to lead the product importers or manufacturers will likely take actions to improve energy efficiency of their products and to phase out low energy-efficient ones.
- Currently, there are 8,240 air conditioner models, 1,173 refrigerator models, 5,642 automobile models and 1,306 motorcycle models ,282 dehumidifier models and 1,717 CFL models have completed mandatory energy label applications , 4,383 Gas Stoves models and 3,325 Instantaneous Gas Water Heaters models.



air conditioner

Effective Year	Categories
2010	Non-ductive Air-Conditioners
2010	Refrigerators
2010	Automobile & motorcycle
2010	Motorcycle
2011	Dehumidifiers
2011	Self-ballasted fluorescent lamps
2012	Gas Stove and Instantaneous Gas Water Heater



automobile

# Achievements of EE Rating Labeling Program

✓ **RAC :**

The rating 1 products are 37% more efficient than rating 5 products

✓ **Refrigerator :**

The rating 1 products are 40% more efficient than rating 5 products

✓ **Dehumidifier :**

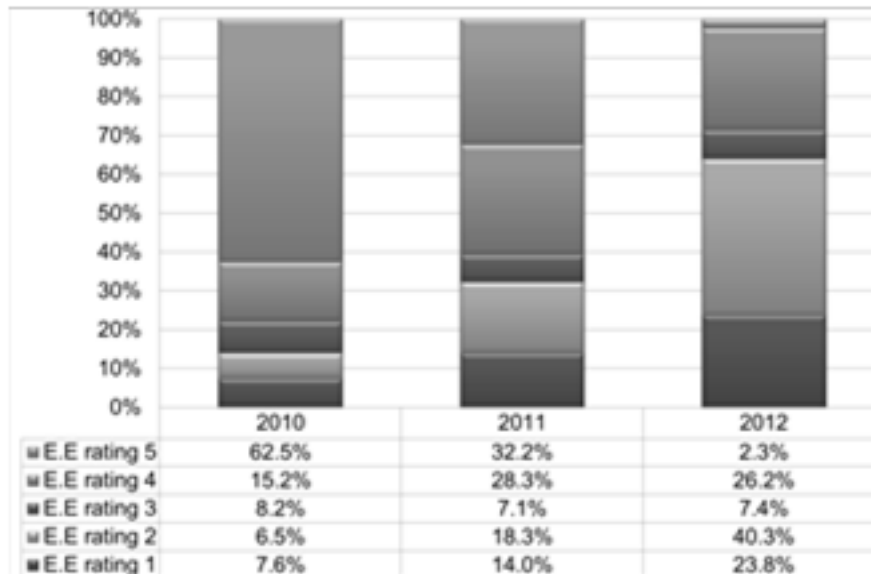
The rating 1 products are 28% more efficient than rating 5 products

✓ **Self-Ballasted Fluorescent Lamp :**

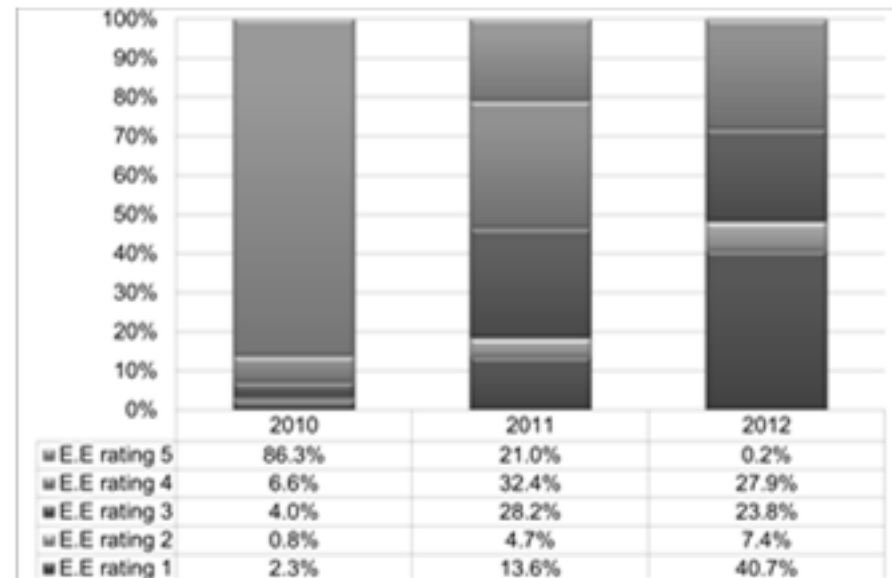
The rating 1 products are 30%~40% more efficient than rating 5 products

■ **Market Transformation of RAC and Refrigerator (2010~ 2012) :**

Market Share of each rating Air Conditioner



Market Share of each rating Refrigerator/freezer





# Voluntary Energy Conservation Labeling Program

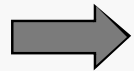
## Benchmarks for Energy Label Products(45 product Categories)

