

Workshop
INPRO Dialogue Forum, IAEA, Vienna, Austria

**“Experiences of Development of
Sustainable Nuclear Energy Systems
in the Republic of Korea”**

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Current Status of Energy Supply in Korea

96.4 % of energy resources were imported in 2011

Year 2011

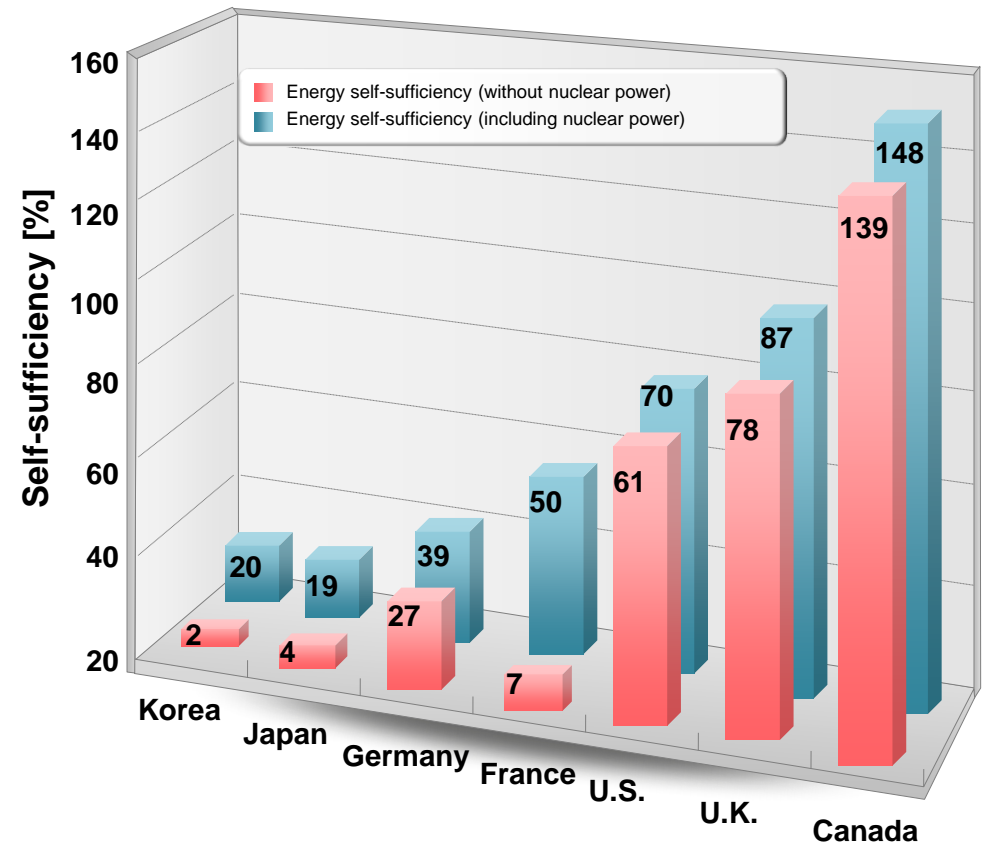
Korea's Energy Consumption

World rank **9th**

- Energy Consumption : 240 Mtoe

Korea's Energy & Oil Import

- Energy Import : 231 Mtoe
(USD 141 Billion, 33 % in total import)
- Oil Import : 159 Mtoe = 865 Million bbl
(USD 86 Billion)

