

# Growing Public Opinion Against the Nuclear Power Phase-Out Policy of Korea





# Contents

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- Electricity and Nuclear Energy Status of Korea**
- Onset of Nuclear Power Phase Out Policy**
- Protest Against Phase-Out Policy and SKN 5,6 Deliberation Process**
  
- Problems of Phase-Out Policy**
- Counter Arguments Against Phase Out Policy**
- Anti Phase Out Organizations and Activities**
  
- Improved Public Opinion**
- Summary**

# Korea and Energy at a Glance

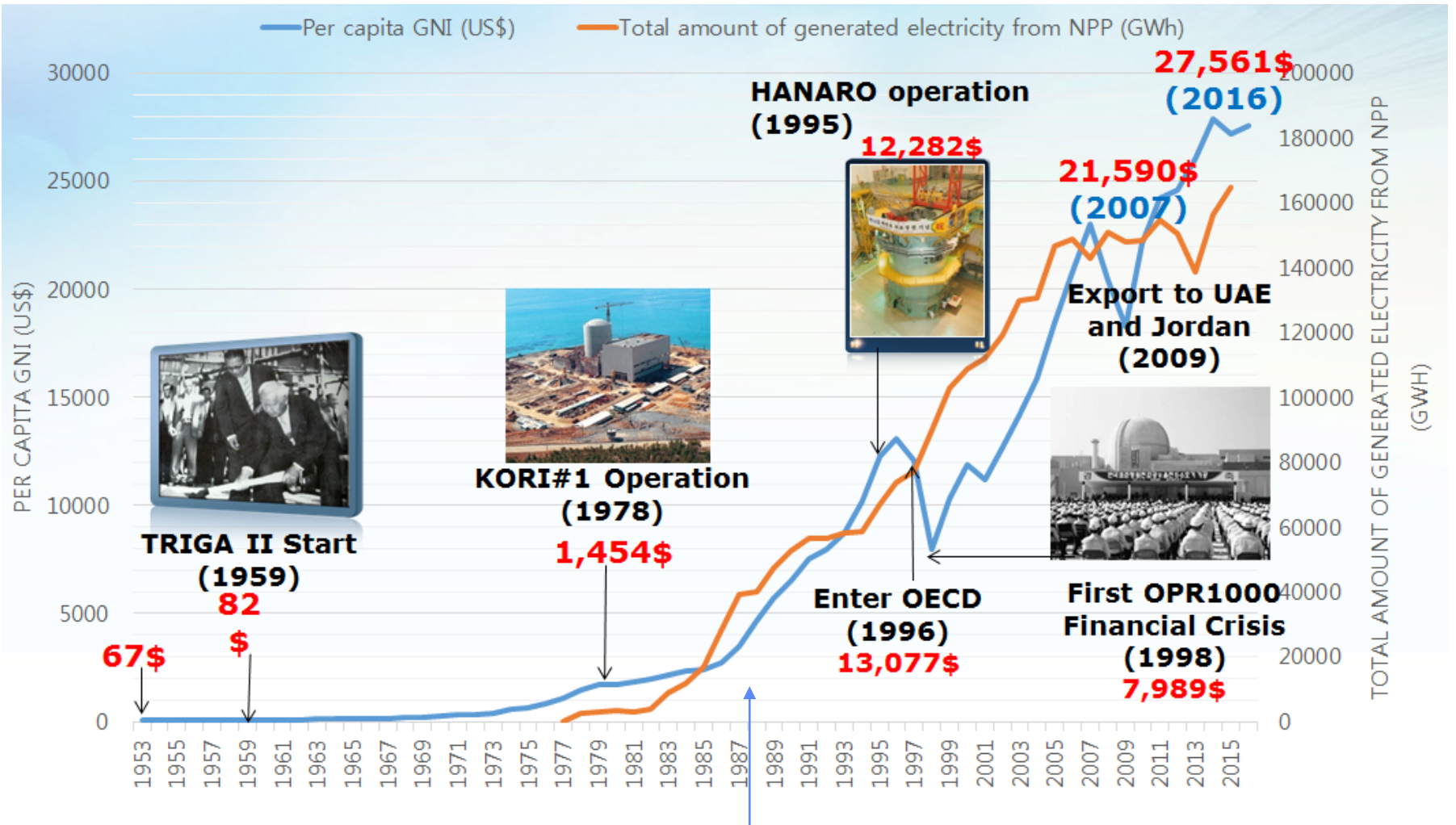
Indicator	S. Korea	Taiwan
Area, km <sup>2</sup>	100,363 (107)	36,197
Population, Million	51.5 (27)	23.6
Density, per km <sup>2</sup>	507 (23)	650
GDP, Billion \$	1,693 (12)	603
PPP GDP/Cap, \$	41,338 (32)	52,960

## □ Energy

- Overseas Dependence: 95%
- Energy Consumption : 9th in the World
- Island with no Grid Connection
- Avg. Electricity Generation: 63.2 GW
  - 1.1 kW/capita (1.2 for Taiwan)
  - Industry 55%, Residential 13%
- Total Gen. Capacity : 116.4 GW
- Nuclear Capacity : 22.5 GW (24 Units)
  - Producing ~30 % of 554 TWh



# Growth of Korean Nuclear Industry

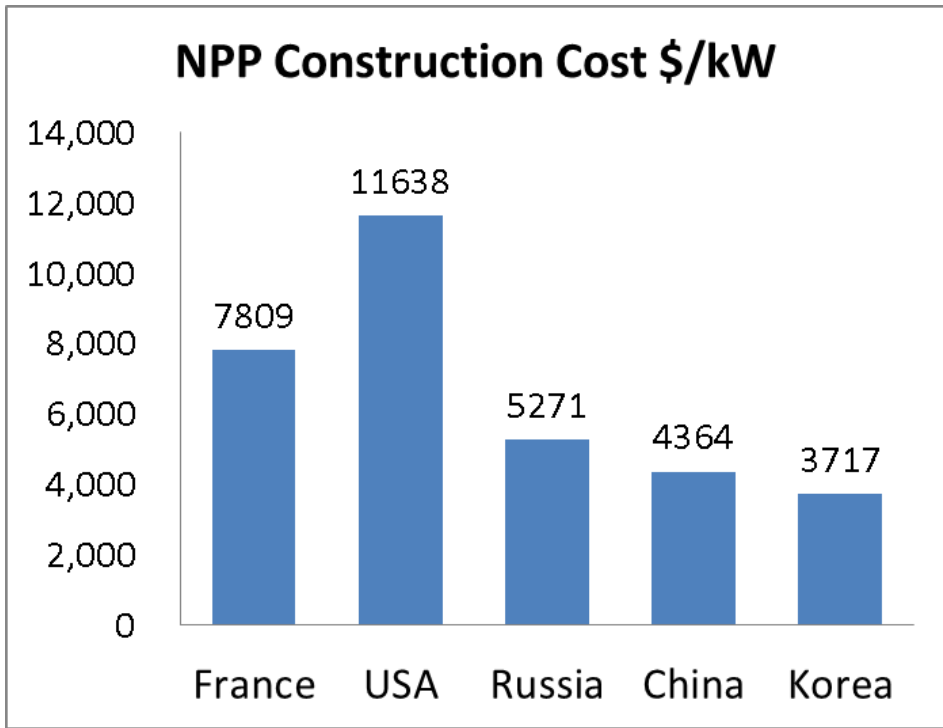
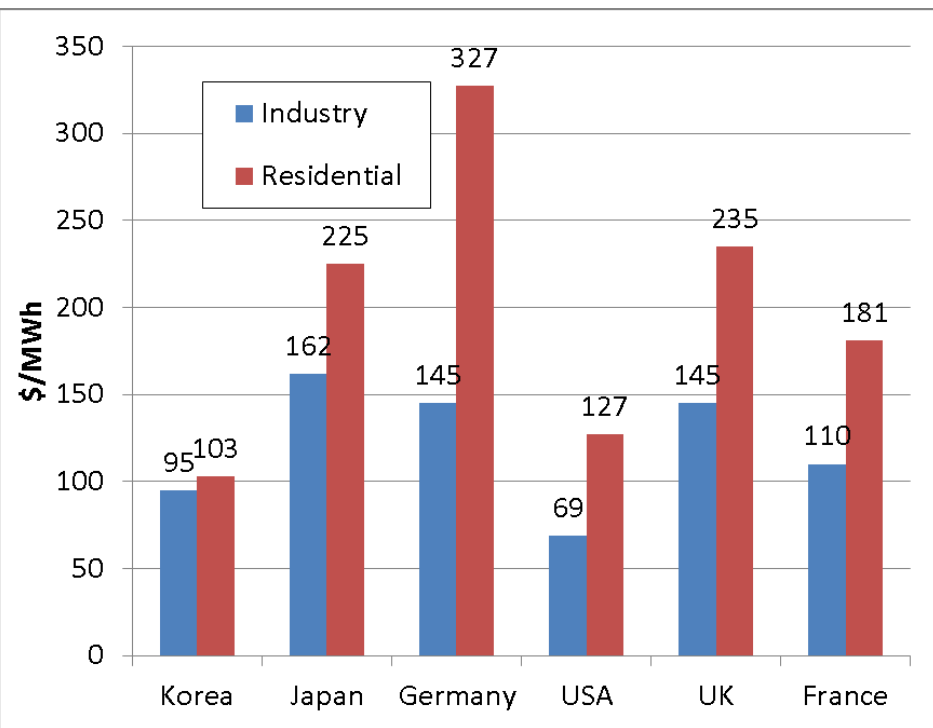


Design Technology Transfer from Combustion Engineering in 1987-1990

# Self-sustaining Korean Nuclear Industry with Full Technology Independence



# International Competitiveness of Korean Electricity Price and NPP Construction



# UAE Barakah NPP Construction

ENEC Timeline 2012 - 2017 updated

\$20.4 billion Contract to build 4 APR1400 units in UAE



✓ In December 2009, the contract to build four APR1400 units at Barakha of the United Arab Emirates (UAE) by 2020. Overall, the construction is about 85% complete.

