

Korea's Renewable Energy Policy

- An Update -

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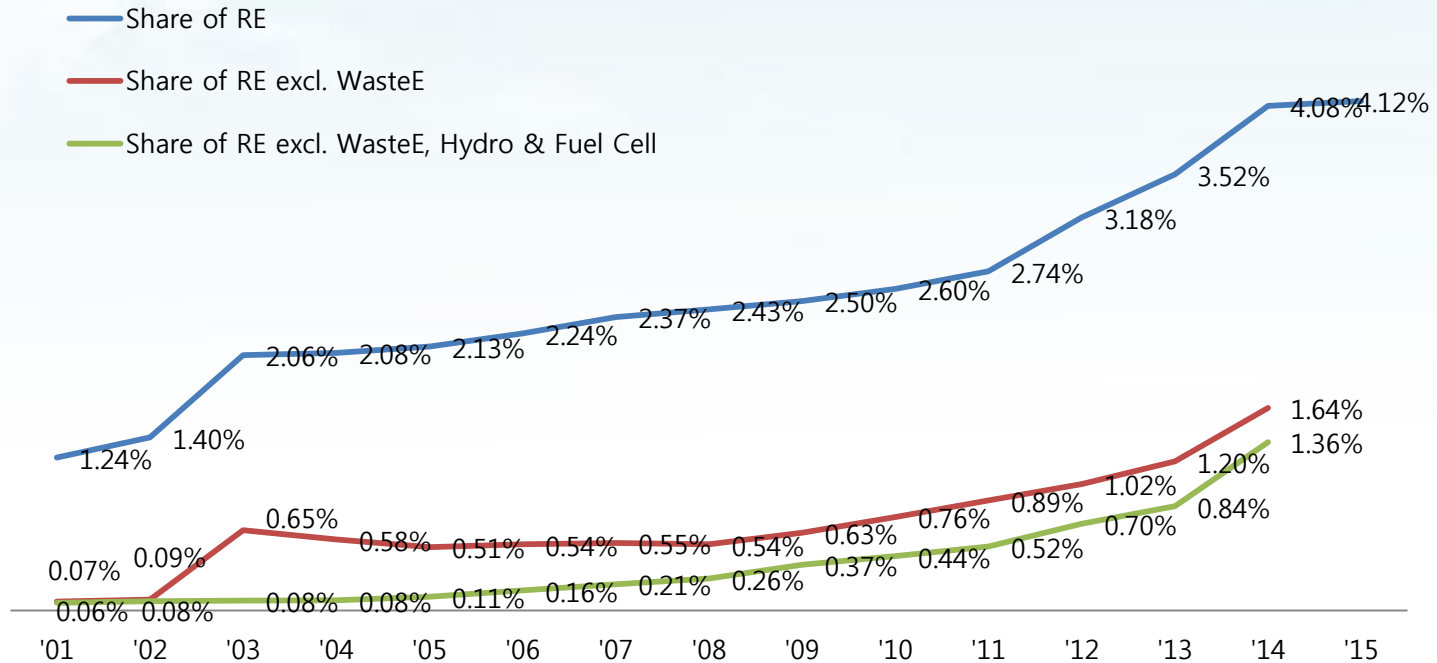
Korea Environment Institute

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Renewable Energy Use

Renewable Energy Supply (share in TPES)

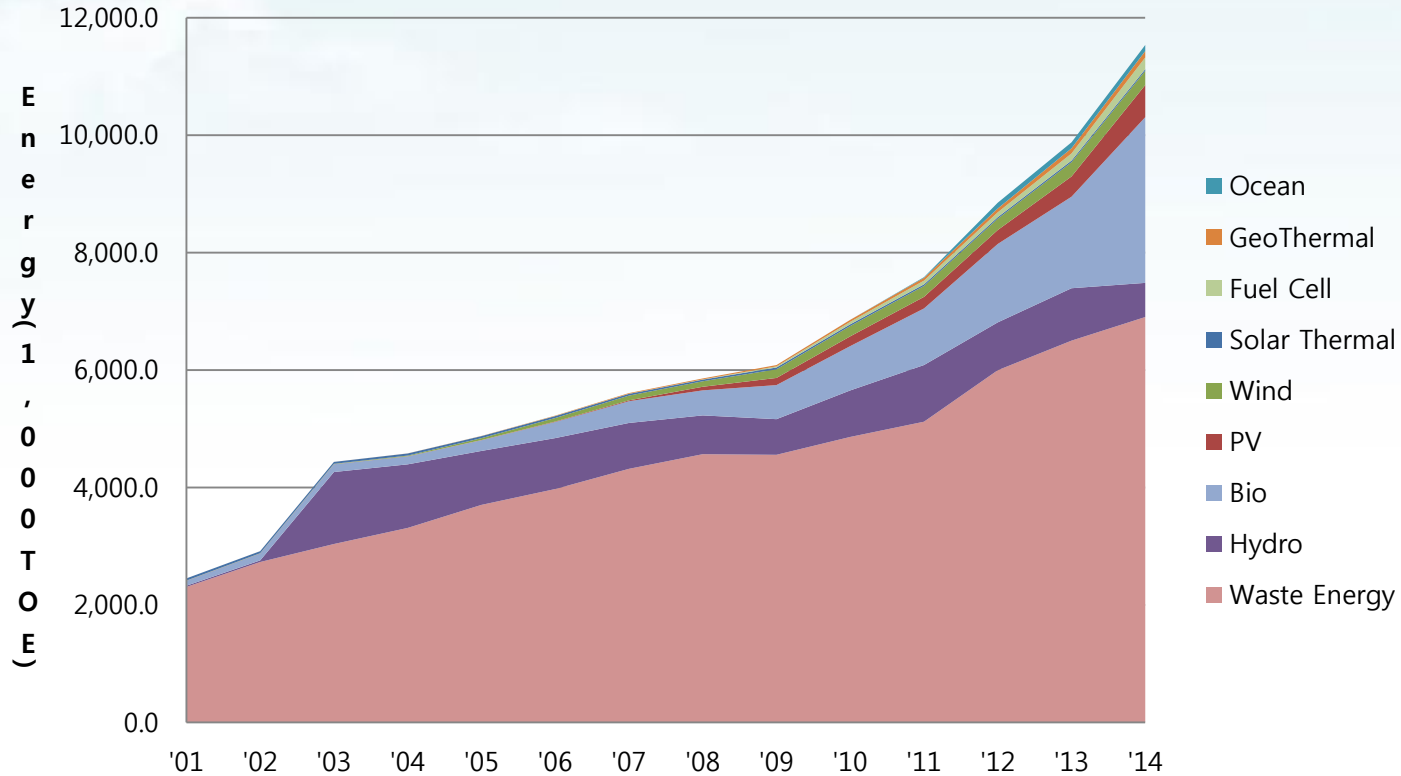


Source: MOTIE(2015), The Economic Consequences of Outdoor Air Pollution

- Definition of Korea's 'New & Renewable Energy' :
RE(IEA) + Waste Energy (mostly industrial waste gas) + Large Hydro + Fuel Cell

