

New and Renewable Energy in Korea

- Best Practices in Policy and Deployment -

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****NRE: New and Renewable Energy***

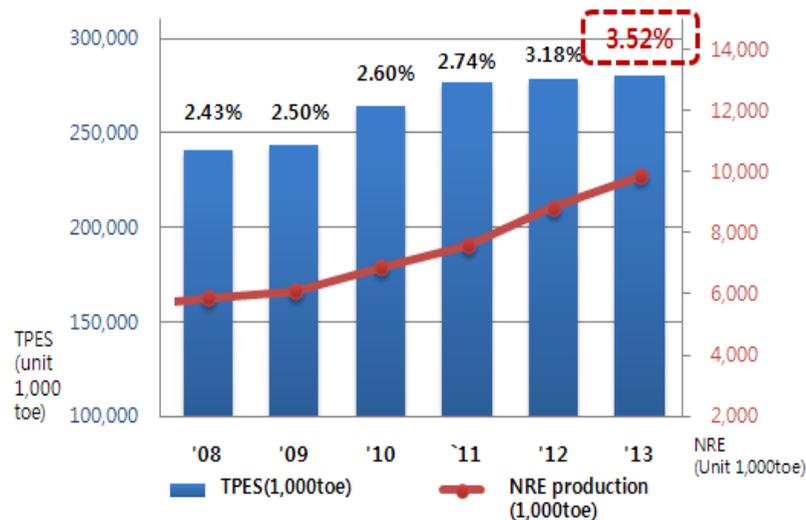


The Status of New & Renewable Energy in Korea

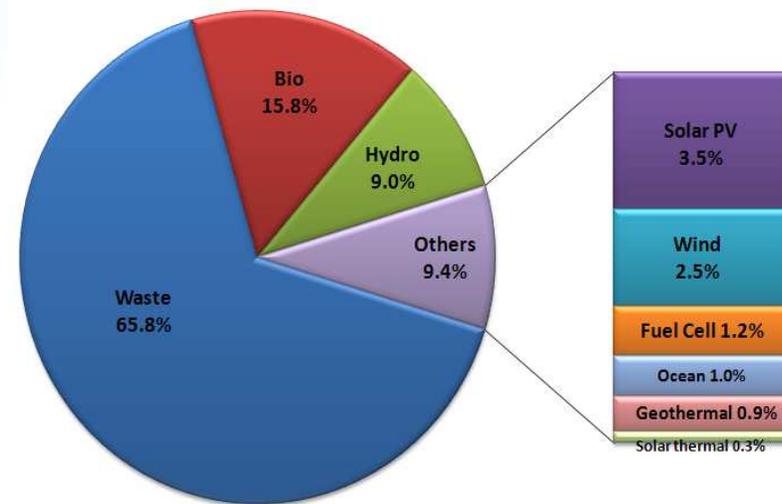
1. The Status of New and Renewable Energy

- ▶ NRE Share in TPES: 3.52% (2013)
 - TPES(280,290 Thousand TOE) vs. NRE Supply(9,879 Thousand TOE)
- ▶ **NRE** supply has been increased by **annual average of 11.0%** (2008-2013) (while annual average of TPES growth is 3.1%)