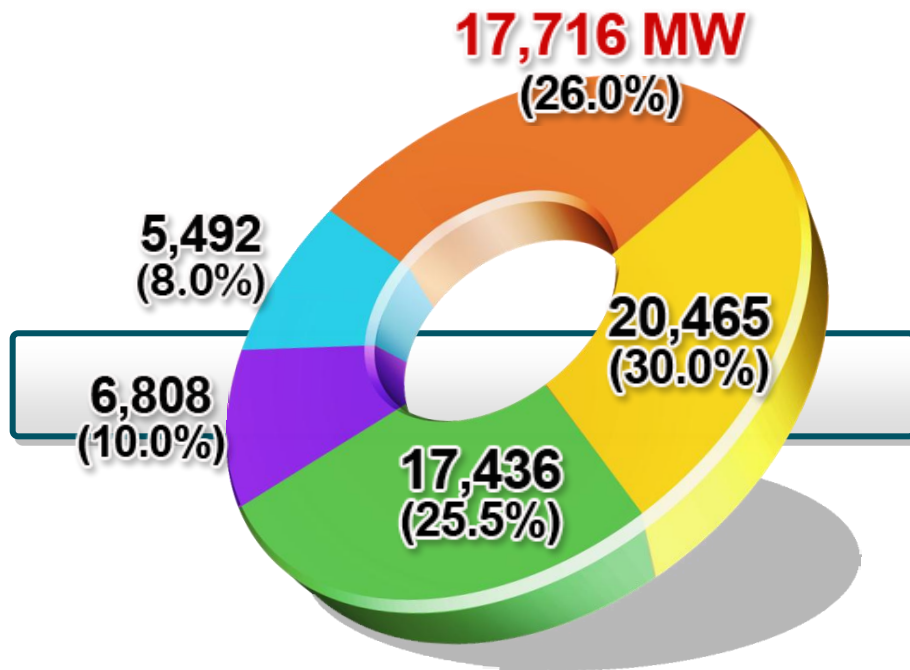


* IEA, Energy balance of OECD countries 2004-2005

Status of Electric Power in Korea

■ Nuclear
 ■ Coal
 ■ Gas
 ■ Oil
 ■ Hydro

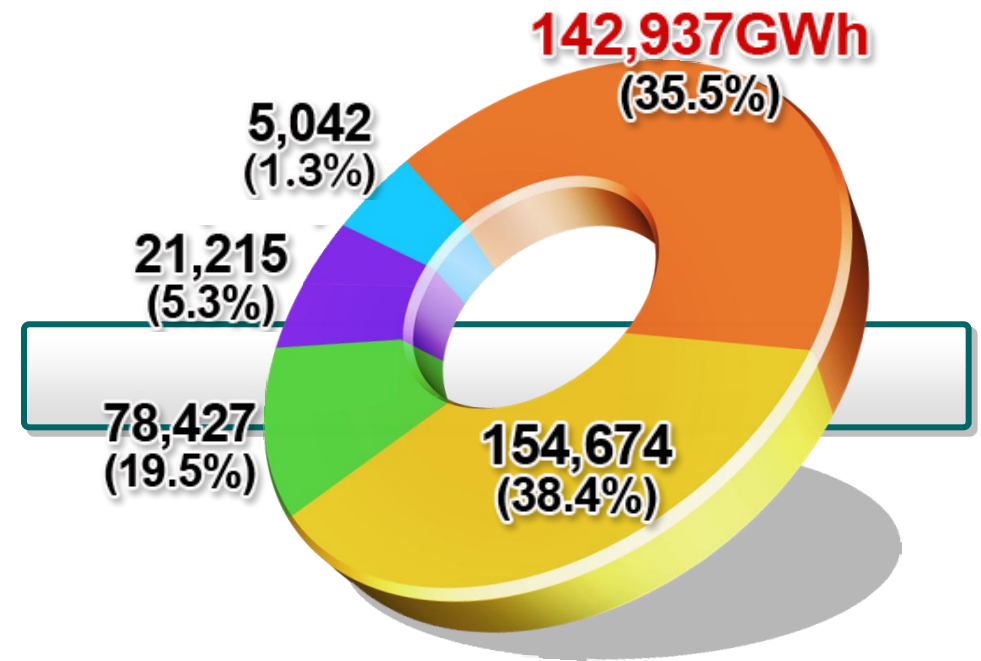
Installed Capacity



*The others : 351 MW(0.5%)