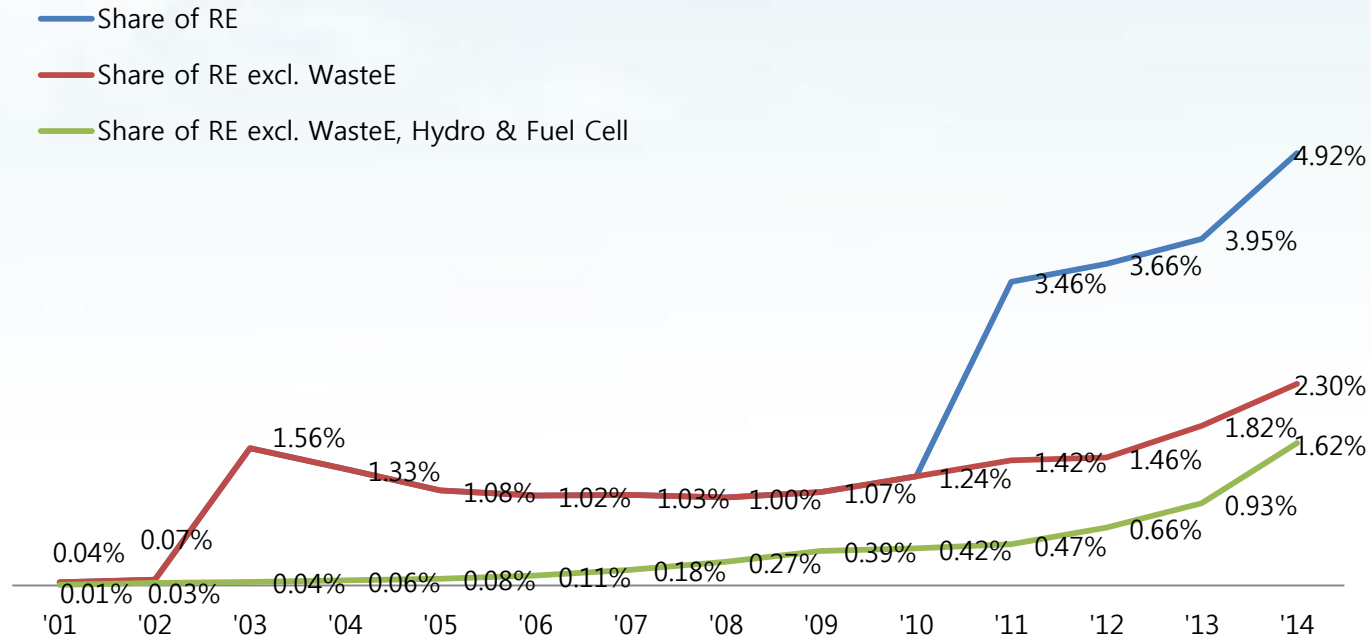
Renewable Energy Use

Renewable Energy Supply



Renewable Energy Use

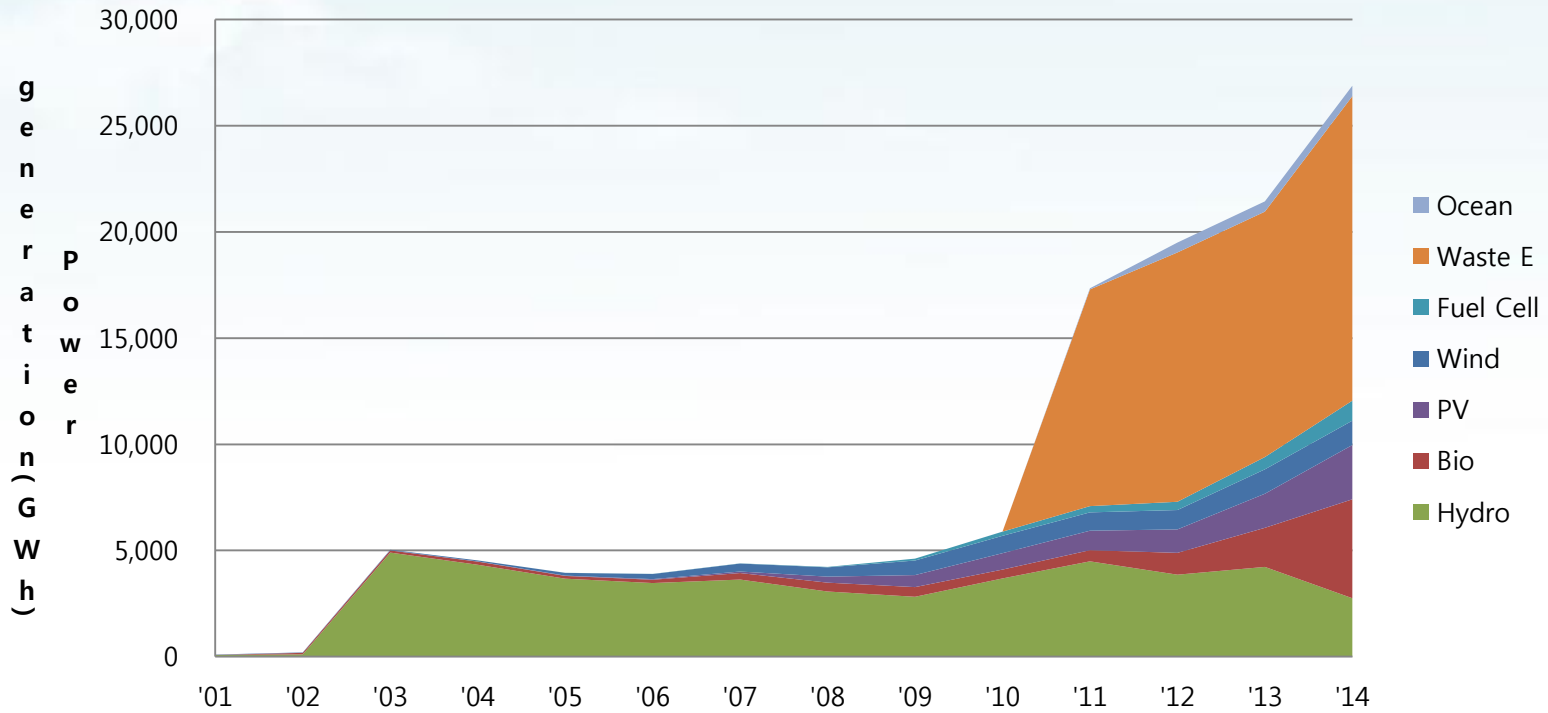
Renewable Electricity



* No data for electricity generation from waste energy before 2011

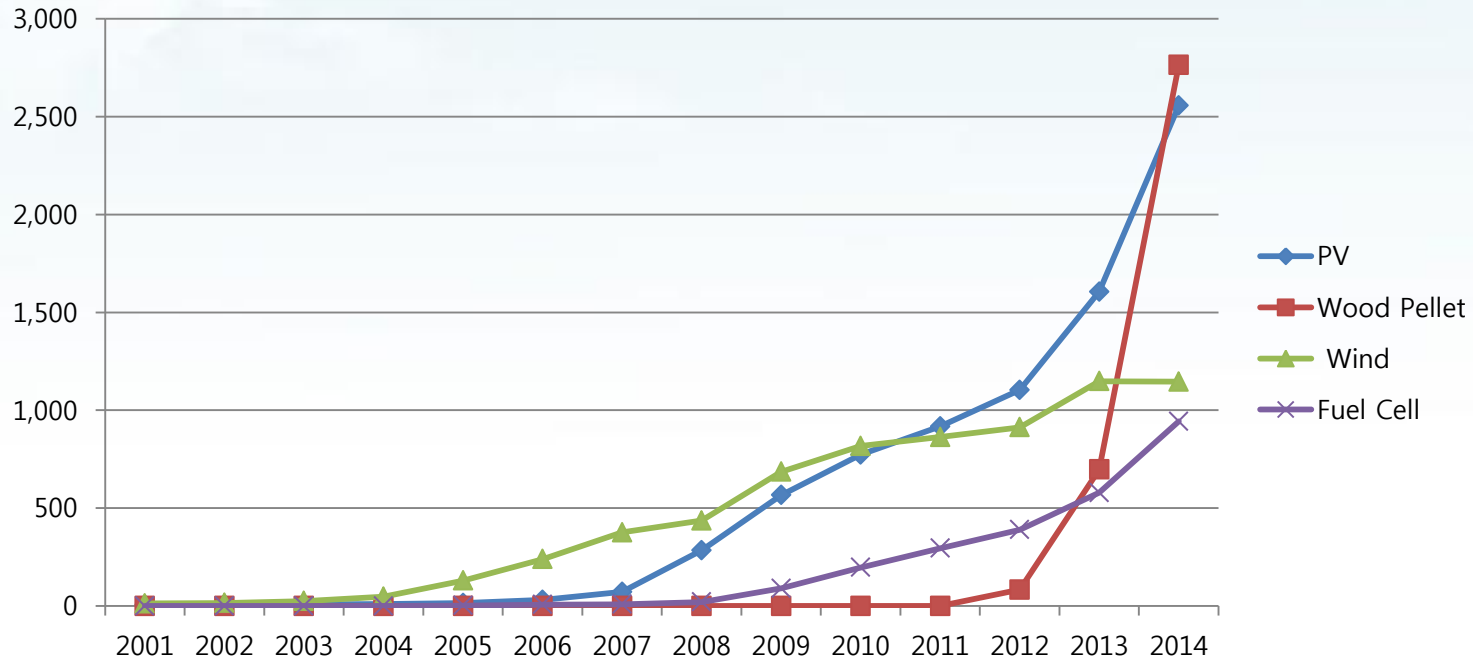
Renewable Energy Use

Renewable Electricity



Renewable Energy Use

🌿 Main Drivers of Recent Development



- PV : new installation of 1 GW per year in 2014-2016
- Wood Pellet (imported) : co-combustion in coal-fired plants

Renewable Energy Use

Capacity target of renewable electricity

Category	2015		2020		2025		2035		Annual increase
	Installed Capacity	Share(%)	Installed Capacity	Share(%)	Installed Capacity	Share(%)	Installed Capacity	Share(%)	
PV	2,221	24.6	6,184	34.6	11,010	43.4	17,504	44.6	10.9
Wind	732	8.1	3,588	20.1	5,884	23.2	12,785	32.6	15.4
Bio	173	1.9	193	1.1	193	0.8	193	0.5	0.5
Hydro	1,759	19.5	1,779	10.0	1,804	7.1	1,854	4.7	0.3
Ocean	260	2.9	835	4.7	835	3.3	1,025	2.6	7.1
Waste	2,788	30.9	2,938	16.4	2,968	11.7	2,968	7.6	0.3
Fuel cell	781	8.7	1,450	8.1	1,788	7.0	2,034	5.2	4.9
Coal IGCC	300	3.3	900	5.0	900	3.5	900	2.3	5.6
Total	9,013		17,867		25,381		39,261		

- The 4th New and Renewable Energy Plan (2014)

Policy Framework – RPS

RPS Target