NRE Share in TPES



NRE Supply by Sources



RE : 8 Sources

- PV, Solar Thermal, Wind, Waste, Bio(LFG, Bio-Fuels), Hydro, Geothermal, Marine

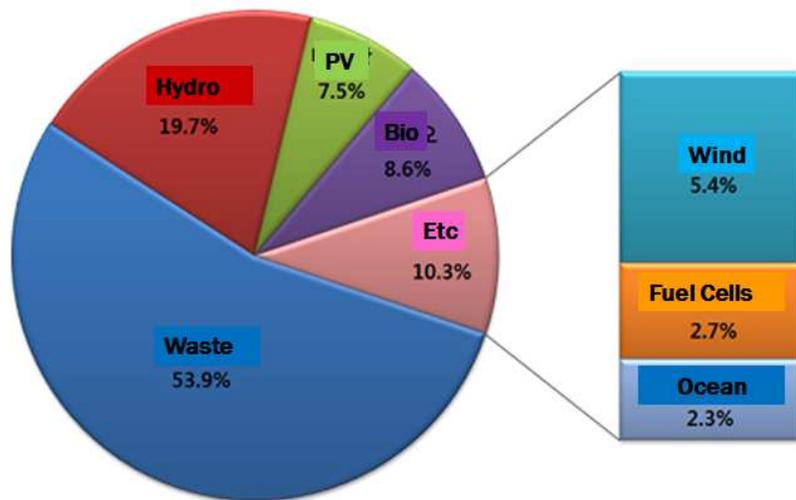
New Energy : 3 Sources

- Fuel-cell, Hydrogen, Coal Liquefaction or Gasification

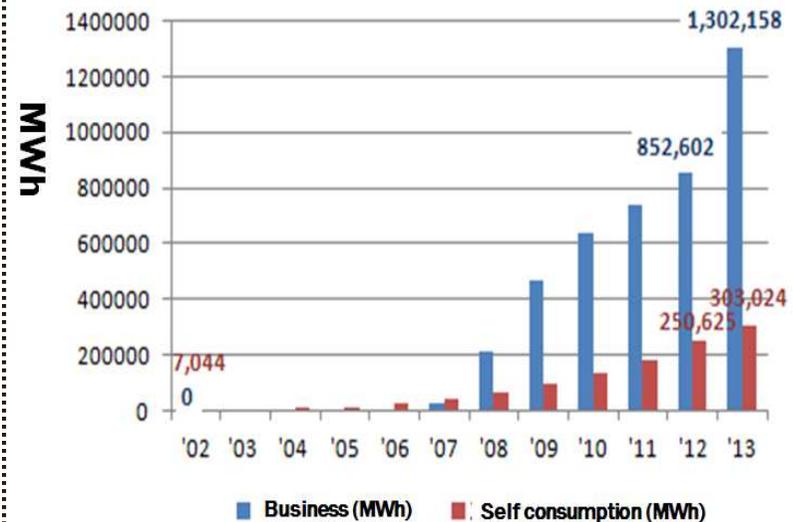
2. The Status of PV Power Generation

- ▶ PV Power Generation takes 7.5%(1,605 GWh) of total NRE Power Generation (21,438GWh) in 2013
- ▶FIT, RPS have contributed remarkable increasing of PV Power Generation

