

The 22nd REFORM Group Meeting
Energy Democracy and Climate Change Policy
August 28, 2018
Salzburg, Austria

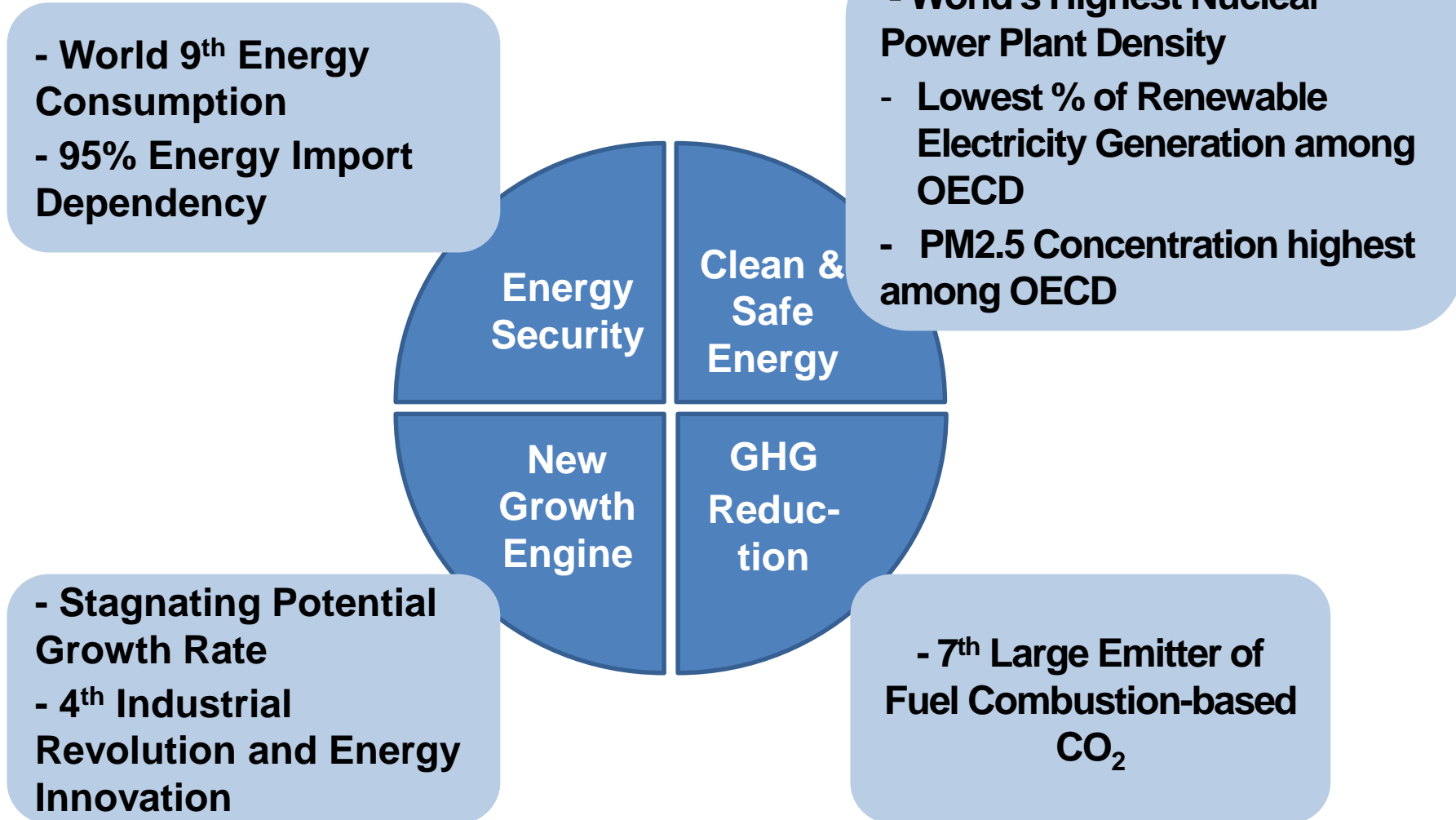
Energy Transition and Democracy in Korea

HONG, Jong Ho and YUN, Sun-Jin
Seoul National University &
Korea Energy Transition Forum

Contents

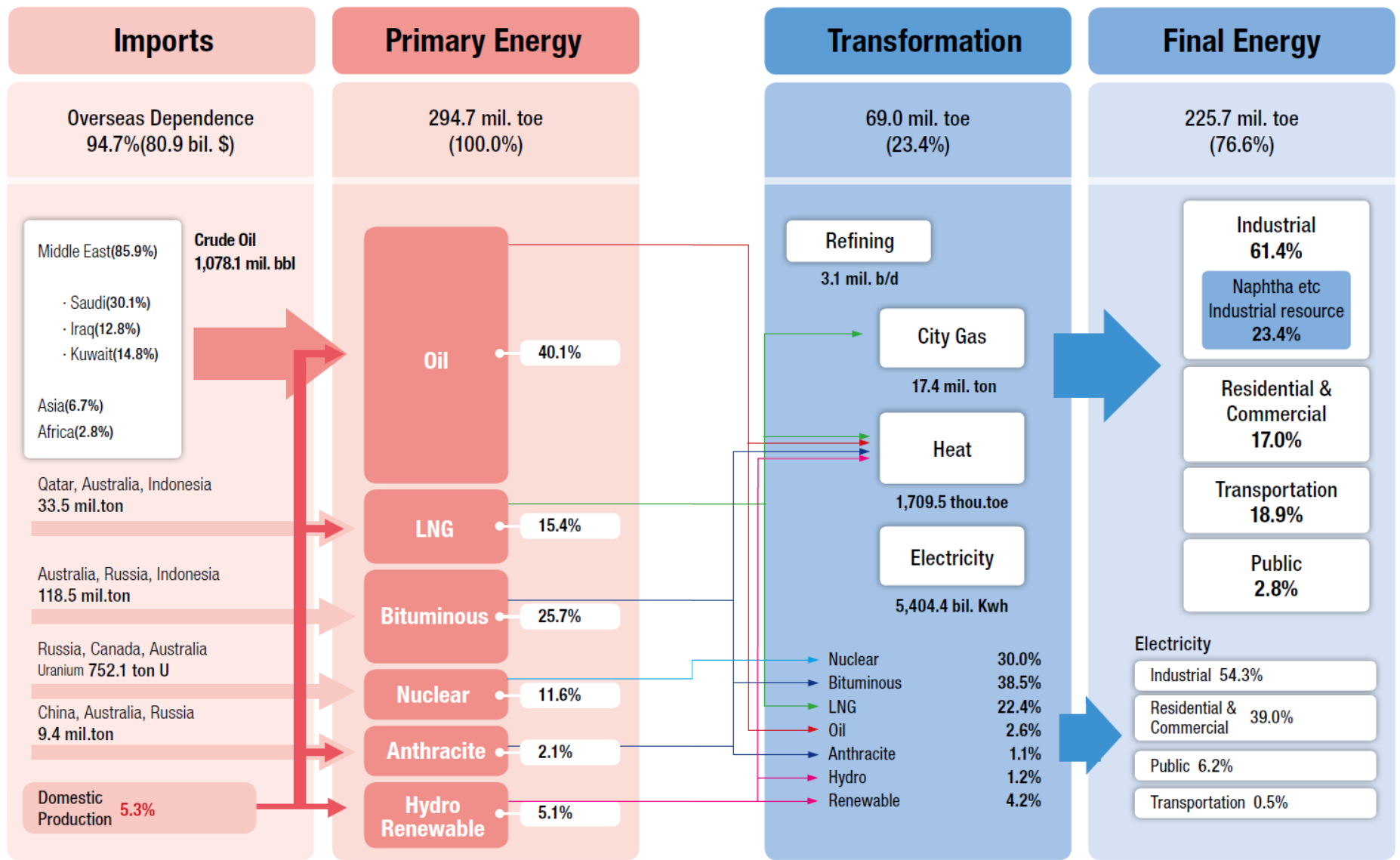
- 1. The Background of Energy Transition in South Korea**
2. The Process & Outcome of Public Engagement in Nuclear Energy Policy
3. Current Energy Transition Issues
4. Challenges & Opportunities

Major Issues in Energy Field in South Korea



1. The Background of Energy Transition in South Korea

Energy Balance Flow (2016)

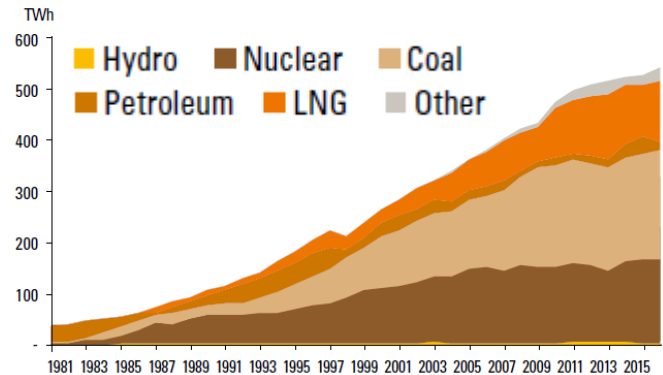
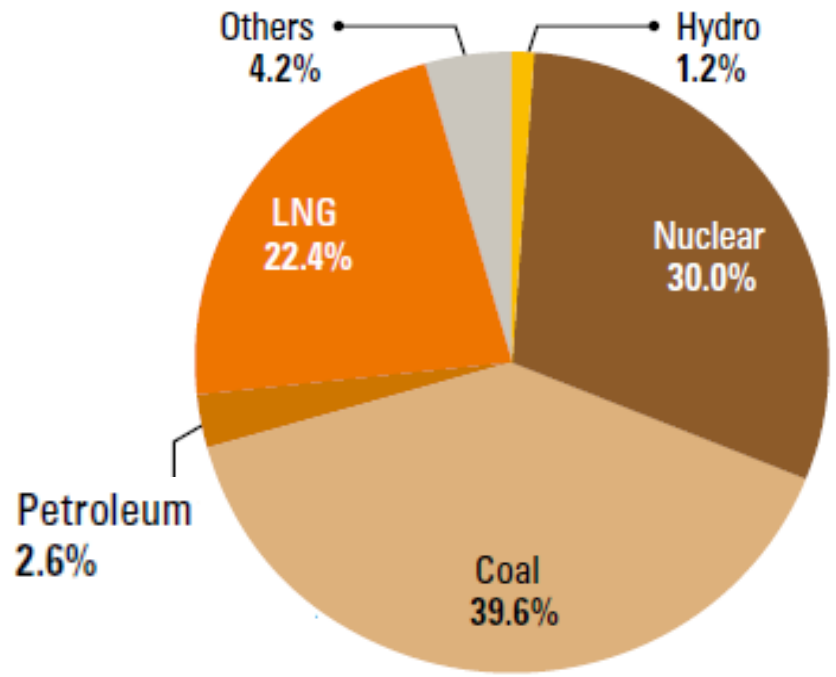
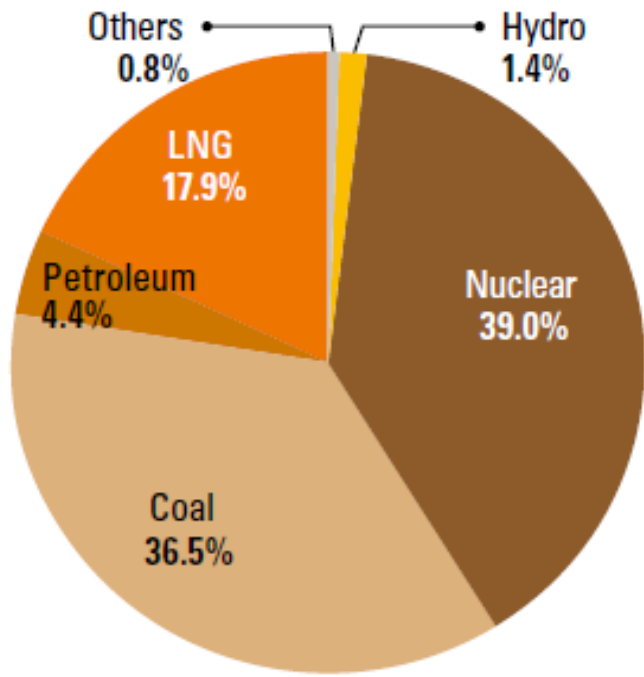


Source: KEEI, Energy Info. Korea 2017, 2018.

