

Understanding Energy Policy

- World Trend and Korea's Plan -

Eunnyeong Heo

Professor of Energy and Environmental Economics, Seoul National University

Vice President of International Association of Energy Economics (IAEE)

Member of Committee on Green Growth, National Economic Advisory Council, Energy Committee



Professor Eunnyeong Heo

- **Joined Faculty of Seoul National University in 1996**

- Ph.D. in Mineral Economics, the Pennsylvania State University, USA
- B.S. and M.S in Petroleum & Mineral Engineering, Seoul National University, Korea
- Head, Dept. of Energy Systems Engineering (2017~)
- Head, Interdisciplinary Program of Technology Management, Economics & Policy (2011~2014)

- **Found IEPP (International Energy Policy Program) in 2009**

- Total 73 government officials from 27 countries have joined the M.S and Ph.D. program
- Six alumni from Mongolia (Ministry of Energy / Electricity)

- **Government Activities**

- 4th Revolution Advisory Council – Smart City Committee (2017~)
- Committee on Green Growth (2013~)
- National Economics Advisory Council (2013~)
- Committee on Energy Policy (2010~2014, 2016~)
- 2018 PyeongChang Olympic & Paralympic Organizing Committee (2011~)
- Presidential Committee on Sustainable Development (2000~2001, 2004~2008)

- **Academic Affiliations**

- IAEE (International Association for Energy Economics) Vice President
- KREA (Korean Resource Economics Association) Vice President
- KSNER (Korean Society for New and Renewable Energy) Vice President
- Committee Chair for **AFORE 2018** (Asia-Pacific Forum on Renewable Energy)

PyeongChang 2018 Winter Olympic

- **The 23rd Olympic Winter Games**

Feb. 9~25, 2018

- **The 12th Paralympic Winter Games**

Mar. 9~18, 2018

www.pyeongchang2018.com



PyeongChang 2018

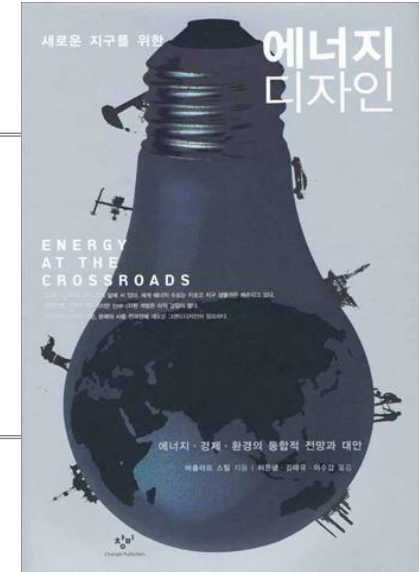


Global Trend in Energy Policy

Vaclav Smil, “Energy at the Crossroads”

21st Century, we ace Two, not One, Targets
[Energy Security} + [CO₂ Control}

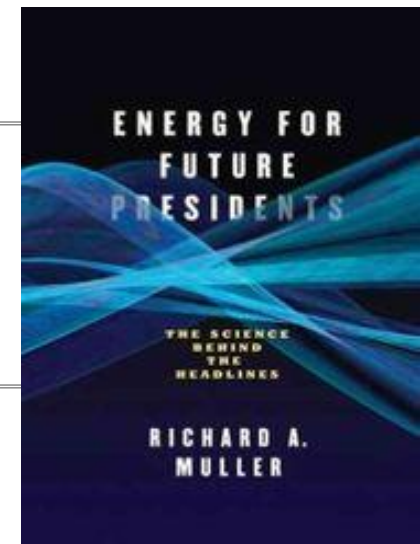
Vaclav Smil, ‘Energy at the Crossroads,’ The MIT Press (2003)



Richard Muller at “Energy for the Future President”

21st Century: - Energy Security (Supply Side)
- Low Emissions (Demand Side)

Richard Muller, ‘Energy for the Future President,’ W.W. Norton (2012)



Global Trend in Energy Policy

- ① USA : 2001 - National Energy Policy (Cheney Report)
- ② Japan : 2003 - National Energy Plan
- ③ Swiss : 2002 - 2,000 W Society Plan
- ④ Russia : 2002 - Energy Strategy towards 2020

- * USA/EU/Russia, all started preparation from 1999 when crude oil price was lower than \$20/bbl
- * All strategy/plan targets to solve TWO objectives : Energy Security & Climate Change Convention
- * All strategy/plan bases on its OWN resources

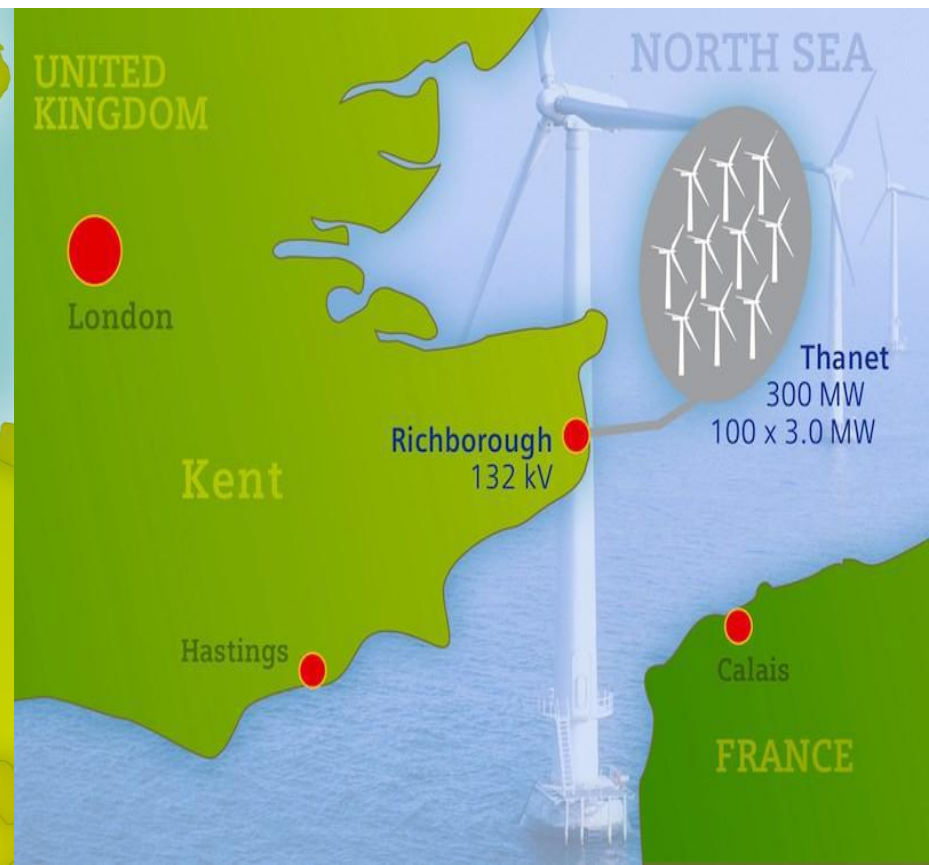
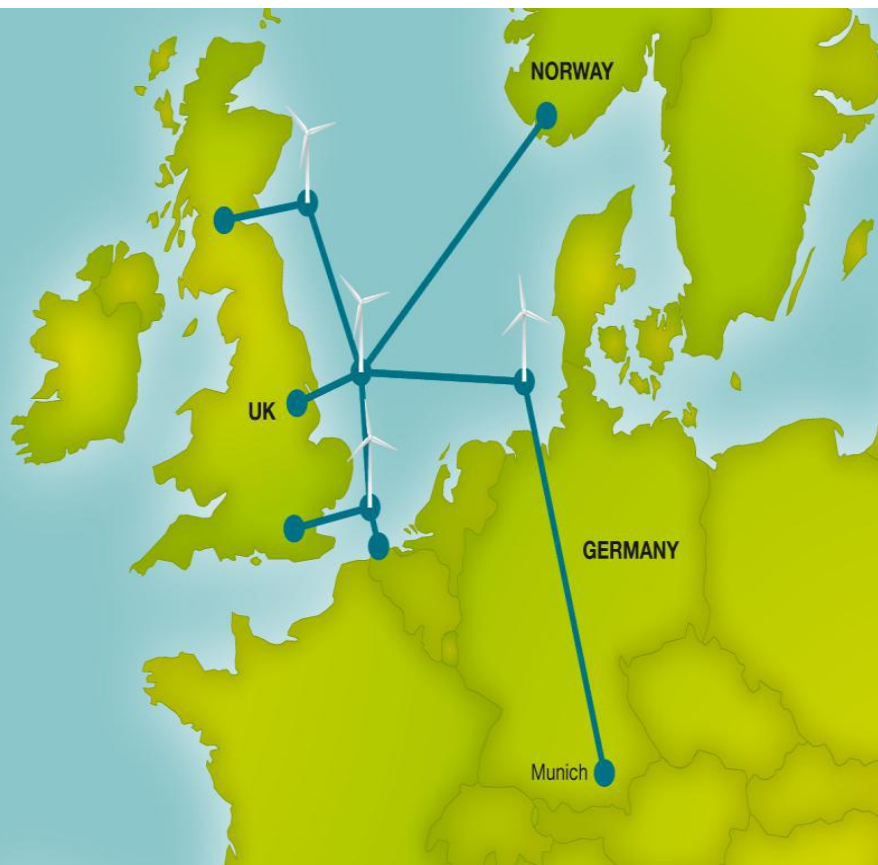
Global Trend in Energy Policy