2013 BARAKAH  
NUCLEAR POWER PLANT

▶ ◀ 🔊 0:17 / 1:33

HD

# Strong Anti-Nuke: Buan Struggle Experienced during Spent Fuel Disposal Site Selection in 2003



Local governor hospitalized after assault





# Growing Anti-Nuke Sentiment after Fukushima

## ❑ Fukushima and Subsequent KHNP Ethical Failure

- ❑ TV Broadcast of the Fukushima accidents
- ❑ KHNP scandals involving
  - Counterfeit test certificates of NPP supplies such as signal cables
  - Hiding the malfunction of emergency diesel generator leading to station blackout for 12 min

## ❑ Various Anti-Nuke Groups

- ❑ Environmentalists
- ❑ Professors and medical doctors
- ❑ Lawyers and national assembly members (33)

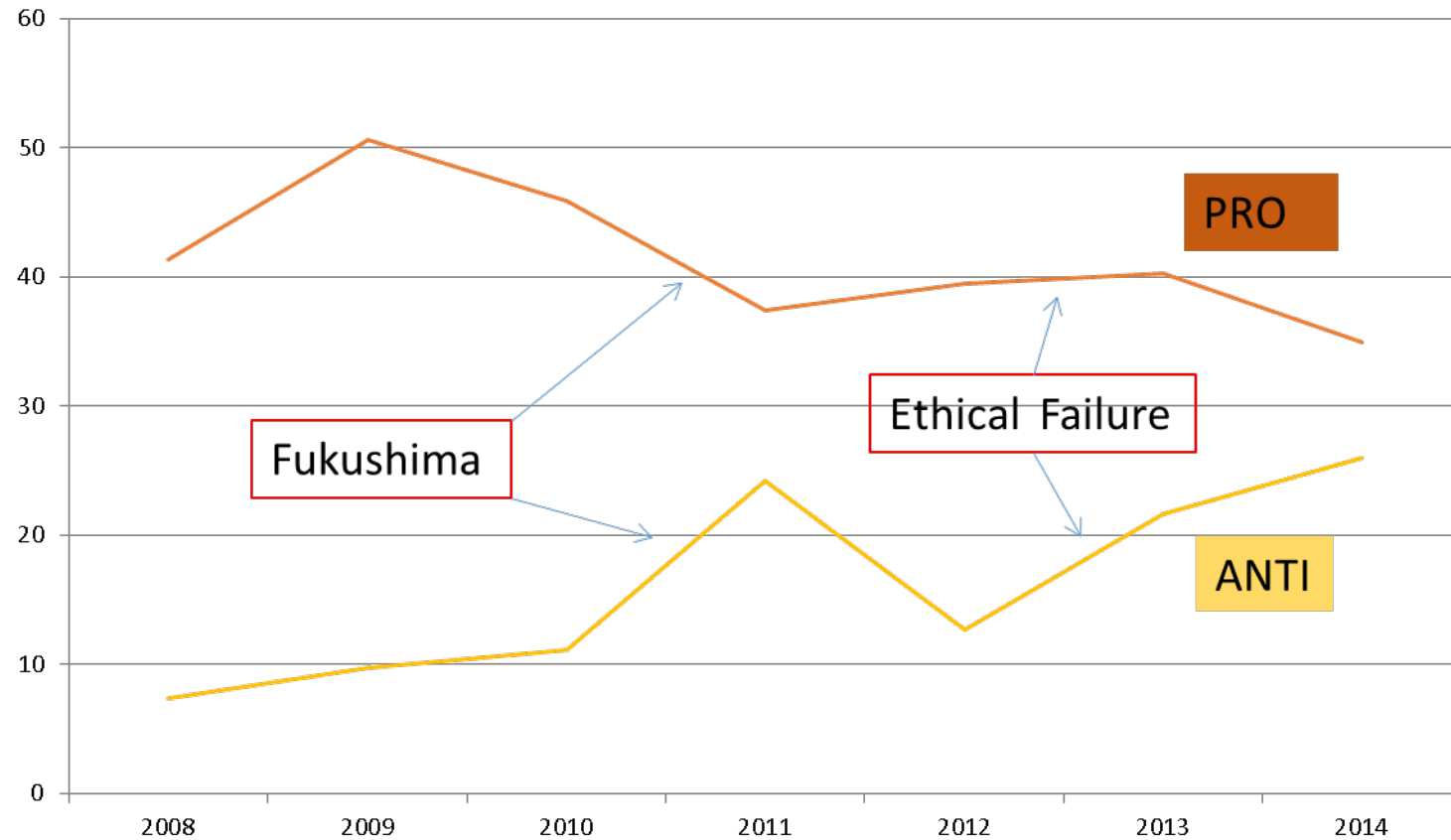
## ❑ Strong Anti-Nuke Public Activities from 2011

- ❑ Seoul City: One Less NPP campaign
  - One less NPP with energy saving
- ❑ Anti-nuke schools
  - Regular teaching program for general public and mid to high school students
  - Slow but very effective process
- ❑ Diversified anti-nuke movements to hinder NPP licensing renewals, transmission tower construction, interim rad-waste storage site preparation...



# Public Opinion Change before 2014

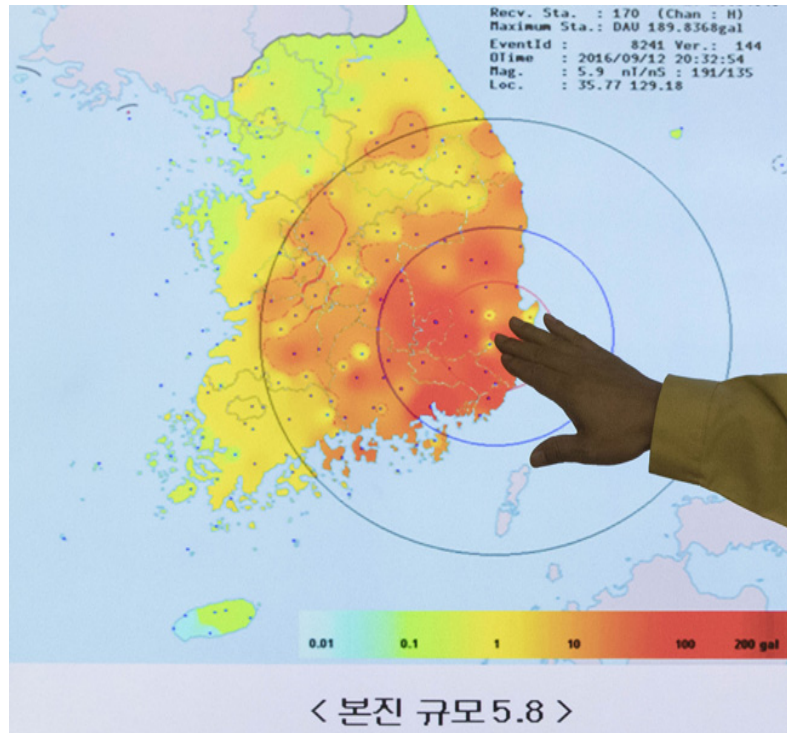
Changes of Public Opinion on NPP Construction



# Record-High Earthquake in Gyeongju

## □ Strongest-ever earthquake hits Korea, tremors felt nationwide

- 5.8-magnitude shock stroke Gyeongju on Sep. 12, 2016
- Danger exaggerated by the anti nukes (even no casualty)
- Only KHNP responded to the issue
- Affect the presidential election pledge on May 9, 2017



# Movie Pandora

- **Unrealistic Fiction Movie Exaggerating the Danger of an Earthquake Induced NPP Accident**



- The film "Pandora," the first local film dealing with a nuclear disaster here, is striking in that it bears much on what is happening in Korea now. - The Korea Times
- Criticizing the [bureaucracy](#) as well
  - [~4.5 million people](#) watched

# Nuclear Power Phase-Out Policy (NPPPOP)

- ❑ **Majority Campaign Promise to Phase-Out Nuclear Power During the May 2017 Presidential Election**
  - ❑ 4 out of 5 candidates chose Nuclear Power Phase-out Policy as campaign promise
- ❑ **President Moon declared NPPPOP at Kori-1 retirement ceremony on June 19, 2017**



- ❑ **Phase-out Nuclear, Phase-out Coal** declared together as the evil source of electricity

# Protests by Group of Professors

- ❑ **Trials to terminate the construction of Shin Kori Nuclear Units 5&6 (29% complete as of June 2017)**
  - ❑ Made by the regime transition team
- ❑ **First Press Conference to Announce the Objection Statement on June 1, 2017**
  - ❑ Joined by 230 professors nationwide
  - ❑ Halt of the construction postponed as a result
- ❑ **President Moon Ordered Temporary Stop of the Construction after 3 weeks**
- ❑ **Second Press Conference to Announce Another Objection Statement on July 5, 2017 (National Assembly)**





# Shin Kori 5&6 Public Deliberation Process

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## □ Overview

- Purpose: make a public decision on SKN 5&6 construction
- Formed a citizen jury consisting of 471 ordinary people
- Go through the deliberation process involving information delivery and discussions for 3 months from July 15, 2017 (Ended on October 20)

## □ Deliberation Process to Rectify the Misunderstanding and Fear about Nuclear Power

- The pro-nuclear group consisting of mostly professors and a few KNHP engineers prepared materials to provide right information about the safety and benefits of nuclear power
- Actively involved in publishing newspaper articles, TV debates, and lectures

## □ Change in Public Opinon

- Continuation: Termination Ratio changed from 3:7 to 5:5
- Final Decision by the Citizen Jury 59.5:40.5

## □ SKN 5&6 Construction Resumed

## □ Energy transition roadmap was issued right after the decision of resuming construction

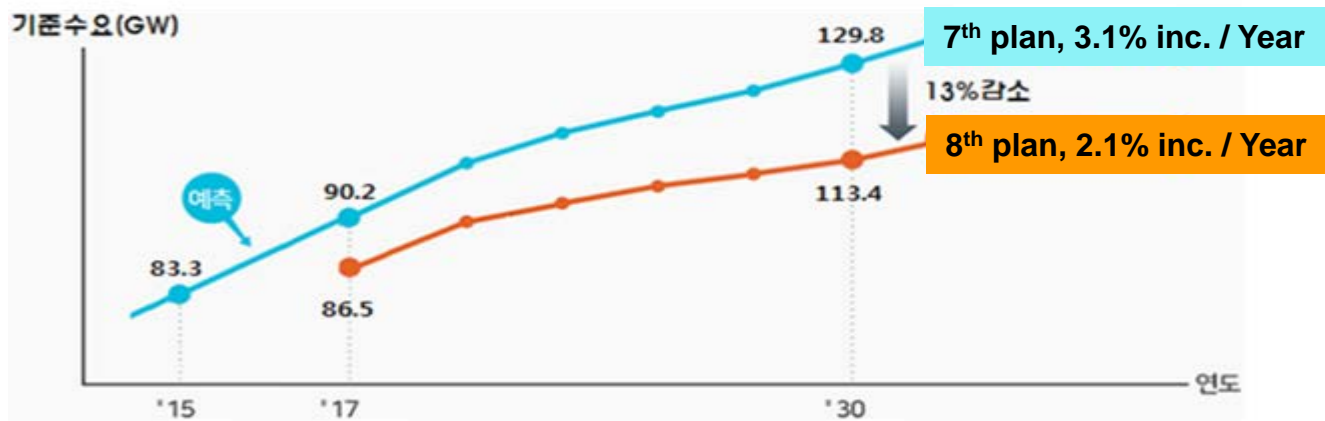
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# 8-th Basic Plan for Electricity Supply (Dec. 2017)

## ❑ Execution of Nuclear Power Phase-Out Policy

- ❑ Cancellation of 6 planned new NPPs (of the 7-th plan)
- ❑ No licensing renewal of 11 NPPs of which the initial license expires before 2030