Year	Categories
2001	(1)air-conditioners (2) refrigerators (3) dehumidifiers (4) clothes dryers
2002	(5)TVs (6) clothes washers (7) electric fans, (8) fluorescent lamps ( $\geq 32$ W)
2003	(8)fluorescent lamps ( $< 32$ W) (9)hair dryers (10) hand dryers
2004	(11)warm-hot water dispensers (12) chilled-warm-hot water dispensers
2005	(13) chilled-warm-hot drinking fountains (14) automobiles & light trucks (15) motorcycles (16) self-ballasted fluorescent lamps
2006	(17) thin film transistor-liquid crystal display (18) instant gas burning water heaters (19) gas burning cooking appliances (20) electric rice cookers
2007	(21)Electric Storage Water Heaters (effective on Jan. 1, 2008)(22) Electric Pots (23) Exit Lights and Emergency Direction Lights(24) DVD Products
2008	(25)Warm-hot drinking fountains (26) Luminaries (27) Integrated Stereo
2009	(28)Compact Fluorescent Lamp
2010	(29)Printer
2011	(30) Copier (31) Air Cleaner (new) { 32 } street lighting (33)Ventilating Fan for Bath Room (34) Window Type Ventilating Fan
2012	(35)Desk top PC (36) Notebook PC (37) Heat pump water heater (38)Range Hoods
2013	(39)Microwave oven (40) Axial-flow Fans (41) Centrifugal fan (42) Ballast for Fluorescent tubes (43) Electric Stove (44) Electric water machine (45) LED bulbs

**7,875**Energy Conservation Labeling certified models with **367** brand names and over **178 million** Energy Conservation qualified models have been used by Mar. 3, 2014

# Energy Management and Audit

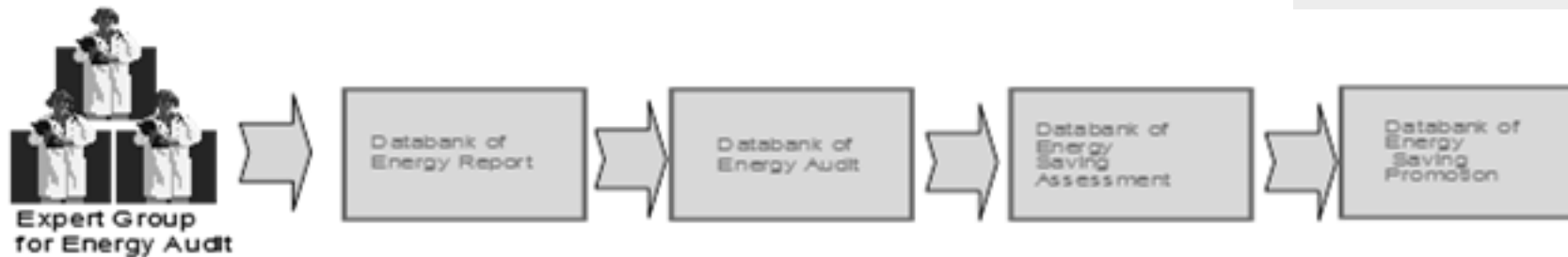
Industrial sector shares around 54% of energy consumption



the significant object of energy conservation implementation

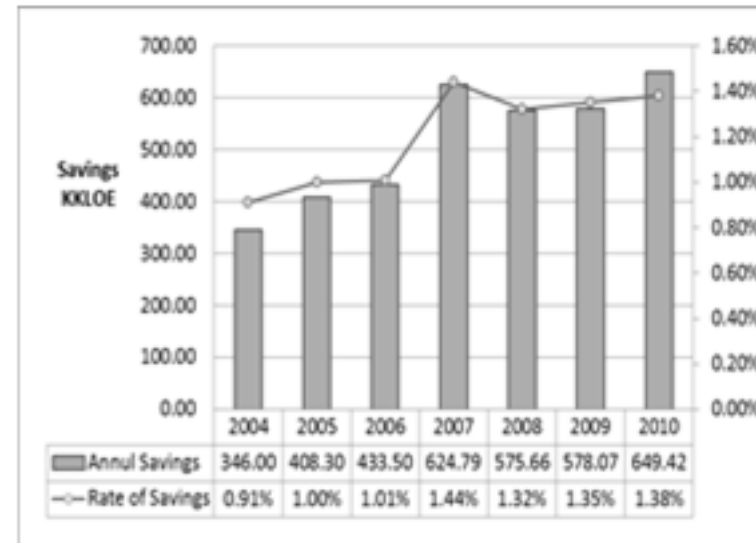
## □ The process of energy audit for Industry sector

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## □ Benefits

- From 2004~2010, average annual saving was 517.55 KKLOE with 1.20% annual saving rate
- An effective strategy can be developed to cope with the situations in different industries



# Chinese Taipei's ESCO Industry Development

## Strategy

### Improve the environment for industrial development

- Formulate industrial development strategy and policy measures
- Set up an all-around industrial services system
- Strengthen industry related laws and risk management
- Establish sound energy-saving performance measurement and verification system
- Promote ESCO servicing capacity registration system
- Set up a third impartial office for measurement verification
- promote strategic alliances between equipment manufacturers, engineering companies and financial institutions