- Mandatory for power producers with installed capacity over 500MW (18 firms in 2016)

RPS Target (%)

year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
target, 2012	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0		
target, 2015	2.0	2.5	3.0	3.0	3.5	4.0	4.5	5.0	6.0	7.0	8.0	9.0	10.0

PV Target

(No extra PV target from 2016)

		2012	2013	2014	2015	2016
Target (GWh)	2012	276	591	907	1,235	1,577
	2013	276	723	1,156	1,577	1,577
	2014	276	723	1,353	1,971	
Corresponding New capacity (MW)	2012	220	230	240	250	260
	2013	220	330	330	320	
	2014	220	330	450	450	

Policy Framework – RPS

REC Weight

	REC Weight	Energy sources & Types	
PV	1.2	On general land	
	1.0		~100kW
	0.7		100kW~3,000kW
	1.5	On existing buildings	3,000kW~
	1.0		~3,000kW
	1.5	Floating facilities on the water	3,000kW~
	1.0	Plants for own use	
Non PV	0.25	IGCC, Waste Gas	
	0.5	Waste, LFG	
	1.0	Hydro, onshore wind, bio-energy, RDF, Waste gasification, tidal (with existing embankment)	
	1.5	Wood biomass, offshore wind (grid connection less than 5 km), water heat	
	2.0	Fuel cell, Current	
	2.0	offshore wind (grid connection longer than 5 km), geothermal, tidal (with existing embankment)	Fixed weight
	1.0~2.5		Variable weight
	5.5	ESS (connected to wind power)	2015
	5.0		2016
	4.5		2017