## ❑ Significant Reduction in the Expected Base Electricity Demand in 2030

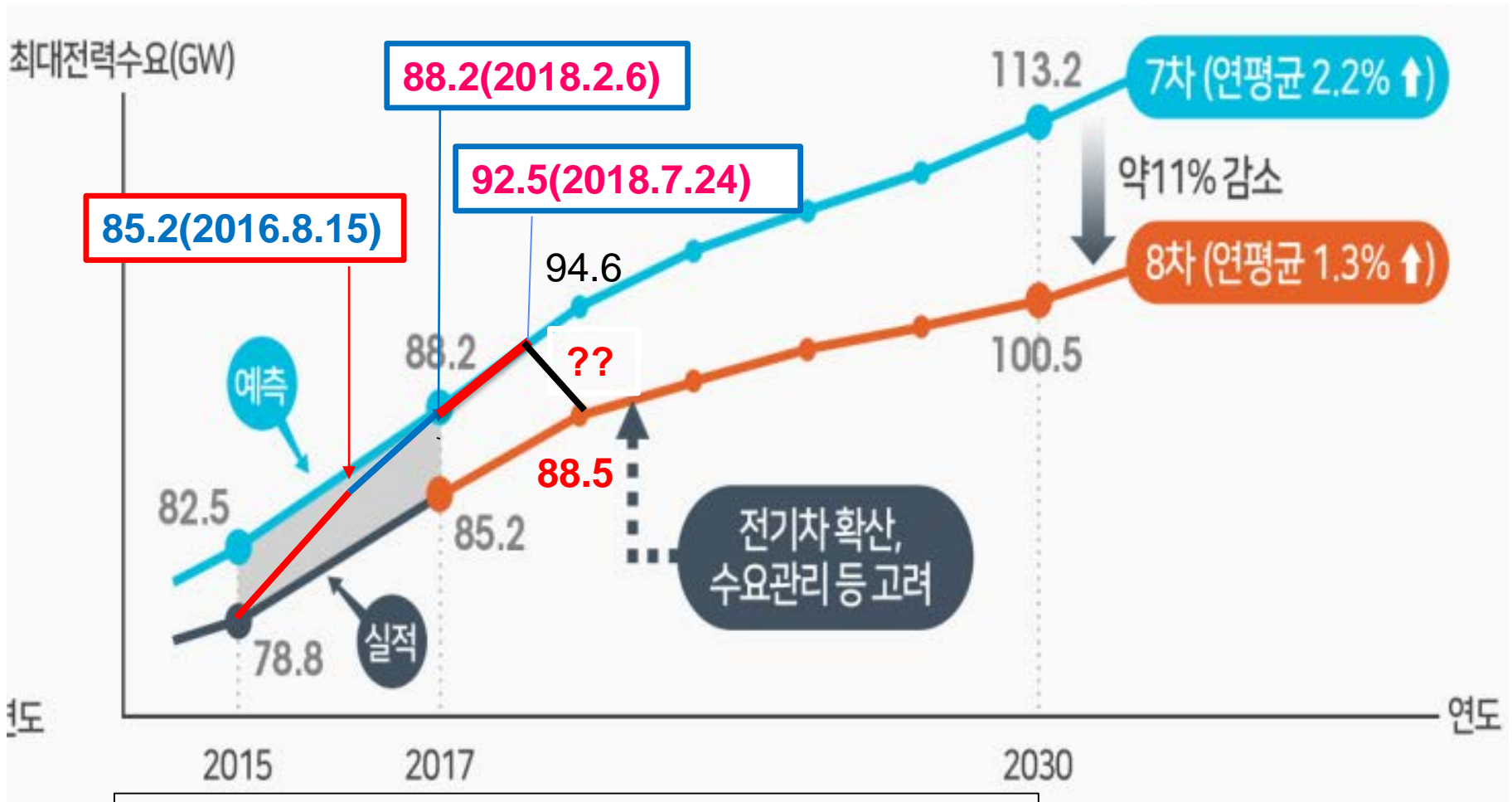


## ❑ Increase of Renewable Share to 20% by 2030

Year	Nuclear	Coal	LNG	Ren.	Others
'17	30.3	45.3	16.9	6.2	1.3
'30	23.9	36.1	18.8	20.0	1.1

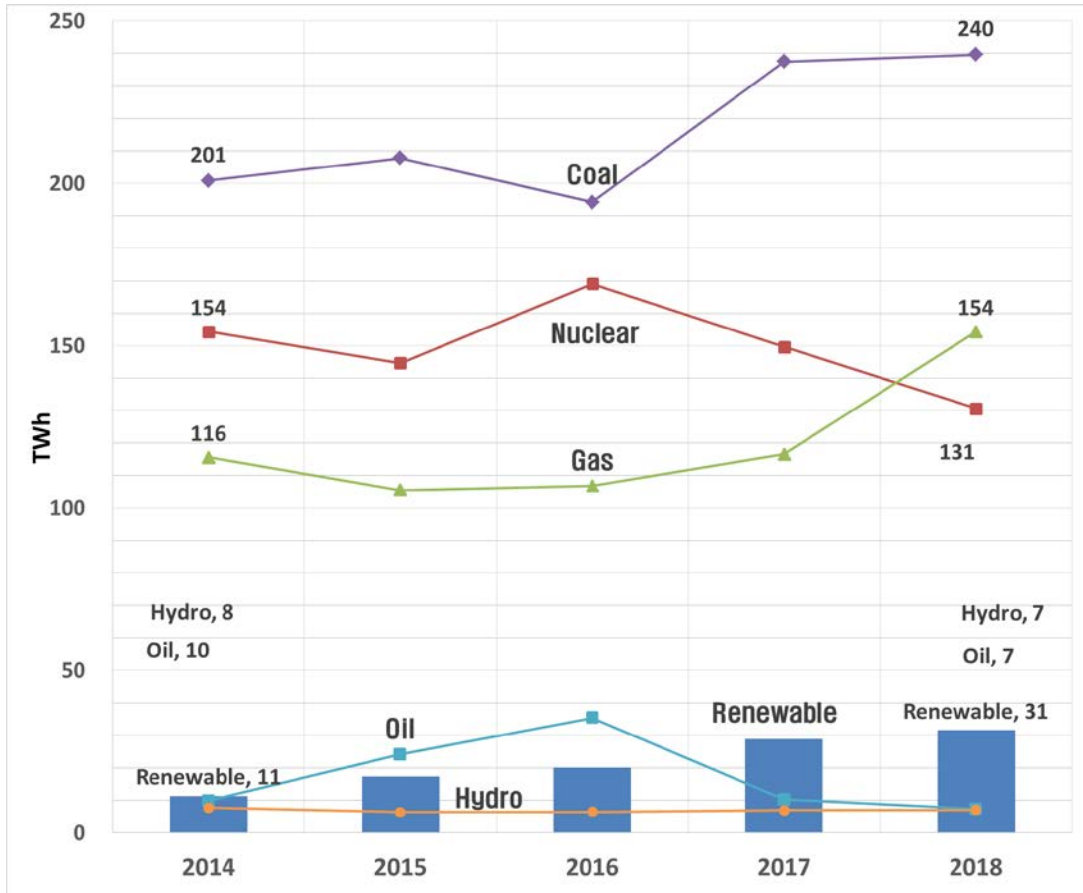


# Mis-prediction Revealed for the First 2 Years



\* IAEA Forecast of Electrification  
 2017 18.5%, 2030 21%, 2050 26.6%

# Reduced Nuclear Power Generation for Last 2 Yrs



Coal and LNG shares increased significantly to cause

1. More CO<sub>2</sub> by 20 MT ton in 2017
2. Deficit in KEPCO and KHNP Finance (Finance Balance in Trillion KRW)

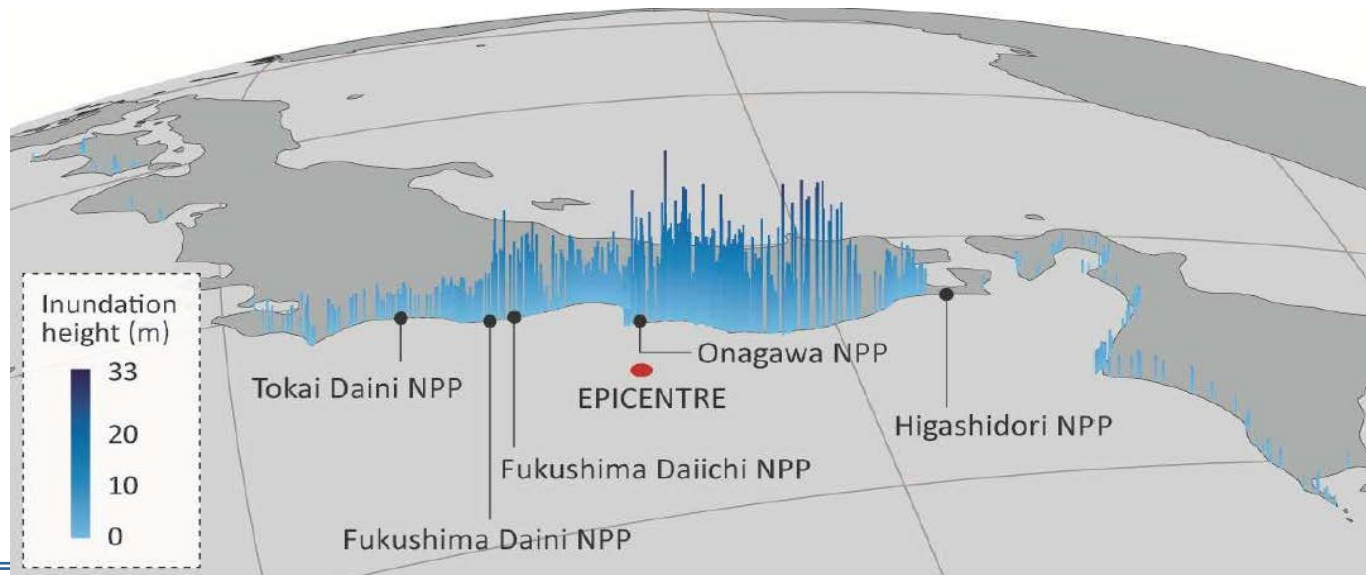
Company	2016	2017	2018
KEPCO	12.2	4.95	-0.88
KHNP	3.85	1.30	-0.40

\*Generation during Nov. 1 through Oct. 31 next year

# Counter Arguments Against the Phase Out Policy

## □ Safety of NPPs Demonstrated by Operation Histories

- Only one fatal accident involving casualty for about 18,100 reactor operation years for more than 50 year operation of 620 NPPs worldwide
  - Chernobyl with fewer than 50 casualties)
- Fukushima accident induced by Tsunami, not by earthquakes
  - Onagawa NPP was safe even with stronger earthquake and higher Tsunami because it is located at a higher site to avoid inundation
- No fatal accident ever due to earthquake. Instead many cases noted that withstood earthquakes stronger than the seismic design



# Safe Spent Nuclear Fuel Storage Possible

## □ Absolutely Less Generation of Spent Nuclear Fuel (SNF)

- Absolute amount of spent fuel is very little so that on-site storage of spent fuels for the lifetime is possible ( SNFs Generated for 20 Yrs in a 1 GW NPP can be stored with area of  $\sim 100 \text{ m}^2$ )

## □ Dry interim storage is also possible for safe storage



Zwilag Interim SNF Storage Facility,  $2800 \text{ m}^2$  ( $\sim 70 \text{ m} \times 40 \text{ m}$ )  
to store SNFs generated for 50 years from two 1 GW NPPs



What do we do with the nuclear waste?  
Nothing. We leave it right where it's at, on  
secure, heavily guarded facilities and taking up  
less space than the parking lot at Dollar  
General. That's what we do with nuclear waste.