Electric Power Generation by Energy Source

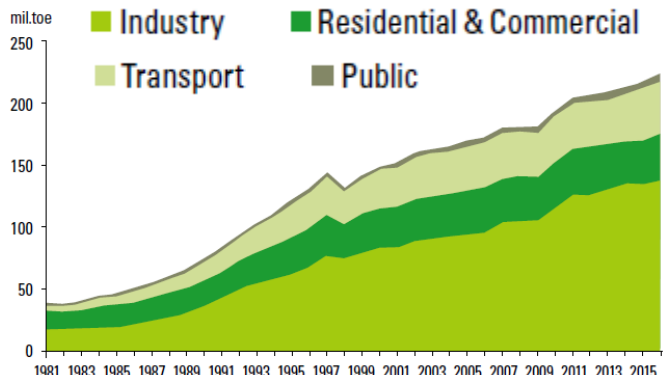
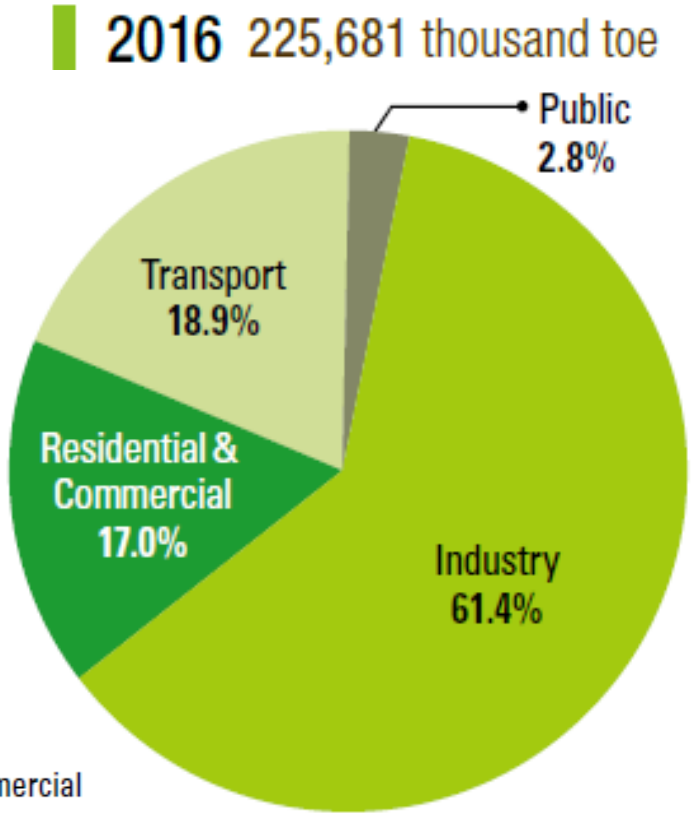
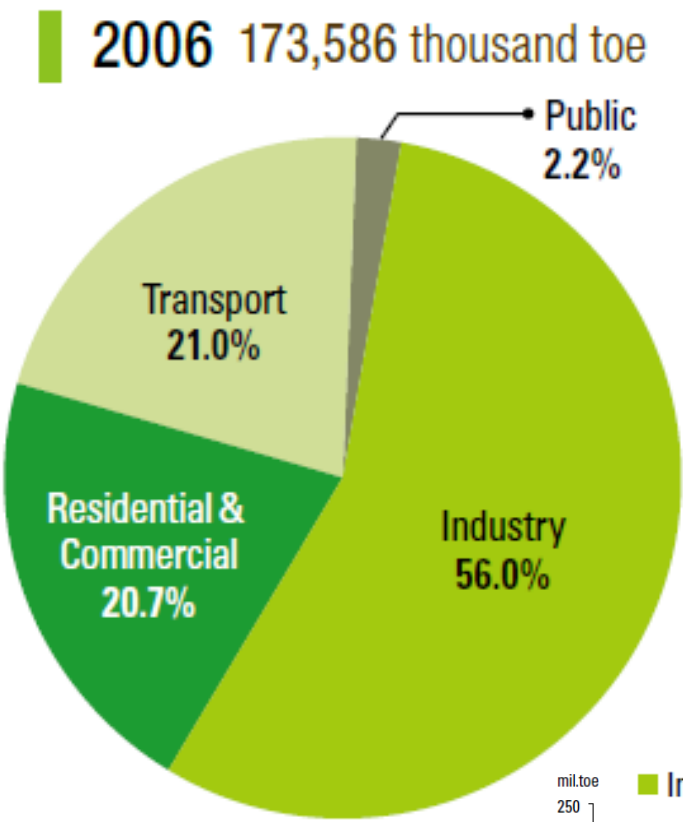
2006 381,181 GWh

2016 540,441 GWh



Source: KEEI, Energy Info. Korea 2017, 2018.

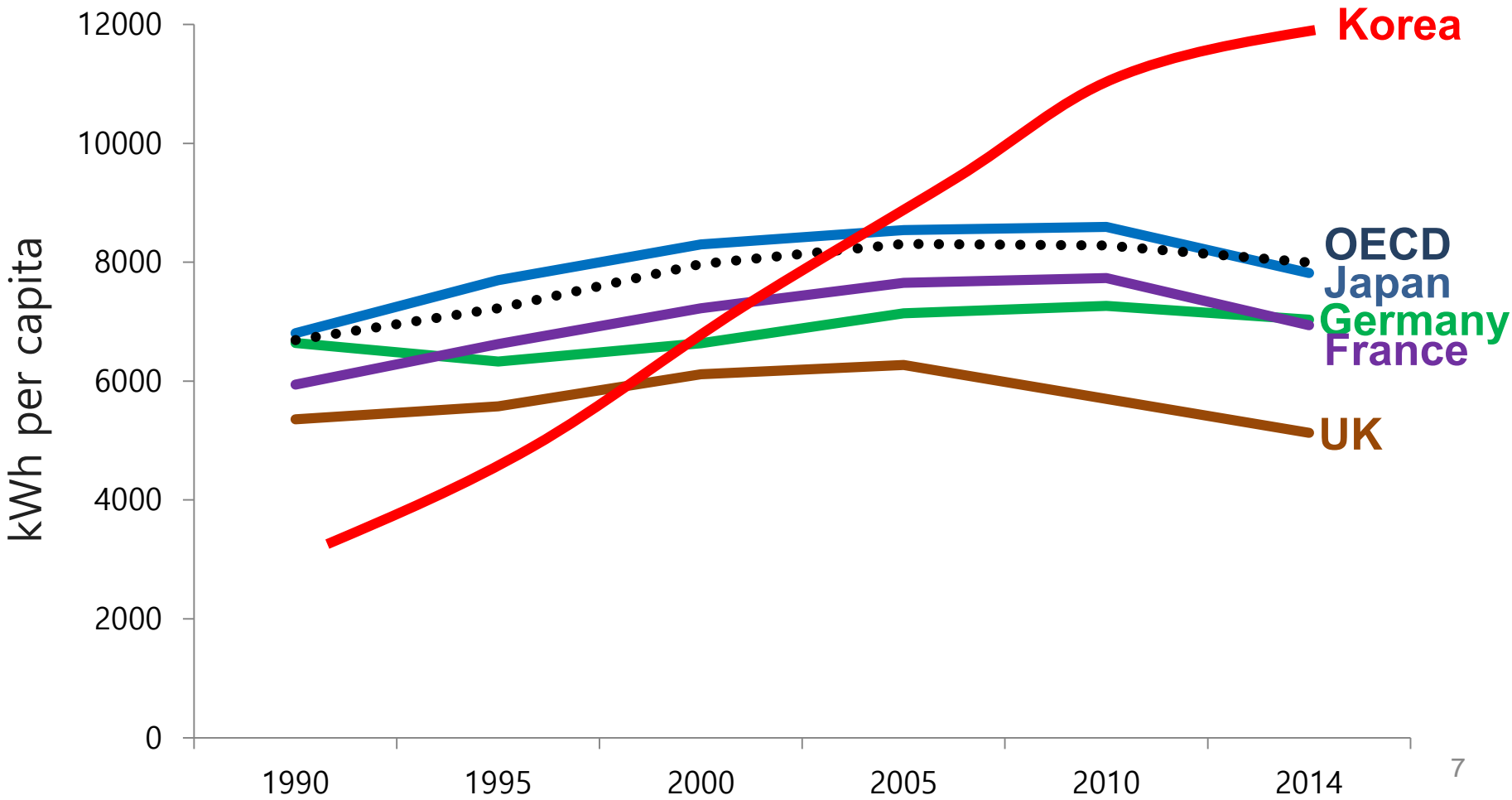
Final Energy Consumption by Sector



Source: KEEI, Energy Info. Korea 2017, 2018.

■ S. Korea is an electricity-intensive society

● Per capita electricity consumption of major OECD Member states



1. The Background of Energy Transition in South Korea

■ Korea, a big CO₂ Emitter & Energy Consumer

Ranking	Country	CO ₂ Emissions from fuel combustion		Population		GDP-PPP		Primary Energy Supply	
		MtCO ₂	%	Million	%	Billion US \$ in year 2005	%	MTOE	%
1	China	9,087.1	28.1	1,364.3	18.8	16,841.0	16.6	3,051.5	22.3
2	USA	5,176.2	16.0	319.2	4.4	16,156.6	15.9	2,216.2	16.2
3	India	2,019.7	6.2	1,295.3	17.9	6,902.1	6.8	824.7	6.0
4	Russia	1,467.6	4.5	143.8	2.0	3,219.8	3.2	710.9	5.2
5	Japan	1,188.6	3.7	127.1	1.8	4,437.1	4.4	441.7	3.2
6	Germany	723.3	2.2	81.0	1.1	3,438.0	3.4	306.1	2.2
7	Korea	567.8	1.8	50.4	0.7	1,697.1	1.7	268.4	2.0
8	Iran	556.1	1.7	78.1	1.1	1,263.8	1.2	237.1	1.7
9	Canada	554.8	1.7	35.5	0.5	1,497.8	1.5	279.9	2.0
10	South Africa	437.4	1.4	54.2	0.7	658.7	0.6	147.0	1.1

Source: IEA, 2016, Key World Energy Statistics 2016 (Data for 2014)

■ Comparison of Nuclear Power Status

	1	2	3	4	5	6	World
Installation Capacity (GWe)	USA	France	Japan	Russia	China	Korea	391.7
	99.5	63.1	40.5	25.3	31.6	23.0	
Number of Reactors	USA	France	Japan	Russia	China	Korea	448
	99	58	43	36	35	25	
Reactors under Construction (GW (Number))	China	Russia	Korea	USA	India	UAE	62.0 (58)
	22.6(20)	5.9(7)	5.6(4)	5.0(4)	3.3(5)	4.2(3)	
Nuclear Power Generation (2015, TWh)	USA	France	Russia	Canada	China	Korea	2,441
	798	419	183	161	161	157	
Proportion of Nuclear Power Generation (2015, %)	France	Ukraine	Slovakia	Sweden	Swiss	Korea	11.5
	76.1	56.5	55.9	34.3	33.5	31.7	
Nuclear Density (kW/km ²)	Korea	Belgium	Taiwan	Japan	France	Swiss	-
	219.7	194.3	139.8	117.0	115.3	78.8	-