Policy Framework – RPS

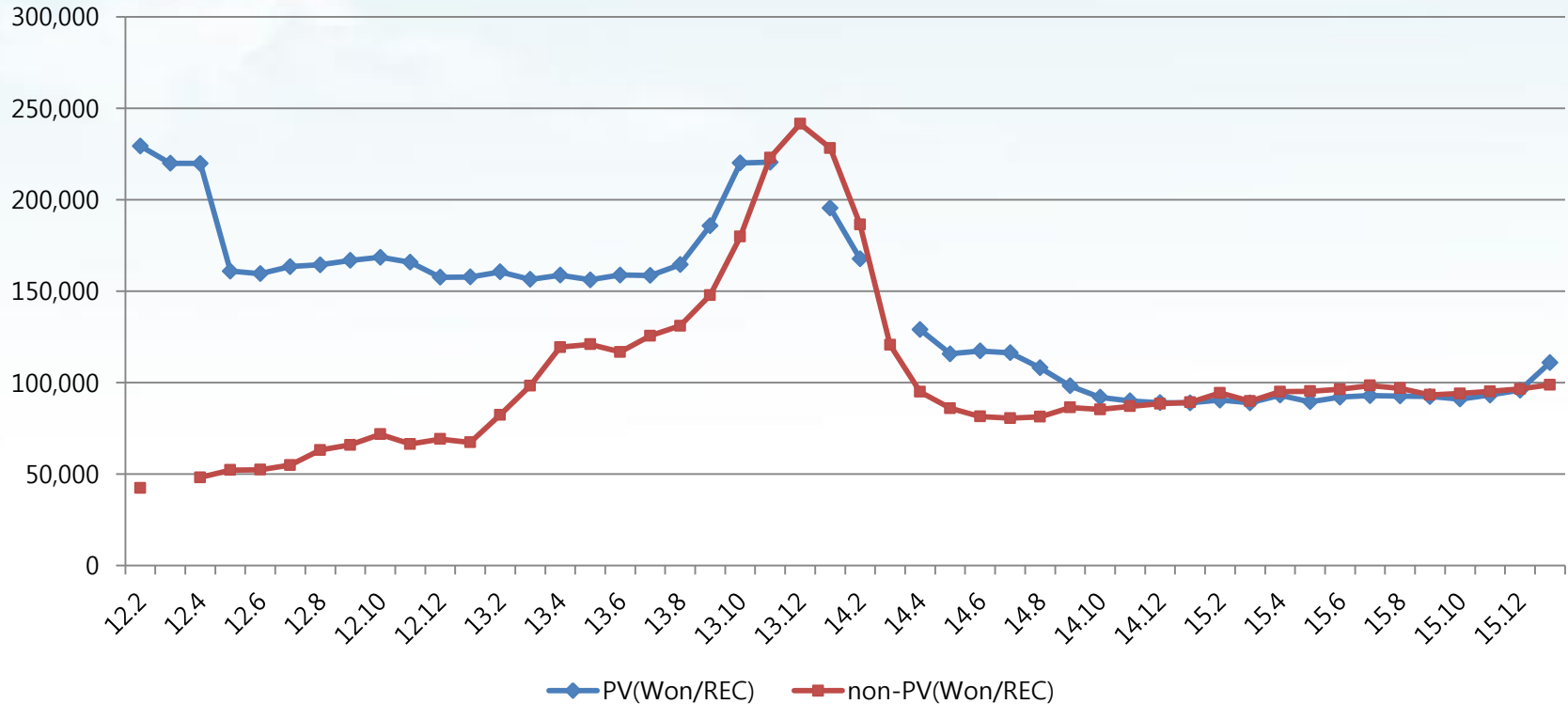
RPS compliance

		2012	2013	2014
Target(REC) (A)	PV	276,000	734,820	1,390,359
	Non-PV	6,144,279	10,161,737	11,515,072
	Total	6,420,279	10,896,557	12,905,431
Performed(REC) (B)	PV	264,180	697,461	1,332,922
	Non-PV	3,890,047	6,627,400	8,745,429
	Total	4,154,227	7,324,861	10,078,351
B/A (%)	PV	95.72%	94.90%	95.90%
	Non-PV	63.31%	65.20%	75.90%
	Total	64.70%	67.20%	78.10%

- Penalty for Non-fulfillment : less than 150% of the market price, considering the reasons etc.

Policy Framework – RPS

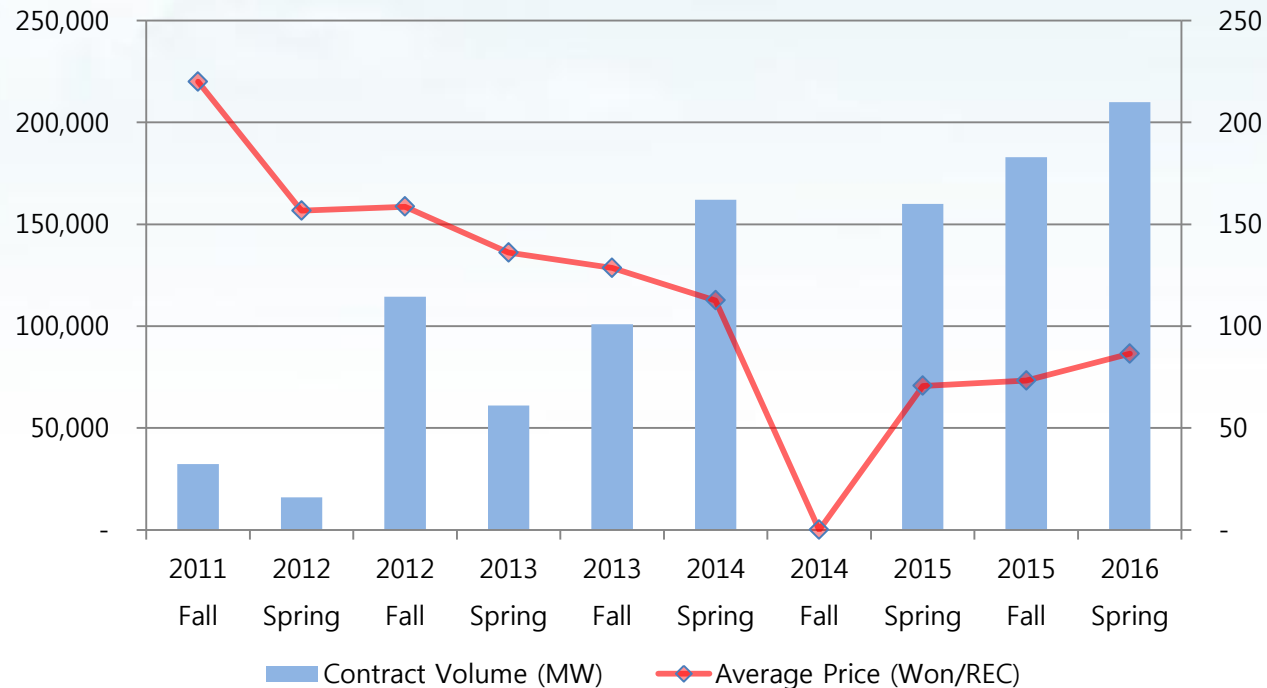
REC Price – Spot market



- REC market is unified since Jan.2016.