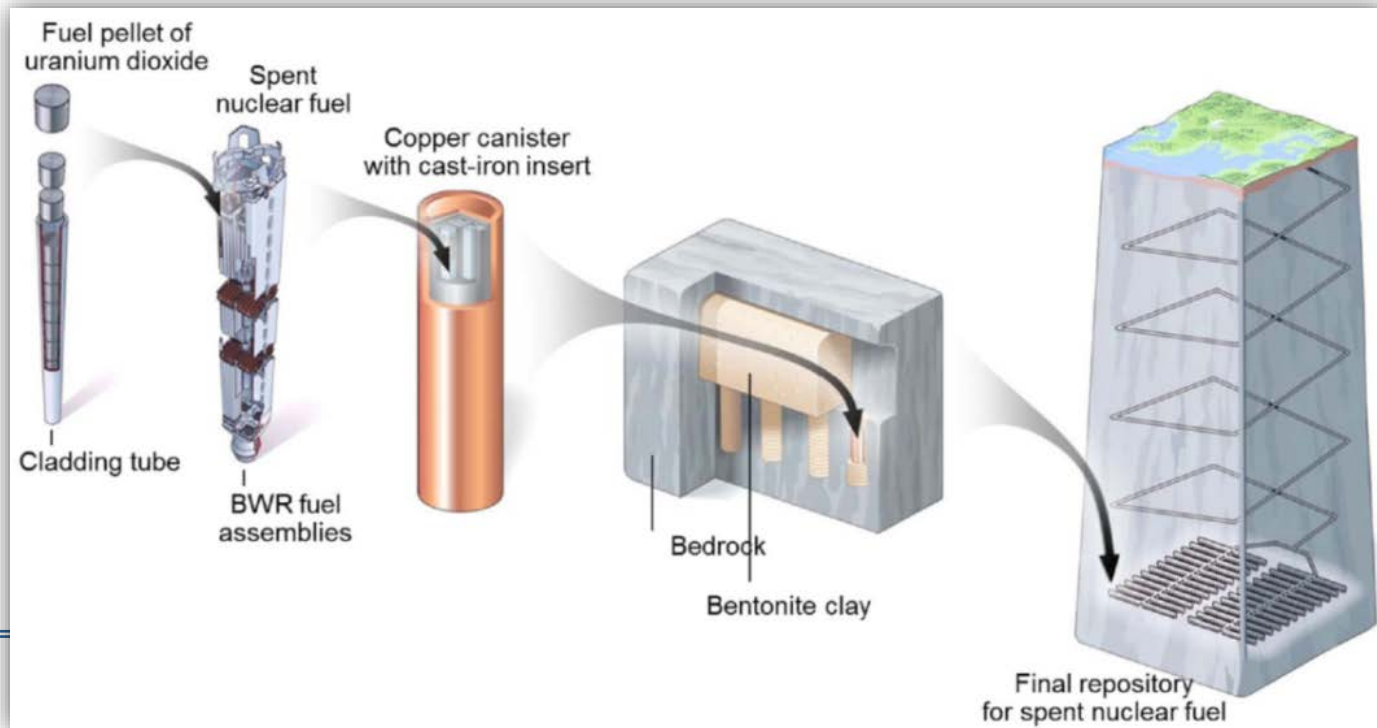
# Safe Disposal Possible with Current Technology

## □ Proven Disposal Technology

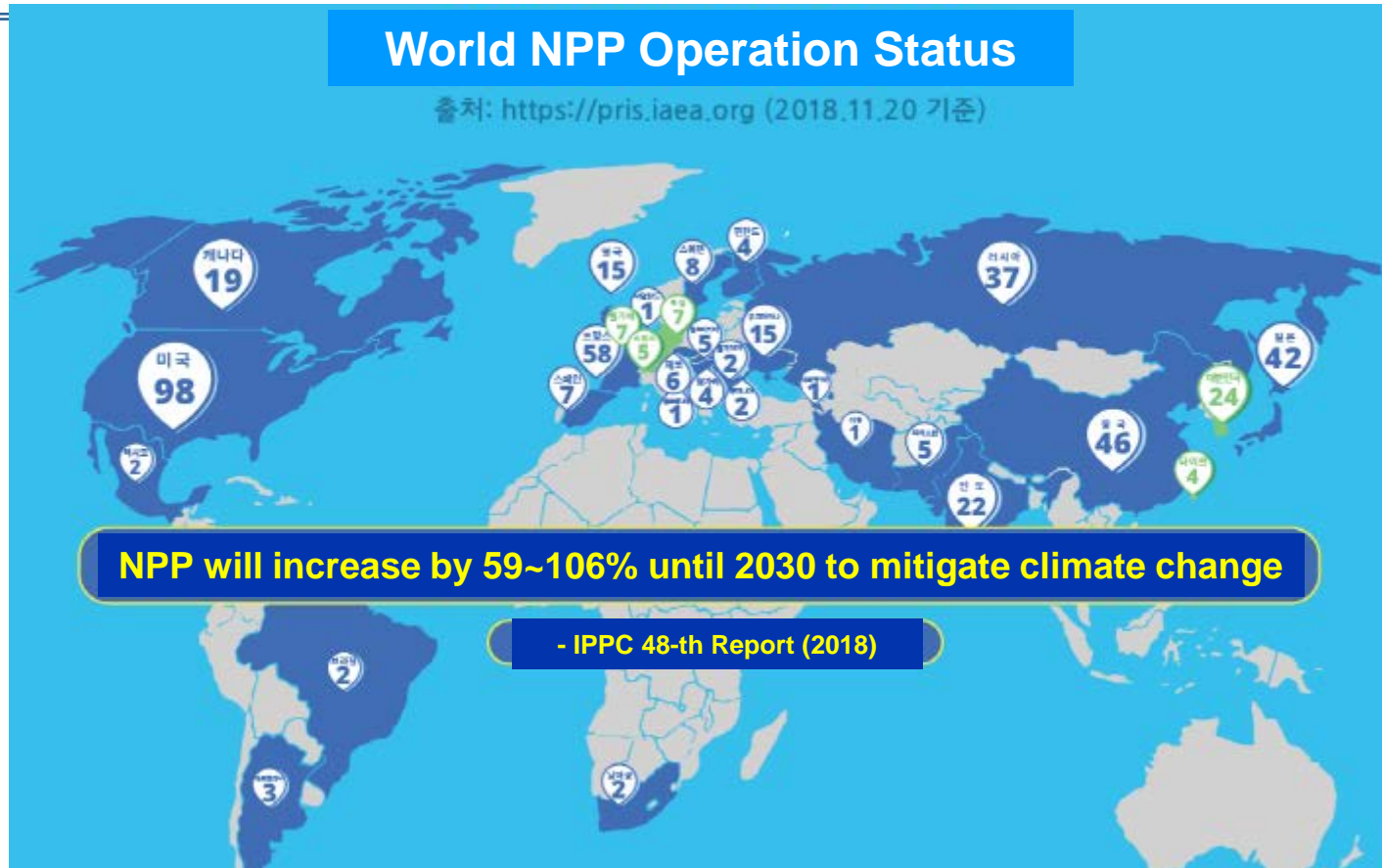
- Thick (~5cm) corrosion resistant copper container
- Bentonite filler which shields water penetration and prevent migration of radioactive elements
- Proved safe storage of SNF for 10,000 years

## □ More effective technology can be developed

- More economical methods are under development



# Increasing Needs for NPPs to Combat Climate Change

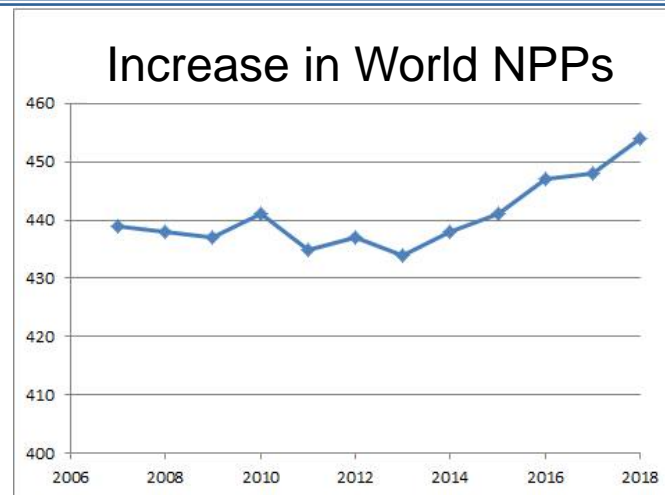


## □ 454 NPPs in Operation in 31 Countries

- Accumulated reactor years of 18,100
- Major countries generating **71.1% of world GDP** use NPPs
- **60.8% of the world population** benefit from NPPs

# Expanding Use of NPPs

Year	Operating NPPs	NPPs under Construction
2014	438	81
2015	441	67
2016	447	74
2017	448	60
2018	454	50



## ❑ Countries Building First NPP (4)

- ❑ UAE, Belarus, Bangladesh, Turkey

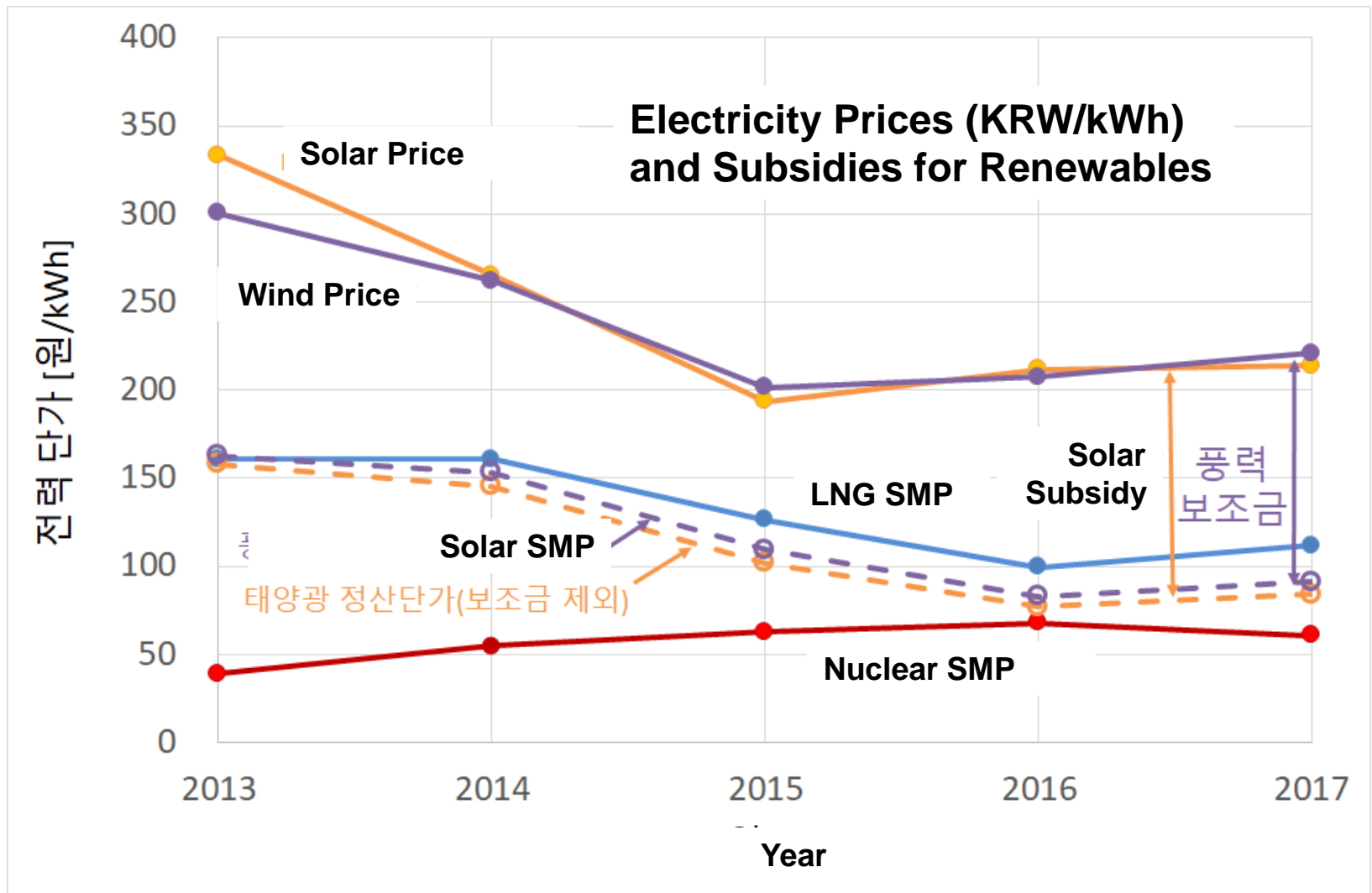
## ❑ Countries Considering First Building of NPP (6)