■ Top of the World in terms of Nuclear Density

● Number of Reactors:
Korea with the highest density



US 99



Russia 35



France 58

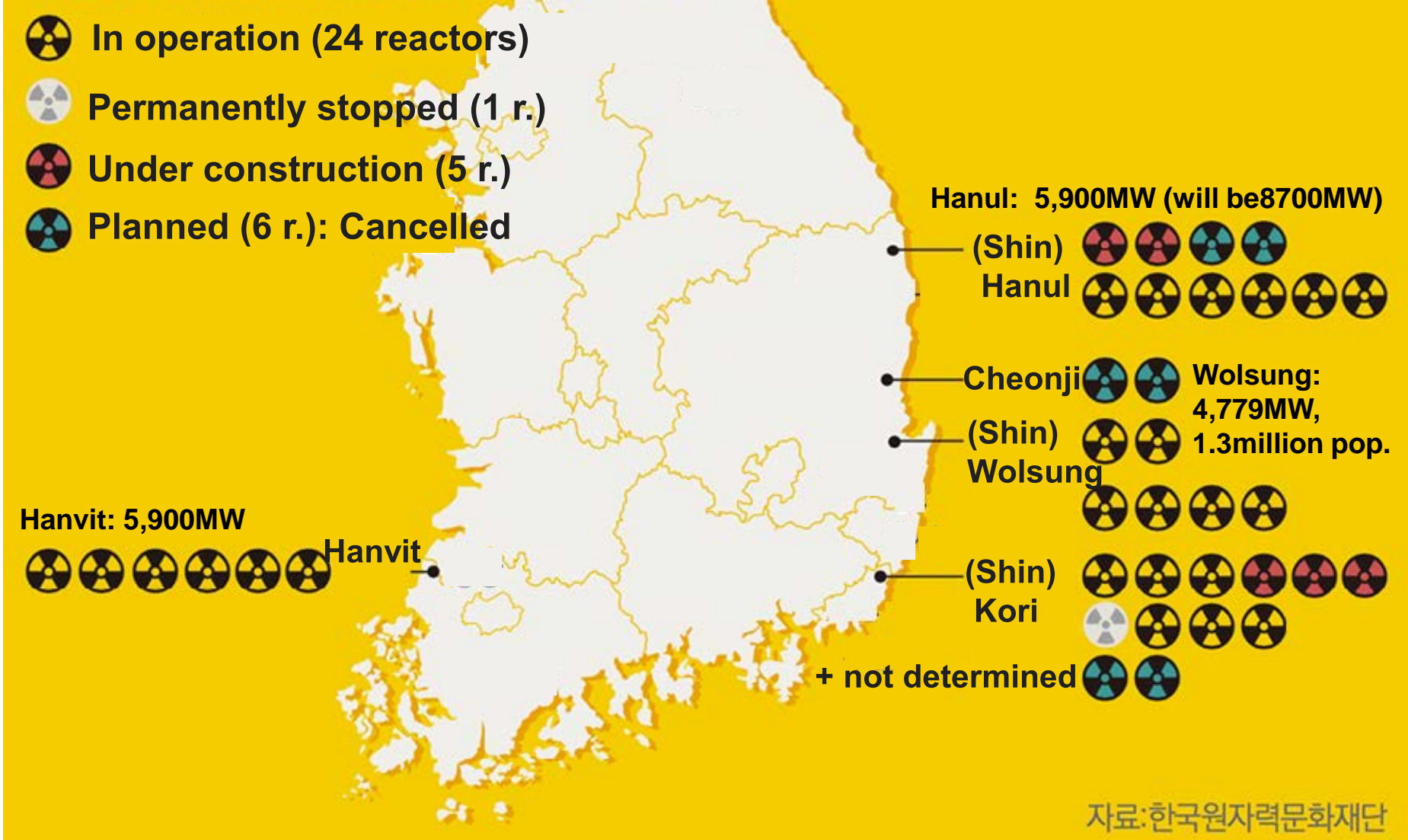


S. Korea 24

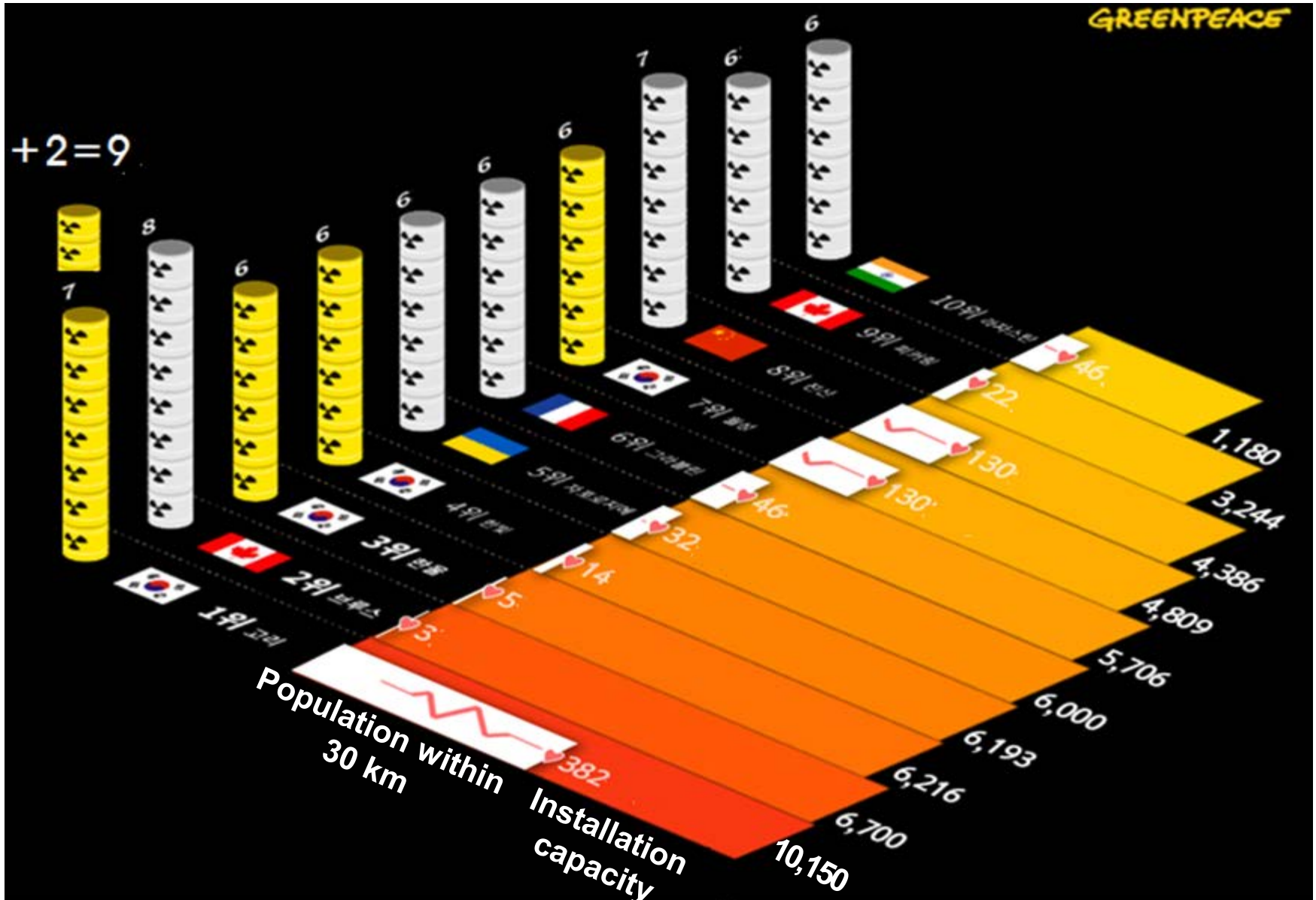


China 38

Condensed Location of Multiple Reactors



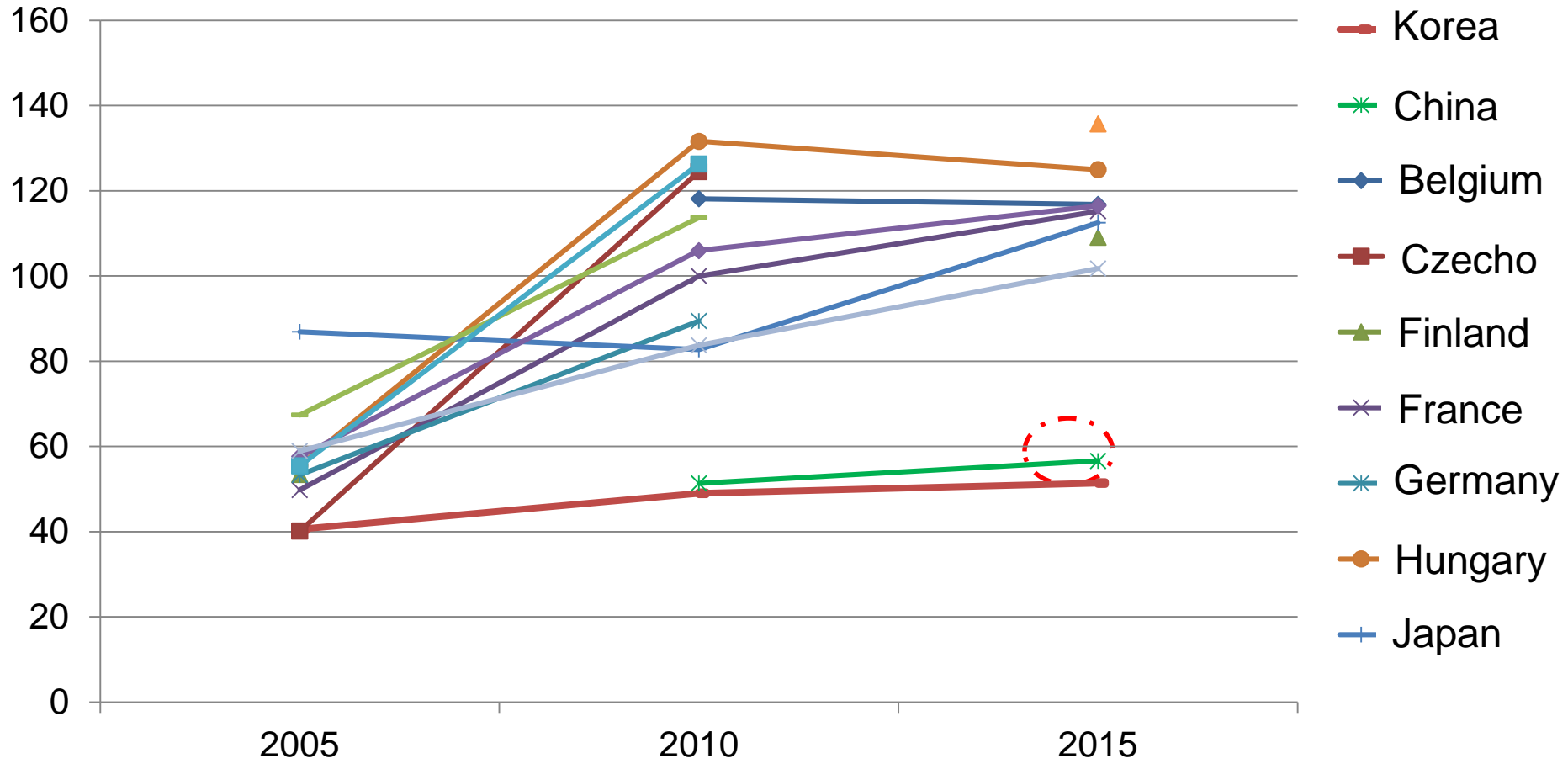
■ With Shin-Kori 5 & 6: the densest site



Nuclear's Levelized Cost of Electricity (LCOE)

● Nuclear LCOE in Korea is much lower than other countries

(Unit: \$/MWh, 2013 USD)

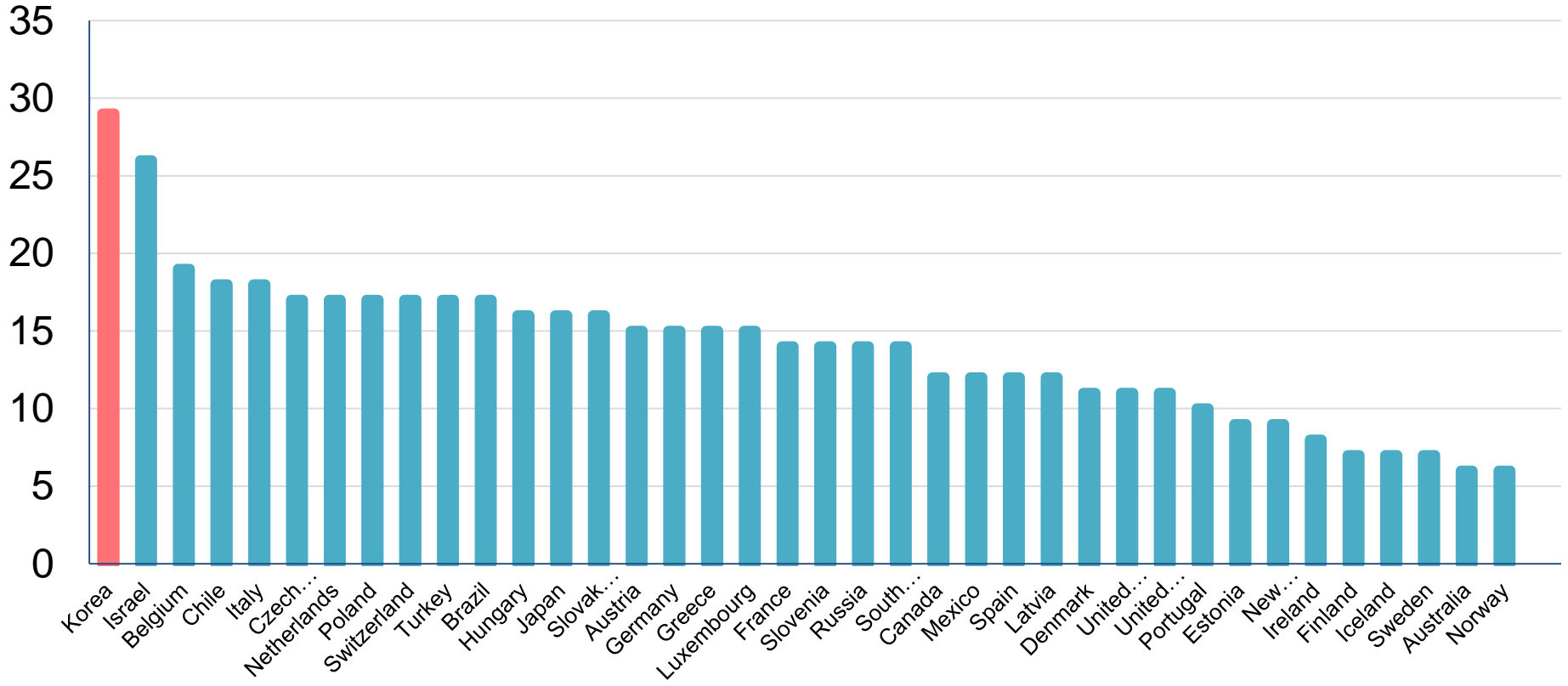


Source: IEA(2015), 『Projected Costs of Generating Electricity

PM2.5 Concentration by Country

● Korea is the highest among OECD countries

(Unit: Micrograms per cubic meter)