Total : 68,268 MW

Electricity Generation

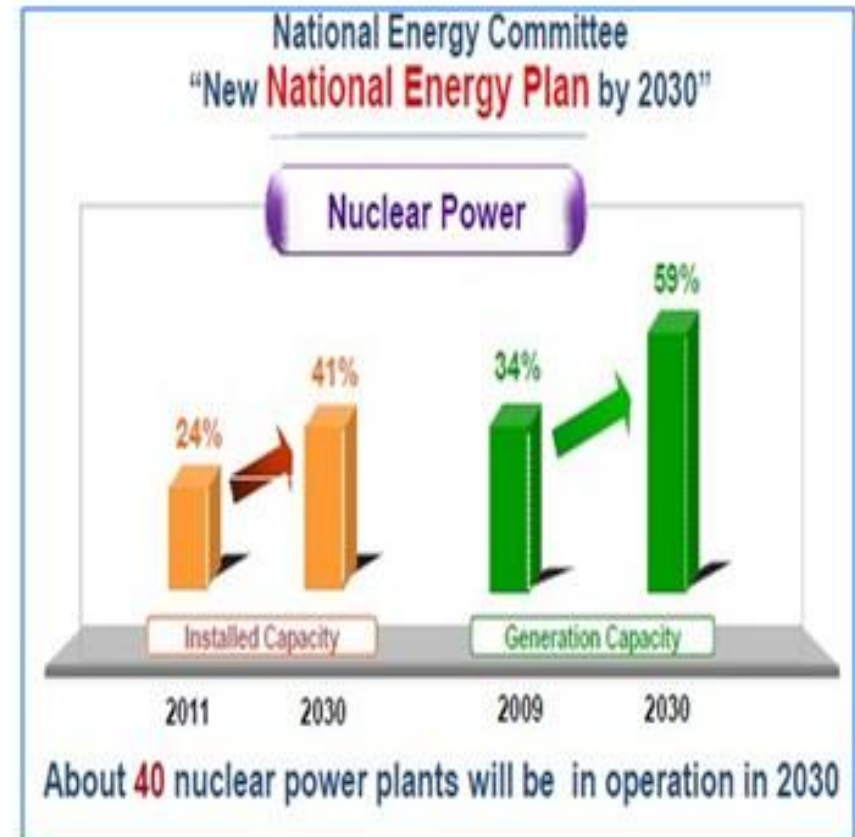
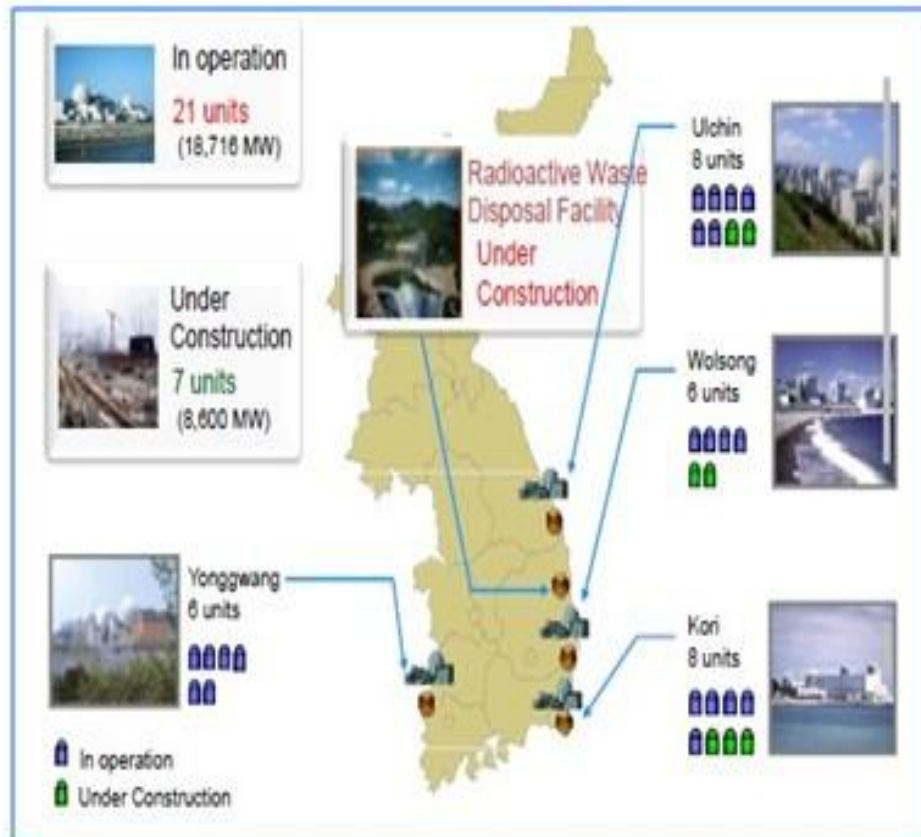


