

DER Status and Way Forward in Korea

September 2008

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DER Overview in Korea

CHP for district heating and industrial cogeneration

- ▶ (2006, 4.0GW) district heating 1.3GW, industrial cogen 2.2GW, small cogen 0.5GW
 - 4.9% of total gen capacity(70.4GW) and 4.3% of total generation(404.7TWh)
- ▶ Recently CHP has deployed in the forms of local community energy systems (21 sites under construction).

Renewables

- ▶ (2006) 5.3 million toe(2.2% of TPES), 3.9TWh(1.0% of total electricity generation)
- ▶ Long-term targets of renewables is set up to 5.6% of Total Primary Energy Supply in 2012 and to 11.0% of TPES in 2030 by the National Energy Fundamental Plan.

DSM/DR

- ▶ DSM goals of electricity, together with load management and energy efficiency, are reduce about 14% of peak demand on the basis of BAU scenario in 2020. (energy efficiency takes up 4% of peak demand reduction)
 - Reserve margin targets of power systems: 10% in long-term perspectives and 6% reserves(near 4GW levels) in normal operations

CHP Diffusion Programs

DHC & CES

- ❑ Provide financial assistance within **80% of their necessary funds** (90 % to small and medium sized companies (public and non-profit organization))
- ❑ The loan interest rates are 3.50% to 4.75% which are about half of the current market (10% of Tax incentives are provided to the companies)

Small CHP

- ❑ **Is being distributed by ESCO and financial support is given at the fixed interest rate of 1.5%. (ESCO are retrieving as much as energy they saved in return for their investment)**
- ❑ **Rebate for Small Scale CHP(< 10MW)**
 - Installation rebates (30,000 won/kW)
 - Designing subsidy (5,000won/kW)

CES(Community Electricity System)

- **Supplies produced electricity directly to end- users in the specific district not through the electricity market (Electricity Business Act)**
- **Supplies electricity and heating (heating, cooling and speed heating) by building combined heat & power generation facilities around the high demand areas, and also sell power generation, distribution, and electricity.**

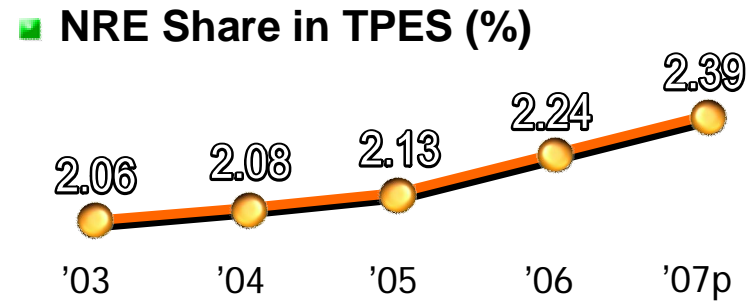
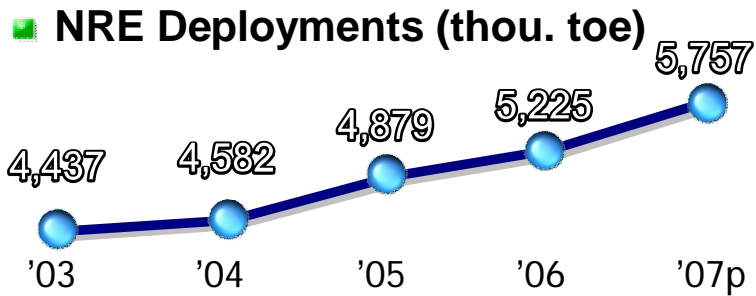
○ **Business Classification (Electricity Business Act)**

Business		Minimum	Maximum
New & Renewable Energy		more than 60% of electricity demand in the specific supply area	Less than 35,000kW
MES	District Heating & Cooling		Less than 150,000kW
	Industrial complexes		250,000kW