- ① **USA: May 2001, National Energy Policy**
Nuke again, More Middle-east, More overseas developments
- ② **Japan: 2003, National Energy Policy**
Out of Middle-east & Petro, More Nuke, efficiency & Security
- ③ **Swiss: 2002, 2,000W Society Plan**
60% efficiency improvements via Technology Developments
- ④ **Russia: “The Only” energy supplier in North-east Asia**
Boost up Positions/potentials, Foreign Investments & Exports

* Korea : started committee in 2003,
Announced its first National Energy Policy in August 2008
Announced ‘Low Carbon Green Growth Policy’ in August 2009

Europe/EU – Energy Saving & Renewables

- Nuclear in France, Oil&Gas in North Sea, Coal in Germany
- All connected via Nord-EU Super Grid
- Plans to stop import Oil from OPEC + Utilize Wind and Solar

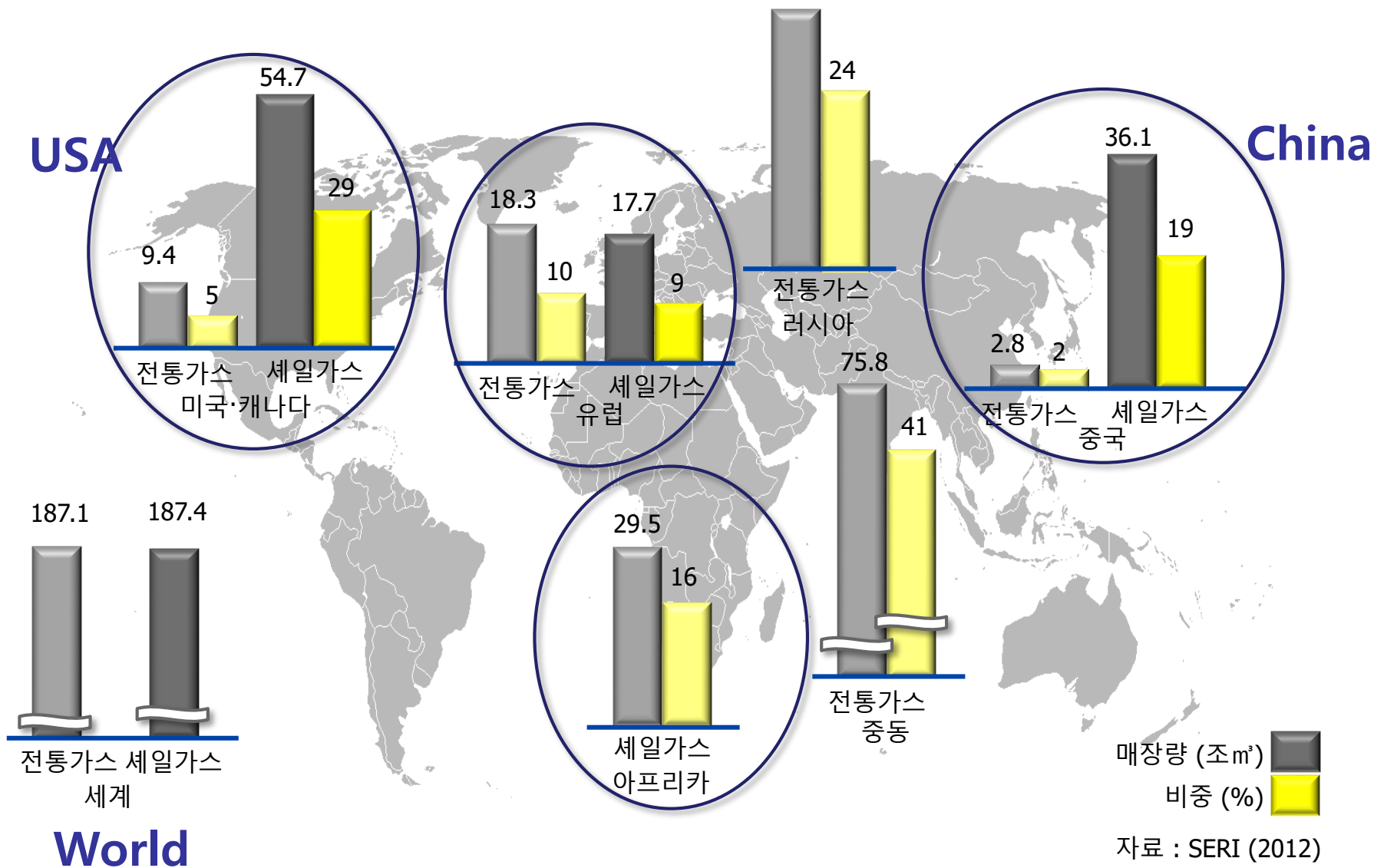


USA – Supply, Supply, Supply

- US wants to stop import Crude Oil from OPEC and also wants to control international markets
- 14 ministries work together to provide a report
- ✱ **National Energy Policy (Cheney Report, 2011.05)**
 - Increase Overseas Oil Development : Middle East, Africa, etc
 - **Intervene Middle-East to control Crude Oil Market**
 - Re-use Nuclear Power
 - Invest in Energy Supply Technology/Business

As a result of the above,
US companies develop Shale Gas Production Tech (2008)
Now US plans to EXPORT, not import energy