*The others : 829 GWh(0.2%)

Total : 403,124 GWh

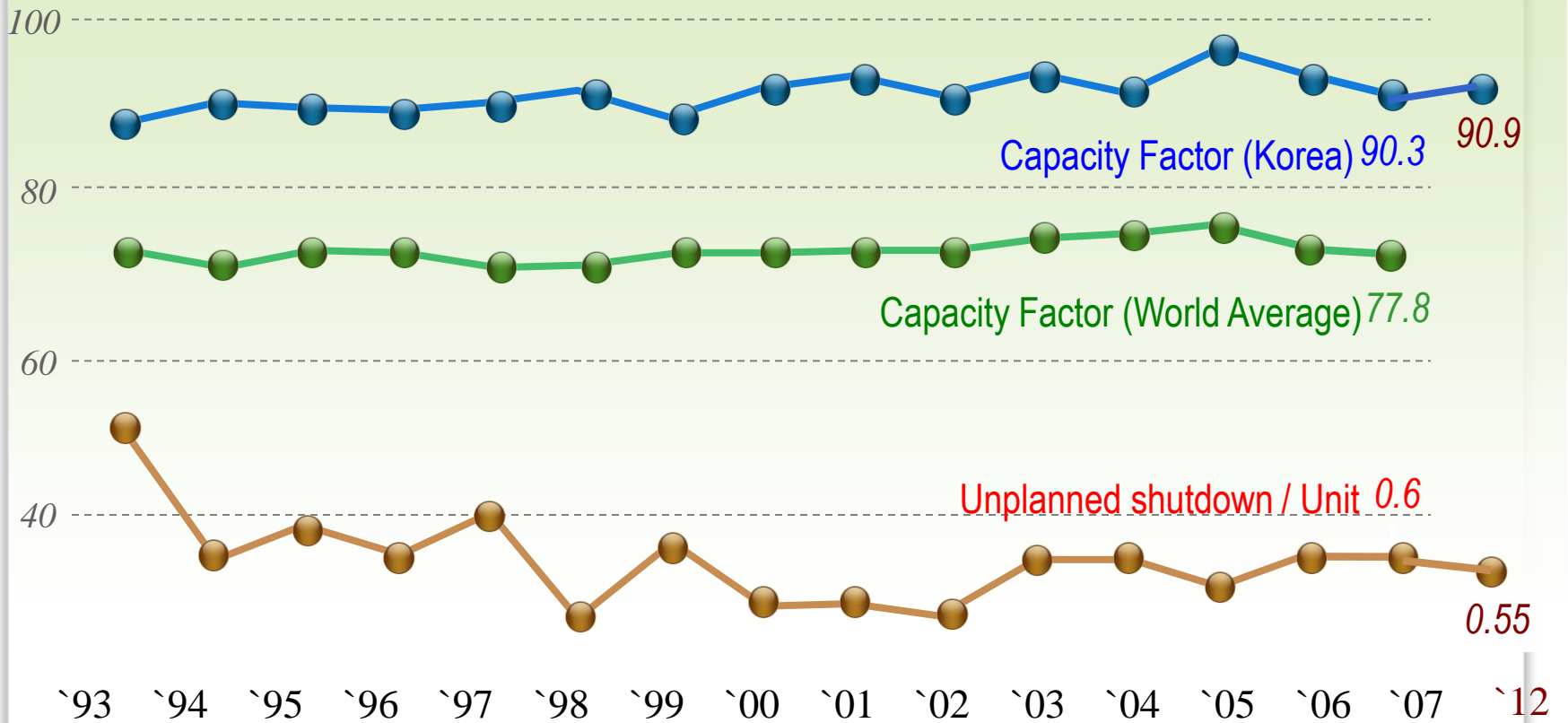
Status & Prospects of the Nuclear Power Programs in Korea