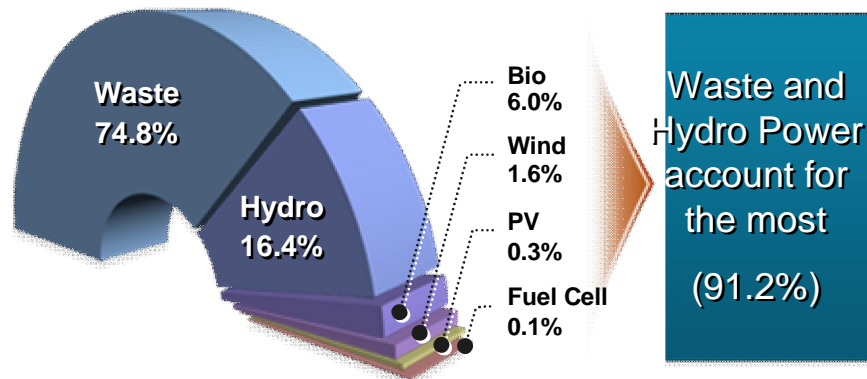
New & Renewable Energy Status

Defined NRE Resources

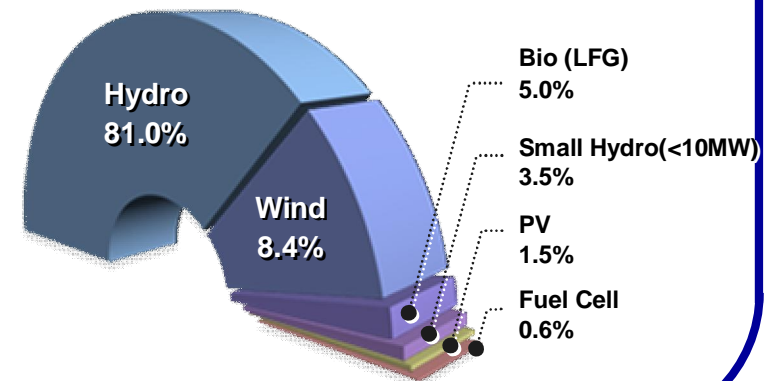
11 Categories : Photovoltaic, Solar Thermal, Wind, Hydrogen, Fuel Cell, Waste, Bio(LFG, Bio-diesel), Hydro, Geothermal, Marine, Coal Liquefaction or Gasification



< Supplied Energy from NRE ('07p) >



< Power Generation from NRE ('07p) >



Deployment Policies

Subsidy Program

- Create initial markets for new technologies and systems
- Establish and activate the deployment infrastructure of commercialized technologies and equipment.
 - Exhibition Program : Build basis for new technology deployment, up to 80%
 - General Program : Aim at market expansion of commercialized technologies, up to 60%(PV, Wind), up to 50%(Solar thermal, Geothermal), up to 30%(Waste)

<Status of Subsidy Program>

[Unit: billion Won, 1000Won=1US\$]

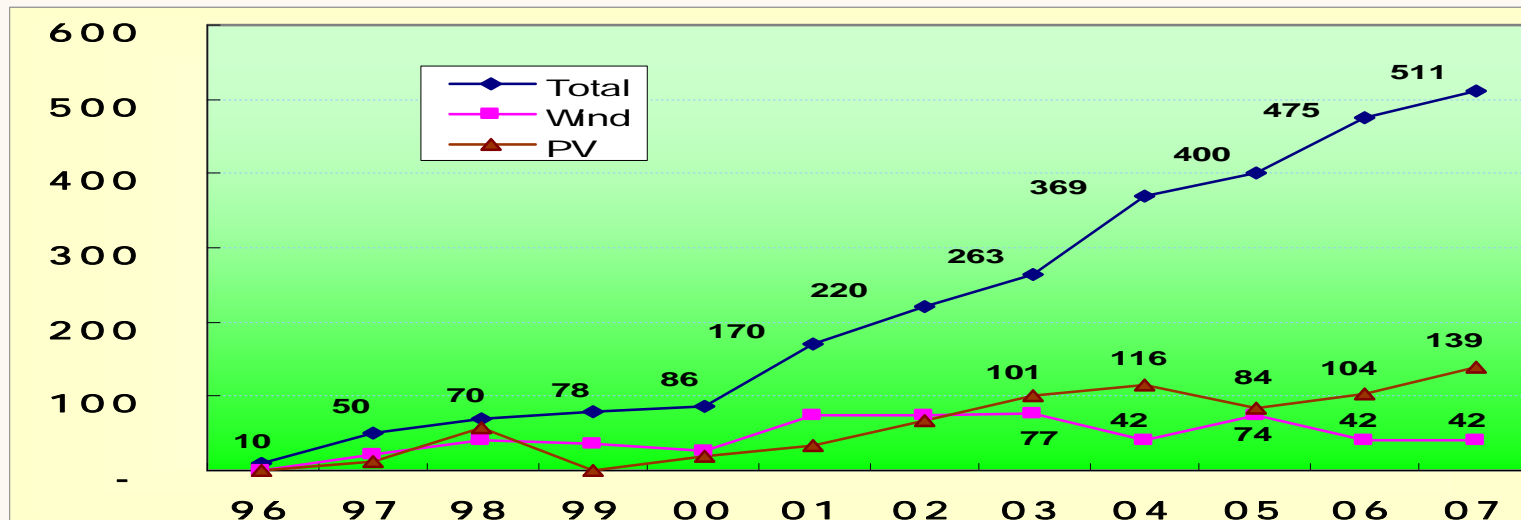
Year	~'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	Total
Bud.	5.8	0.7	0.74	1.2	2.1	4.7	23.3	28.0	41.0	41.0	148.5