NRE Power Generation

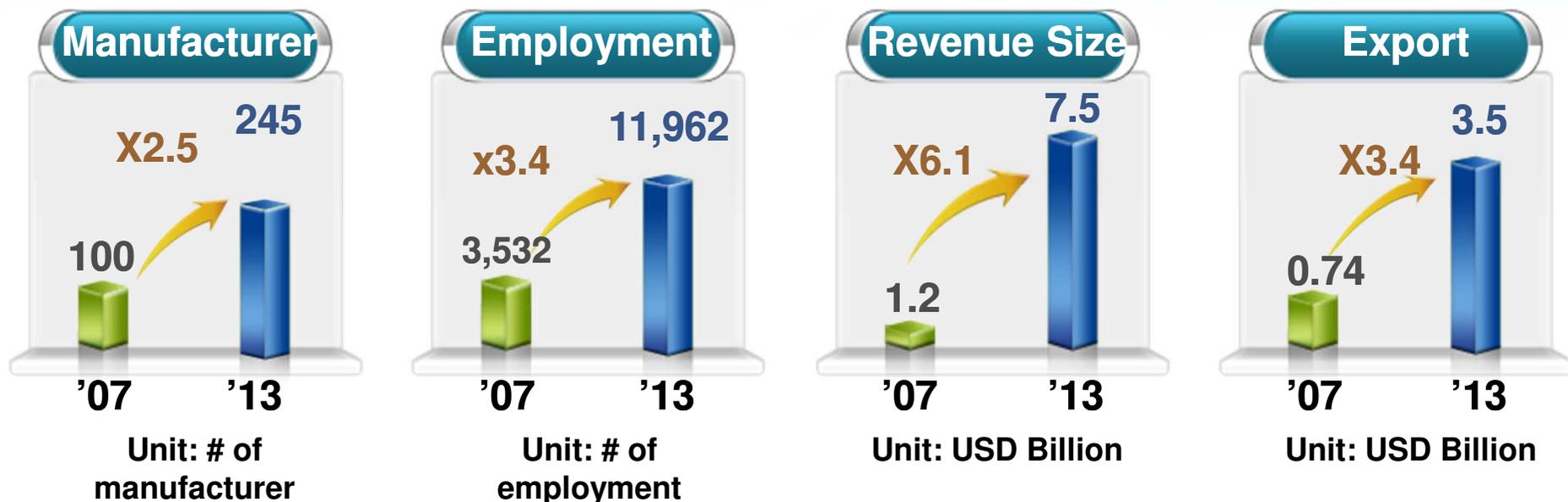


PV Power Generation



3. The Status of NRE Industry

- ▶ Rapid growth of NRE Industry
 - Compared to 2007, the number of manufacturers was **more than doubled** in 2013
 ☞ 100('07) → 245('13) *Unit: # of manufacturer
 - The revenue size was **increased by 7 times** (2007→2013)
 ☞ Recovering from the global economic crisis, growth of the industry achieved **6.4 billion dollars of revenue** in 2012



* Manufacturers based on 6 Sources(PV, Wind, Bio, Fuel Cell, Solar Thermal, Geothermal)

4. Achievements(PV)



With its complete value-chain, Korea is one of the most competitive players in global PV market

	Polysilicon	Ingot/Wafer	Cell	Module	Component /Material	Equipment	Total
Large Enterprises	3	4	7	11	9	5	39
SMEs	1	2	1	13	22	9	48
Total	4	6	8	24	31	14	87

II

The 4th Renewable Energy Scheme / Implementation Plan

5. Target

Primary Energy

Target rate: **11.0%**(2035)

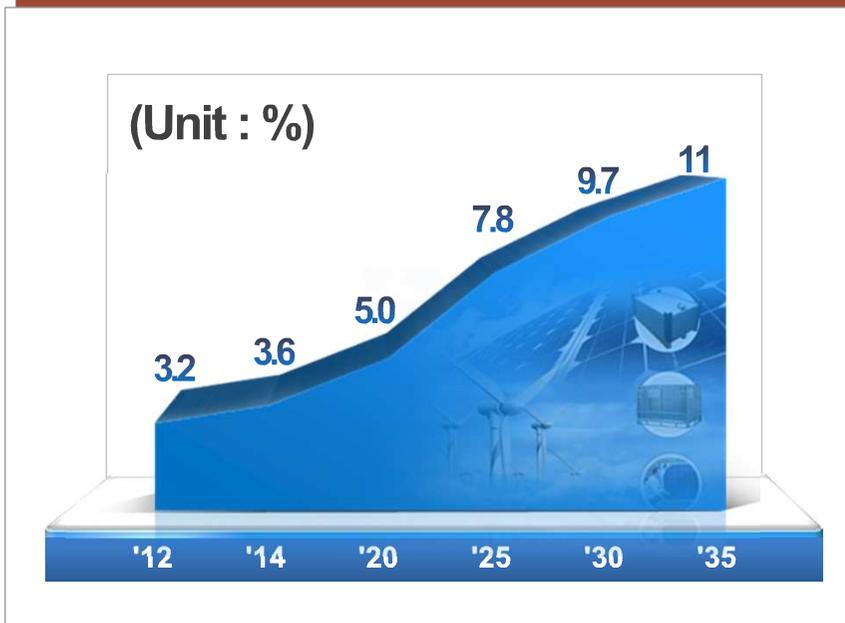
Annual NRE growth rate between 2014 and 2035: 6.3% ➤ Annual demand rate of primary energy: 0.7%