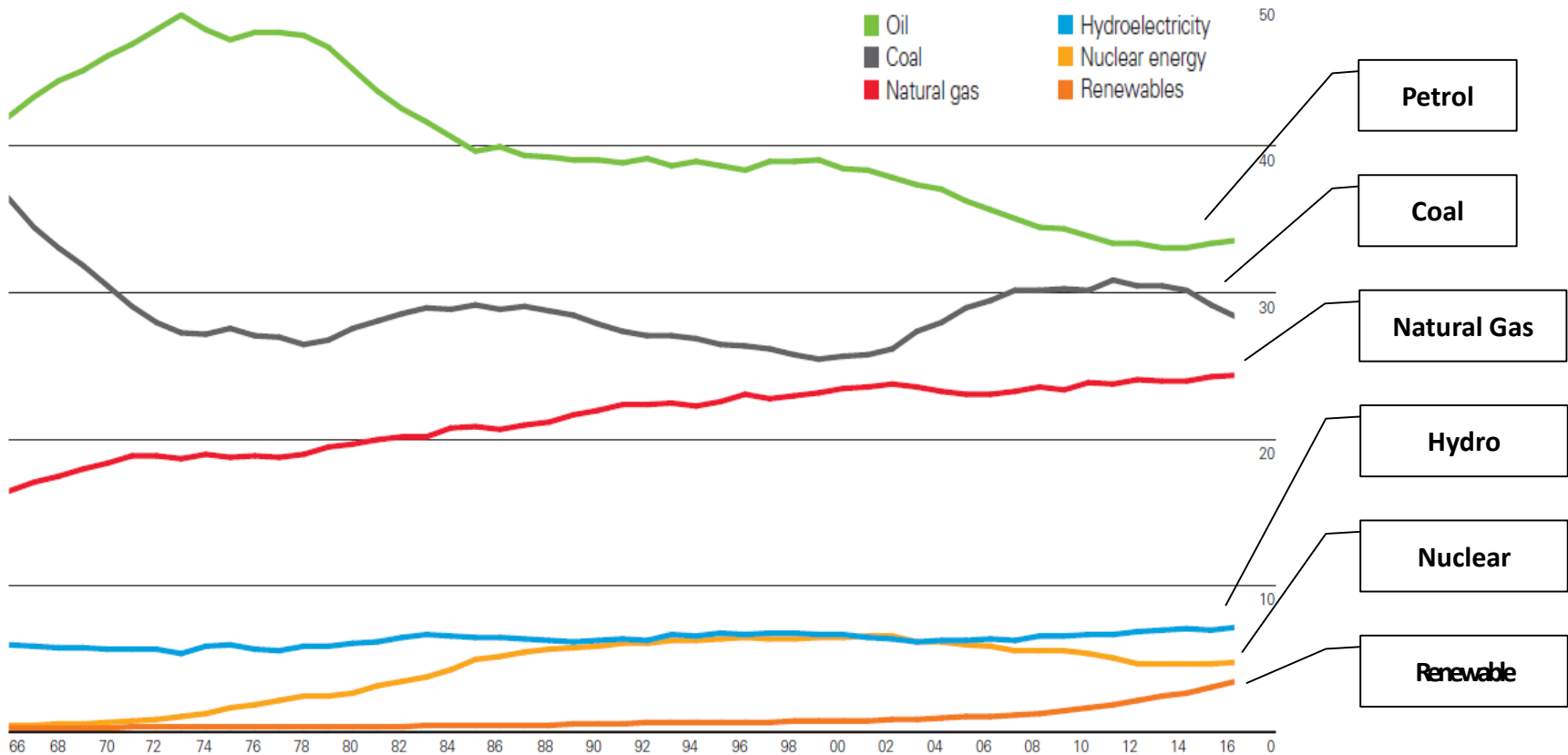
Shale Gas in the World



Global Changes in Energy

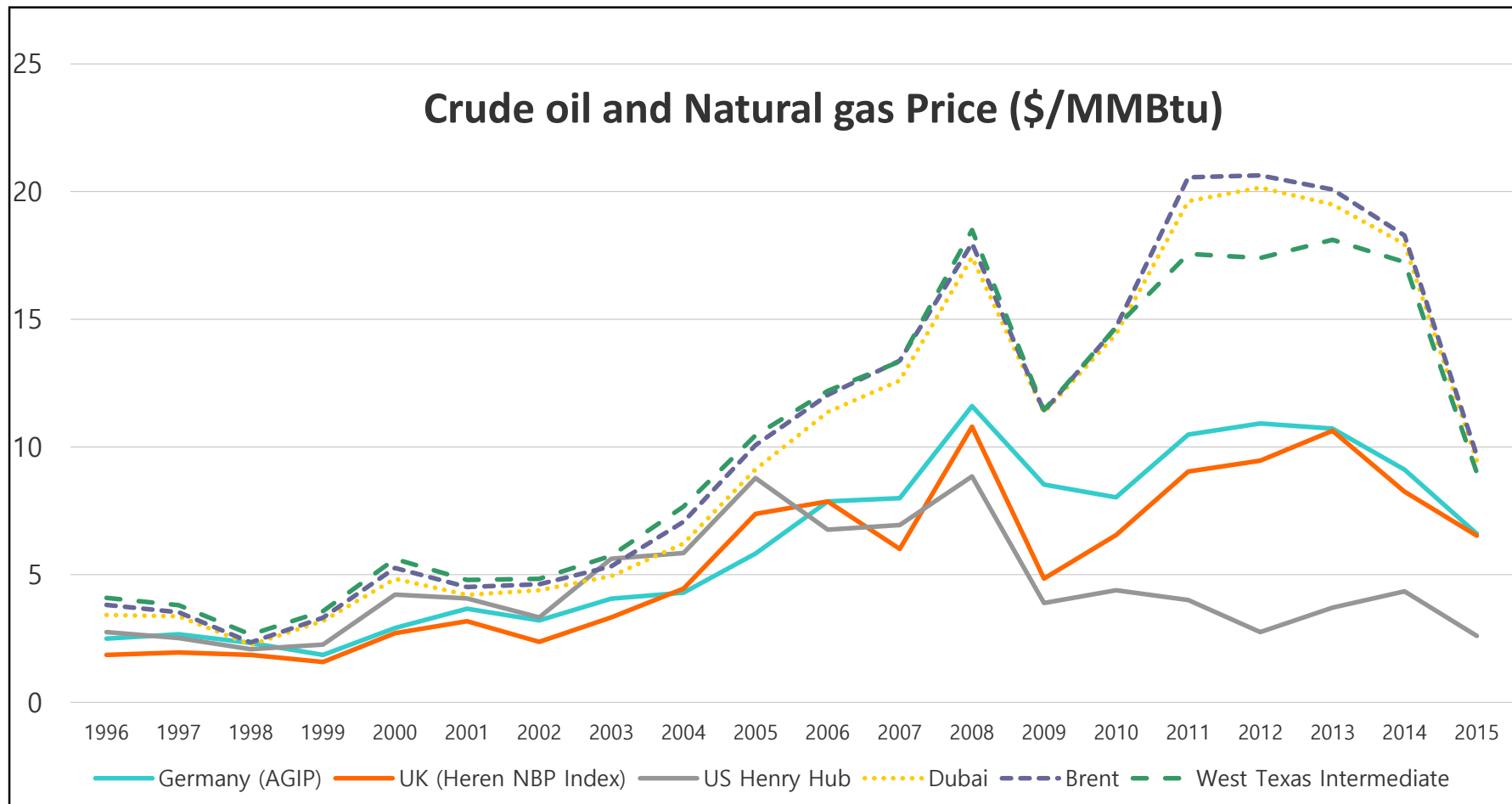
Petrol & Coal in decline, NG & Renewables in rise

% Changes in Energy Use (1966~2016, %)