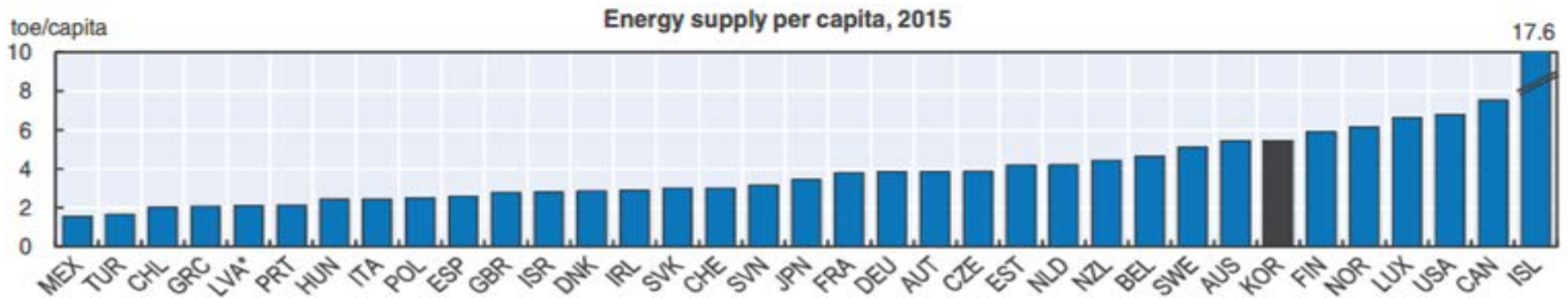
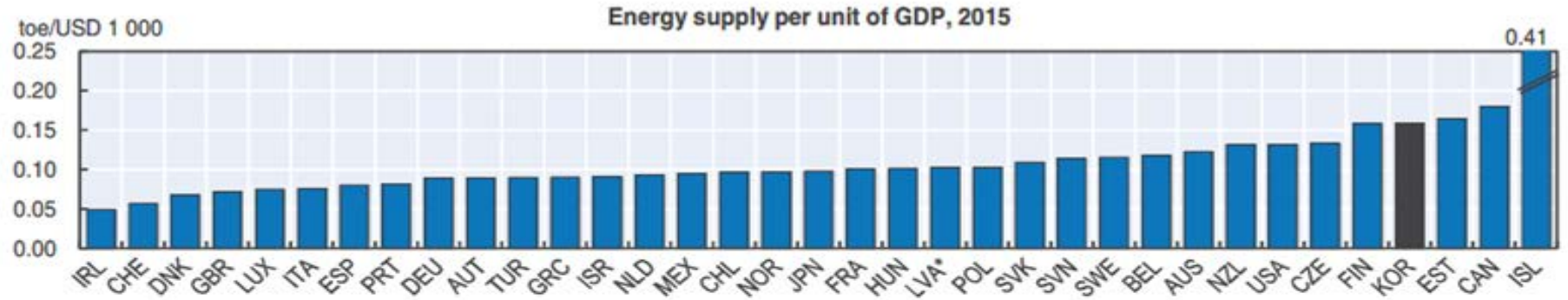


Data: OECD(2016), Better Life Index
The World Bank(2016),<http://data.worldbank.org/indicator/>

Energy Intensity

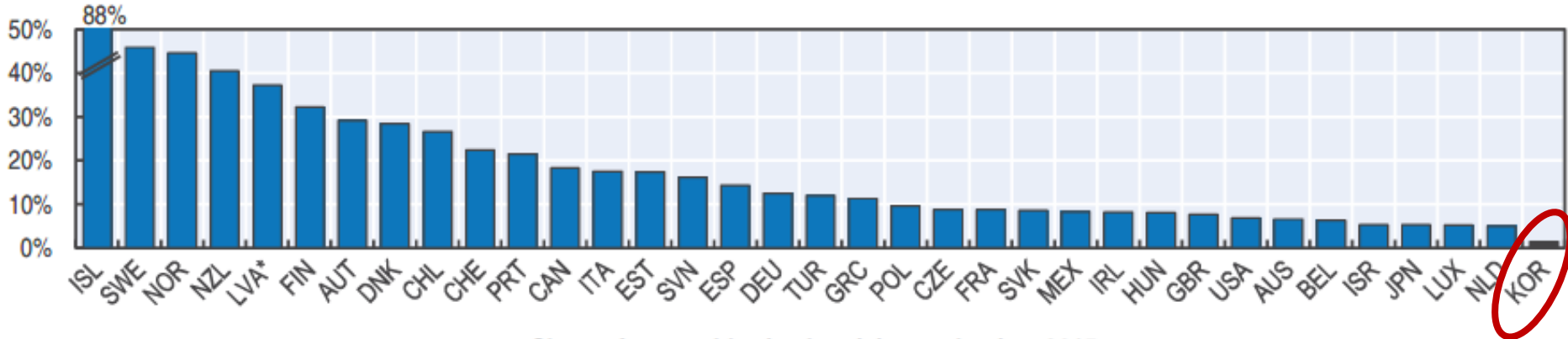
● Korea's Energy Intensity is 31/34 among OECD Countries (2013): More than 2 times compared to U.K., Japan, Germany, and EU Countries

	Korea	Japan	Germany	U.K.	EU
Energy Intensity (toe/Thousand USD)	0.22 (100)	0.095 (43)	0.100 (45)	0.07 (34)	0.107 (49)

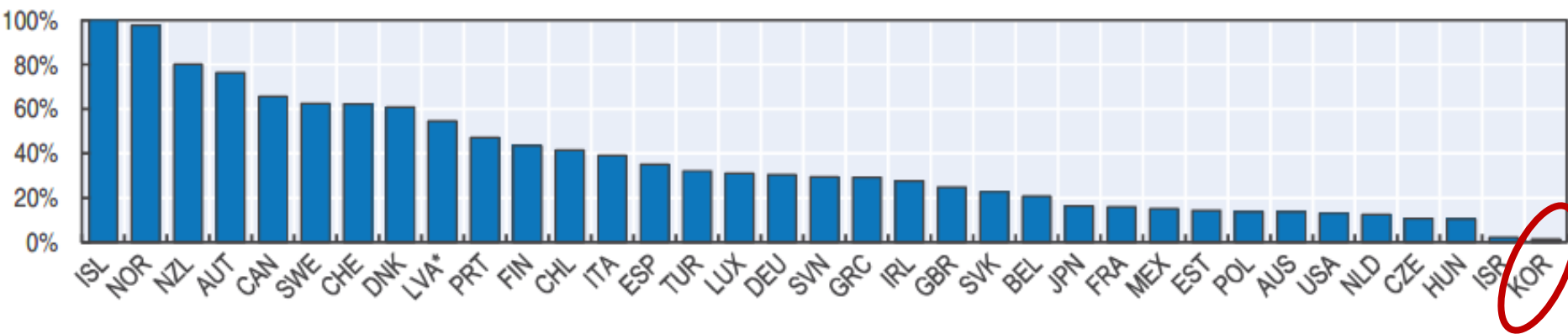


The Status of Renewables

Share of renewables in primary energy supply, 2015



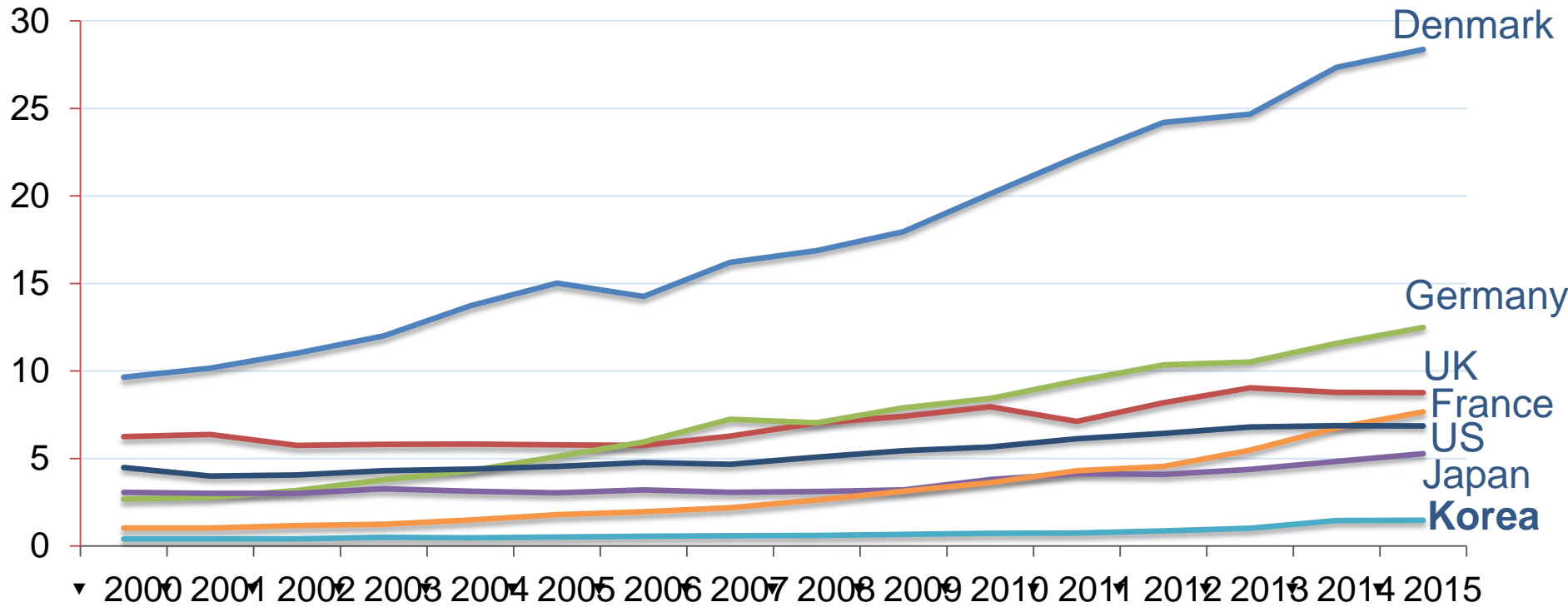
Share of renewables in electricity production, 2015