### Expand the industrial market

- Promote the energy conservation performance guarantee program promotion subsidies
- promote public sector to ESCO
- Promote Groups and enterprises to perform initial diagnosis and introduce ESCOs
- Promote LED street lights and ESCO subsidies
- Commend of excellence ESCOs
- Energy audit of colleges and universities
- Promoting PV-ESCO

### Promote ESCO development

### Nurture industry talent

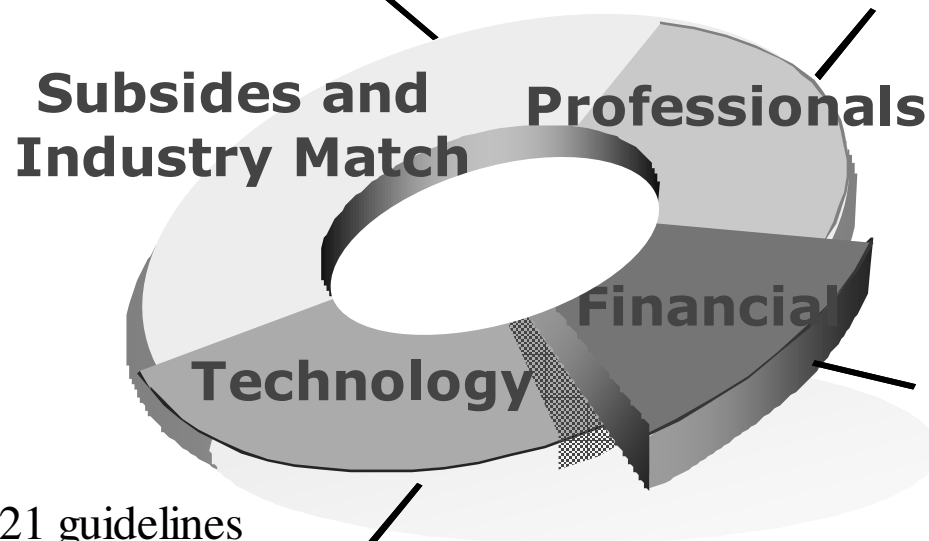
- Promote talent certification system
- Introduce IPMVP energy saving performance measurement and verify the licenses of specialists
- “ESCO Project Development Technology” training course
- Promote the inclusion of ESCO courses in college curriculum

### Develop project financing system

- Establish credit guarantee financing system
- Promote low-interest loans
- Promote industry project financing
- Promote the Industry Revolving Fund

# Achievement of ESCO Promotion

- Subsidize ESCO project during 2006-2013 for 99 projects with NTD 420 million
- The six cities using the ESPC model set up lighting reached 60.5 thousand, around NTD 540 million output values.
- Subsidy 102 universities to perform ESCO energy conservation initial diagnosis, predicting saving electric power 549.2 hundred kilowatts
- Organize M&V training workshop during 2006-2013 with more than 2,000 participants.



- Provide credit guarantee fund for 5 cases with NTD 265 millions..
- Provide NTD 20 billions for project finance by local bank.
- Government provide low interest rate loans (3.825%) for energy saving equipment procurement, total loan is NTD 2,118 million.
- Publish 21 guidelines for M&V (lighting, heat pump, A/C, and cooling system)

# Campaign for Energy Saving (1/2)

## 1. Promoted Energy Saving Campaign, “Cool Style for Summer Dresses”

- First time to maximize work capacity with service sector, design and fashion industries of textile.
- Offered funds by test and verification mechanism for expanding commercial opportunity. All 45 verified patterns from 25 companies fit in the idea of cool feeling textiles and moisture transferring and quick drying textiles.
- Open market by sales competition among textile companies. 215 sale spots out of 28 companies were in the competition and 140 thousand items were sold during the campaign.

## 2. Connected social resources to promote the network for energy saving volunteer

- Worked with environment groups and scientific and technology museum system to cultivate volunteers and promote energy saving.
- Trained 492 volunteers, organized 985 activities, which attracted 59 thousand people’s attendance in total.

### Launching ~“Cool Style for Summer Dresses”



# Campaign for Energy Saving (2/2)

## 3. Conducted Contest of "Power Saving in Summer Months" Among 22 Cities and Counties.

- Contest of "Power Saving in Summer Months" among 22 cities and counties was firstly held in 2012; the contest is based on 5 pools of index, such as government, household, service sector, energy education and policy administration.
- Compared with the reference year of 2011, the electricity saved respectively was more than 2.45 billion kWh (9.1%) in 2012, and 1.20 billion kWh (4.78%) in 2013.
- Promoted campaign identity of "Power Saving in Summer Months" for 11 designated businesses which consume significant electricity. There were more than 20 thousand physical stores, equal to 90% stores in Chinese Taipei taking part in the event.
- For promoting high energy efficiency household appliances, 8 cities and counties organized special deal events dedicated to energy saving appliances. In aggregate, more than 200 thousand items were sold, equal to 1.04 billion NTDs.