Global Changes in Energy

NG & Crude Oil Prices in International Markets after 1995



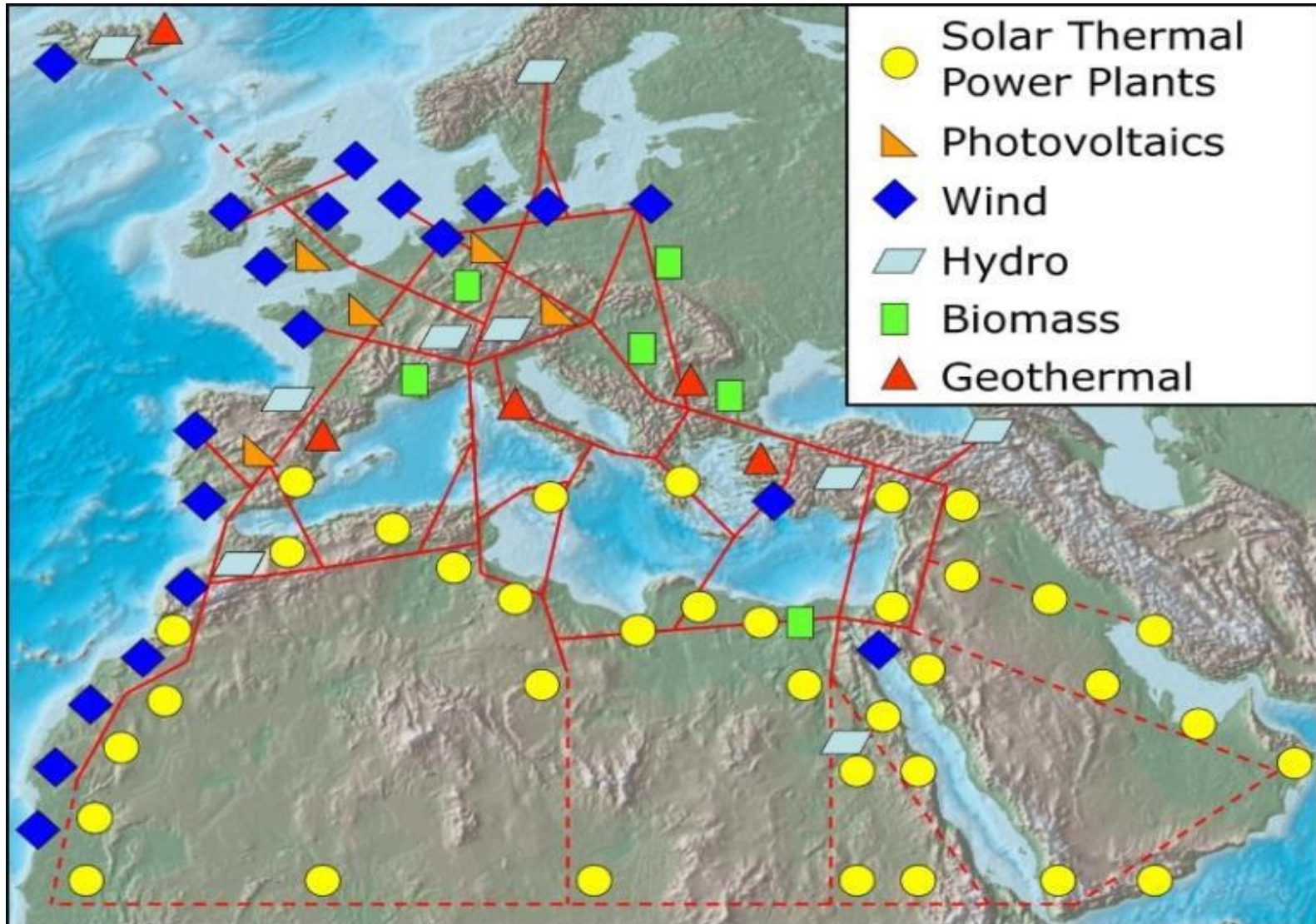
Global Trend in Energy Policy

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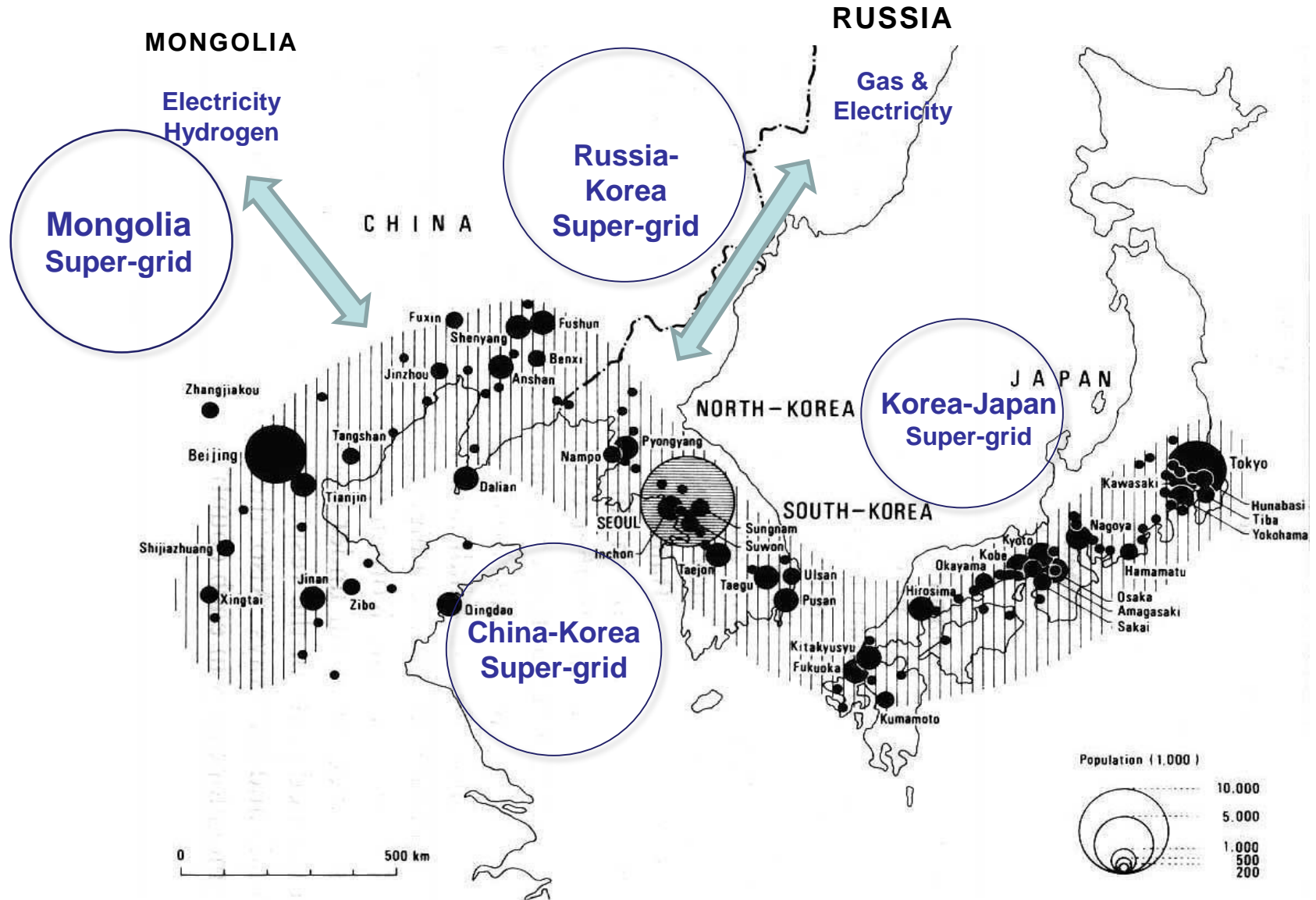
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Then, what do you have?