Trend of Renewable Energy Supply

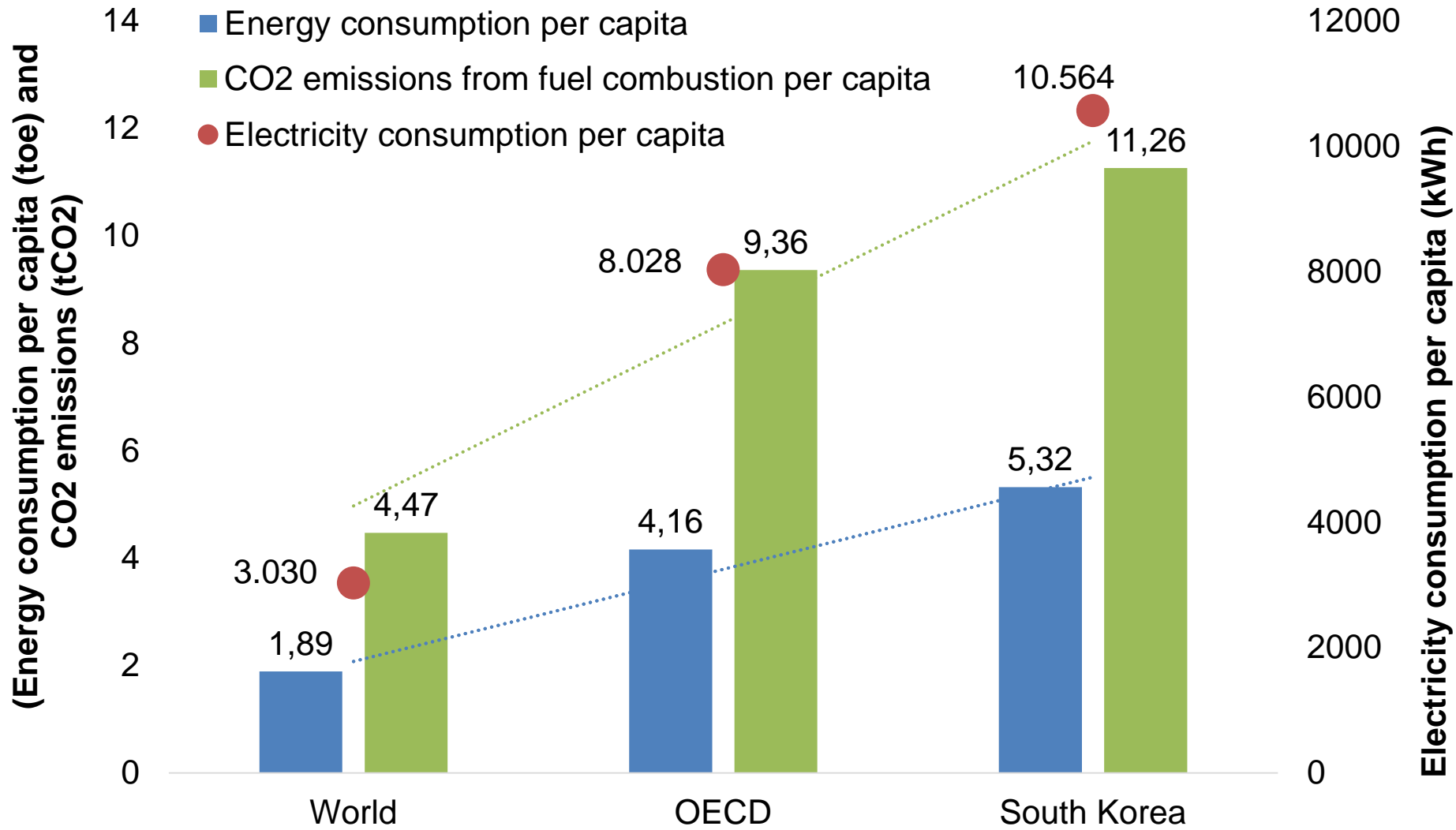
● Lowest among OECD countries

(Unit: %)

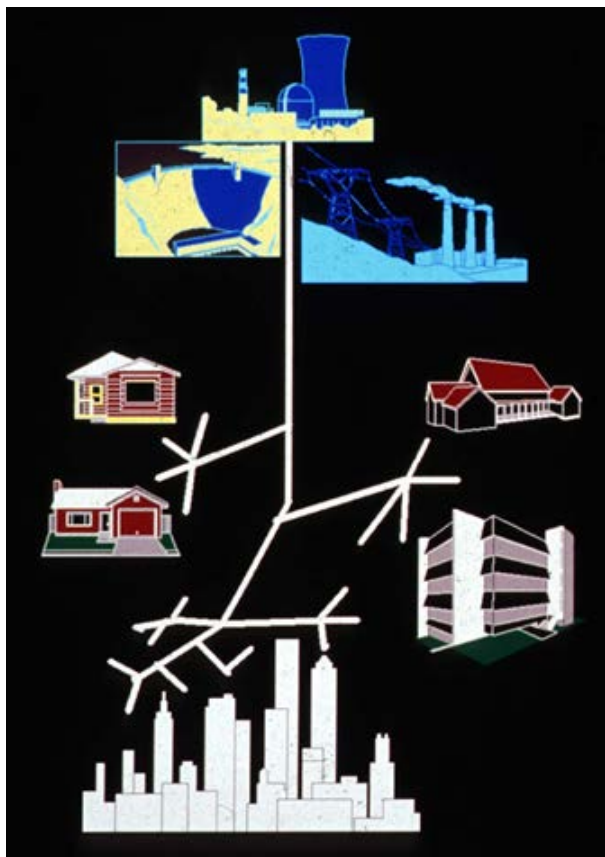


Data: OECD Data, Renewable Energy

Comparative Energy Consumption of Korea



Problems of the Conventional Energy System



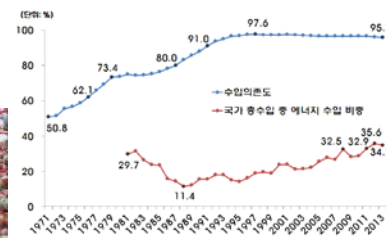
The Centralized Supply-oriented Fossil Fuel- and Nuclear-based Energy System (94.9% of TPES; 94.6% of electricity energy source)



Increasing energy consumption



Climate change



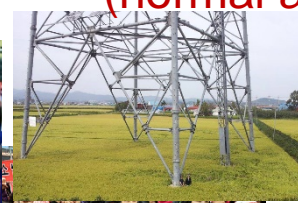
Vulnerable energy security



Fine dust



Deepened nuclear risk (normal accident/spent fuel)



Environmental injustice/Social gap
➔ Social conflicts

Contents

1. The Background of Energy Transition in South Korea
- 2. The Process & Outcome of Public Engagement in Nuclear Energy Policy**
3. Current Energy Transition Issues
4. Challenges & Opportunities

Energy-related Presidential Pledges of Mr. Moon

17. Safe & Healthy Korea

The state will take responsibility for People's life

- Establishment of Nuclear Zero Post-Nuclear State after 40 years
 - Closure of aged nuclear power plants and stopping new reactors' construction
 - Accomplishment of 20% of renewable energy by 2030
- 30% Reduction of Fine Dust within Moon's Tenure
 - Stopping construction of new coal-fired power plants and closure of aged ones
 - Temporary Shut-down of coal-fired power plants during Spring season

현정 사상 최초! 정당 사상 최초!
정책쇼핑몰
문재인 1번가 GRAND OPEN
www.moon1st.com

지역, 세대, 관심사에 따라 필요한 정책 공약을 '쇼핑' 하세요
마음에 드는 정책은 SNS로 널리 알려주세요

1 나를 나라답게 문재인

4월 17일 문재인이 정책 쇼핑의 문을 엽니다!

안녕~ 재인이에요

문재인 1번가
대한민국 최초 정책쇼핑몰

문재인 공식사이트 60

전체 카테고리

파란나라 당일배송 신청하기

내 삶을 바꾸는
스페셜 상품

좋아요순 최신통

BEST

안전하고 깨끗한 대한민국 에...
283,961건

BEST

도시재생 뉴딜 NEW DEAL
229,182건

BEST

이사 걱정 없는 대한민국
225,161건

BEST

가계동신비 부담 절감 정책
215,600건

■ President Moon pledged Nuclear-free Society


"The shutdown of KORI 1 is the beginning of a nuclear-free energy country, a paradigm shift for a safer Korea"(June 19, 2017)

- Nullifying construction of new nuclear power plants under preparation
- Prohibiting lifetime extension and closure of extended Wolsung 1
- Deriving social consensus on construction of Shingori 5 and 6 with consideration on safety, completion rate, given investment, compensation costs, electricity reserved margin and so on.



■ Energy-related Policy Tasks among 100 Ones

National Vision	A Nation of People, a Just Republic of Korea
Five Main Policy Goals	A Government of the People
	An Economy Pursuing Co-Prosperity
	<i>A Nation Taking Responsibility for Individual Lives</i>
	Well-balanced Development Across Every Region
	The Korean Peninsula of Peace and Prosperity

- 
- Safe Society Keeping People's Security and Life
 - Creation of Clean Air Quality without Worry about Fine Dust
 - **Energy Transition** through Post-Nuclear Policy toward a safe and clean energy society
 - Establishment of faithful implementation system of New Climate Regime

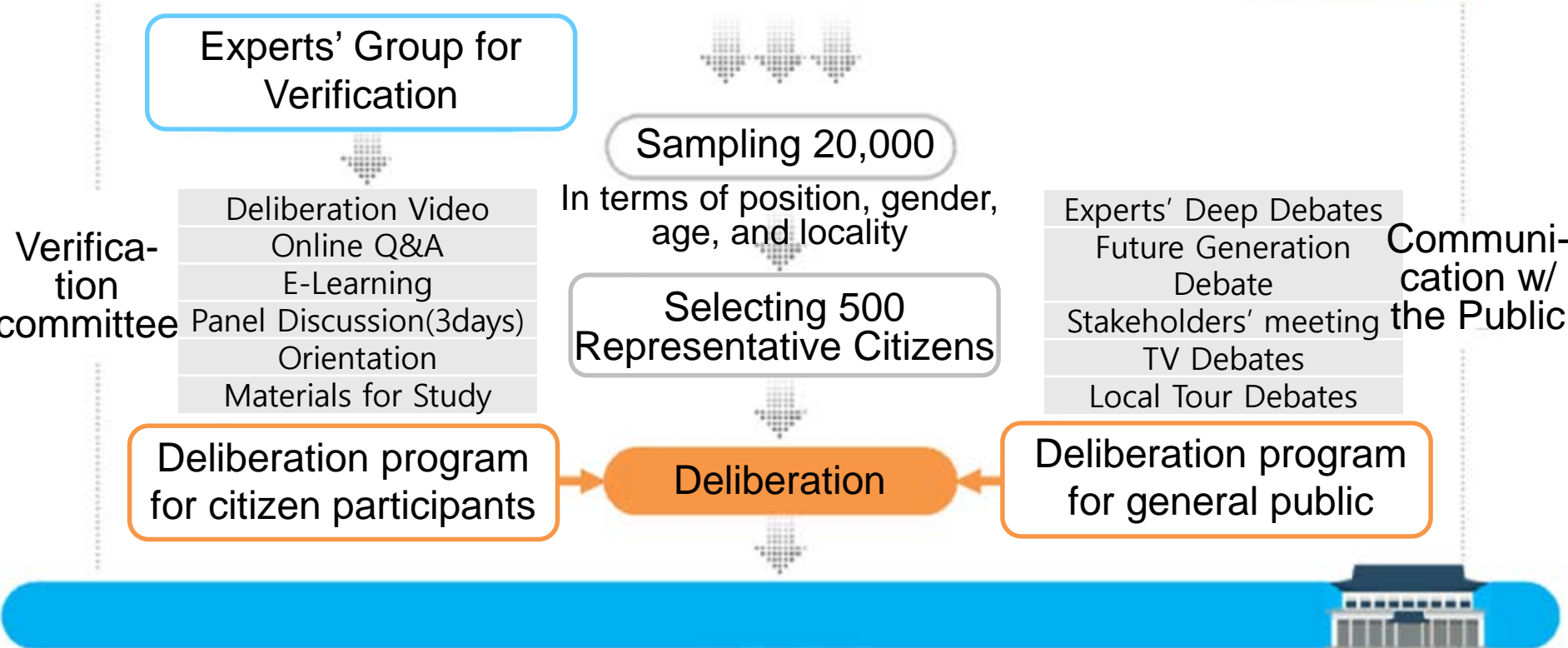


■ The Public Engagement Process on Shin-Kori 5 & 6

- Presidential Pledge: Stop of the construction
- Celebration Speech in the Permanent Shut-down of Kori 1 on June 19, 2017: Suggestion of decision based on social consensus
- The President moderated cabinet meeting on June 27, 2017: Decision on Public Engagement Process
- Suspension decision on the construction on June, 14, 2017
- Establishment of Public Engagement Committee on Shin-Kori 5 & 6 on July 24, 2017
- Activities of the Citizen Representative Group from Sep. 16 to Oct. 15, 2017
- Submission of the Outcome of public engagement process on Oct. 20, 2017

Public Engagement Process

Public Engagement Committee on Shin-Kori 5&6



“Final decision by the government based on the people’s will”

Source: Report of the PEC, 2017

Recommendation of the PEC

- Resuming suspended construction of Shin-Kori 5&6
- Promoting energy policy to make the share of nuclear power reduced
- Supplementary recommendations needs to be implemented as soon as possible