# Award and Demonstration for Energy Saving



## ❑ Promoted Energy-efficient Performance Award

For promoting entrepreneur's voluntary energy saving and encouraging public, private sector and school for energy saving, Ministry of Economy yearly holds Energy-efficient Performance Award.

## ❑ Organizing Demonstration of Energy Saving for Award Winner

Invited Excellent Energy-Saving Performance Award winners to share successful cases and experiences. Around **580** entrepreneurs attended live demonstration of energy saving technologies annually.



## ❑ System for promotion

Constructed sharing platform for successful cases and technologies, produced e-book (More than **2,200** cases have been compiled) from industries' successful cases and organized demonstration.

## ❑ The Result of Energy Saving in 2013

In 2013, 37 winning corporations, governmental institutions and schools conserved **36 thousand kiloliters of oil equivalence**, saved **303 million NTDs** and reduced **119 thousand tons emission of carbon dioxide**.



# Installation of Renewable Energy

- The installed capacity of renewable energy was 3,769 MW at the end of 2013.
- Targeted renewable power generation capacity is 13.75 GW by 2030.

Energy Source	2013	2015	2020	2025	2030
On-shore Wind	614	814	1,200	1,200	1,200
Off-shore Wind	0	15	320	1,520	3,000
Hydro Power	2,081	2,089	2,100	2,150	2,200
Solar PV	333	847	2,120	4,100	6,200
Geothermal	0	4	66	150	200
Biomass	741	745	768	813	950
<b>Total</b>	<b>3,769</b>	<b>4,514</b>	<b>6,574</b>	<b>9,933</b>	<b>13,750</b>

Source: Bureau of Energy, Ministry of Economic Affairs, Chinese Taipei



# Others

## ○ Conventional Hydropower

- ◆ Total hydro power capacity is 2,081.3 MW, of which the Public utilities (Taipower) accounted for 98% of large hydro power plants (2,042.2 MW), privately owned 39.1 MW only

## ○ Solar Water Heaters

- ◆ 2.27 million m<sup>2</sup> of heat collectors installed, effective households penetration rate 3.63% (around 300 thousand households)
- ◆ Ranked No. 5 globally for installed density (land area based)
- ◆ Annual Energy Production: 154 million litres oil equivalent



source : <http://www.flickr.com/photos/hanksun88/6608214497/>

# Mechanism of Feed-in Tariffs

- Tariffs and formula should be reviewed annually by referring to technical advancement, cost variation, goal achievement status, etc.  
→ no degression system in place
- **Tariffs shall not be lower than the average cost for fossil-fired power of domestic power utilities.**
- Current, only Solar PV tariff rates are set on date when generating equipment installations are completed. Other technologies have tariff rates set on the Power Purchasing Agreement (PPA) signing date.  
→ **applied for 20 years**
- BOE announces PV capacity quota every year. PV systems > 30 kW are subject to a bidding procedure to decide tariffs. Developers proposing higher discount rates get the priority to get the quota.

# FIT for Renewables (2014)

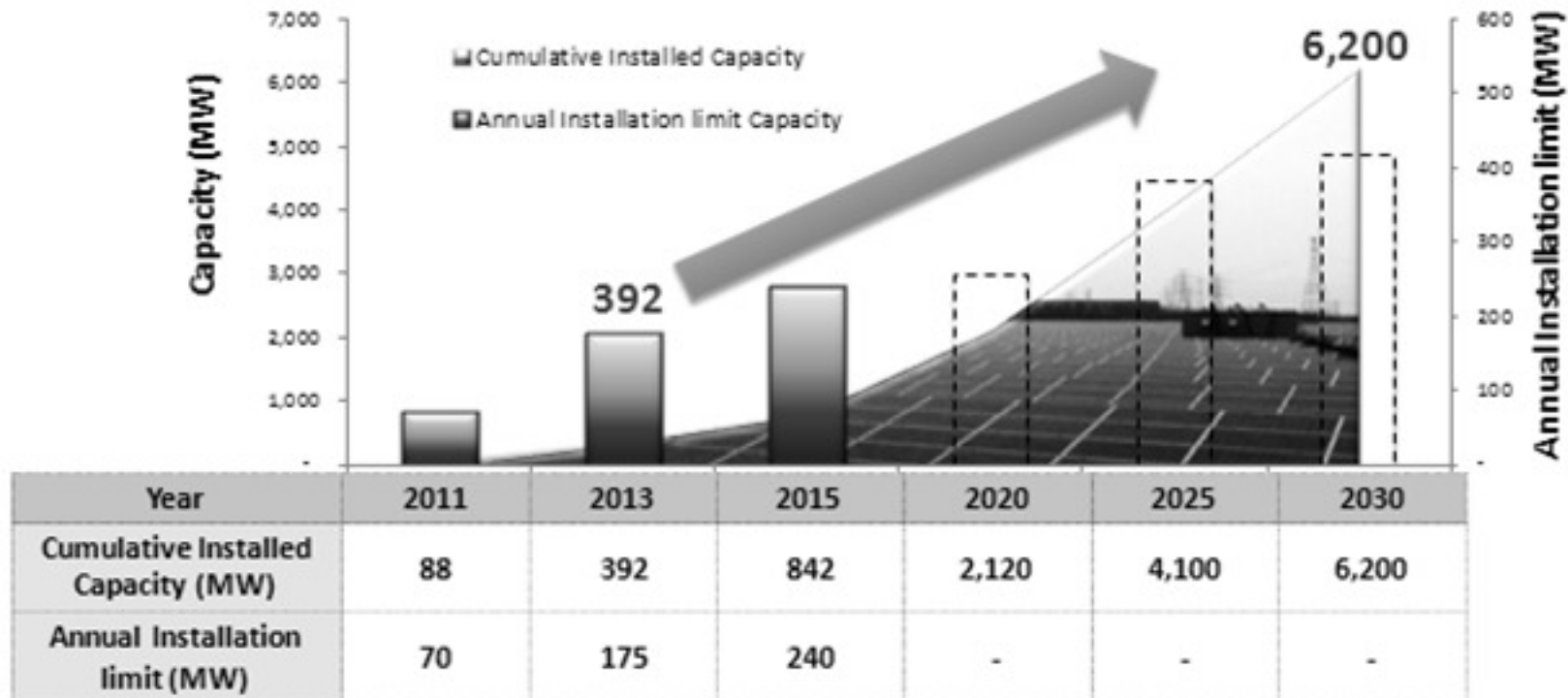
- Applied for 20 years to electricity from renewables (except PV) whose owner signs PPA with power utility from **1 Jan. 2014 to 31 Dec. 2014**