Policy Framework – RPS

REC Contract Market for PV : Price and Volume

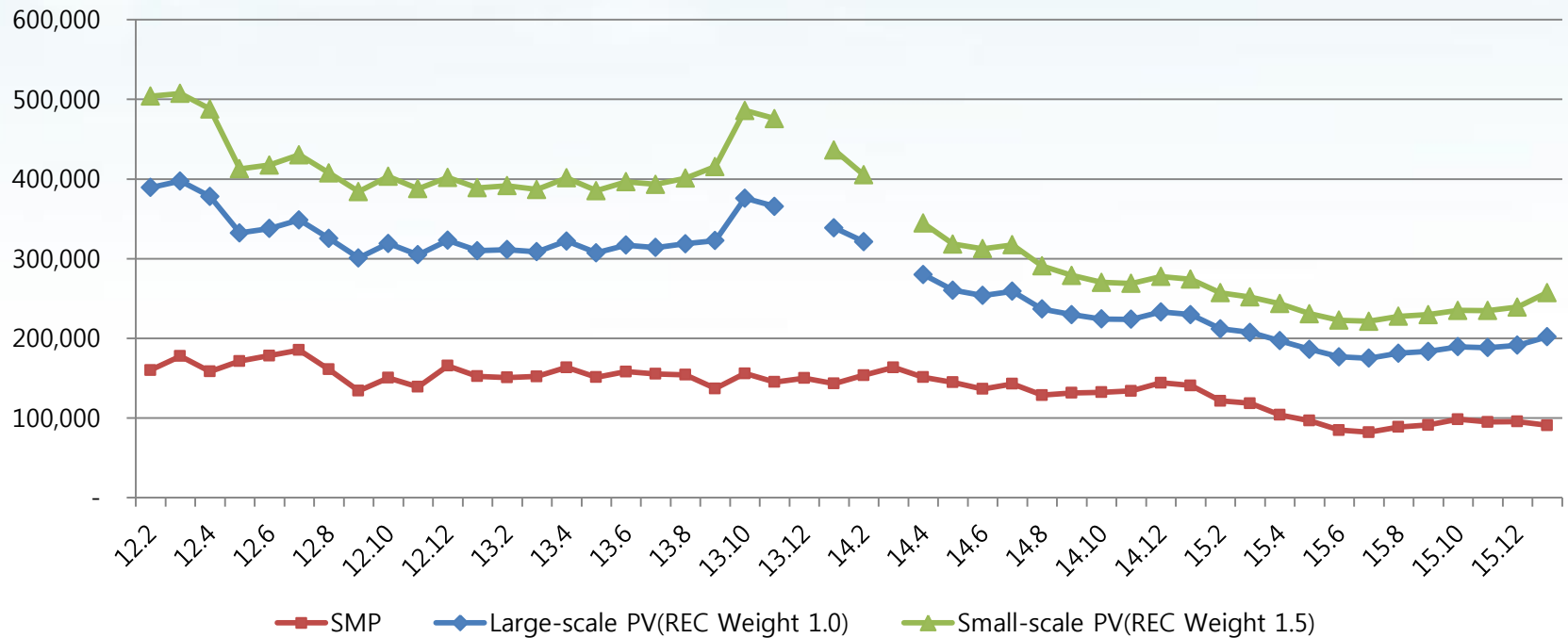


- Mandatory for 6 big power producers (with capacity over 5GW) to buy RECs in a bidding system in a 12-year constant price contract : 300MW per year
- Prefer the small scale PVs : at least 150MW for the capacity less than 100kW

Policy Framework – RPS

🌿 PV Revenue (REC price + SMP)

PV Revenue : REC price + SMP



- SMP(System marginal price) : wholesale electricity price

Policy Framework – RPS

LCOE of PV

<Table> LCOE of Small scale PV

Category	Unit	2013	2015	2020	2025	2030	2035
Investment Costs	1,000KRW/kW	2,500	2,365	2,060	1,794	1,562	1,360
Technical lifetime	Years	20	20	25	25	25	25
Fixed O&M	1,000KRW/kW	49	46	39	32	24	18
Load Factor	%	15.5	15.5	15.5	15.5	15.5	15.5
LCOE	KRW/kWh	197	186	148	127	108	91

<Table> LCOE of Large Scale PV

Category	Unit	2013	2015	2020	2025	2030	2035
Investment Costs	1,000KRW/kW	2,100	1,981	1,713	1,481	1,280	1,107
Technical lifetime	Years	20	20	25	25	25	25
Fixed O&M	1,000KRW/kW	49	46	39	32	24	18
Load Factor	%	15.5	15.5	15.5	15.5	15.5	15.5
LCOE	KRW/kWh	171	161	128	109	91	77