Distribution of Opinions

Source: Report of the PEC, 2017

category	Resume	Stop	category	Resume	Stop
Male	66.3	33.7	Seoul	57.4	42.6
Female	52.7	47.3	Incheon·Gyeonggi	58.6	41.4
20s(+19)	56.8	43.2	Daejeon·Chungcheong	65.8	34.2
30s	52.3	47.7	Gwangju·Jeolla·Jeju	46.1	54.9
40s	45.3	54.7	Daegu·Gangwon·Gyeongbuk	68.7	31.3
50s	60.5	39.5	Busan·Ulsan·Gyeongnam	64.7	35.3
60s+	77.3	22.5	Total	59.5	40.5

Share of nuclear power	Reduce	Maintain	Enlarge	Don't know
	53.2%	35.5%	9.7%	1.6%

■ The Moon Government's Position on PEC's Recommendation

● Resuming Construction of Shin-Kori 5&6 + Confirming a Road map for Energy Transition

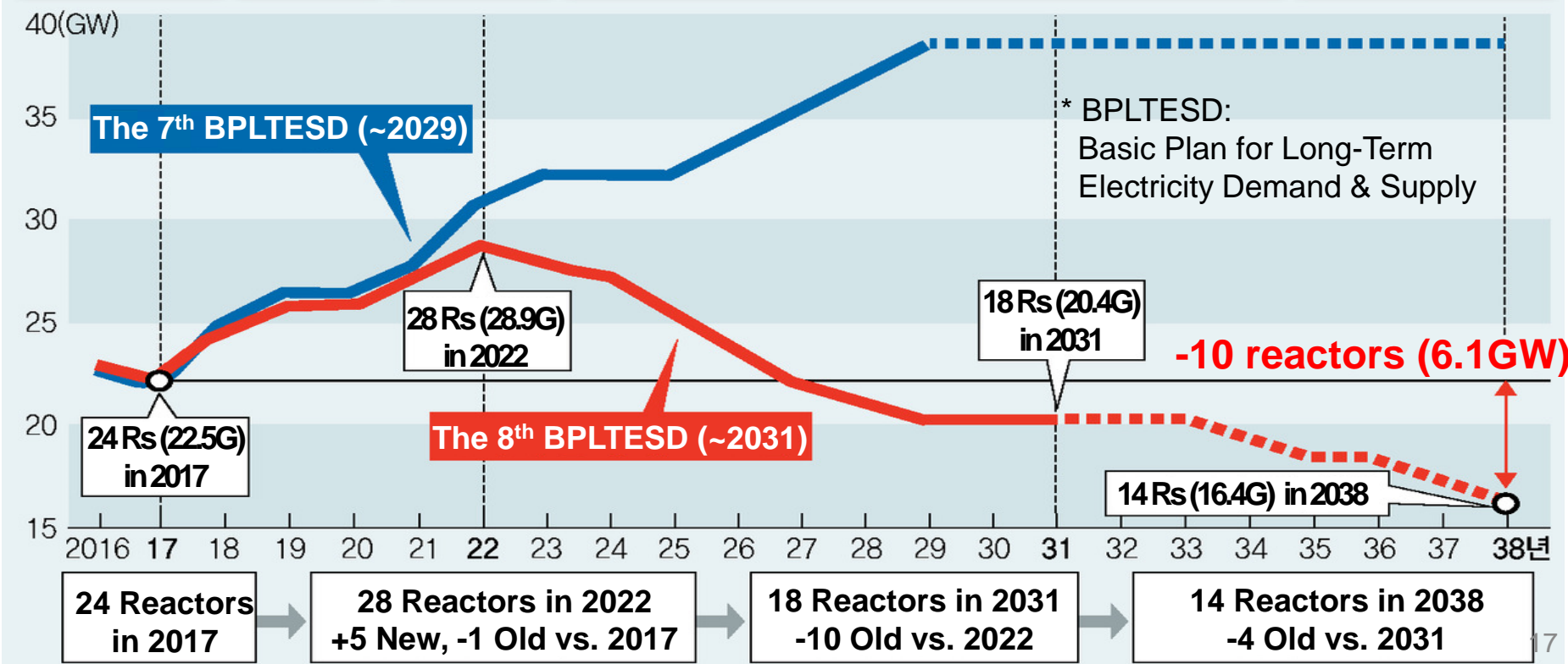
- Pushing for follow-up measures and complementary actions: Strengthening nuclear safety standard, expanding investment in renewable energy, preparing solutions for spent-fuel of nuclear power plants
- Strengthening nuclear safety standards: Strengthening safety evaluation of multiple reactors, Strengthening earthquake proof standard, Eradicating nuclear corruption
- Energy transition: Transition toward safe and clean energy, Scrapping the new reactor construction plan, nuclear-phasing out through prohibiting life-time extension of aged reactors, expanding the share of renewables to 20% by 2030

Contents

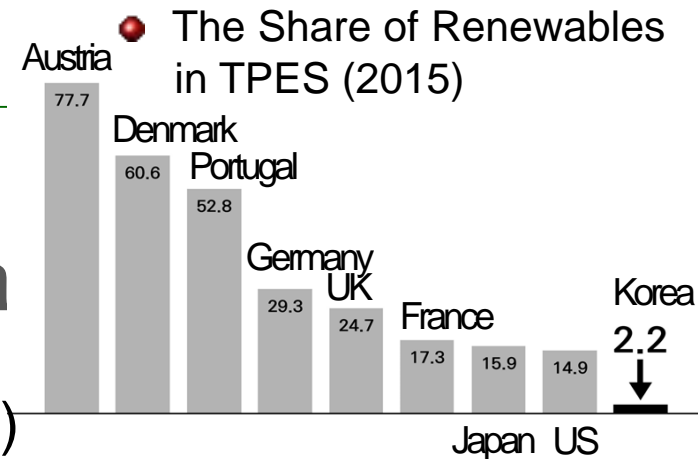
1. The Background of Energy Transition in South Korea
2. The Process & Outcome of Public Engagement in Nuclear Energy Policy
- 3. Current Energy Transition Issues**
4. Challenges & Opportunities

The Roadmap of Nuclear Phase-out

	#	Capacity	Object	Project
New Reactor	6	8.8GW	Shin-Hanul 3·4, Cheonji 1·2, New 1·2	Nullification
Old Reactor	14	12.5GW	14 reactors by 2038(Kori 2~4, Wolsung 2~4, Hanbit 1~4, Hanul 1~4)	No lifetime extension
Wolsong 1	1	0.7GW	Wolsong 1	Early closure



The Current Status of New & Renewables in Korea



New & Renewable Energy in Korea (2016)

	Installed Capacity (GW)		Power Generation (TWh)	
Total	110.4 GW	100.0%	561.7 TWh	100.0%
New & Renewables	13.3 GW	12.0%	39.1 TWh	6.95%

Comparison of the Status of Renewable Energy

	S. Korea	Germany	U.K.	Japan
Share of power generation in 2015 (PV & Wind)	6.41% (0.95%)	29.2% (18.40%)	24.8% (14.23%)	16.0% (3.96%)
Employment in 2016 (Share of population)	13,750 (0.027%)	334,000 (0.4%)	110,000 (0.17%)	313,000 (0.25%)
New installation (2011 to 2015) (PV & Wind)	6.3GW (3.5GW)	42.3GW (39.8GW)	21.0GW (18.0GW)	31.8GW (31.1GW)

Vision & Goals of Renewable E Expansion

Vision

Transition to the Participatory Energy System to improve people's quality of life
- Energy Transition will All People's Participation, 'RE3020' -

Goals

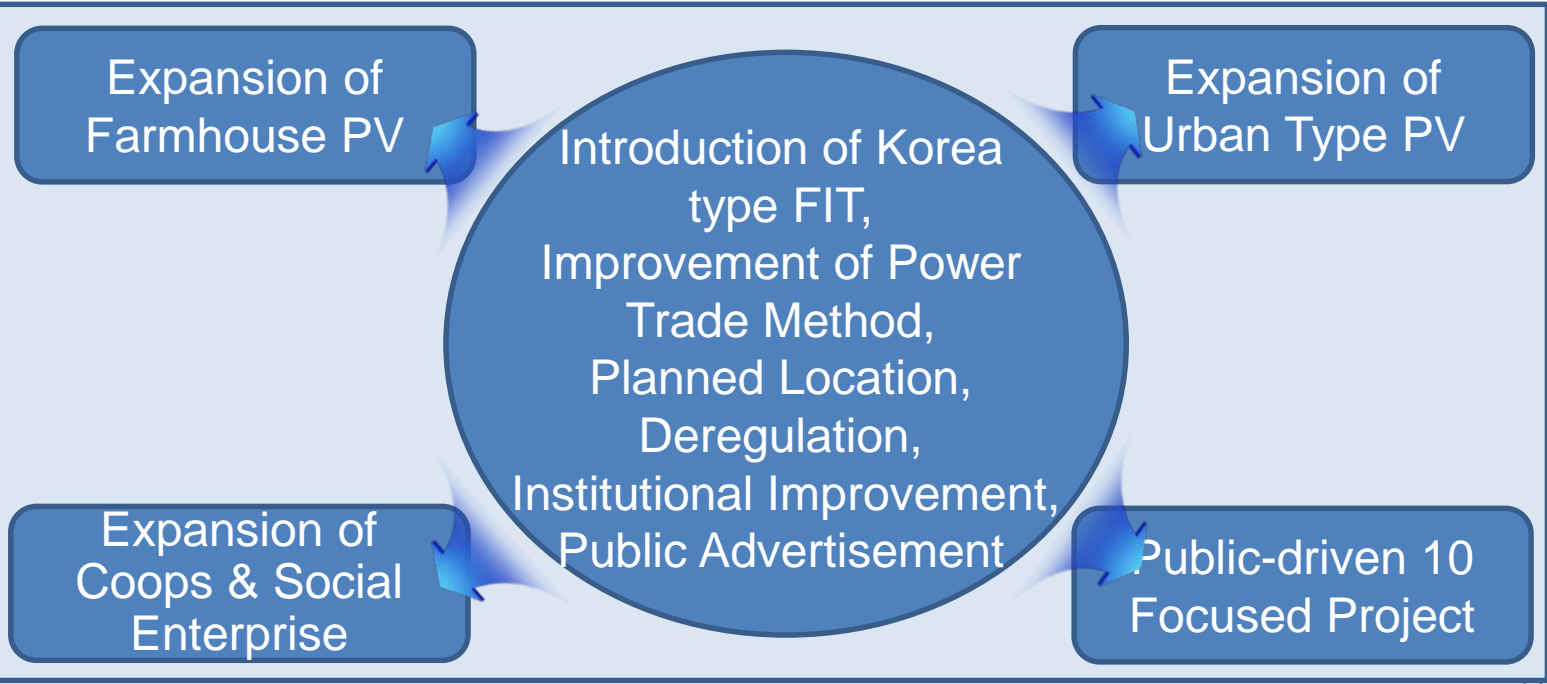
Renewable Energy		2017	2022	2030
Share of power generation		7.6%	10.5%	20.0%
People's Power plant	Urban	290,000 households	760,000 households	1,560,000 households
	Rural	0.1GW	4.9GW	15GW
Jobs		14,000	14,000	277,000

Promotion Strategy & Implementation Plan

Promotion Strategy

- Installing renewable energy facilities in each household
- Energy transition together with agriculture
- From centralized system to decentralized one
- Expansion of local governments' and residents' participation