Electricity

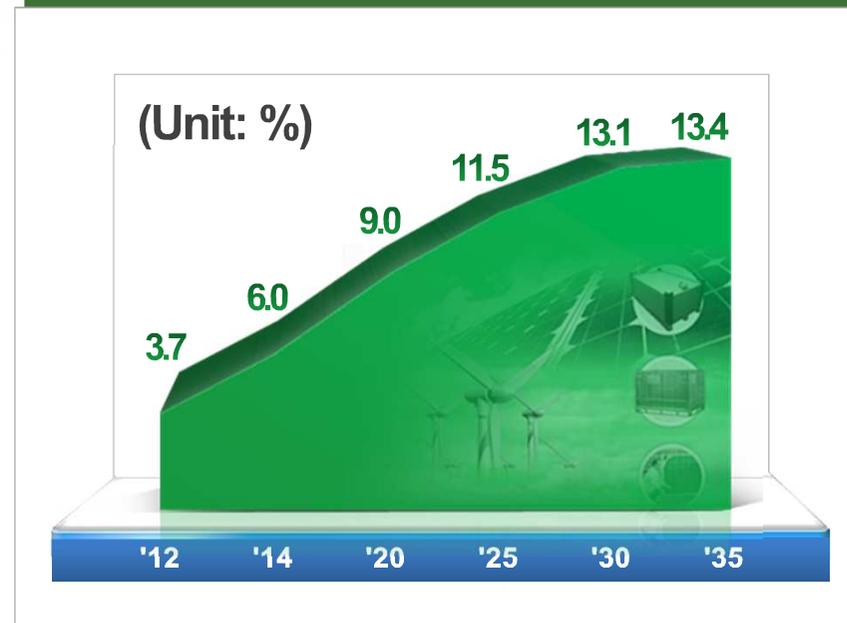
Target Rate: **13.4%**(2035)

Annual NRE growth rate between 2014 and 2035: 5.8% ➤ Annual demand rate of electricity: 1.8%

NRE share in total primary energy



NRE share in total generation capacity



Ref. Deployment Target by Resources

- While **ratio of waste has decreased largely**, the amount of shortfalls are expected to be replaced with Solar PV and Wind

* Ratio per energy resource(% , '12→'35) : Waste(68.4→29.2), Wind(2.2→18.2), Solar PV(2.7→14.1)

Target for NRE Production Share(%)

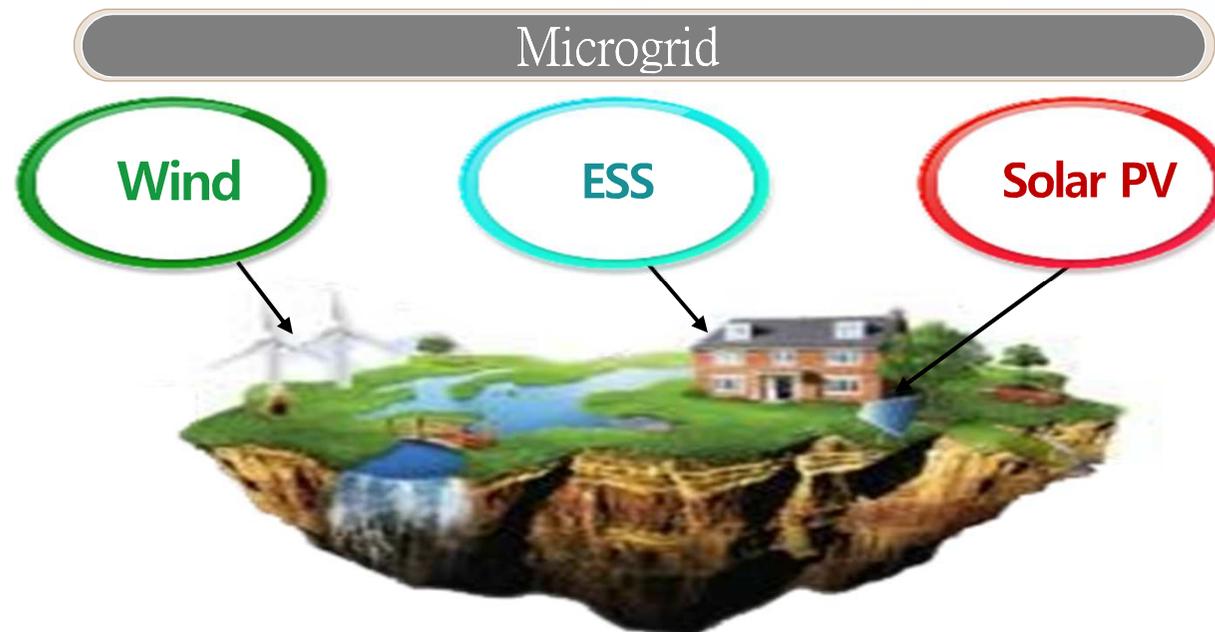
- Waste and Hydro will be decreased / PV, Wind, Geothermal, Solar thermal will be increased