- ❑ Saudi Arabia, Jordan, Indonesia, Lithuania, Kazakhstan, Egypt

## ❑ Other NPP Policies

- ❑ Japan exit from NPP Zero to reach 20% nuclear share by 2030
- ❑ UK to build 13 NPPs
- ❑ China, India, Russia to actively expand NPPs
- ❑ 160 NPPs expected to be built by 2030

# Cheap Nuclear Generation Cost which can be used to Pay for Renewable Subsidies





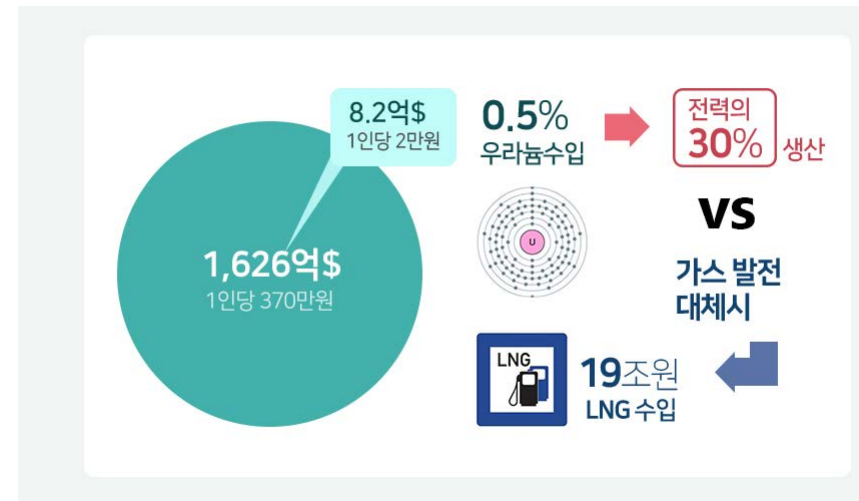
# Energy Security and Semi-Domestic Energy Source

## □ Nuclear Fuel Requiring Very Small Amount of Fuel

- 22 tons of nuclear fuel which would be sufficient for two truck loads
- cf. 2.2 million ton for coals (11 loads of 200,000 ton ships)
- Storage of 25 year fuel for 1 GW plant is possible with an area of an apartment (100 m<sup>2</sup>)

## □ Beneficial for Trade Surplus

- 162 B USD for energy imports for past 5 years in Korea
- Only 0.8 B USD (0.5%) for uranium import, 30% electricity generation with 0.5% expense
- If Uranium is replaced with LNG, 19 B USD should be spent more which increase the trade deficit significantly



# Need for Maintain NPP Supply System

## ❑ No Domestic Build to Cause Rapid Collapse of Korean Nuclear Industry that has Complete NPP Construction and Supply Chains

- ❑ Big economic loss by discarding world top class nuclear technology
  - No more generation of ~10 Billion USD induced production
- ❑ Loss of employment (~18,000)

## ❑ NPP Export Effect

- ❑ Direct gain of foreign money
  - Construction 20 Billion USD for the UAE Project
  - Operation 50 Billion USD for 60 years
- ❑ Indirect gain
  - 20 Billion USD by collaboration in other industrial areas such as energy, medical, and semiconductor



"이 자리 있던 선반, 내다 팔았죠" - 28일 경남 창원시 의창구에 있는 원전 부품 가공 업체 영진테크원에서 강성현 대표가 대형 선반이 있던 자리를 가리키고 있다. 밀감이 끊겨 직원들 월급조차 주기 어려워진 그는 지난해 선반을 헐값에 내다 팔았다. /김동환 기자

## ❑ Difficulty in Export of NPP

- ❑ Loss of credit and trust
- ❑ Even though a contract can be made, the cost and construction time will increase due to the collapse of many small companies

# Organizations to Generate Pro-Nuke Information

## ❑ Nuclear Energy Collective Intelligence (NECI)

- ❑ Online discussion group consisting of ~30 passionate people who can provide expert knowledge and generate right information regarding the safety and benefit of nuclear energy

## ❑ Nuclear Experts Forum (NEXFO)

- ❑ Task force groups consisting of about 50 experts to work on specific subjects
- ❑ Generates fact check reports on anti-nuke textbooks and materials

## ❑ Professor Association for Rational Energy Policies (PAREP)

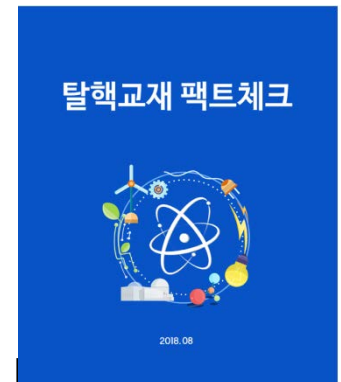
- ❑ Association of volunteered professors to resolve unreasonable problems in national energy policies
- ❑ Offers seminars and debates and issue position statements

## ❑ Nuclear Energy Policy Coalition (NEPC)

- ❑ Coalition of nuclear energy sector labor union and professors
- ❑ Execute offline activities and seminars with National Assembly

## ❑ Nuclear Engineering Students Union (NESU)

- ❑ Union of college students majoring nuclear engineering (14 colleges)



서울대학교 원자력정책센터  
SNU Nuclear Energy Policy Center

# Ways to Spread Right Information

- Articles in Newspaper Opinion Sections
- Media News Interview (Newspaper, TV) – Frequent News Articles
- Issuing Position Statements, Hosting Seminars and Debates
- Operating Atomic wiki (atomic.snu.ac.kr), SNS (FaceBook)
- Signature Movements for Petition

chosun.com 오피니언

뉴스룸 오피니언 정치 사회 경제 국제 스포츠 연예 전국 문화 라이프

## 시론기고 > [시론] 한국 원자력에 꼭 이렇게 甝鐘을 울려

조선일보 | 주한규 서울대 원자핵공학과 교수

입력 2018.06.21 03:12

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Twitter

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주한규 서울대 원자핵공학과 교수

한국수력원자력 이사회는 지난주 월성 1호기 조기 정지와 천자대진 원전 사업의 종결을 의결했다. 정부의 탈원전 정책은 제8차 전력수급기본계획에 노후 원전 가동 중단과 신규 원전 건설 백지화로 명기됐다. 하지만 이 계획은 구축력이 있는 행정계획이 아니기에 여건 변화가 있을 때 바뀔 여지가 있다. 2년 전 수립된 7차 계획에 적시된 6기의 신규 원전 건설계획이 8차에서 백지화로 변경됐던 것처럼 말이다.

그런데 한수원 이사회는 '경정 불확실성 제거'라는 명분 아래 신규 원전부지 해제라는 돌이킬 수 없는 조치를 성급하게 결정했다. 이로써 신규 원전 건설이 없을 대한민국 원자력에 조종(甝鐘)이 울렸다. 40여 년 공들여 세계 최고 수준으로 일궈 놓은 한국 원자력 산업과 기술이 고사(枯死)의 길로 접어들게 된 것이다.

joins

중앙일보

오피니언

사설칼럼 오피니언 방송 만평 디지털발전 e&g

## [시론] 탈원전 논리 속에 감춰진 진실 확

[중앙일보] 입력 2018.12.06 00:11 | 통합 3면 지면보기 >

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대만 국민, 투표로 탈원전에 반대 잘못 알려진 사실 바로잡은 결과 한국은 진실 일부만 보여주거나 유리한 사실만 동원해 진실 왜곡

국회에서 에너지특별위원회가 최근 개최됐다. 여야 국회의원들은 '탈(脫) 원전'과 '진(覈)원전'의 상반된 주장을 펼쳤다. 모두가 사실을 바탕으로 했지만 지향하는 진실은 달랐다. 주장을 펼치기에 유리한 사실을 선택적으로 사용했기 때문이다.



정범진 경희대 원자핵공학과 교수

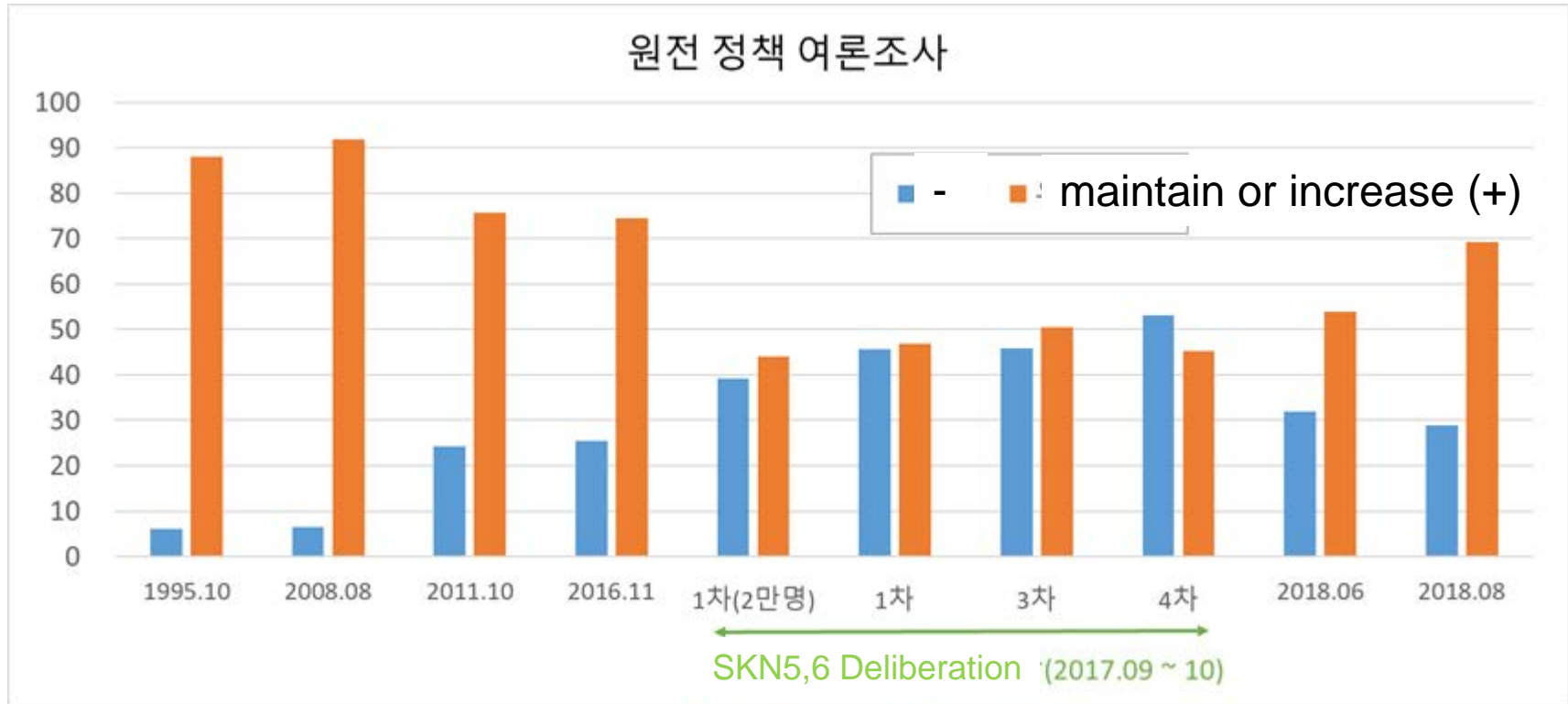
지난달 24일 치른 대만 국민투표에서 원자력발전 중단(탈원전)을 규정한 전기사업법 제95조 1항을 폐지하는데 59%가 찬성표를 던졌다. 집권 민진당의 탈원전 대체론이 무너졌다. 급진적인 주장이 잠시 인기를 얻을 수 있지만, 결국 국민은 경제라는 엄연한 현실을 택한다는 점을 대만 국민투표가 보여줬다. 이번 탈원전 지지 여론은 대만