Item	Type	Capacity (kW)	2014 Tariff Rates (US ¢/kWh)		2013 Tariff Rates (US ¢/kWh)		Variation	
			period 1	period 2	period 1	period 2	period 1	period 2
PV	Roof type	$\geq 1 \sim < 10$	23.8673	23.8673	27.9903	27.2787	-14.7%	-12.5%
		$\geq 10 \sim < 100$	21.3967	21.3967	25.1439	24.4323	-14.9%	-12.4%
		$\geq 100 \sim < 500$	20.1493	20.1493	23.7207	23.0091	-15.1%	-12.4%
		$\geq 500$	17.4387	17.4387	21.1113	19.9253	-17.4%	-12.5%
	Ground type	$\geq 1$	16.4074	16.4074	19.9253	18.7393	-17.7%	-12.4%
Wind Power	Onshore	$\geq 1 \sim < 10$	27.2450		24.5207		11.1%	
		$\geq 10$	8.7793 (with LVRT)		8.7527 (with LVRT)		0.3%	
	Offshore	--	18.6920		18.5420		0.8%	
Hydropower	Stream-Type	--	8.3510		8.2174		1.6%	
Geothermal	--	--	16.4383		16.0130		2.7%	
Biomass	No biogas equip.	--	8.3510		8.2174		1.6%	
	With biogas equip.	--	10.8370		9.3380		16.1%	
RDF	--	--	9.4133		9.4133		0.0%	
Others	--	--	8.3510		8.2174		1.6%	

\* Exchange rate: USD 1 = NTD 30

# Million Solar Rooftop PVs project (1/2)

- **Solar Energy Potential** ◆ Goal : 6,200 MW developed by 2030  
 A. Roof-top (3,000 MW) B. Ground (3,200 MW)
- **Strategy - Gradual expansion/ incentivizing roof-tops prior to ground installations**
  - ◆ Buildings will be installed with PV panels through the incentives of feed-in tariffs.
  - ◆ Restricted annual quota at present, while large scale expansion after grid-parity reached
  - ◆ To expand the PV power applications in the domestic market, the annual installation limit has been raised to 210MW in 2014, up from 70MW in 2011