Super Grid in Europe - Desertac

Sud-EU, Maghreb, ME & Desertec Project



Super Grid in Asia – Softbank's Son Plan



Super Grid in Asia – IEEJ Japan

● Continental Asian Energy Network advancing

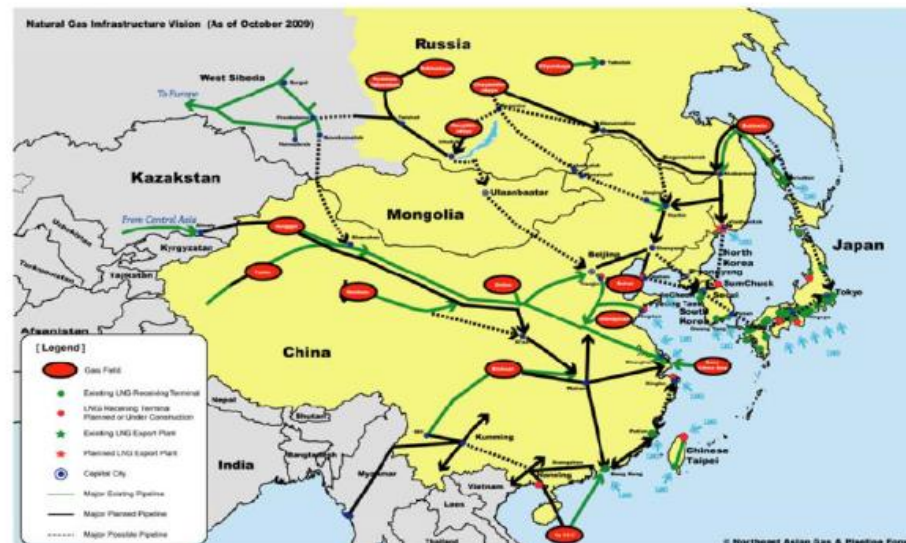
Recent moves

- ① **China and Russia:** (Presidents Xi Jinping and Putin)
Agreement on natural gas supply deal (May 2014)
- ② **Korea and Russia:**
(former Presidents Li and Medvedev)
Agreement on cooperation for construction of gas pipelines (November 2011)
 - • • with China too?

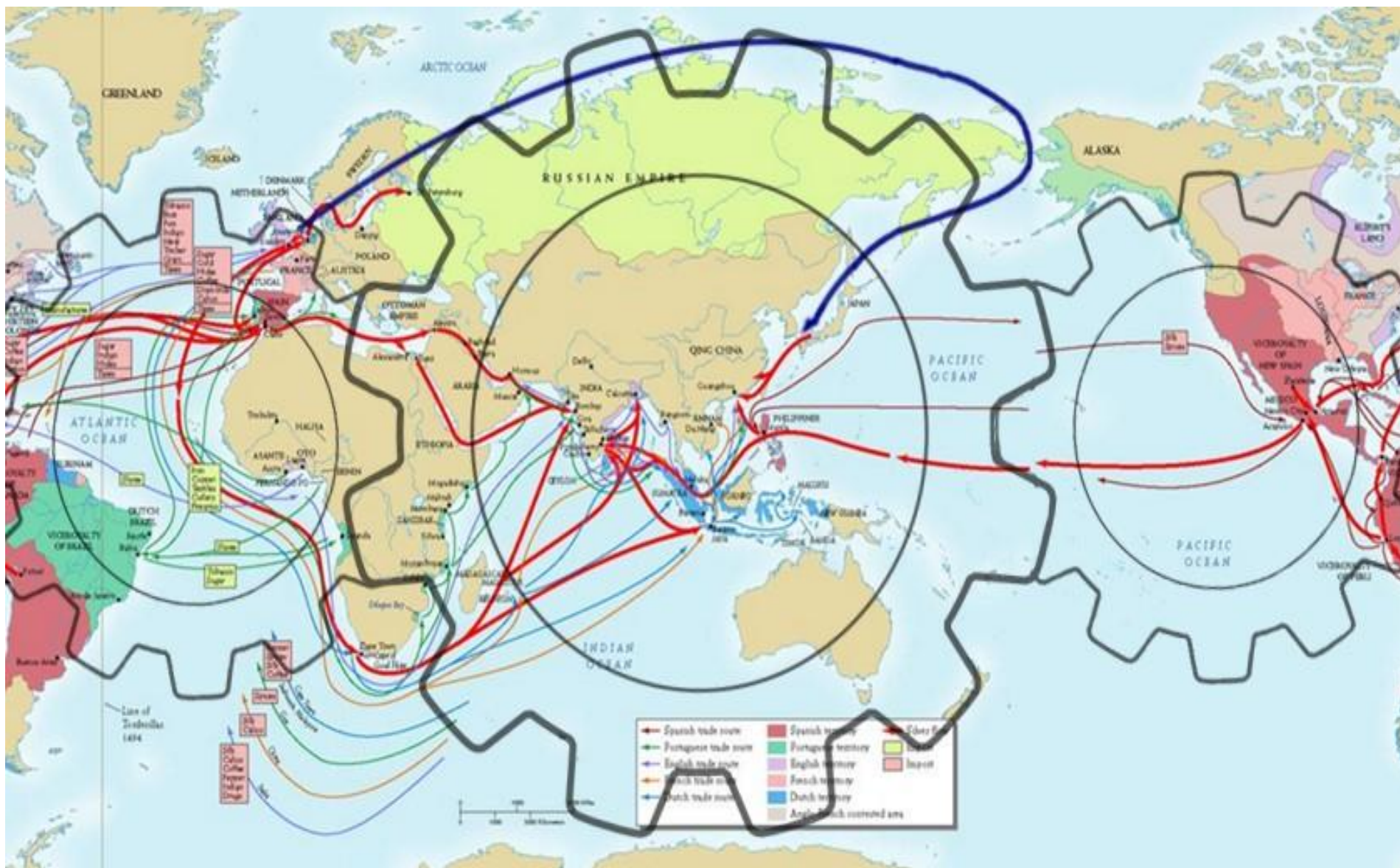
● Japan's options

- ① **Independent route**
⇒ Asia premium to Japan premium?
- ② **Natural gas pipeline?**
International connection of its electricity grid?

Blue Print for
North East Asia
Gas & Pipeline
Infrastructure



Super Grid in Asia – Yeoseje Plan (Korea)





EVER-GROWING NEED FOR ENERGY COOPERATION



- Ever-growing need for energy cooperation in the Northeast Asian region
 - Political side:
 - President Park's '**Eurasia Initiative**'
 - President Xi Jinping's '**New Silk Road**'
 - President Putin's '**New Eastern Policy**'
 - Economic side:
 - Bilateral or trilateral FTA talks
 - Energy side:
 - Establishing trans-border energy transport networks
 - ➔ Forming nuclear safety body
- Active promotion of cross-border energy grid projects
 - Multilateral cooperative mechanism for creating a more favorable conditions for investment and financing

EVER-GROWING NEED FOR ENERGY COOPERATION



- More interests in a proactive response to **supply crises, emergencies, and emerging supply sources**
- **North Pole Route** as a new energy transportation route and abundant undeveloped energy resources in the Arctic region
- **Energy supply infrastructure** (e.g. pipeline, transmission line) is required to facilitate the **intra-regional trade**
 - Improved self-sufficiency of energy in the region and reduced dependency on imports from outside the region, particularly the Middle East
 - Cost-effective and sustainable energy mix
- But, a lack of effective measures to address emerging **common safety, environment, and security** issues as compared to Europe and America
 - **Intergovernmental Collaborative Mechanism on Energy Cooperation in the Northeast Asia** (Nov. 2005)

Opportunities for Cooperation in NE Asia

<< Technology cooperation opportunity >>

- **Energy conservation/efficiency improvement**
- **Clean Coal Technology**
- **Renewable energy for low carbon Green Growth**
- **Cross-border power interconnection grids**
- **Nuclear safety**
- **Non-conventional energy sources**

<< Solving Energy Poverty Problems >>

- **Solution to energy accessibility problem in developing economies in the region**

A large crowd of people, many wearing team jerseys (red and white, blue and white), cheering and holding up white cards or phones, likely during a Formula 1 race event.