Tasks



신재생
3020

신재생에너지를 통한
전력 생산 비율을
2030년까지 20%까지
끌어올리겠다는 의미

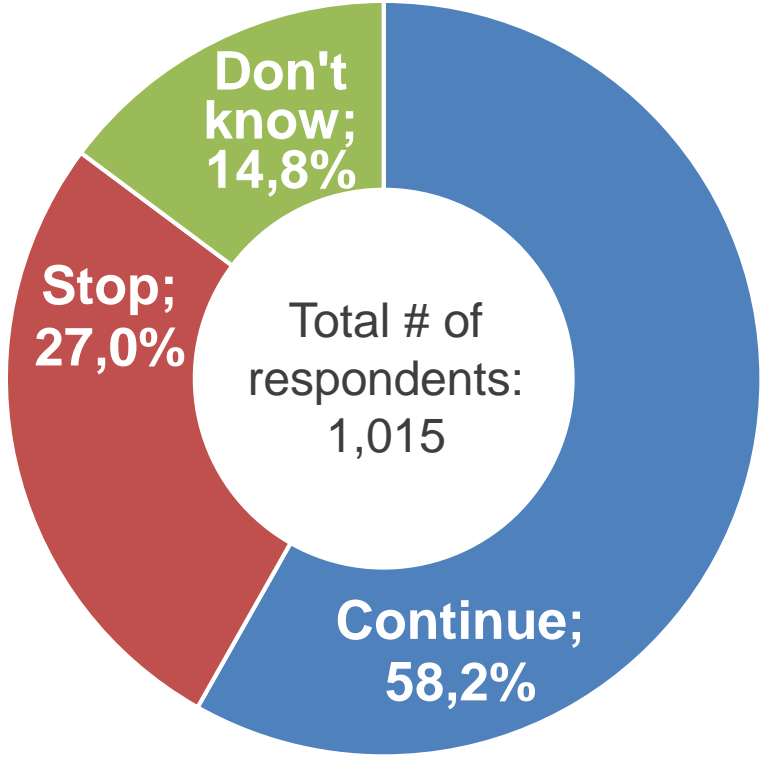
이를 위해서는 2030년까지
53GW 규모의 신규 설비 보급이 필요
정부는 태스크포스(TF)를 구성해 8월 말까지
신재생 3020 이행계획을 수립할 예정

산업통상자원부

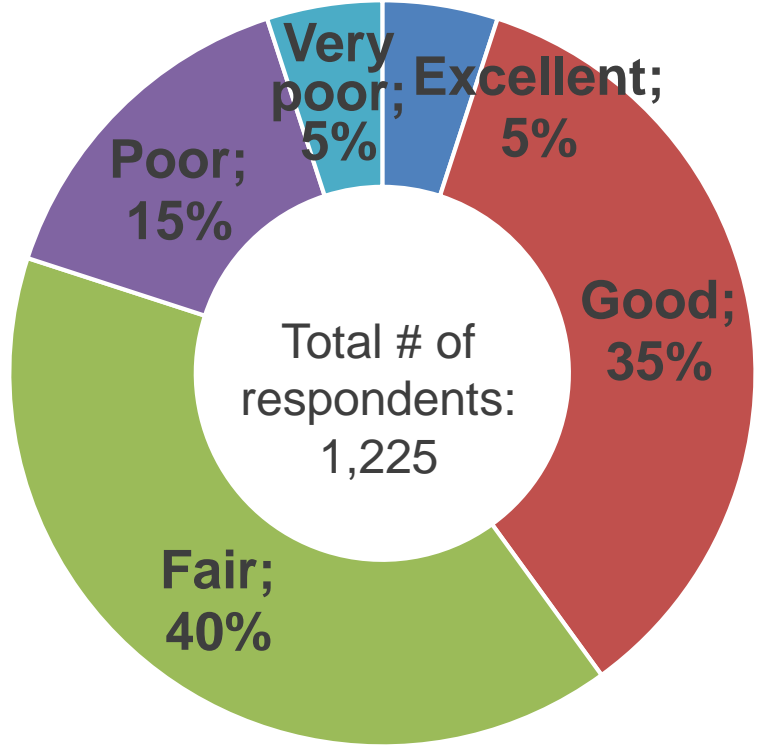
Policy Goal of Renewable Energy 2030

		PV	Wind		Hydro	Bio	Waste	Marine	Total
			On Shore	Off Shore					
Installed Capacity (GW)	New (2018~30)	30.8	4.6	12.0	0.3	1.0	-	-	48.7
	Existing (~2017)	5.7	1.2	0.03	1.8	2.3	3.8	0.3	15.1
	Total (share, %)	36.5 (57.3)	5.7 (9.0)	12.0 (18.8)	2.1 (3.3)	3.2 (5.2)	3.8 (6.0)	0.3 (0.4)	63.8 (100.0)
Power Generation (TWh) (Share, %)		46.1 (34.9)	11.1 (8.4)	31.5 (23.8)	4.0 (3.1)	16.2 (12.2)	22.8 (17.3)	0.5 (0.4)	132.3 (100.0)

Public Opinion on Energy Transition Policy



● Realmeter, 2017



● KEEI & Green Strategy Research Institute, 2018

Contents

1. The Background of Energy Transition in South Korea
2. The Process & Outcome of Public Engagement in Nuclear Energy Policy
3. Current Energy Transition Issues
4. **Challenges & Opportunities**

■ Diversification of Anti (Post)-Nuclear and Energy Transition Movements' Participants

Local residents
Near nuclear
power facilities
+
Environmental
NGOs

The diagram consists of two main parts. On the left, a light brown, irregularly shaped bubble contains the text 'Local residents Near nuclear power facilities + Environmental NGOs'. A large blue arrow points from this bubble to a larger, dark blue, irregularly shaped bubble on the right. Below the left bubble is a rounded rectangular box containing the text 'Before 3.11'. Below the right bubble is a similar rounded rectangular box containing the text 'After 3.11'. The right bubble contains a list of participants: 'Local Residents', 'Environmental NGOs', 'Experts (Professors, Lawyers, Medical Doctors)', 'Politicians', 'Local Governments', 'Cooperatives', 'Educational Org.', 'Religious Groups', and 'Peace Org.'.

Before 3.11

Local Residents
Environmental NGOs
Experts (Professors,
Lawyers, Medical Doctors)
Politicians
Local Governments
Cooperatives
Educational Org.
Religious Groups
Peace Org.

After 3.11

■ Diversified Anti (Post)-Nuclear and Energy Transition Movements' Objects & Methods

	Before 3.11	After 3.11
Objects	<ul style="list-style-type: none"> • Construction of NPP • Construction of Radioactive Waste Disposal Facility • Compensation 	<ul style="list-style-type: none"> • Construction of NPP • Power Saving Plants • Closure of aged NPP • Construction of High-Voltage Transmission Lines • Radioactivity in Living Environment (Foods and Space)
Methods	<ul style="list-style-type: none"> • Demonstrations • Campaigns • Issuing Statements 	<ul style="list-style-type: none"> • Alternative Energy Scenarios • Renewable Energy Farmers • Citizens' Energy Cooperatives • Education: Post-Nuclear School • Post-Nuclear Lawsuits • Rejection against Pro-Nuclear Politicians • Changes of Daily Life

■ Increasing Tension and Conflicts between Energy Transition Advocacy Group vs. Anti-ET

Environmental & Civil Movement Groups
Energy Transition Forum
Local Energy Transition Forum
Rural Energy Transition Forum
Energy Coops
Experts' Group (Professors, Lawyers, and Medical Doctors)

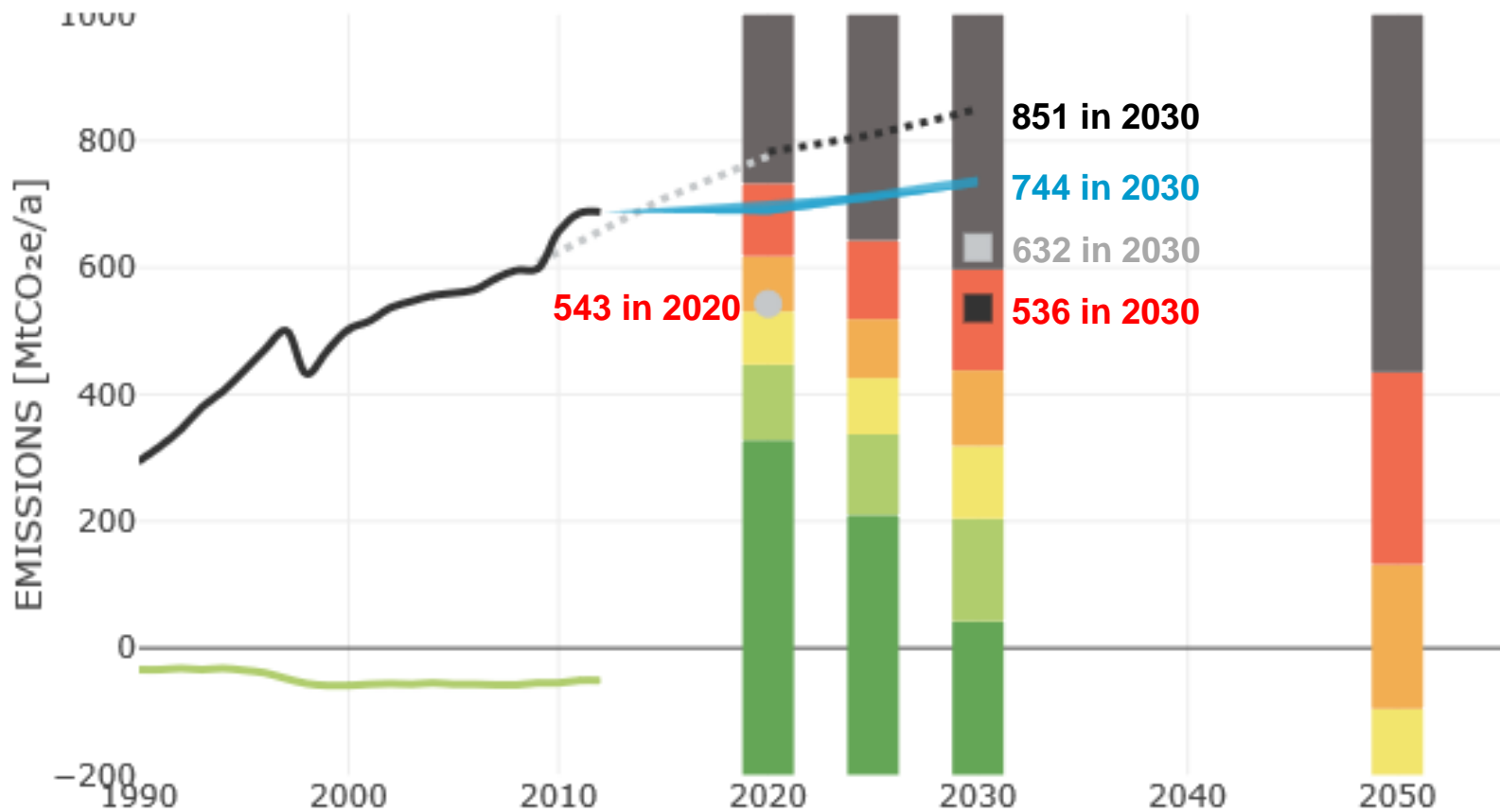
Nuclear Academia,
Trade Union of Nuclear-related Industries,
Governmental Officials,
Nuclear Power Plant Construction Companies,
Conservative & Business Newspapers

Climate Action Tracker's Evaluation



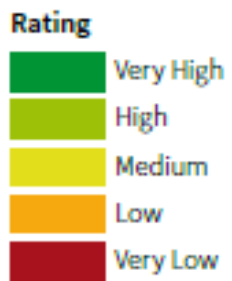
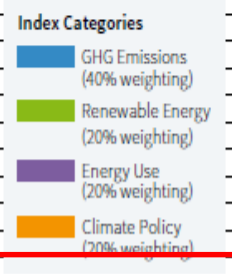
HIGHLY INSUFFICIENT
< 4°C WORLD

- Historical emissions, excl. forestry
- Historical emissions/removals from forestry
- Current policy projections
- 2020 pledge
- NDC, domestic reductions
- NDC
- ⋯ Reference for 2020 pledge