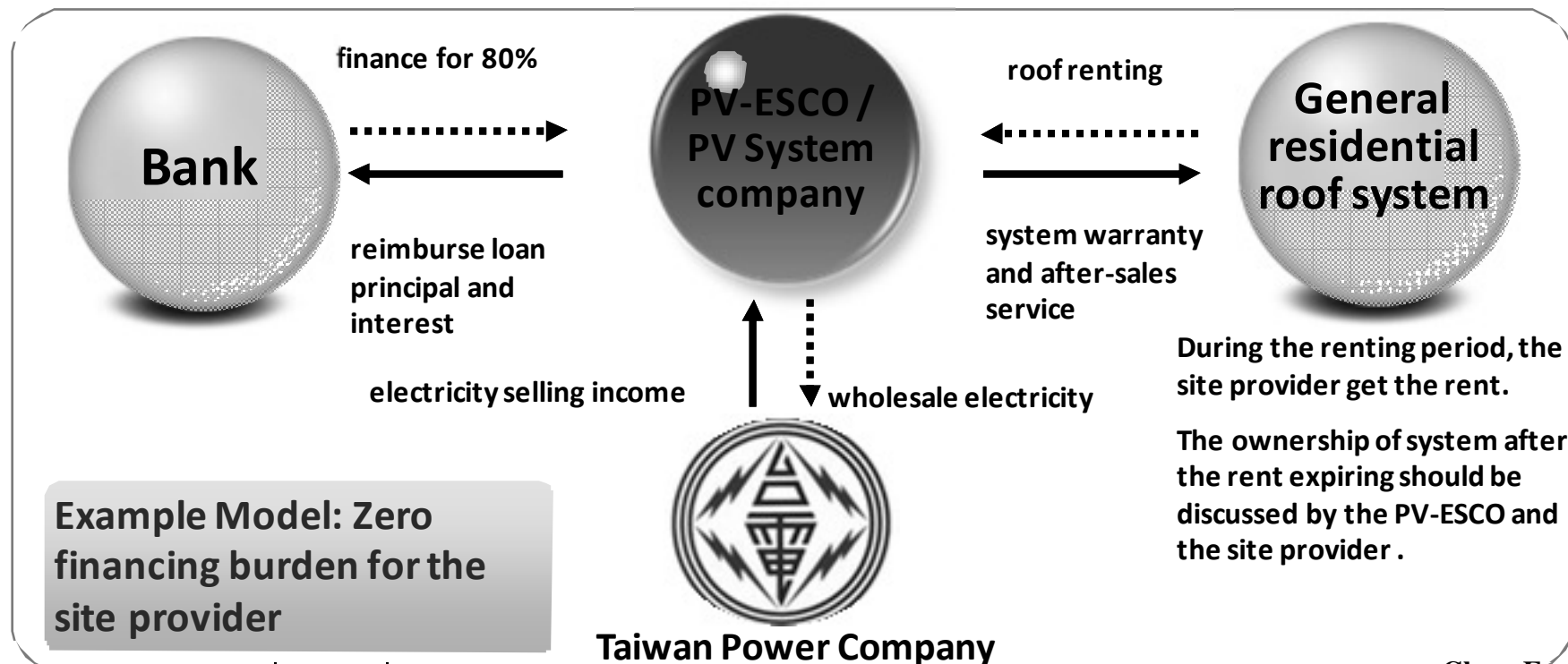
# Million Solar Rooftop PVs project (2/2)

## o Encouraging participation from local governments

- ◆ Besides FIT, some local governments (e.g. Kaohsiung City) granting extra capital subsidy
- ◆ Encouraging public buildings and constructions equipped with PV
- ◆ BOE assisting local governments on Solar Roof-top Program and Solar Community Program to facilitate public participation

## o Establishment of PV-ESCO mechanism

- ◆ Encouraging banks to participate in project financing and to provide soft loans to PV-ESCO players



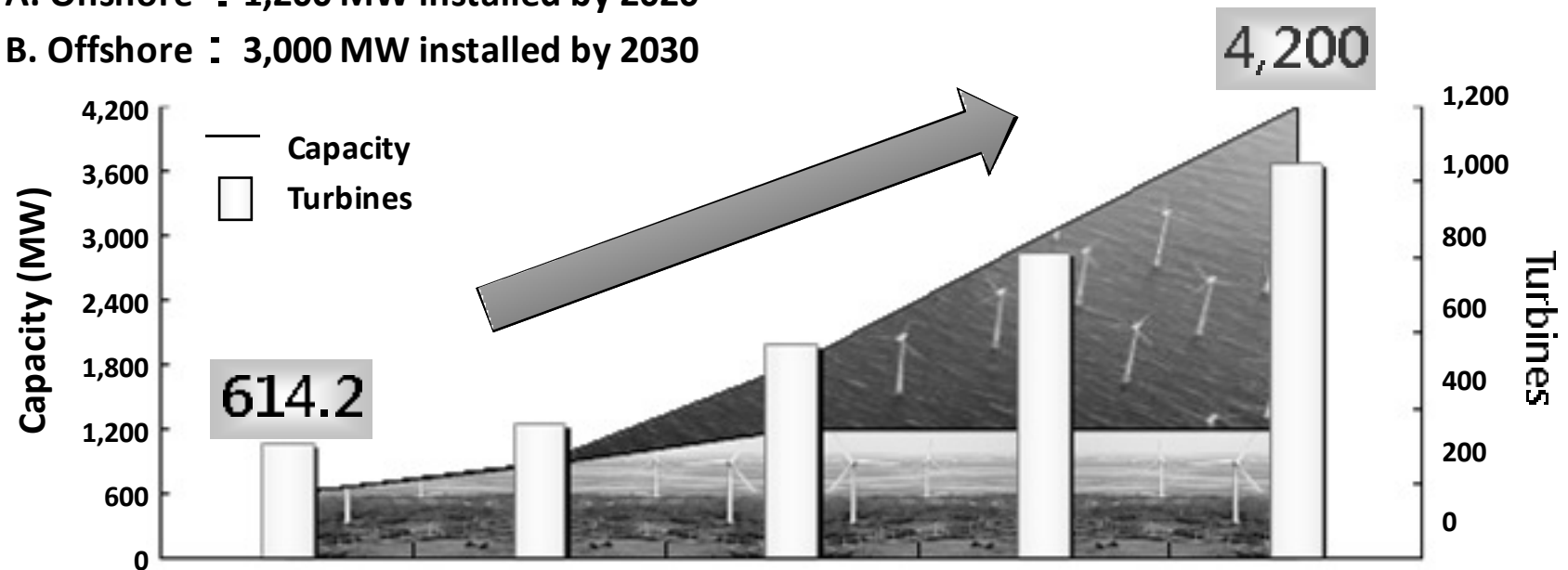
# Thousand Wind Turbines Project (1/2)