Korea, Republic of

❖ Korea Now : Just got some attentions

- Population : 51,465,228 in Aug. 2015, 22nd in the world)
- Population density : 518/km² (2014), 3rd after Bangladesh and Taiwan
- GDP : 1,411.0 billion \$ (2014, BOK) 15th in the world
- GDP per capita : 27,964 \$ (2014, BOK)
- Exports/Imports : 621.2/535.4 billion \$ (2014, BOK)
- 255 Universities (more than 80% of high school grads go to college)
- 22 pro-football teams, 10 pro-basketball teams, 10 pro-baseball teams
- PSY's Gangnam Style !!!



Korean Economy

Table Korean Economy during the last 60 years

	1953	1960	1970	1980	1990	2000	2010
GDP (100mil \$)	13	20	81	643	2,703	5,335	10,147
GNI (100mil \$)	14	19	82	633	2,702	5,308	10,160
GNI per capita (\$)	67	79	255	1,660	6,303	11,292	20,562
Change in GNI per capita (%)	-	18	223	551	280	79	82

Table from Il SaKong & Youngsun Koh Ed. "THE KOREAN ECONOMY - Six Decades of Growth and Development -" KDI, 2010

Korean Economy

Table Share of the Top 10 export items in total exports

Rank	1961	1970	1980	1990	2000	2008
1	Iron Ore	Textile	Garments	Garments	Semi-conductors	Ships and ship components
2	Tungsten	Plywood	Steel plate-rolled products	Semi-conductors	Computers	Petroleum products
3	Raw yarn	Wigs	Footware	Footware	Automobile	Mobile phone
4	Coal	Iron Ore	Ships	Video equipment	Petroleum products	Automobile
5	Cuttlefish	Electronic goods	Audio equipments	Ships	Ships	Semi-conductors
6	Live fish	Confectionery	Man-made filament fabrics	Computers	Mobile phone	Flat display screens
7	Graphite	Footware	Rubber products	Audio equipments	Synthetic resin	Steel plate-rolled products
8	Plywood	Tobaccos	Wood and wood items	Steel plate-rolled products	Steel plate-rolled products	Synthetic resin
9	Rice	Iron Products	Video equipment	Man-made filament fabrics	Garments	Automobile parts
10	Swine Bristle	Metal products	Semi-conductors	Automobile	Video equipment	Computers

Korean Economy

Public Infrastructure
improved in advance via government

Case 1 : Housing & Transportation

	1962	1970	1980	1990	2000	2008
Housing Supply Ratio (%)	82.5 (1960)	78.1	71.2	72.4	96.2	109.9
Roads (km)	27,169	40,244	46,951	56,715	88,775	104,236
Expressways (km)	-	-	1,225	1,551	2,131	3,447
Railroads (km)	3,032	3,193	3,135	3,091	3,123	3,381
Cargo through Seaports (M tons)	-	-	82.3	224.3	430.4	758.6
Flight through Airports (1,000 flights)	140	600	1,006	1,331	2,025	2,222