- Now 21 NPPs (18.7 GW) are in operation & 7 NPPs under construction.
 - About 40 NPPs (59 % of total electricity) will be operated in 2030.
- Low & Medium Level Waste Facility is under Construction.



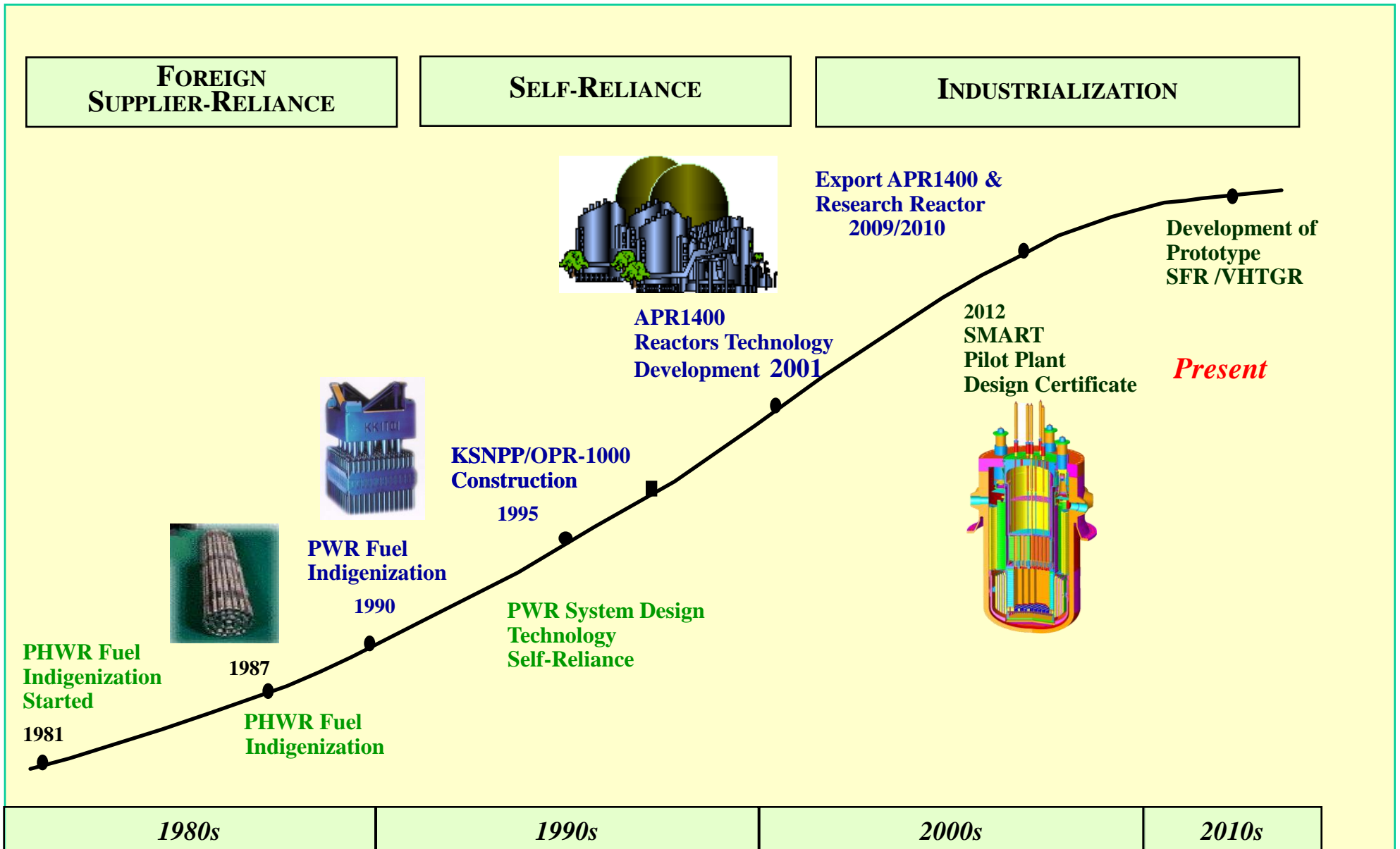
Performance of NPP in Korea

Capacity Factor (%)