## ○ Wind Power Generation Target

◆ Goal : 4,200 MW developed by 2030

A. Onshore : 1,200 MW installed by 2020

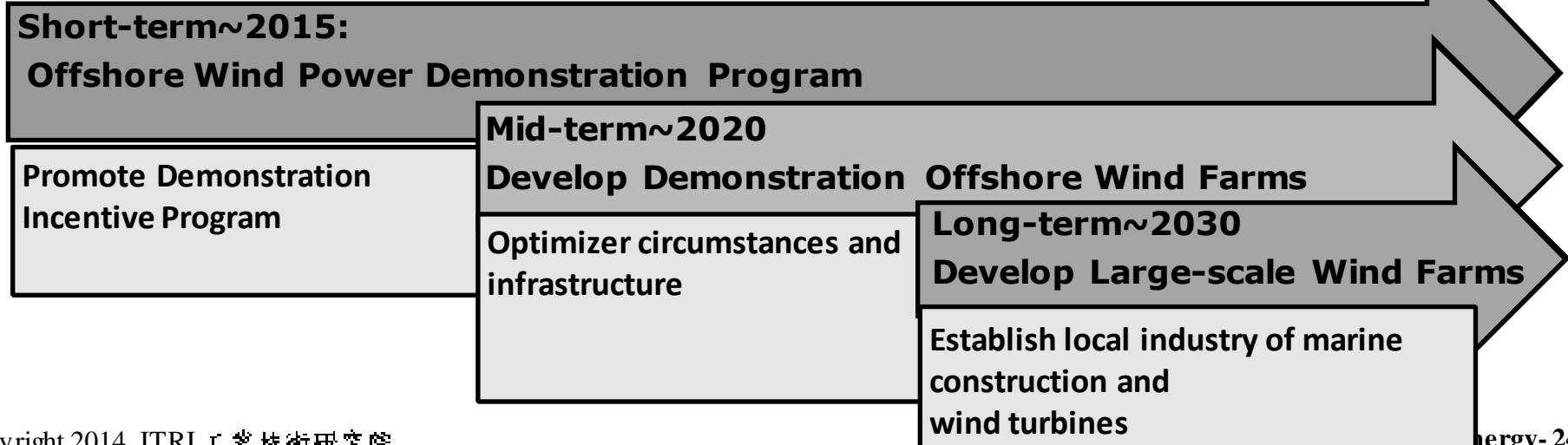
B. Offshore : 3,000 MW installed by 2030



Year	2012	2015	2020	2025	2030
Onshore(MW)	614.2	814	1,200	1,200	1,200 (450 turbines)
Offshore(MW)	0	15	320	1,520	3,000 (600 turbines)
Cumulative Installed Capacity (MW)	614.2 (311turbines)	829 23	1,800	3,000	4,200 (1,050 turbines)

# Thousand Wind Turbines Project (2/2)

- **Strategy — Develop on- shore prior to off-shore wind farms**
  - ◆ **On-shore: develop areas with higher power generating potentials prior to 2015, then develop areas with less potential thereafter.**
    - Develop areas with higher power generating potentials prior to 2015 (estimated 800 MW)
    - Develop areas with less potential thereafter (400 MW), with total installed capacity reaching 1.2 GW by 2020
  - ◆ **Off-shore: develop among the shallow areas prior 2020 then develop in deep water offshore areas.**
    - Establish the first off-shore wind farm by 2015, and reach 320 MW installed capacity on shallow off-shore areas (approximately 100 turbines) by 2020.
    - Develop large wind-farms in areas possessing economic scalability between 2021-2030 (reaching 2,680 MW, which is approximately 500 wind turbines in 10 years)





# Offshore Wind Power Demonstration Program

## ○ Demonstration Wind Farms

- ◆ In the ocean of 5 m isobaths or deeper, with total capacity above 100 MW but not exceeding 200 MW.