# Street Activities (Rally on April 21, 2018)



# Public Opinion Favoring Nuclear Power

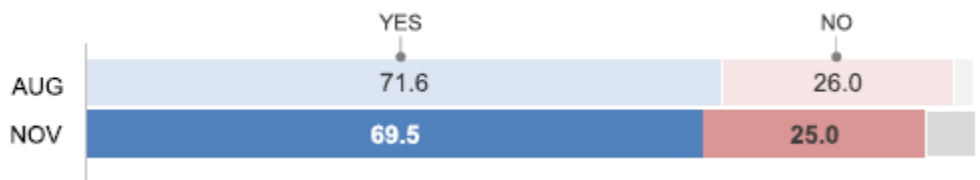
## □ Opinion on Desired Share of Nuclear Power in the Future



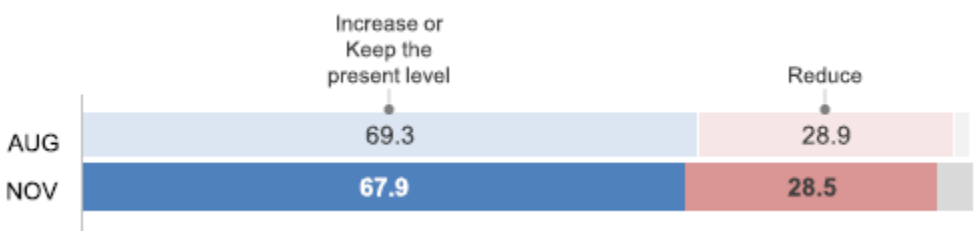


# Consistent Results in two Recent Polls (Aug. & Nov.)

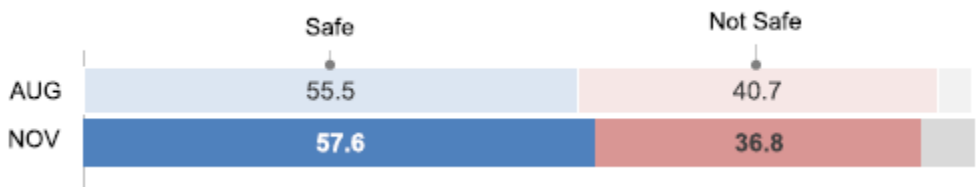
## 1) Yes or No on NPP utilization



## 2) Future share of NPP



## 3) NPP Safety

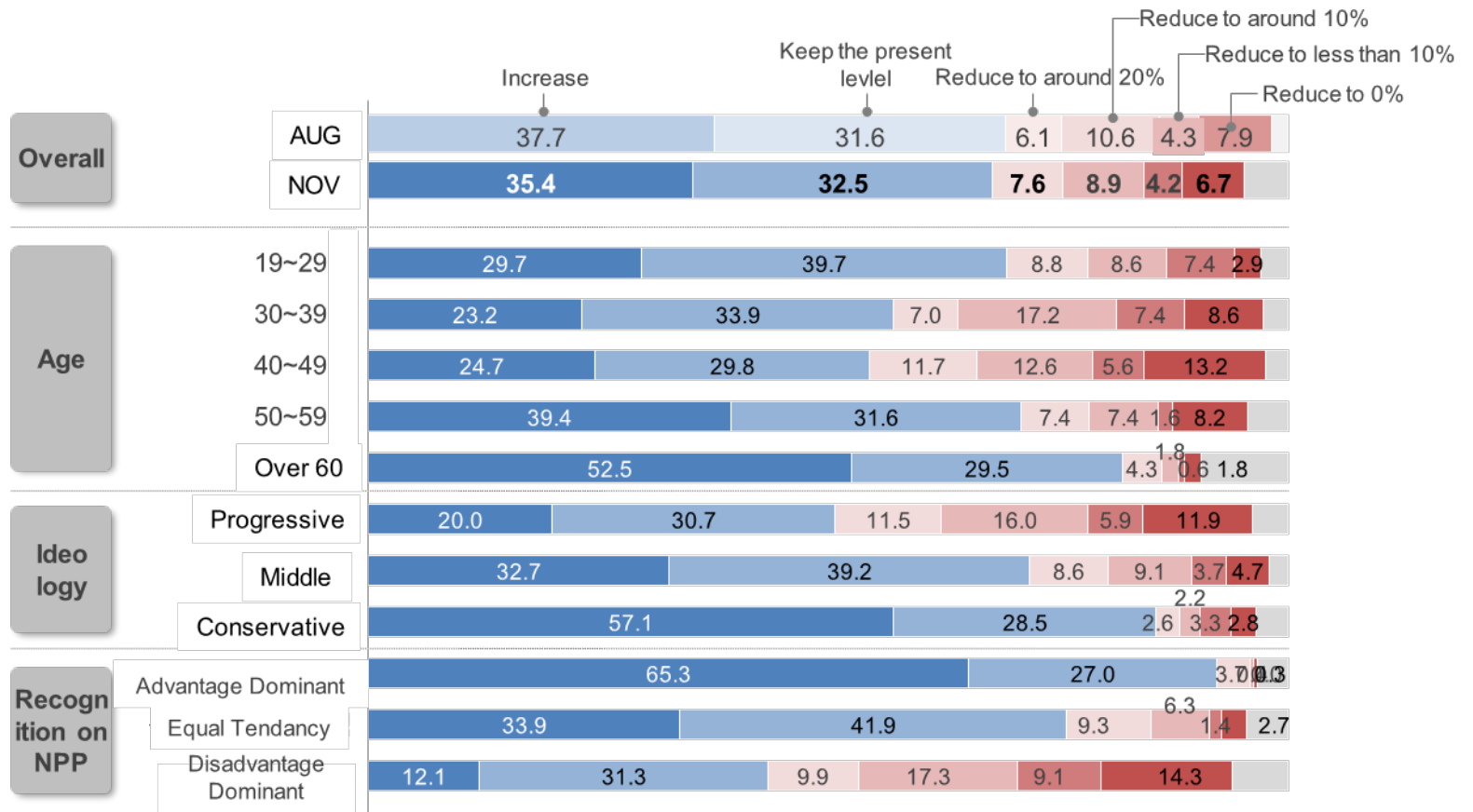


# Detailed Opinion on the Share of Nuclear Power

[Ref] Future share of NPP

[ unit : %, Aug.(n=1,000), Nov.(n=1,006) ]

- Results indicating that people do not support phase-out





# Anti Phase-Out Signature Movement

## □ Purpose

- Get people's consent to change the nuclear power phase out policy also to request to resume the construction of Shin Hanul 3&4 for which the site are made and major devices were already manufactured

## □ Goals

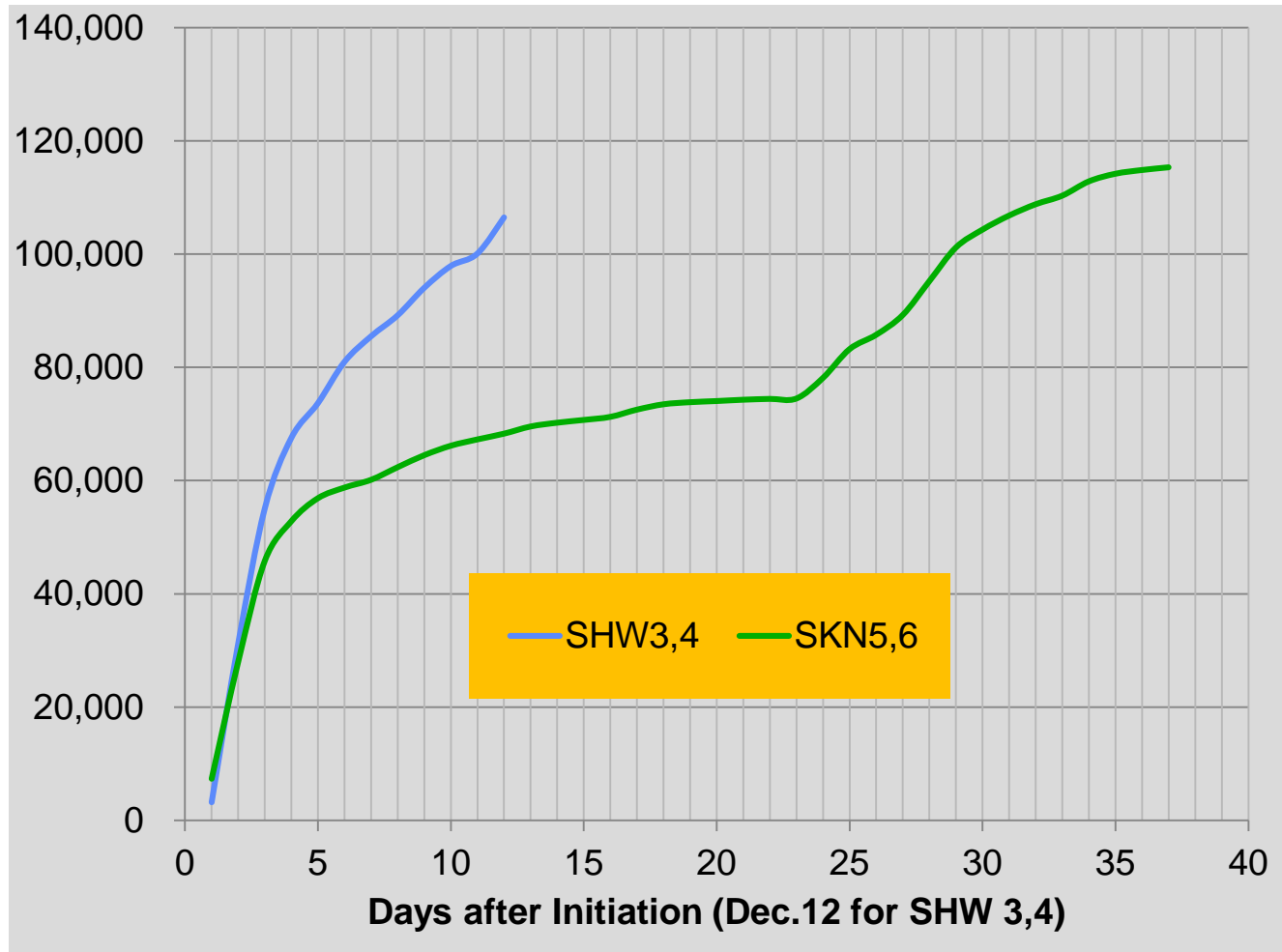
- First get 200,000 consents by mid Jan (Started officially on Dec 13, 2018)
- Continue to 1 million people