C.F.(%)	87.2	87.4	87.3	87.5	87.6	90.3	88.3	90.4	93.2	92.7	94.2	91.4	95.5	92.3	90.3	90.9
shutdown	1.6	0.9	1.1	0.9	1.1	0.4	0.9	0.5	0.5	0.4	0.6	0.6	0.5	0.6	0.6	0.55

Nuclear Technology Development Roadmap in Korea



Nuclear Reactor Development Milestone in Korea



1st Phase : Gen II

- Turn-key base
- 600 MWe



2nd Phase : Gen III

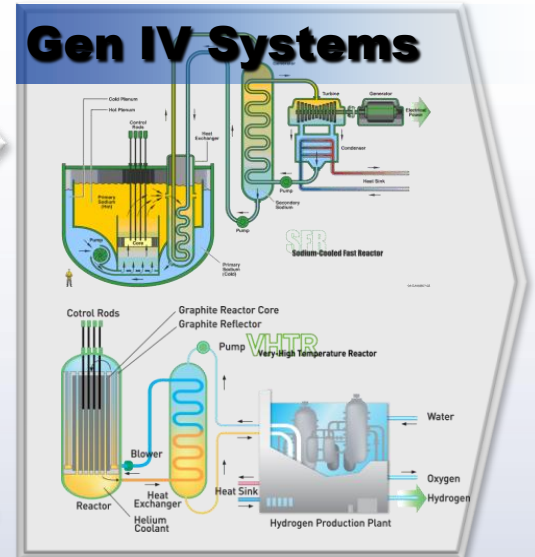
- Standardization
- KSNP(OPR1000)
- 1,000 MWe



3rd Phase : Gen III+

Evolutionary PWRs

- APR1400
- SMART



4th Phase : Gen IV

Revolutionary

- SFR : recycle SF and waste minimization
- VHTR for hydrogen production

1970s

1980s

1990s

2000s

2010s

2020s

2030s ~

The 1st Nuclear Power Projects in Korea

**Kori - the site of the 1st Korean NPP :
before (top) and now (bottom).**



**1st unit of Nuclear
power plant started
to build in 1971**

- Turn Key basis
- 587MWe
- Commercial operation in 1978
- Life extension after 30 years operation (2007.12)

Evolutionary NPP Technology Development in Korea

● Evolution of Korea's self-reliance



* OPR1000 (Optimized Power Reactor 1,000)

* APR1400 (Advanced Power Reactor 1,400)

Local Participation in Nuclear Power Projects in Korea

Localization Results in Korea



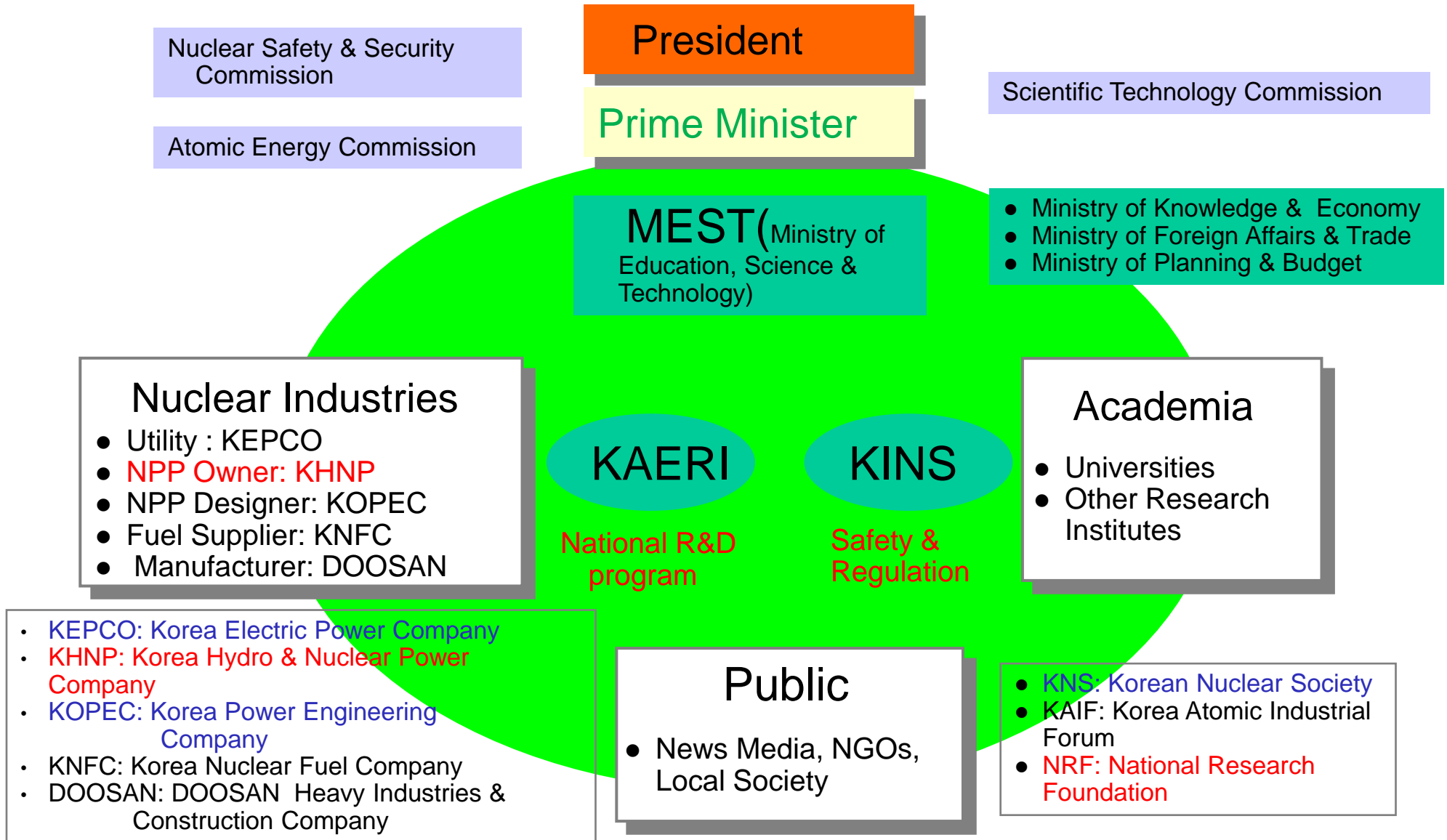
Engineering(%)	-	-	-	37	44	46	75	90	95
Equipment(%)	8	13	14	29	35	40	74	75	79