NRE Sources	Waste	Hydro	Bio	PV	Wind	Geo-thermal	Solar-thermal	Marine	Total(%)
2020	47.3	6.3	17.6	11.1	11.3	2.5	1.4	2.4	100
2025	40.2	4.3	19.6	13.3	12.5	4.6	3.9	1.6	100
2035	29.2	2.9	17.9	14.1	18.2	8.5	7.9	1.3	100

6. Independent Energy Island

Independent Energy Island

- Build microgrid in small island areas instead of independent system which is relied on diesel generators with high-expenditure of fuel currently
- Pilot project of connection of wind, solar PV, geothermal, ESS etc. in Ulleung Island
 - * Supply costs of electricity are approx. 4 to 14-fold higher than land areas
 - * 30MWh of ESS installed, NRE ratio: 3.6% →68% (2017)



7. PV in RPS

Improvement in the conditions of RPS

- **Extend two years in achievement of supply target of 10% (2022→2024)**
- **Integration of Solar PV-Non Solar power markets (after 2016) and diverse selection**
- **Strengthen the flexibility for operators improving conditions of delayed performance**

* Available duration to be postponed was one year initially, but extended 3 years

Rationality of RPS weighted value

- **(Solar PV) Dynamic investment from respective installation models and sizes**
- **(Non-Solar PV) Adoption of transformative weighted values on Offshore Wind & Tidal etc., fostering relevant industries with introduction of weighted values (*Multipliers*) when installing ESS**



Best Practices –

PV Deployment & Infrastructure Programmes

8. Feed-in-Tariffs (FIT)

Overview

- Provide the difference in between The standard electricity price And System Marginal Price(SMP) for 15-20yrs.

*Government regulates the standard electricity price



Current Status

- FIT established early deployment foundation by deploying NRE facilities with the capacity of 1,030MW for 2,089 power plants for 10 years (2001-2011)
- FIT subsidy Details (Nov. 2013)

	2002 ~ 2007	2008	2009	2010	2011	Total
Generation (GWh)	2,474	1,183	1,504	2,447	2,521	10,129
Subsidy (million USD)	58.121	119.465	262.652	331.8	368.941	1,140.979

Best Practice

- SudoKwon LFG power plant (Capacity of 50MW, Incheon) (2001)
 - Produces electricity and contributes to reduce Green House Gas emission by utilizing landfill gas
 - Annual generation of 345GWh(in 2012) can supply 96,000 households (*electricity usage of 300kWh/month per household*)



9. Renewable Portfolio Standard(RPS)

Overview

- Enforces 17 power producers to supply certain amount of the total Power generation by NRE (Implemented in 2012)
 - ※ Obligators: power producers with capacity of 500MW or above



Goal and Current Status

- Goal : ('12) 2.0% → ('13) 2.5% → ('14) 3.0% → ('17) 5.0% → ('20) 8.0% → ('24~) **10.0%**
- Current Status : RPS achieved **3.1 times** of total FIT installed capacity (proceeded for 10 years) in 3 years