Korean Economy

Public Infrastructure

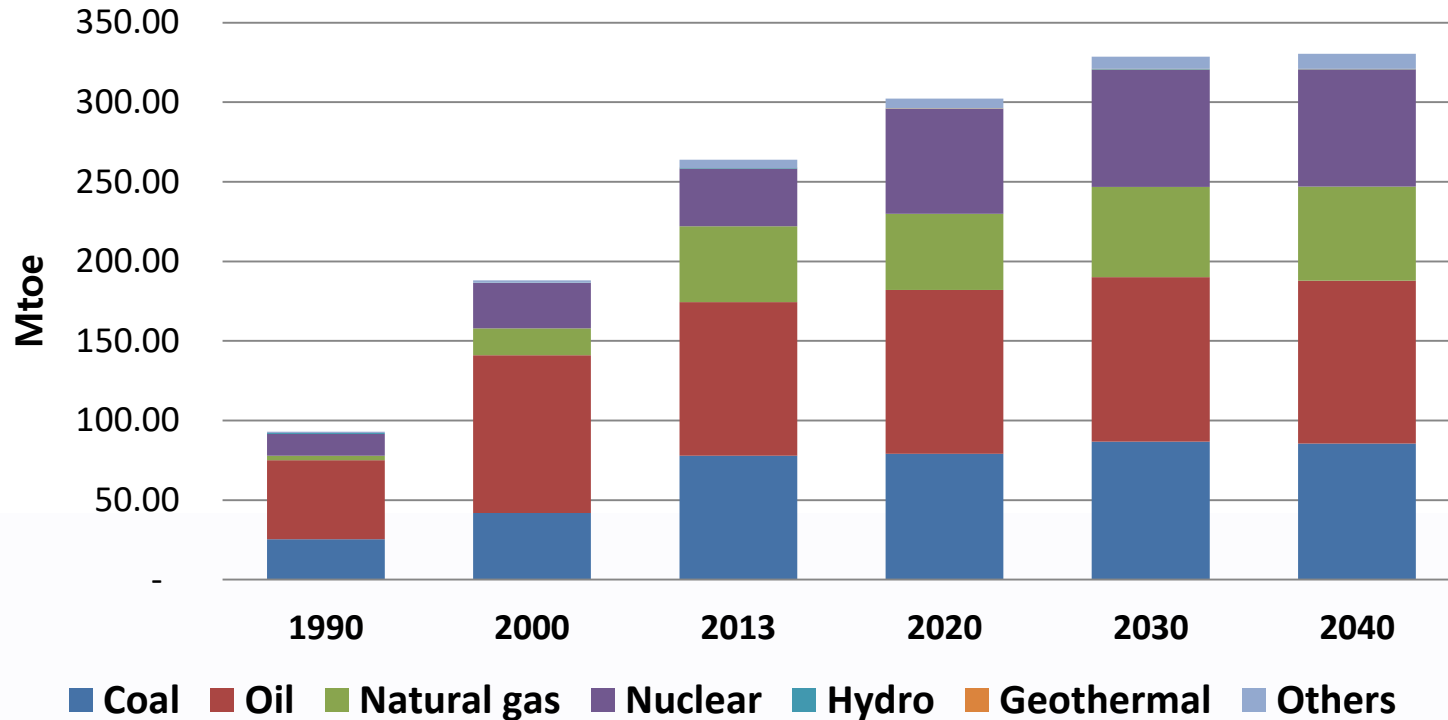
improved in advance via government

Case 2 : Telecommunications & Internet connections

Growth contributions by ICT industries

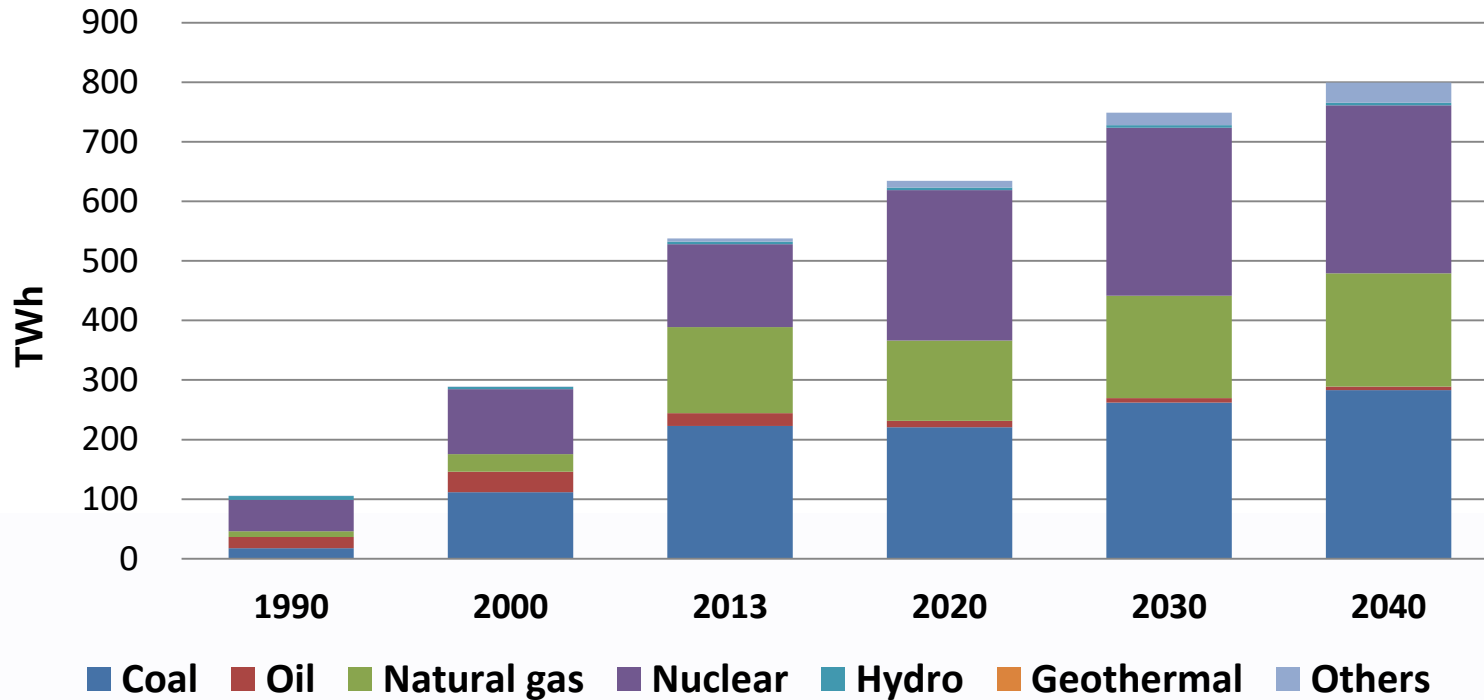
	1998	1999	2000	2001	2002	2003	2004
GDP Growth	-6.9	9.5	8.5	3.8	7.0	3.1	4.6
ICT Growth	23.0	35.3	33.8	10.5	17.6	14.2	20.4
Contribution (percentage points)	1.1	2.2	2.3	1.0	1.8	1.6	2.5

PRIMARY ENERGY DEMAND IN KOREA



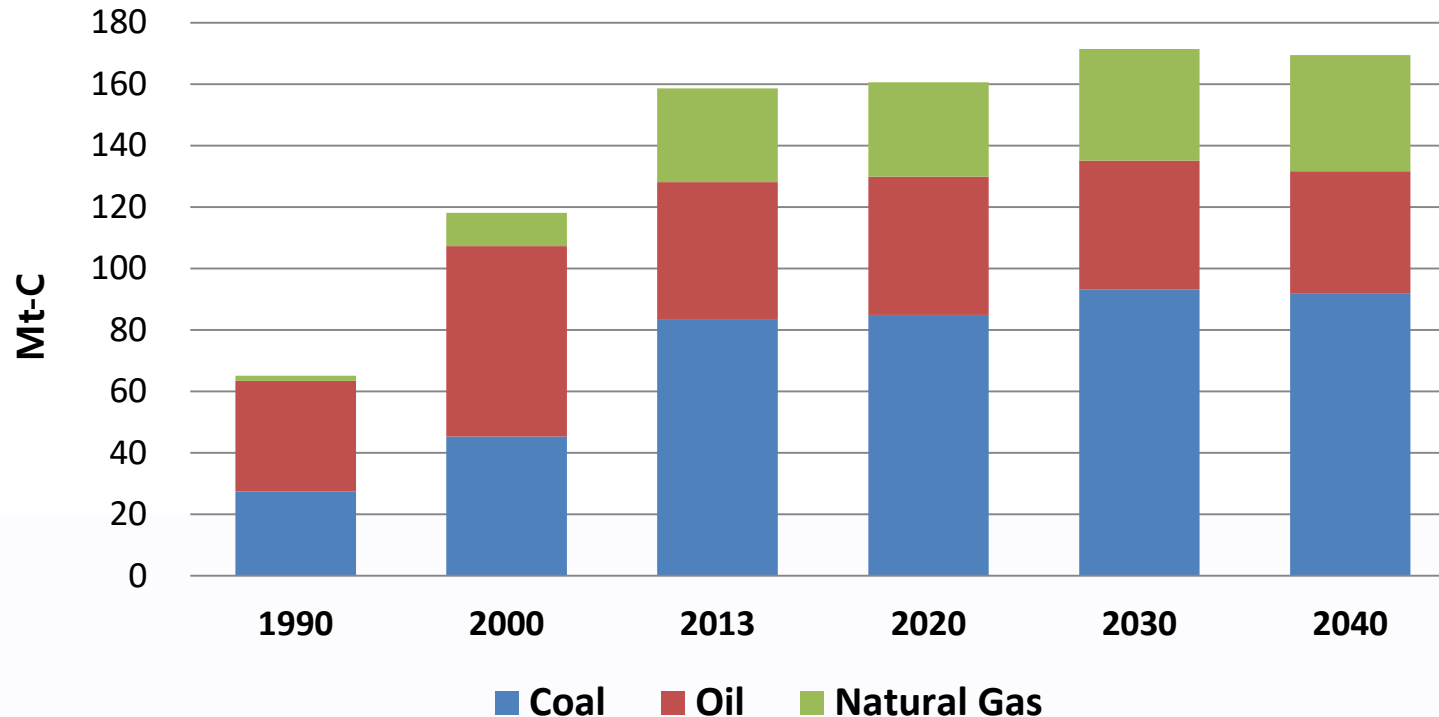
- TPED will grow an annual rate of 0.9%, reaching 330Mtoe in 2040 from 264Mtoe in 2013
- The share of oil will drop to 31% in 2040 from 37% in 2013, coal's share will drop to 26%
- Gas will keep its share at around 18%
- The share of nuclear will increase to 22% in 2040 from 14% in 2013