Construction Experience of NPP in Korea

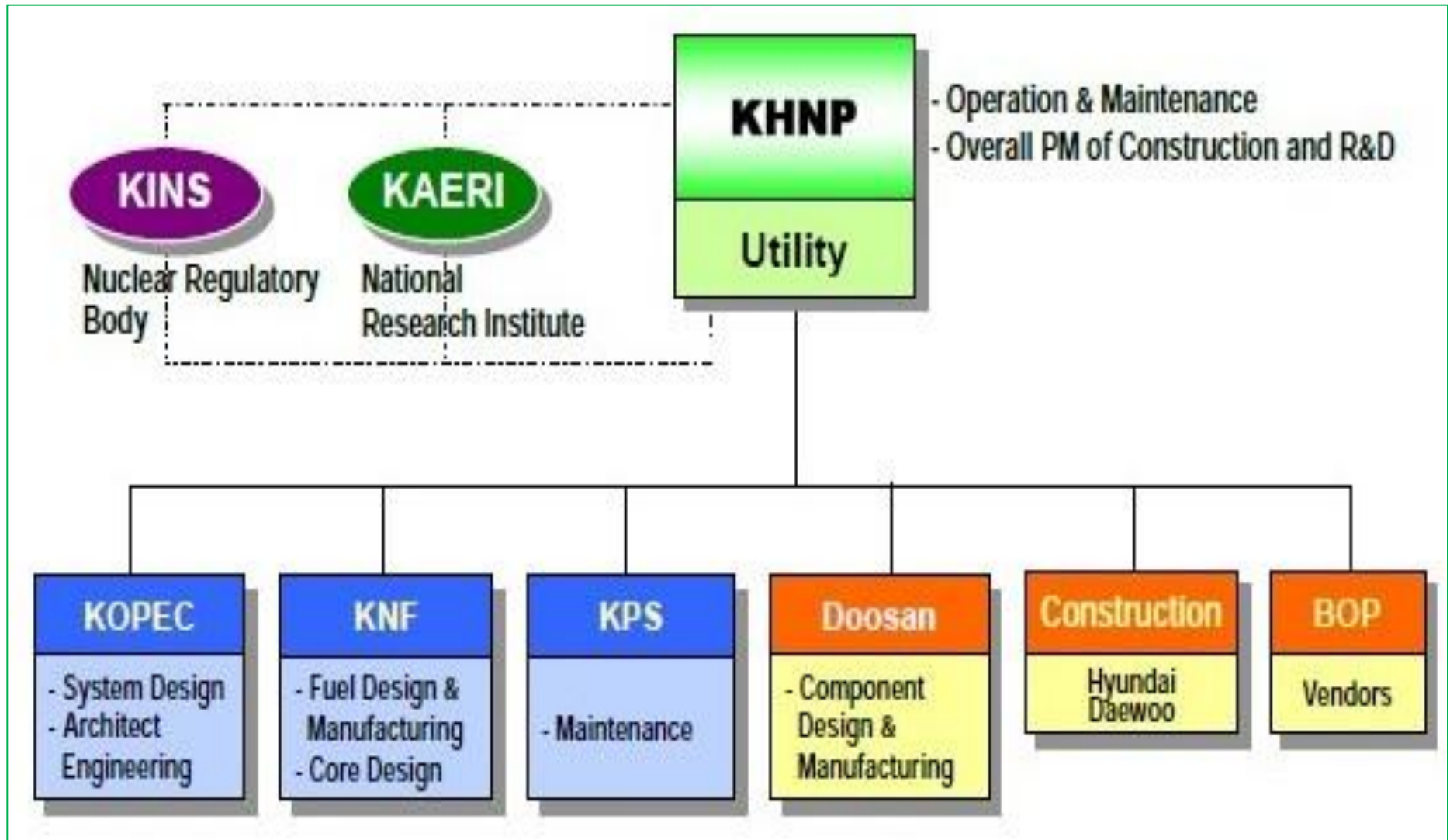
Construction - Time Schedule



Nuclear Related Organizations in Korea



Nuclear Industry in Korea




Status of Construction of NPPs in Korea & UAE

- 10 APR 1400 (1400 MW) are under construction:
 - 6 in Korea & 4 in UAE, which was exported in December 2009.
- Average construction period is aimed to be 48 months.

NPPs under Construction


Shin-Kori 3&4 (APR1400)



- O/L Application : 2010.5.31
- First Energization : 2011.6.1
- Unit #4 RV Setting : 2011.7.18
- Unit #3 Fuel Loading : 2013.1
- Commercial Operation :
 - Unit #3 : 2013.9
 - Unit #4 : 2014.9

74 % In Progress

Shin-Ulchin 1&2 (APR1400)



- Site Preparation completed
- PSAR Review for CP completed
- Construction Permit : 2011.8
- Commercial Operation :
 - Unit #1 : 2016.6
 - Unit #2 : 2017.6

25% In Progress

Braka NPP in UAE



- PSAR Submit : 2010.12.31
- Construction Permit : 2012.6
- Unit #1 RV Setting : 2014.7
- Operating License : 2016.10
- Commercial Operation : 2017.5 ~ 2020.5

6 % In Progress

New NPP Construction

Shin-Kori 5&6 (APR1400)

Advanced Power Reactor 1400



- Construction Plan Set
- PSAR Preparation will Start
- Commercial Operation :
 - Unit #1 : 2018
 - Unit #2 : 2019

Initial Preparation

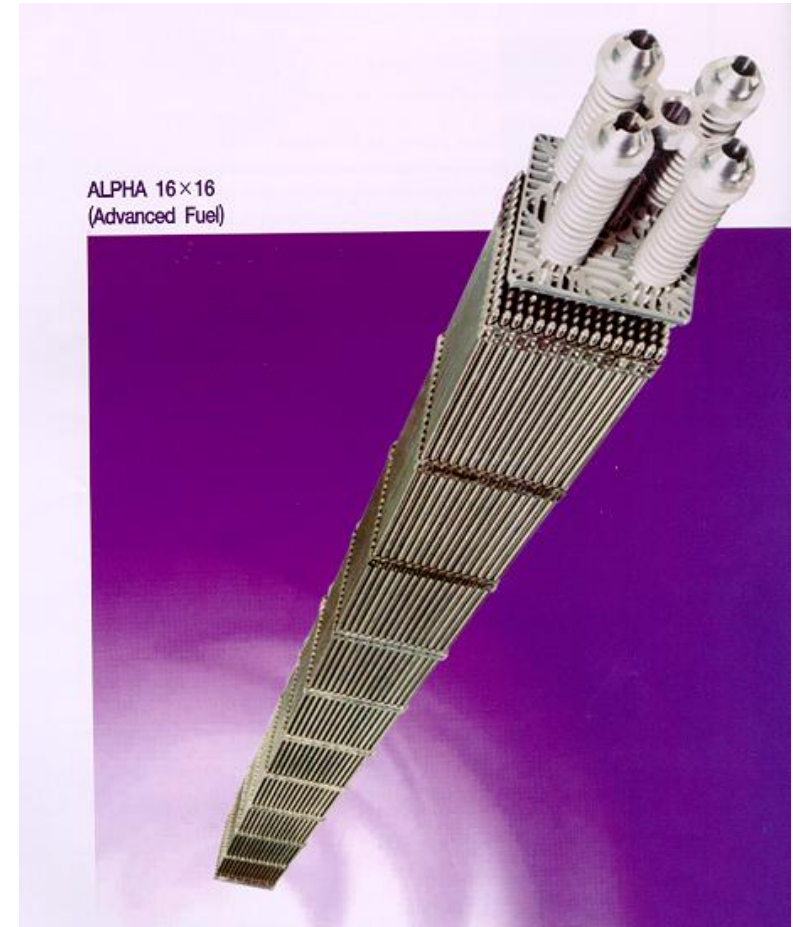
CANDU Fuel Technology Development in Korea

- ❑ R&D Facility Set-up at KAERI (1978)
- ❑ Governmental Decision to Localize CANDU-PHWR Fuel (1981)
 - Initiation of R&D Project Funded by Government & KEPCO
- ❑ Manufacturing of Prototype Fuel Bundles and Out-of Pile Test (1983)
- ❑ Pilot Scale Production and Test Irradiation in Power Reactor (1984)
- ❑ Expansion of Fabrication Capacity to Full Domestic Supply of CANDU-PHWR Units
 - 1988: 100 MTU/yr
 - Since 1998: 400 MTU/yr