New Issues

Air Pollution : Environmental Performance Index 2016












80

OVERALL RANK
OUT OF 180

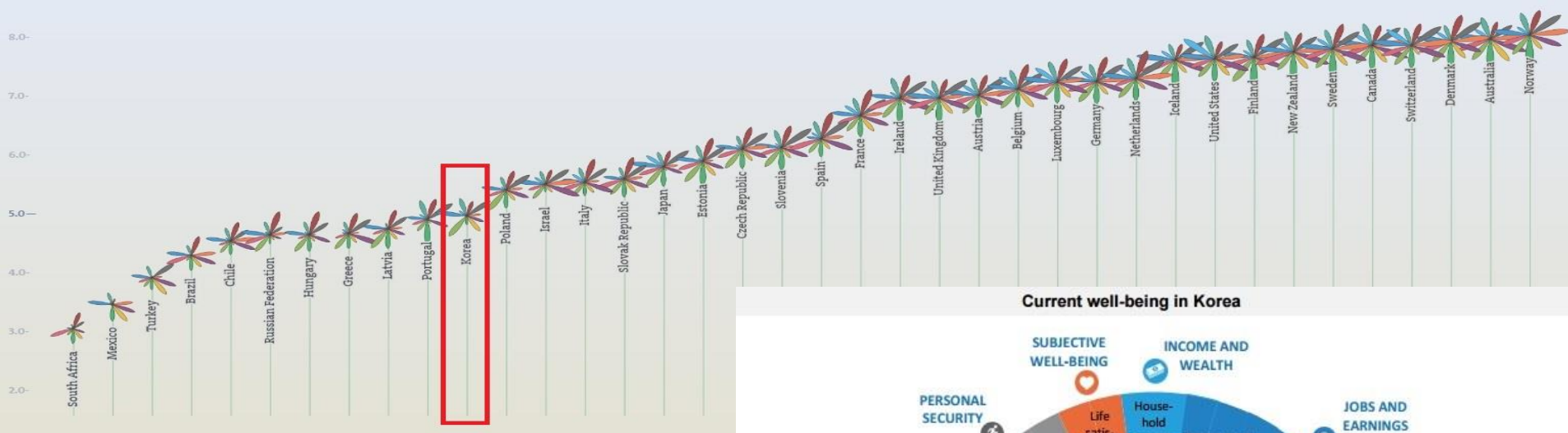
70.61

OVERALL SCORE
OUT OF 100

NAME OF INDICATOR	SCORE	RANK	10 YEAR CHANGE
 Health Impacts	65.93	103	-1.2%
 Air Quality	45.51	173	77.15%
 Water and Sanitation	95.11	35	-2.1%
 Water Resources	93.15	19	8.87%
 Agriculture	57.8	133	8.89%
 Forests	74.42	32	0.11%
 Fisheries	58.47	33	2.01%
 Biodiversity and Habitat	69.34	126	-0.53%
 Climate and Energy	62.39	83	0%

New Issues

Air Pollution : OECD Better Life Index 2016



Current well-being in Korea



Indicators

Air pollution

29.1 micrograms

Rank:

38 / 38

Water quality

77.6%

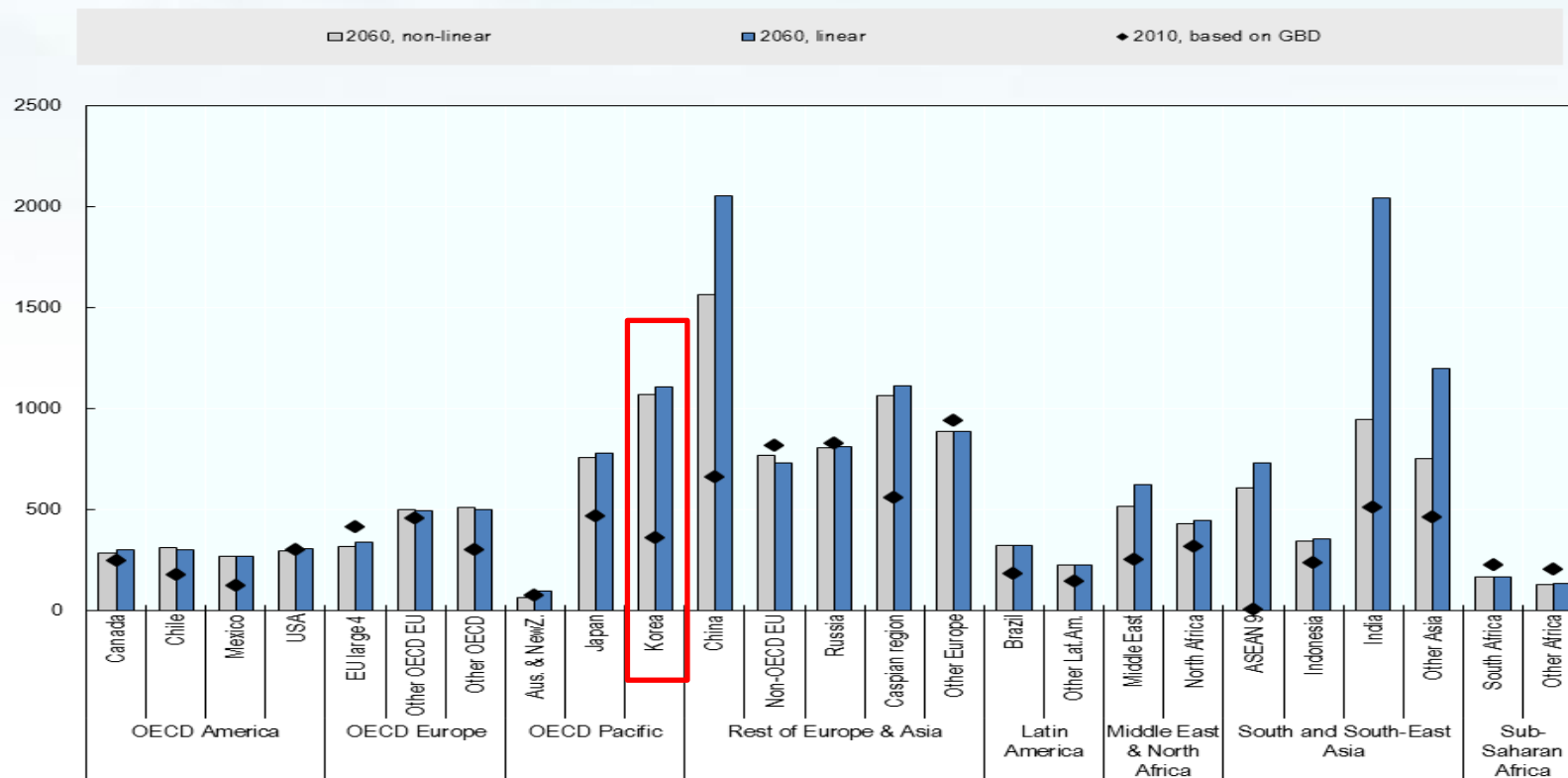
Rank:

26 / 38

Air Pollution : Health Risk

Premature deaths from exposure to particulate matter and ozone

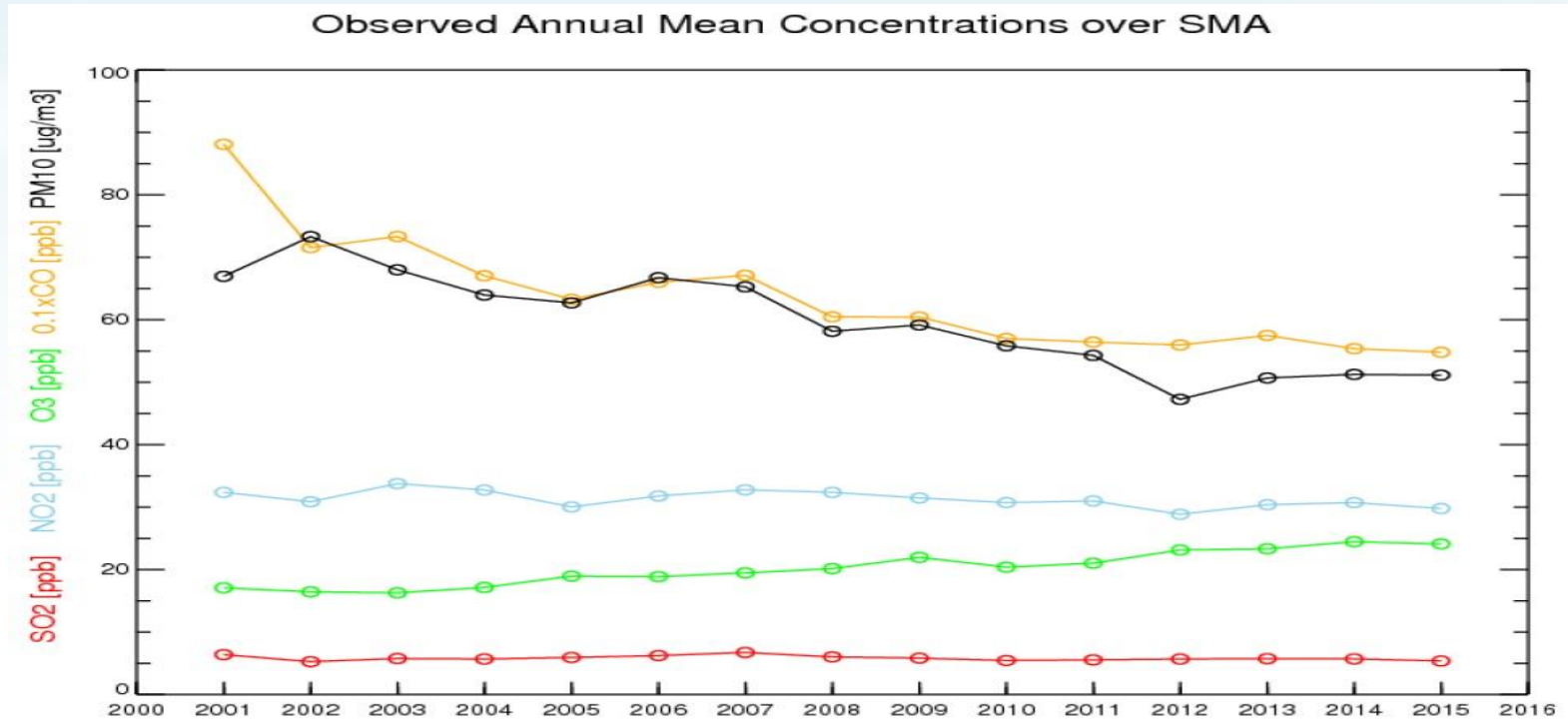
(Number of deaths caused by outdoor air pollution per year per million people)



Source: OECD(2016), The Economic Consequences of Outdoor Air Pollution

New Issues

Air Pollution : Trend reversed



Source: S.Kim et. al. (2016)

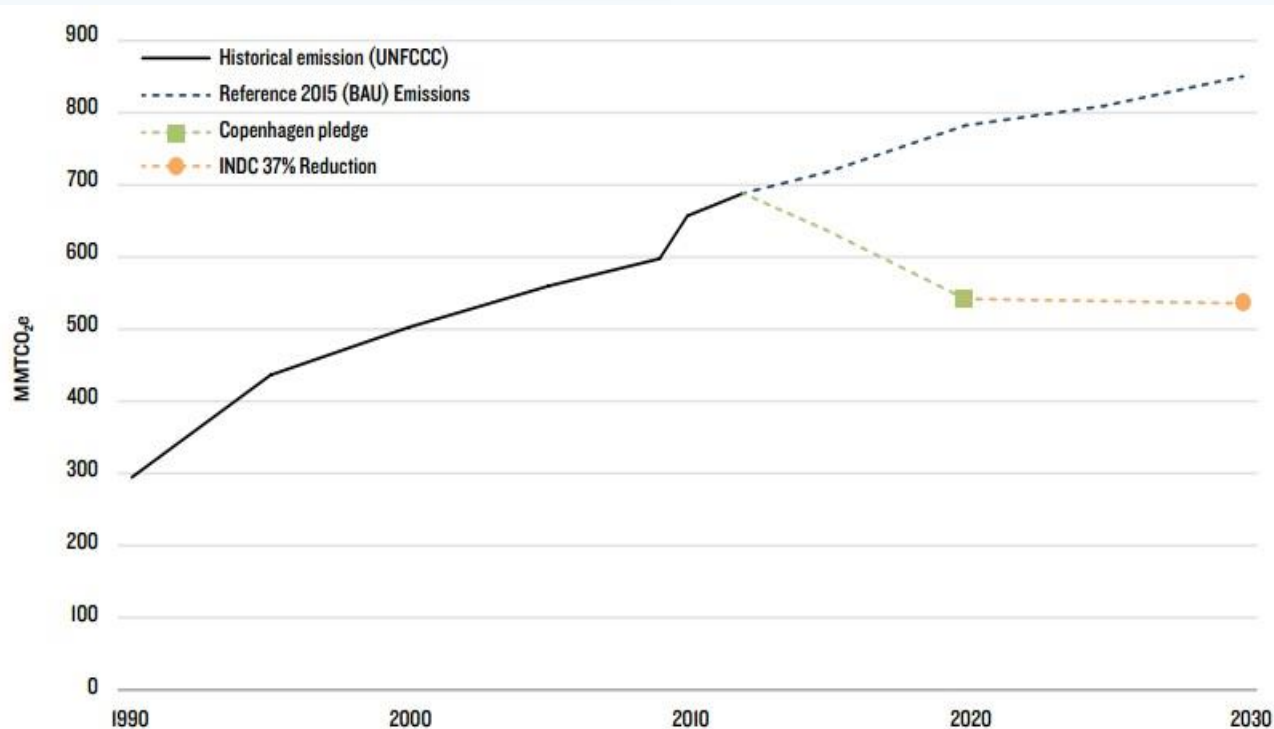
- **New Measures (2016.6)**
 - From diesel to electric or hybrid cars
 - Shut down of old coal-fired power plants

New Issues

Climate Change : INDC

Korea's INDC

- 37% Reduction from the BAU level : 850.6 → 535.9 (MtCO₂eq)
- 11.7% of 37% by using international market mechanism



Source: NRDC(2015), Paris Climate Conference South Korea

Climate Change : INDC

Greenhouse Gas Emissions in BAU (MtCO₂eq)

	2013	2030
Energy total	606.2	738.9
Energy Industries	274.7	333.1
Manufacturing & Construction	182.1	239.1
Transport	88.3	104.1
Other Sectors	56.6	54.1
Fugitive emissions	4.6	8.4
Industrial Process	52.6	75.6
Agriculture	20.7	15.5
Waste	15.0	20.7
Total CO ₂ Equivalent Emissions	694.5	850.6

Source: 2013 data from National Greenhouse Gas Inventory Report of Korea 2015,
2030 data (estimated) from Y. Cho(2016)

- **Limited reduction target for industry:** 12 % reduction from the BAU level
 - More pressure for the energy sector
 - From Coal to Nuke, LNG, Renewable Energy?