Regional Deployment Program

- Support various projects carried out by local governments to improve the energy supply & demand condition
 - Subsidy for building the infrastructure : up to 100%
 - Subsidy for installing NRE systems : up to 70%

<Status of Regional Deployment Program>

(Unit: 0.1 Bil.Won, 1000Won=1US\$)



KOREA ENERGY MANAGEMENT CORPORATION

100,000 Solar Roof Program

● Deploy 100,000 PV systems in residential houses by 2012 to foster PV facility enterprises and create PV market

- Induce the decrease of installation cost to 11.2% annually
- Subsidy for solar roof program : 60%

<Status of 100,000 Solar Roof Program>

Year	No. of Solar Roof Houses	Total Capa.(kW)
2004	310 private homes	771
2005	907 private homes	2,356
2006	5,964 private homes and public-lease houses	7,337
2007	7,317 private homes and public-lease houses	9,246
Total	14,498 private homes and public-lease houses	19,710

Feed-In-Tariff

- To compensate for the difference between NRE power generation cost and fossil fuel power generation cost to promote production and use of NRE.
- From 2002, the standard price has been applied to the power produced by the certain NRE source

< Fixed Standard Prices of individual resource (won / KWh) >

Resource	Photo-voltaic	Wind	Hydro	Landfill gas	Waste	Tide power
Fixed Price	677.38 (30kW ↑) 711.25 (30kW ↓)	107.29	72.80~ 86.04	68.07 (20MW ↑) 74.99 (20MW ↓)	SMP+5	62.81~ 90.50

SMP : '07 average(83.8Won/kWh)

- The standard price is guaranteed for 15 years
- Capacity limit of the FIT is (100MW ⇒ 500MW) for PV, 1,000MW for Wind, 50MW for fuel cell

Public Institution's Renewable Obligation

The new buildings of public institutions having the floor area of which exceeds 3,000 square meters are obliged to use more than 5 % of their total construction expenses to install renewable energy resource systems.

<Status of Public Institution's Renewable Obligation >

(Unit: Bil. Won, 1000 Won=1US\$)

Year	The No. of Installation Plan	Construction expenses (A)	Investment for NRE systems				Investment ratio of NRE systems(B/A)
			Solar Thermal	Photovoltaic	Geothermal	Total(B)	
2004	30	213	1.4	4.9	10.3	16.6	7.8 %
2005	113	868	2.7	14.8	34.5	52	5.9 %
2006	129	1,285	2.3	26.5	39.0	67.8	5.3 %
2007	142	1,012	1.5	29.8	21.4	52.8	5.2%
Total	414	3,378	7.9	76.1	105.2	189.2	5.6 %

Renewable Portfolio Agreement

- **Agreement of Investment to NRE between the Government and Public Energy Companies**