RPS('12~'14.12)	FIT('02~'11)	Rate of change
3,485MW (Solar PV 1,437MW)	1,042MW (Solar PV 497MW)	335%↑(Solar PV 289% ↑)

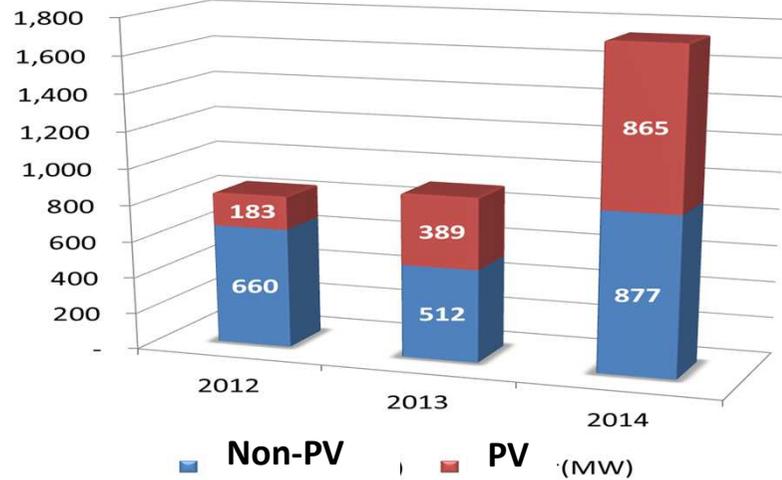
Best Practice

- Converting rooftop of the factory and parking lot into Solar PV Power Plant (Busan) (2013)
 - The largest Solar PV Plant for the single factory utilized existing facilities in the world (20MW, Renault Samsung Motors)
 - Generated electricity(26GWh/yr.) provides 7,300 households
 - * Ave. usage rate 15%, 1 household uses 300kWh/month

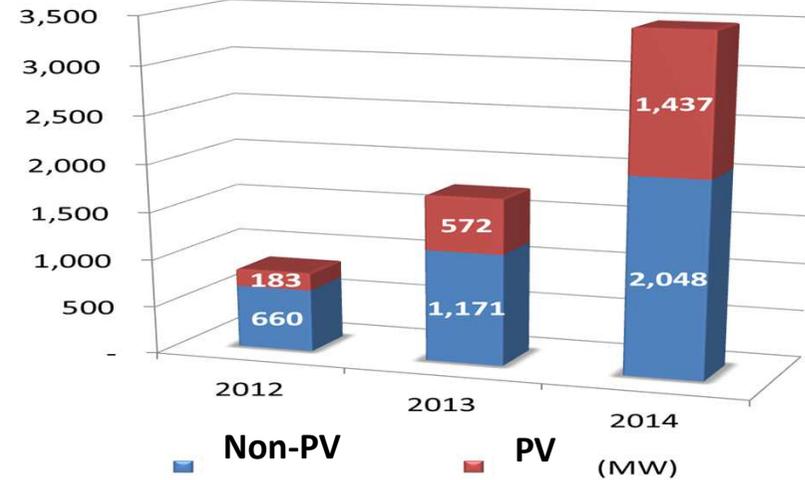


10. Renewable Portfolio Standard(RPS)

< RPS Facilities(New) >



< RPS Facilities(Accum.) >



		'12	'13		'14	
		Capacity (MW)	Capacity (MW)	Increased %	Capacity (MW)	Increased %
New	PV	183	389	212.6%	865	222.4%
	Non-PV	660	512	77.6%	877	171.3%
	Total	842	901	107.0%	1,742	193.3%
Accum.	PV	183	572	312.6%	1,437	251.2%
	Non-PV	660	1,171	177.4%	2,048	174.9%
	Total	842	1,743	207.0%	3,485	199.9%

* New Facilities only(Excl. Large Hydro)