POWER GENERATION IN KOREA



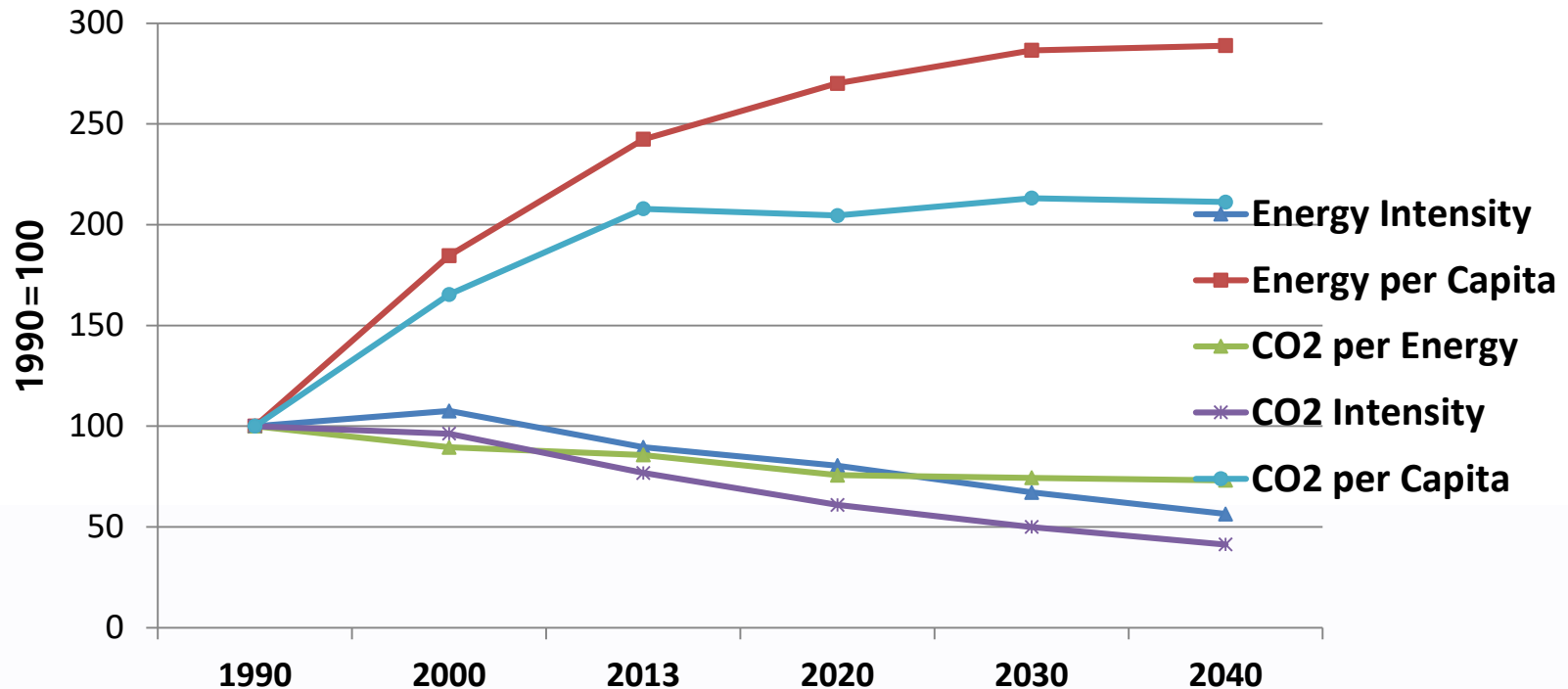
- Power generation will increase at 1.5% a year, reaching 800TWh in 2040.
- Nuclear will increase its share in the total power generation to 35% in 2040 from 26% in 2013
- Coal and gas will be the major fuels for the power generation, however, their shares will drop from 41%(2013) to 35%(2040) for coal and from 27%(2013) to 24%(2040) for gas.

CO2 EMISSIONS



- CO2 emissions will peak at 33 Mt-C in 2036
- CO2 emissions per GDP will improve from 2005 level by 24% in 2020, 37% in 2030

ENERGY AND CARBON INTENSITY



- Energy intensity will decrease during the outlook period with an annual average growth rate of -1.7%. As compared with the that of 2013, it improves by 37%
- Carbon intensity will improve from 2005 level by 24% in 2020 and 37% in 2040.

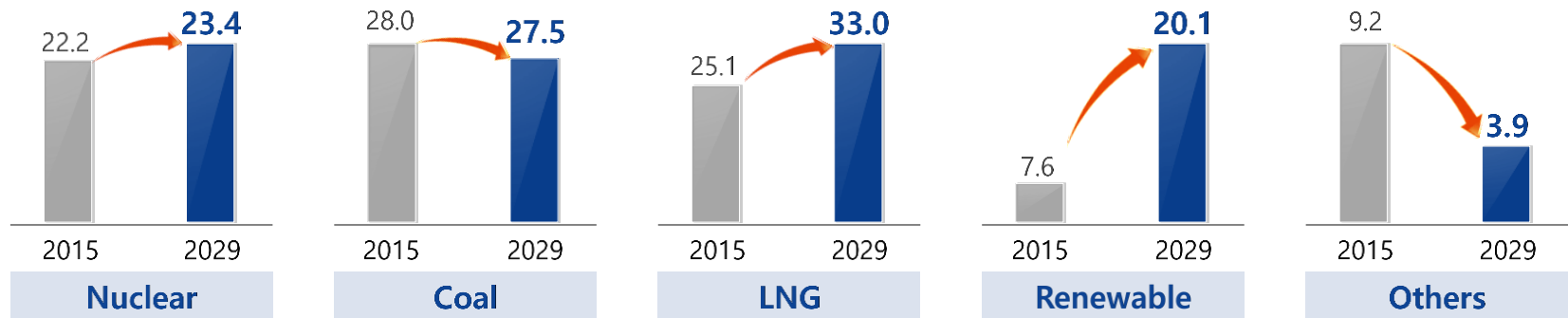
7th Basic Plan for Electricity Supply and Demand (2015)

Power Mix

- Strengthened the low-carbon power mix in preparation for the new climate regime
- Minimized CO₂ emissions by closing down four existing coal-fired power plants and meeting new installation volume with low-carbon energy sources
- Decided to allow construction to replace thermal power facilities that have been in operation for more than 40 years only when environmental conditions are improved
- Compared to 2015, ratio of coal decreased (0.5%p) but that of non-fossil fuels, such as nuclear and renewables, will increase (1.2%p, 12.5%p respectively)

Current status and forecast of power mix

(Unit: %, installed capacity)



Future Plan

- The 8th Basic Plan for Electricity Supply and Demand will be formulated in 2017 after consultations with experts in consideration of recent high temperature volatility and new power demand, such as electric vehicles

New Energy Industries (2013~)



Industries

Photovoltaic

- ④ Joint entry into foreign markets by large & state-owned companies and SMEs

EV & Charger

- ④ More exports of EVs
- ④ Entry into foreign charger markets

ESS

- ④ Linking with renewables
- ④ Support for overseas demonstration, such as ESS for RF

Prosumer

- ④ Small-scale prosumer
 - ④ Large-scale prosumer
- Trading between neighbors

Smart grid

- ④ Customized strategy for each regional market



Models

Eco-friendly energy towns

- ④ Best practices in Korea
- ④ Introduction to Fiji and Poland

Energy independent islands

- ④ Export and commercialization of various ongoing energy independent island models

Zero-energy buildings

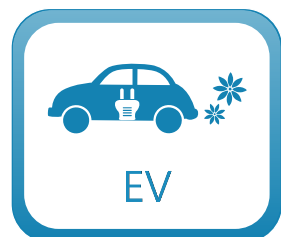
- ④ Obligation for zero-energy buildings by 2025



■ Bold Regulatory Reform and Various Support Systems



- ④ Improve regulations on sites in rivers, off-shore areas and idle lands for power plants (Mar. 2016)
- ④ Give RECs when trading extra power from independent photovoltaic generators (Mar. 2016)



- ④ Increase subsidy for purchasing electric vehicles from KWN 12 mil. → KWN 14 mil. (Jul. 2016)
- ④ Mandate the purchase of electric vehicles for public agencies (Jun. 2016)
- ④ Introduce four types of rate systems for EV charging service providers (Mar. 2016)
- ④ Discount 50% of the base rate



- ④ Allow the sale of ESS-stored power to Korea Power Exchange (Dec. 2014)
- ④ Allow the replacement of emergency power generators with ESS (Apr. 2016)
- ④ Introduce a rate system that encourages the use of ESS (Mar. 2016)



- ④ Allow direct selling of photovoltaic power to neighbors (Feb. 2016, demonstration project)
- ④ Allow the use of power from independent photovoltaic generators of big buildings to reduce electricity costs (Feb. 2016)

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