- ✓ KEPCO and 6 Power Companies

- ✓ Korea District Heating Corporation, Korea Water Resources Corporation plan to invest \$1,260 M to NRE from 2006 to 2008

- ✓ \$ 430 M was invested in 2007 and \$ 706.8 M is expected invested in 2008

<Expected Investment to Power Generation Facility>

	PV	Wind	Hydro	Fuel Cell	Others
Capa.(kW)	30,377	184,550	29,630	3,500	100,000

Loan & Tax Incentives for Renewables

- The government provides **long-term, low-interest loans** for the consumers or manufacturers of NRE systems which have been completely commercialized.
 - Loans are provided for **up to 90 %** of the total cost (**up to 80 % for large corporations, up to 50% for public institution**)
- **10 percent** of total investment in installation of NRE systems can be deducted from the income tax or corporate income tax.

Renewable Energy Service Company

- Registration system for the specialized company in NRE
 - Prior qualification for government deployment program
 - Solar energy (PV, thermal) occupies 60%

< Status of RESCO (by the end of 07) >

Solar	Bio	Wind	Hydro	Marine	Coal-gas
1452	71	258	42	24	25
Fuel cell	Waste	Geo	Hydrogen	Others	Total
41	53	399	29	11	2,405

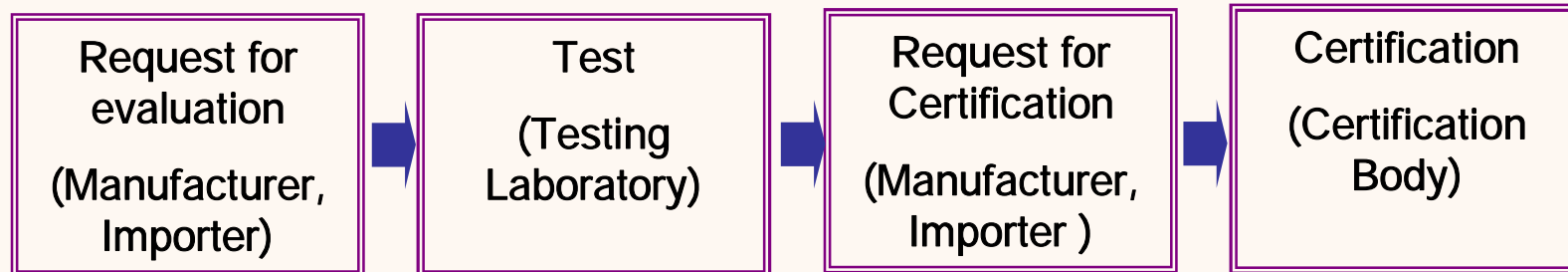
** As a company can register itself at the several areas, Net No. of RESCO is 1631*

Certification

● To Increase the reliability of NRE facilities for consumers and guarantee the quality of the products

➤ **21 items : Solar panel, PV inverter, small wind system etc**

<Certification Process>



■ CB: New & Renewable Energy Center(KEMCO)

- Inspection for certification
- Issuing certificate
- Post management for certified facilities

Policies, driving forces for DG, RES, DSM/DR

DG (CHP)

- ▶ Policy drives are vague except the Community Energy Business Act

Renewables

- ▶ The 2nd Renewable Energy Development and Dissemination Plan (2003~2012)

DSM/DR

- ▶ The 3rd basic plan for Electric Power Supply and Demand (2006~2020)

Energy Efficiency

- ▶ The 3rd basic plan for Rational Energy Utilization (2004~2008)

Energy storage

- ▶ Not commercially focused except pumped hydro
- ▶ Battery storage widely used for UPS, smart grid is introductory R&D stage

Checksum on Market Potentials

CHP

- ▶ Some researches on the potential estimations of CHP, but until now there was no publicly informed or agreed opinions on the diffusion goals on DG resources.

Renewables

- ▶ NRE Center affiliated in KEMCO estimated the economic potentials for adopting renewables as from 3.1% to 5.0% of TPES in 2012.
- ▶ But, the governmental target was eagerly set to 5.6% in 2012.

DR

- ▶ Market potential has not been studied yet.