11. RPS – REC & Multipliers

Evaluation Criterion

- ① Economic feasibility
- ② Environmental effect
- ③ Potential
- ④ Industrial promotion effect
- ⑤ Policy priority

Energy Source	Multiplier	Eligible Energy Sources	
		Installation Type	Detail
Solar PV	1.2	On Land	Less than 100kW
	1.0		More than 100kW
	0.7		Exceed 3,000kW
	1.5	On Building & Existing Facilities	Under 3,000kW
	1.0		Exceed 3,000kW
	1.5	Floating on the Water Surface	
Other REs	0.25	IGCC, Byproduct Gas	
	0.5	Waste, LFG	
	1.0	Hydro, Onshore Wind, Bioenergy, RDF Combustion (全焼) Power Generation, Waste Gasification Power Generation, Tidal(潮力) (with Embankment, 防潮堤)	
	1.5	Lignocellulosic Biomass Combustion (全焼) Power, Off shore wind(less than 5km connecting distance)	
	2.0	Fuel Cell, Current Power(潮流)	
	2.0	Offshore Wind(more than 5km connection distance), Geothermal, Tidal(潮力)(without Embankment, 防潮堤)	-
	1.0 ~ 2.5		-
	5.5	ESS(with Wind Facility)	2015
	5.0		2016
	4.5		2017

12. PV Rental Program

Overview

- Household owners pay electricity bill as under 80% of ave. Electricity bill, PV Rental companies earn rental fee and benefit from REP selling
- ※ REP: Renewable Energy Point(No Multipliers applied)

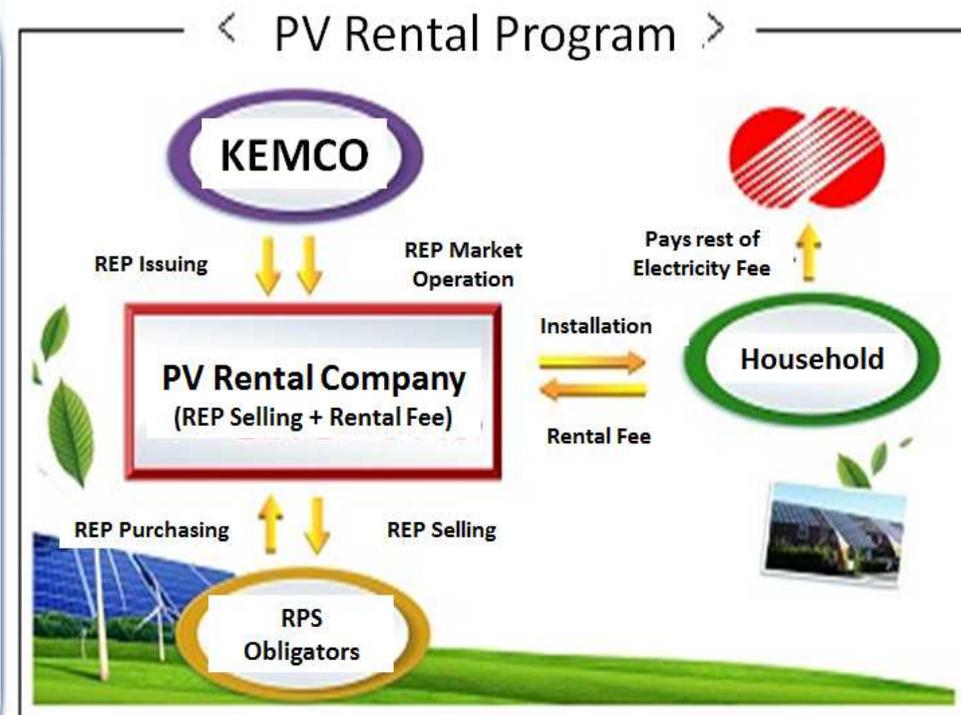


2015 PV Rental Program

- Up to 10.5MW, detached household + apartment household

2014 PV Rental Program

- Up to 6MW, 2,006 Households



Thank You

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