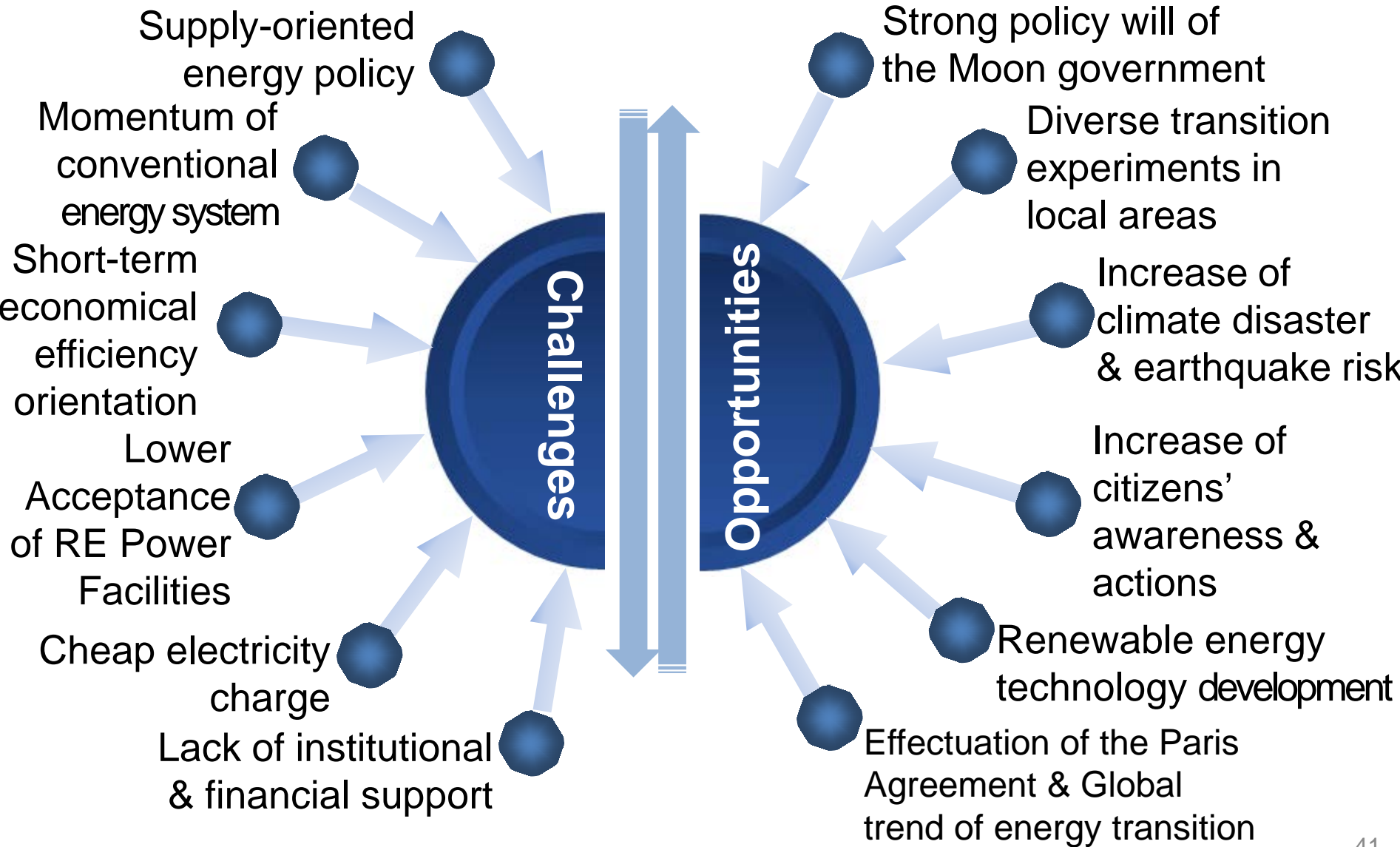
Climate Change Performance Index (CCPI)

Rank	Country	Score**		Rank	Country	Score**	
1*	-	-		31.	Slovenia	50.54	
2.	-	-		32.	Belgium	49.60	
3.	-	-		33.	New Zealand	49.57	
4.	Sweden	74.32		34.	Netherlands	49.49	
5.	Lithuania	69.20		35.	Austria	49.49	
6.	Morocco	68.22		36.	Thailand	49.07	
7.	Norway	67.99		37.	Indonesia	48.94	
8.	United Kingdom	66.79		38.	Spain	48.19	
9.	Finland	66.55		39.	Greece	47.86	
10.	Latvia	63.02		40.	Poland	46.53	
11.	Malta	61.87		41.	China	45.84	
12.	Switzerland	61.20		42.	Bulgaria	45.35	
13.	Croatia	61.19		43.	Czech Republic	45.13	
14.	India	60.02		44.	Hungary	44.00	
15.	France	59.80		45.	Algeria	43.61	
16.	Italy	59.65		46.	Argentina	41.21	
17.	Denmark	59.49		47.	Turkey	41.02	
18.	Portugal	59.16		48.	South Africa	40.61	
19.	Brazil	57.86		49.	Ireland	38.74	
20.	Ukraine	57.49		50.	Japan	35.76	
21.	European Union (28)	56.89		51.	Canada	33.98	
22.	Germany	56.58		52.	Malaysia	32.61	
23.	Belarus	56.38		53.	Russian Federation	29.85	
24.	Slovak Republic	56.04		54.	Chinese Taipei	29.43	
25.	Luxembourg	55.54		55.	Kazakhstan	28.17	
26.	Romania	55.32		56.	United States	25.86	
27.	Mexico	54.77		57.	Australia	25.03	
28.	Egypt	54.02		58.	Republic of Korea	25.01	
29.	Cyprus	52.29		59.	Islamic Republic of Iran	23.05	
30.	Estonia	52.02		60.	Saudi Arabia	11.20	



● South Korea, along with Saudi Arabia, Islamic Republic of Iran, Australia and the United States, forms the bottom five of CCPI classification, scoring low or very low across almost all categories

Opportunities and Challenges



WWF's Suggestion for Korea's 2050 Energy Vision



REPUBLIC OF KOREA 2050 ENERGY STRATEGY FOR A SUSTAINABLE FUTURE

Korea Energy Vision 2050

Summary

BUSINESS AS USUAL

- Continuation of current policies and trends
- <10% energy supplied by renewable energy



MODERATE TRANSITION

- 7% reduction in demand compared to 2014 levels
- 45% energy supplied by renewable energy



ADVANCED TRANSITION

- 24% reduction in demand compared to 2014 levels
- 55% energy supplied by renewable energy



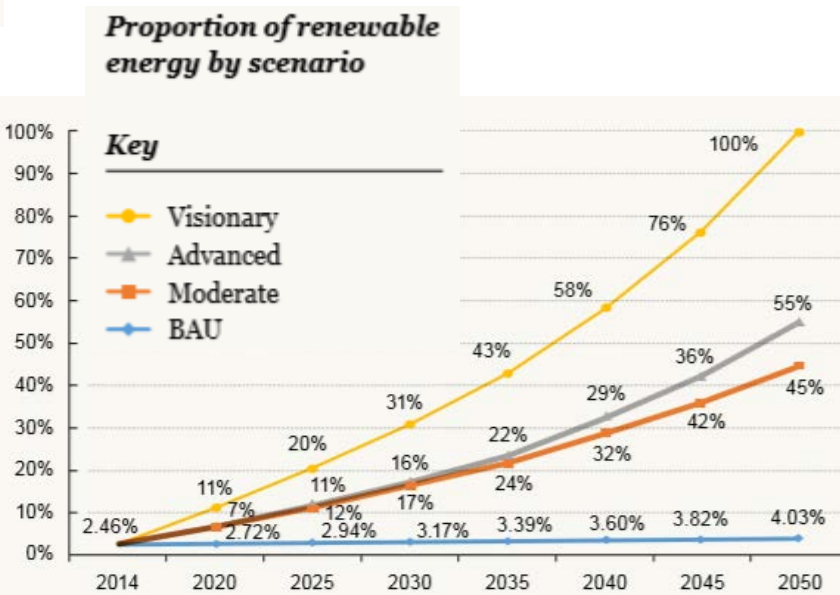
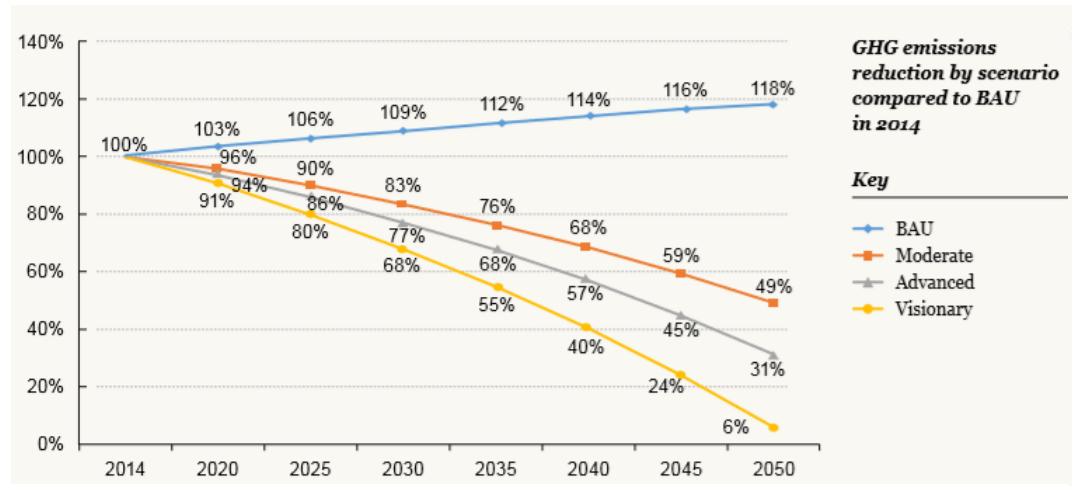
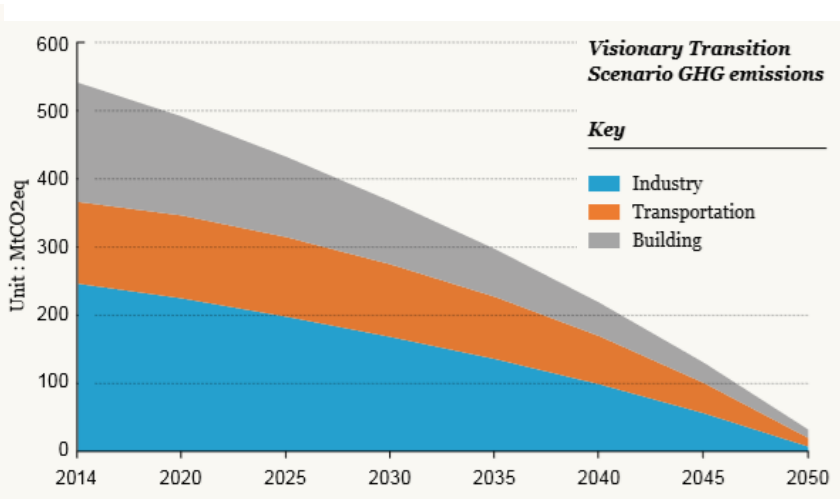
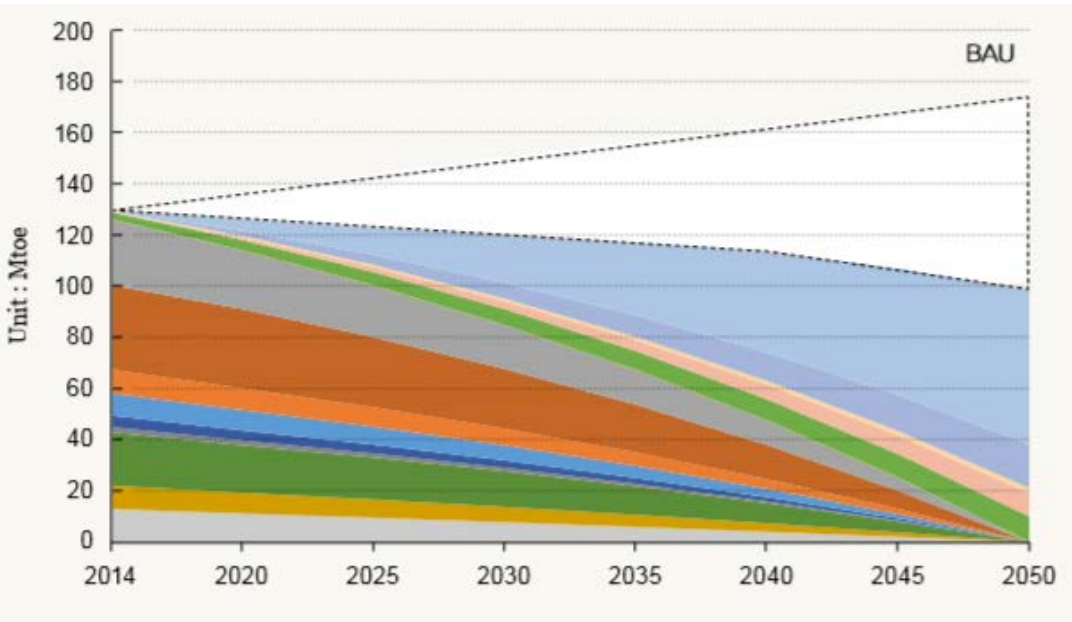
VISIONARY TRANSITION

- 24% reduction in demand compared to 2014 levels
- 100% energy supplied by renewable energy



5. 에너지 전환을 위한 도전과 과제

WWF's Suggestion for Korea's 2050 Energy Vision



22nd REFORM Group Meeting
Energy Democracy and Climate Change Policy
August 28, 2018
Salzburg, Austria

THANK YOU!

HONG, Jong Ho and YUN, Sun-Jin
Seoul National University