Energy efficiency market potentials, from 7% to 15% of TPES per annum

- ▶ Domestic market potential of energy efficiency has been studied by KEMCO through the industrial energy audits and the ESCO programs.
- ▶ But specific energy efficiency potentials by energy sources such as, electricity, natural gas, petroleum, etc. are not comprehensively assessed until now
- ▶ Despite the energy efficiency goals of national concerns are set up, the targets of efficiency by individual energy resources are not specifically linked to the national levels.

Market Access of DER

❏ Mandatory market pools for electricity transactions

- ▶ Generators above 200kW which want sales should register to KPX
- ▶ Only KEPCO purchases all the electricity from the pool
- ▶ DG/renewables is treated as the one of market participation entities.

❏ Compensate the market participated renewables with feed-in tariffs

- ▶ The government compensates eligible renewable generators for any shortfall between the pool price and feed-in tariffs.
 - Renewable standard prices(KRW/kWh, 2007): PV(700), Fuel Cell(283), Wind(107), Small Hydro(95)

(As of 2006)	CHP		Renewables*	
	MW	GWh	MW	GWh
Current Resources	3,455	17,244	550**	616
Market Access	892	2,597	428	511
(Ratio)	26%	15%	78%	83%

Source: KEMCO, KPX (* Hydro power is excluded, ** provisional data)

Grid Concerns focused on CHP

❏ Interconnection of DER (including renewables)

Capacity	100kW	above 100kW	above 3MW
Interconnection	220V, 380V (DL)	22.9kV (DL)	154kV (Substation)

❏ Cogeneration Efficiency: 57%~92%

- ▶ Typical Industrial Cogen Efficiency: Textiles(74.7%), Petrochemical(57.7%), Paper&Pulp(83.4%), Non-Metal(59.0%)

❏ No electricity market incentives for CHP

- ▶ But, installation subsidy (35 USD/kW) and wholesale gas price reduction (below 5% in summer) can be supported from KOGAS

* CHP facilities can be eligible for the government low interest loans.

DER Business Model in Korea

CHP

- ▶ Community Energy System (permission of zonal electricity business)

Renewables

- ▶ Feed-in-Tariffs, Renewable ESCO, RPA for the energy suppliers
- ▶ RPS is planned

Energy Efficiency

- ▶ ESCO, DSM investment of energy suppliers
- ▶ EERS (or White Certificates) is planned

DER Expansion Plan

Focus on the Nuclear, CHP and renewables

▶ Renewables are gradually increasing but not satisfactory

■ Renewable Generation(GWh): 350('04) → 404('05) → 511('06) → 830('07)

< Registered Generation Capacity to the Korean Electricity Markets (unit: GW, as of 2008) >

	Hydro*	Coal	Oil	LNG	Nuclear	CHP	Renewables	Sum
Capacity	5.5	20.5	5.4	17.9	17.7	0.9	0.4	68.3
Share(%)	8.0	30.0	7.9	26.3	25.9	1.3	0.5	100

* Hydro(5,492MW): Large(1,528MW), Small(64.0MW), Pumped Storage(3,900MW)

< 2020 Generation Capacity Outlook (unit: GW) >

	Hydro	Coal	Oil	LNG	Nuclear	CHP	Renewables	Sum
Capacity	6.3	26.4	2.3	26.2	27.3	3.8	2.0	94.3
Share(%)	6.7	28.0	2.5	27.7	29.0	4.0	2.1	100

* Source: the 3rd basic plan for Electric Power Supply and Demand (2006~2020)

Need of DER Integration

Why integrate the resources?

- ▶ (Objectives) Obtain better information, Promote better efficiency
- ▶ For the diverse DERs of lower carbon or carbon free energy supply
 - CHP, renewables, energy efficiency ... Most of them are small sized & widespread

How can we integrate?

- ▶ (Directions) Proper signals on the energy price and quality
 - Providing desirable competition between various DERs
- ▶ Information exchange between DERs on the status of supply and demand
- ▶ Mutual energy transfer or delivery if necessary
- ▶ Smart grid implementation can be used as a groundwork

감사합니다

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