## □ Methods

- Online signature using an SNS
- Offline signature on the streets
- Cooperation between concerned national assembly members and nuclear sector people



# Trend of Signee Increase





# Summary

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- ❑ **Korea should exit from the nuclear power phase-out policy to keep**
  - ❑ World class NPP construction industry which generates big revenues and employments
  - ❑ Affordable electricity prices
  - ❑ Reduction of green house gas generation and fine particulate matters
  - ❑ Energy security and trade surplus
  - ❑ Stable supply of electricity in the future where electrification increases
- ❑ **Generating and spreading right Information are crucial to gain public acceptance of nuclear energy**
  - ❑ Exaggeration of the possible danger of nuclear power should be rectified
  - ❑ Should criticize false claims of the anti-nuke people with fact checks and make the corrections be spread widely
  - ❑ Need to approach to the people with friendlier contents and more easily accessible tools such as YouTube or instagram
- ❑ **Cooperation with Korean and Taiwanese myth busters would be beneficial to each other.**



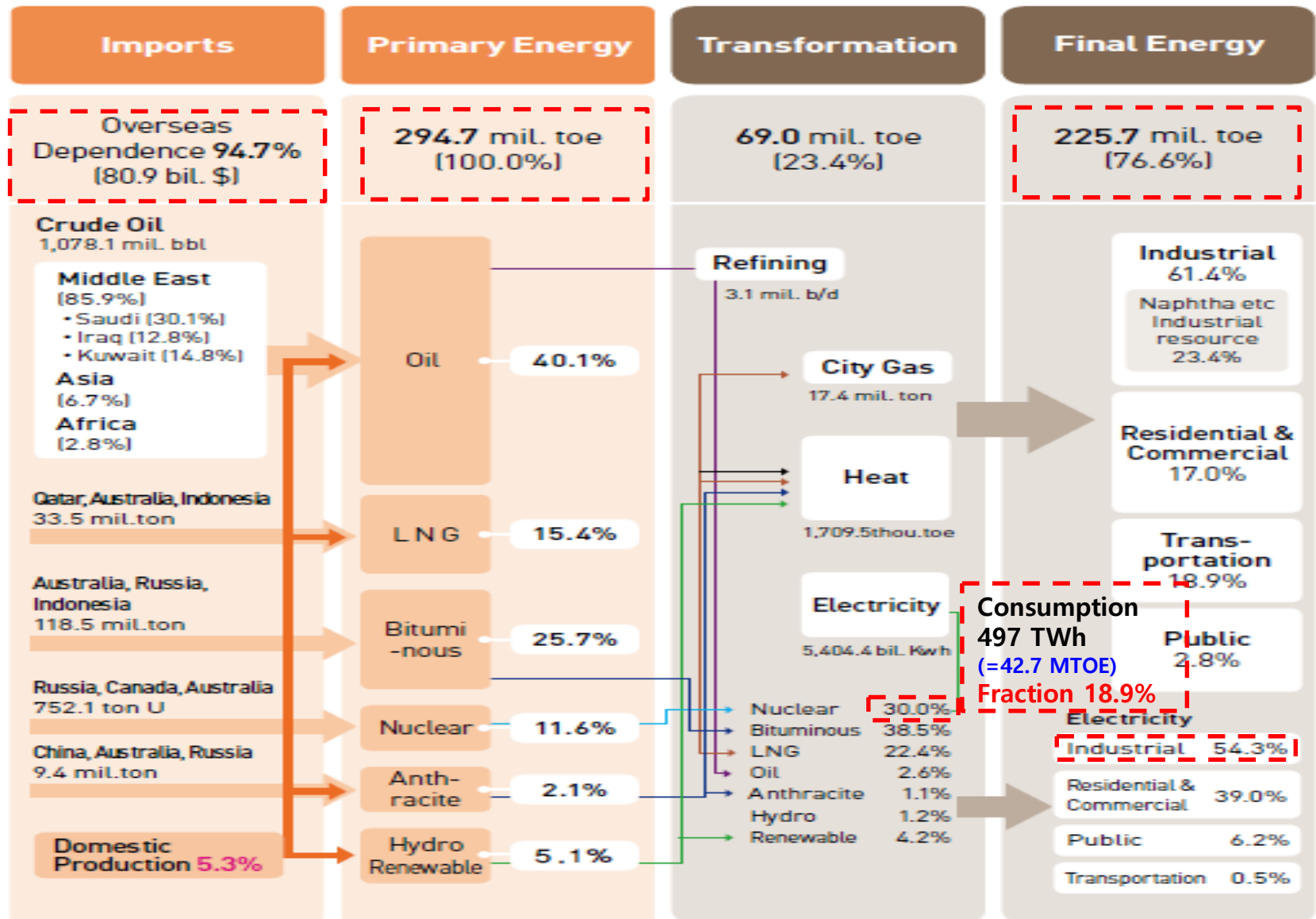

행복한 설,  
에너지 백년대계를 위한 범국민서명에 참여하며 즐겨주세요.

**okatom.org** 에  
원자력으로 밝아지는 대한민국을 위한  
여러분의 의사를 밝혀주세요

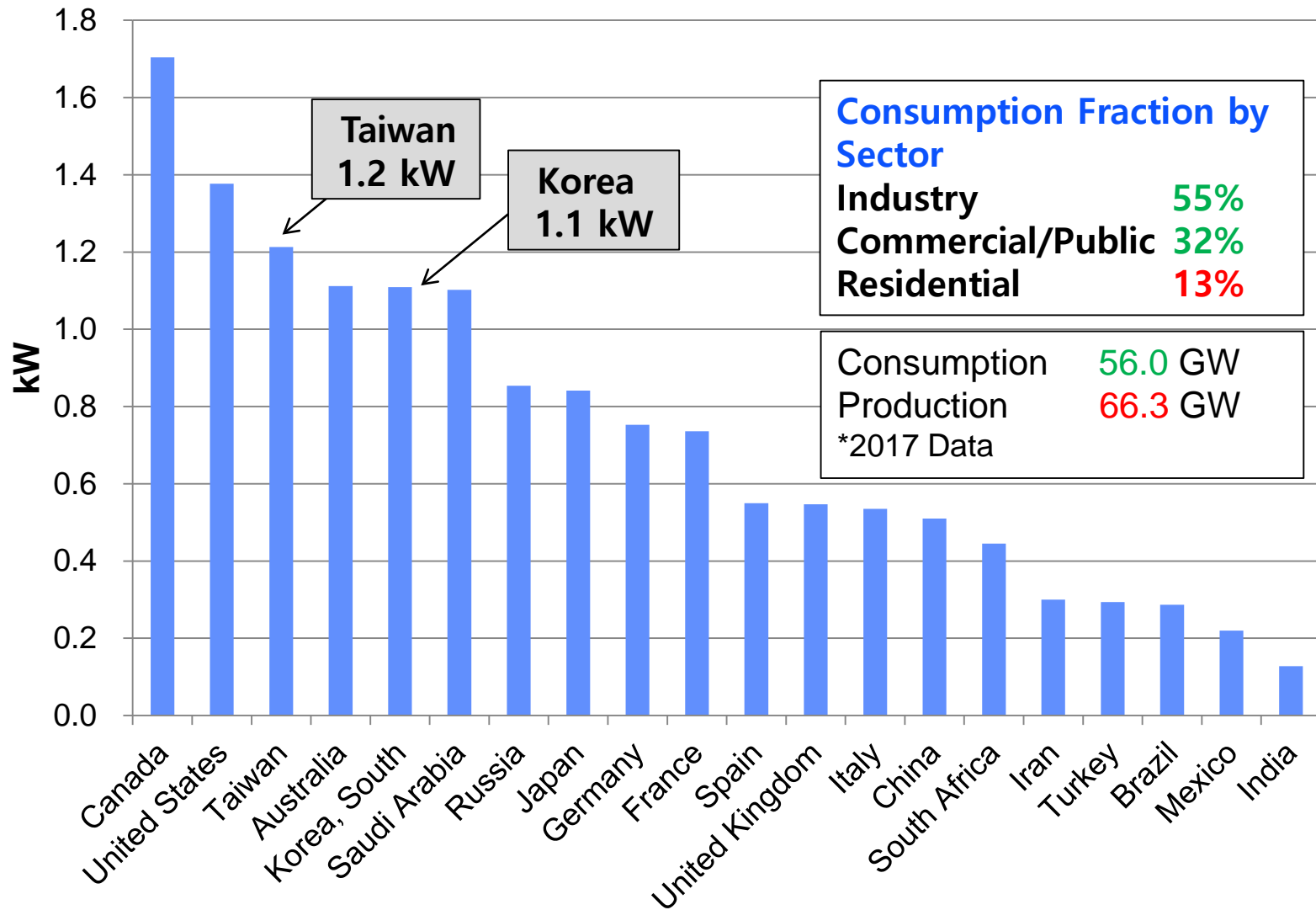
인터넷 주소창이나 카톡 메시지창에 **okatom.org**를 입력해 주세요

 새해 복 많이 받으세요 

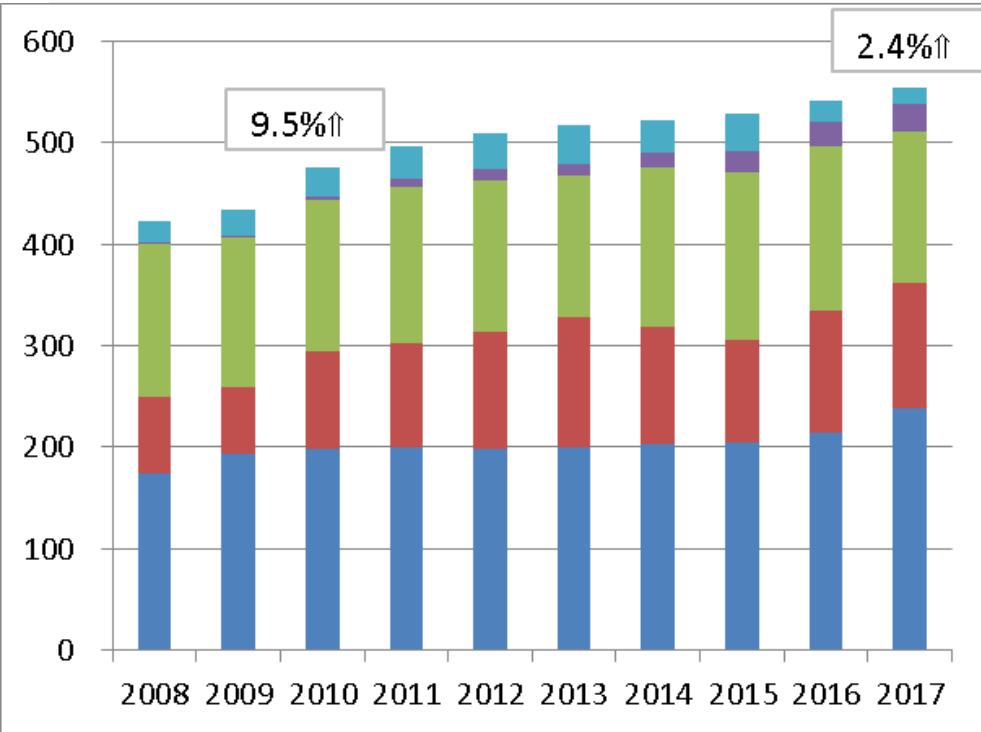
# Energy Balance (2016)