## ○ Demonstration Devices

- ◆ 2 offshore wind power systems of single capacity above 3 MW

### Awarded Demonstration Projects

#### ■ Fuhai @Changhua

- Capacity: 108 MW (30 turbines)
- Distance from Shore: 11 km
- Water Depth: 25-40 m

#### ■ Formosa @Miaoli

- Capacity: 108 MW (30 turbines)
- Distance from Shore: 1-5 km
- Water Depth: 5-30 m

#### ■ TPC @Changhua

- Capacity: approx.. 108 MW (22-36 turbines)
- Distance from Shore: 6-8 km
- Water Depth: 15-25 m



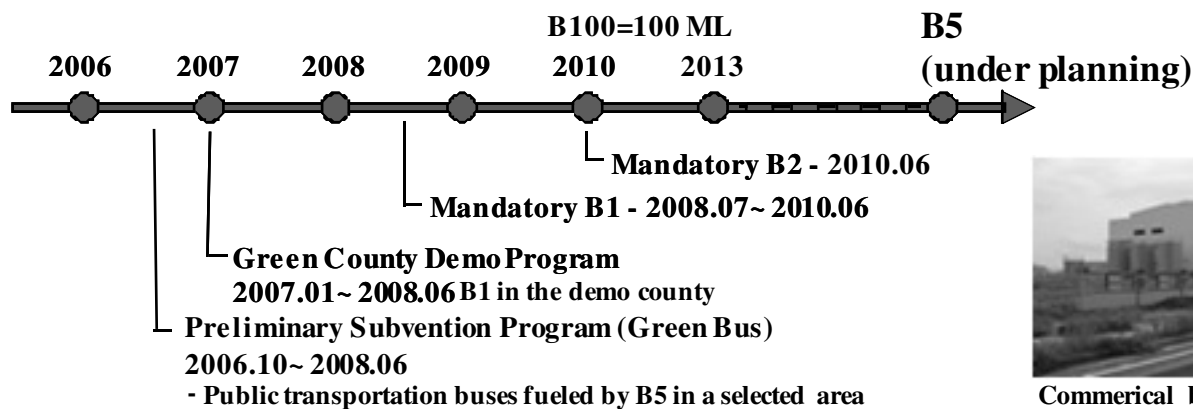
# Bio-Energy (1/2)

## □ Bio-power

- Current status: total installed capacity of bio-power in 2013 is 740 MW fueled by MSW, biogas and RDF (Refuse Derived Fuel)
- Prospect: the goal in 2020 is 950 MW, focusing on the co-firing of bio-coal and pellet in coal-fired units

## □ Bio-diesel

- Mandatory B2 diesel starting from June 2010, which could reduce 0.26 million ton CO<sub>2</sub> emission annually.
- Spent cooking oil is the main feedstock for domestic production, and looking for oversea plantation and microalgae as future feedstocks.
- Higher blend ratio in the future depends on the supply of feedstock.



Commerical bio-diesel plant  
(10,000 kL/yr in Changhua , 2007)

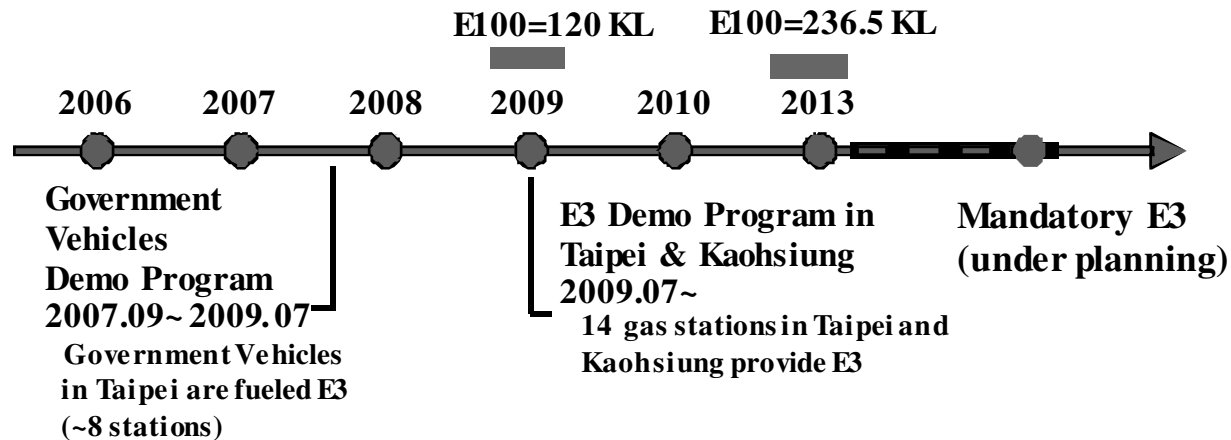


Microalgae Cultivation

# Bio-Energy (2/2)

## □ Bio-alcohol

- Promote E3 gasoline in Taipei and Kaohsiung cities since July 2009. There are 14 gas stations in Taipei and Kaohsiung supply E3 with an incentive price 2NT\$/L cheaper than gasoline.
- Compatibility of old model vehicles and scooters is the major concern for mandatory nationwide E3 gasoline
- No fuel ethanol plant in Chinese Taipei now. Cellulosic alcohol (ethanol & butanol) technologies are under development via enzyme/chemical hydrolysis of lignocellulose.



Typical gas station



Enzyme / Chemical Cellulosic Hydrolysis