Perspectives

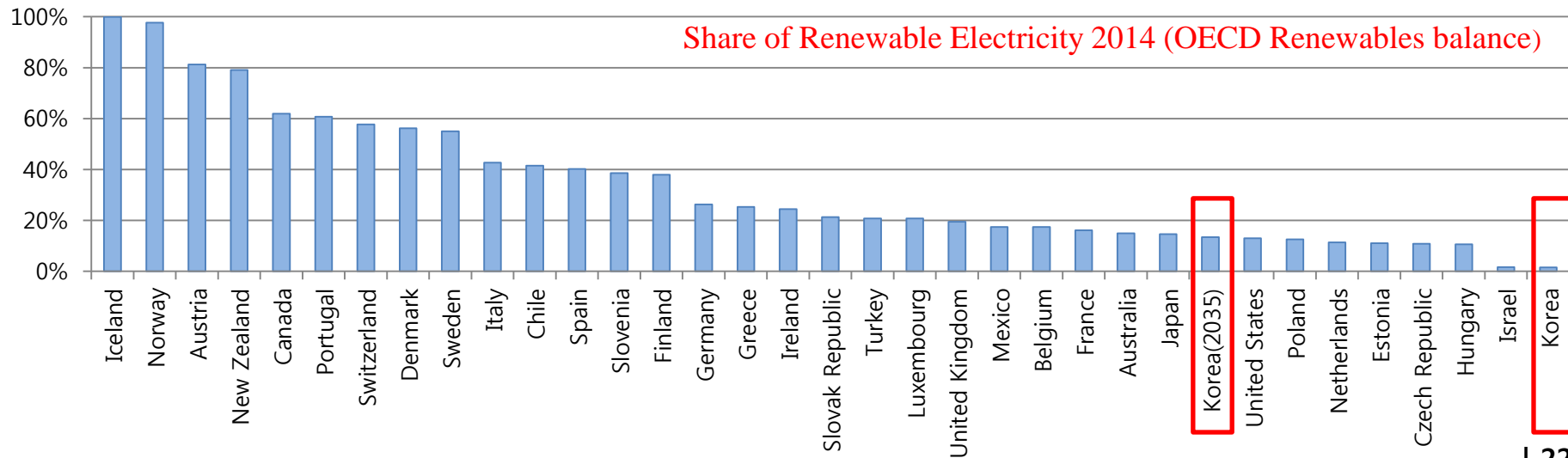
How much of Renewable Energy?

- Higher RPS target for 2018~2020 as a response to PM issues mainly to compensate for earlier shut-down of 10 old coal-fired plants (3GW)

year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
target, 2012	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0		
target, 2015	2.0	2.5	3.0	3.0	3.5	4.0	4.5	5.0	6.0	7.0	8.0	9.0	10.0
target, 2016							5.0	6.0	7.0				

* 2016 target from : MOTIE(2016.7), Measures for New Energy Industry and Improved Regulation.

- Is it not too low to set 2035 RE target as much as 11% (13.4% of electricity supply)?

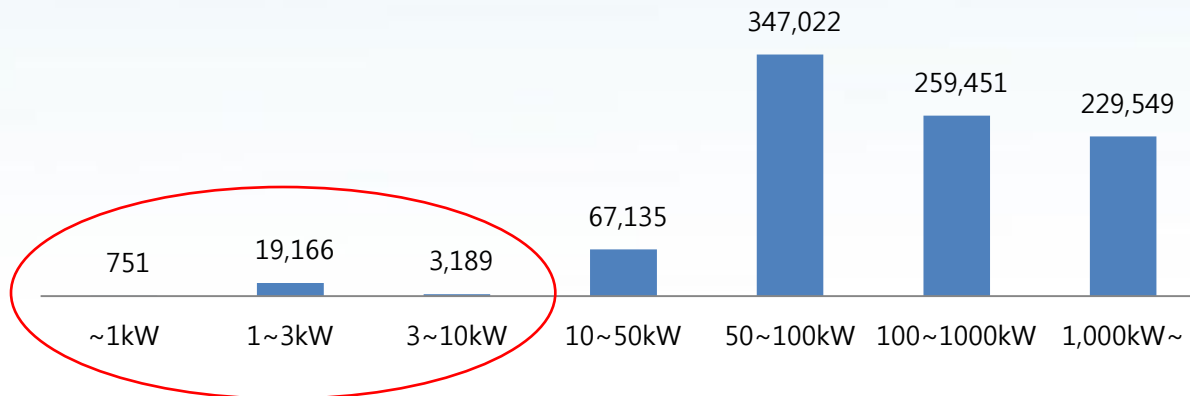


Perspectives

🌱 How : Is the RPS enough?

- A very weak diffusion of the small-scale facilities
 - The market mechanism of RPS is too complicated to a private household

Installed Capacity of PV in 2014 (kW)



- A **Re-Introduction of FIT for small scale facilities** is in discussion.
- But in avoiding windfall profit caused by an artificial tariff setting in traditional FIT
 - Setting the tariff similar to market price of REC & SMP of the last year or the last quarters
 - Volume-dependent tariff setting analog to German FIT(2014)

Who pays for more Costs of RE ?

- A main reason of switch of FIT to RPS in 2012 : an unclear financing mechanism
 - no automatic transfer mechanism of more production costs of renewable energy to consumer price of electricity (contrary to German and Japanese cases)
 - More costs of RE was paid by the 'Electricity Industry Fund' which is financed and limited by a surcharge(3.7%) of electricity tariff
 - A big concern of the government about the case in that the subsidy for RE is not fully covered by the fund
- Electricity consumer price is a regulated price in Korea
 - RPS implementation costs of electricity producers are paid by KEPCO, the sole electricity retailer, but the consumer price is not automatically adapted so much, but regulated by Ministry of Strategy & Finance
 - Electricity price stability is a very high priority of the government, not only for private consumers, but also to back up the competitiveness of Korean manufacturing industries
- Regardless of RPS or FIT, an **automatic pricing and transfer mechanism** of more costs of renewable energy is indispensable
 - to ensure a more expansion of renewable energy financially
 - to have a demand management effect additionally



Thank you

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