# Per Capita Electricity Consumption (kW/Person)

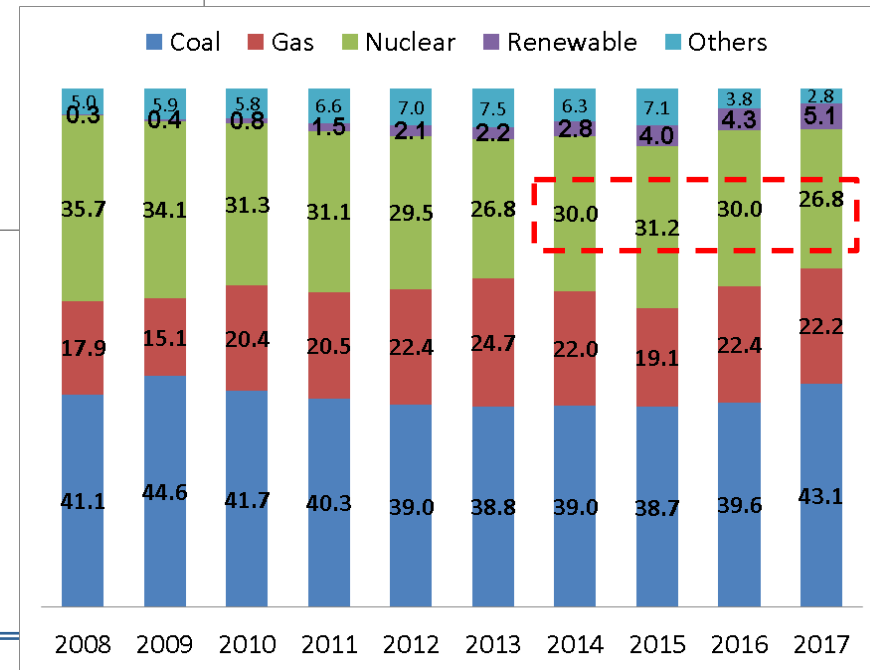


# Electricity Generation Trend



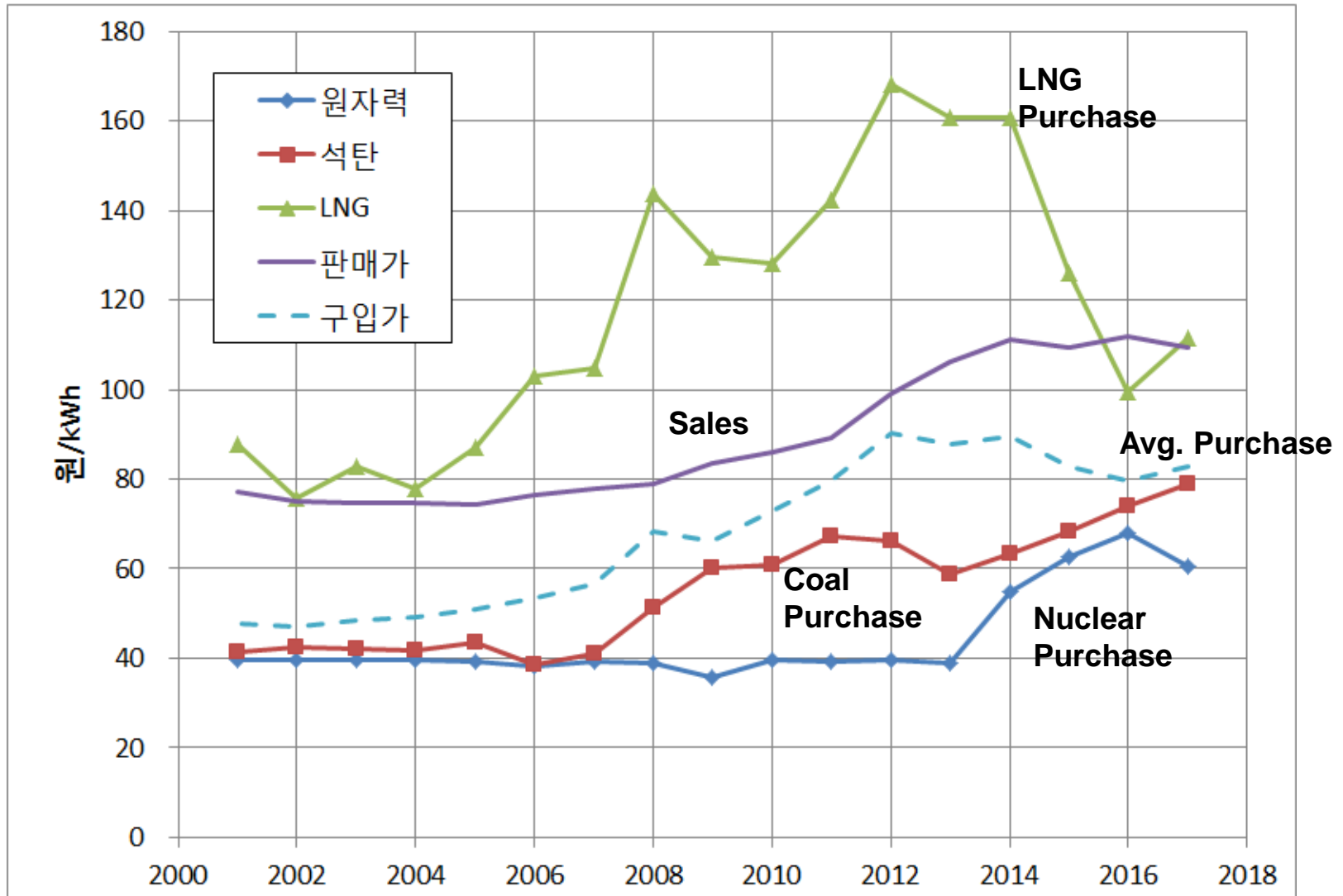
554 TWh in 2017 and  
2~3% Steady Increase

- Others
- Renewable
- Nuclear
- Gas
- Coal



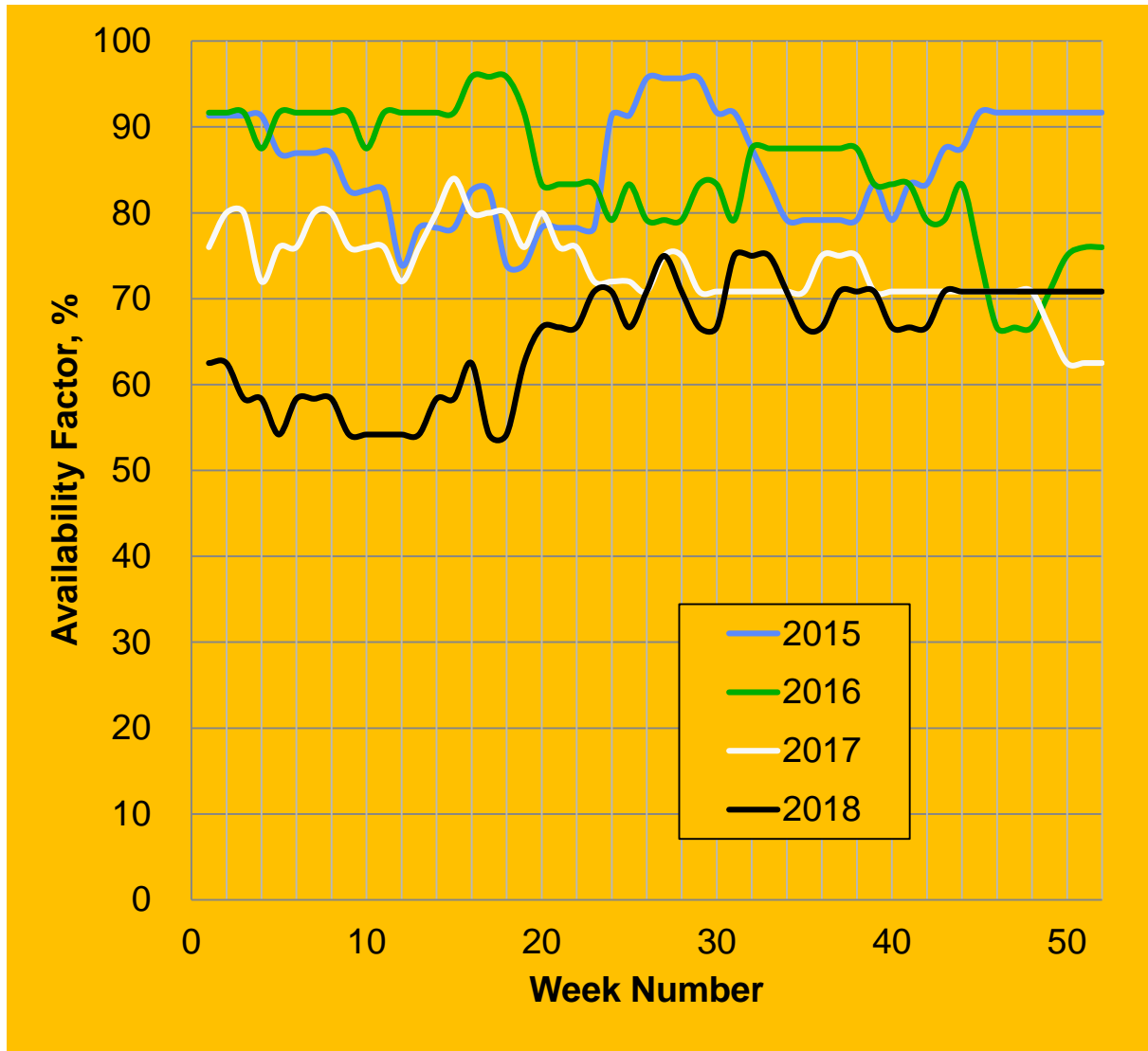
~30% Electricity from Nuclear Power  
~5% from New & Renewables in 2017

# Electricity Market Prices (KRW/kWh)





# Reduced of NPP Operation due to Phase-out



# Poll Results Showing that People recognize well the Pros and Cons of Nuclear Energy

## 1) Recognition of NPP advantage and disadvantage

[ unit : %, Aug.(n=1,000), Nov.(n=1,006) ]