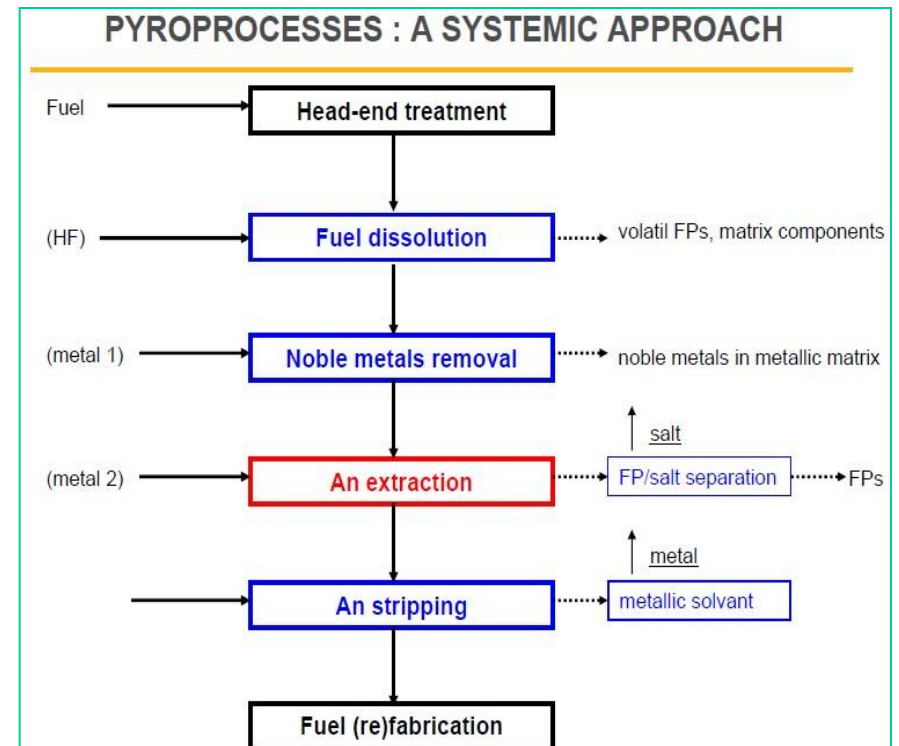
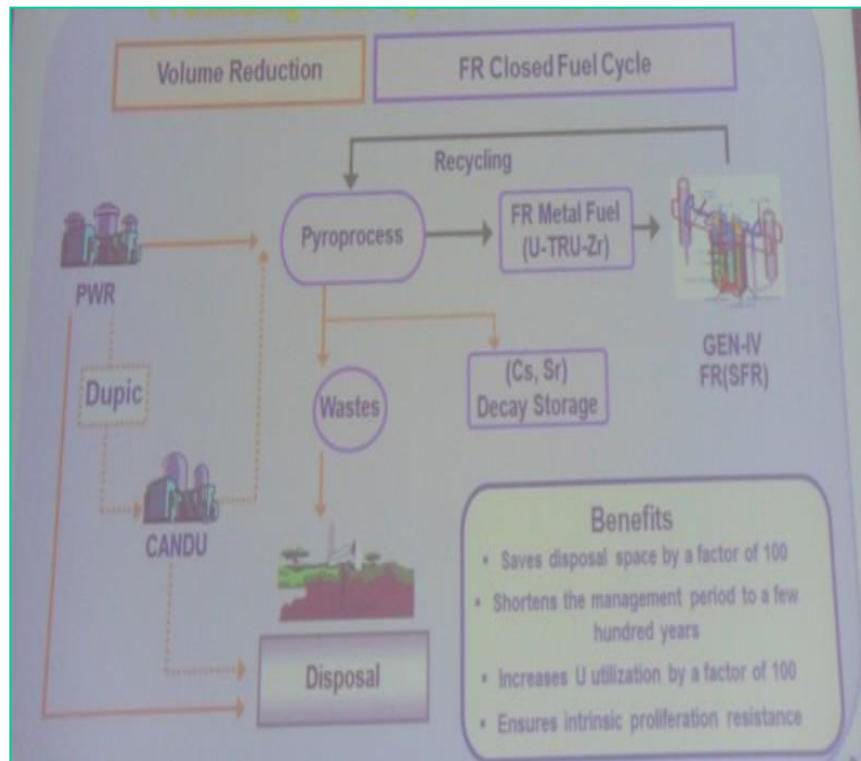
PWR Fuel Technology Development in Korea

- ❑ Government Decision to Localize PWR Fuel (1981)
- ❑ Korea Nuclear Fuel Company Formed (1982)
- ❑ Technology Inducement Contract with KWU (1985)
 - KAERI/KWU for PWR Fuel Design
 - KNFC/KWU for PWR Fuel Fabrication
 - Introduction of Joint Design Concept
 - Joint R&D
- ❑ Construction of Fuel Fabrication Plant (1986-1989)
- ❑ First Delivery of Domestic Fuel (1989)



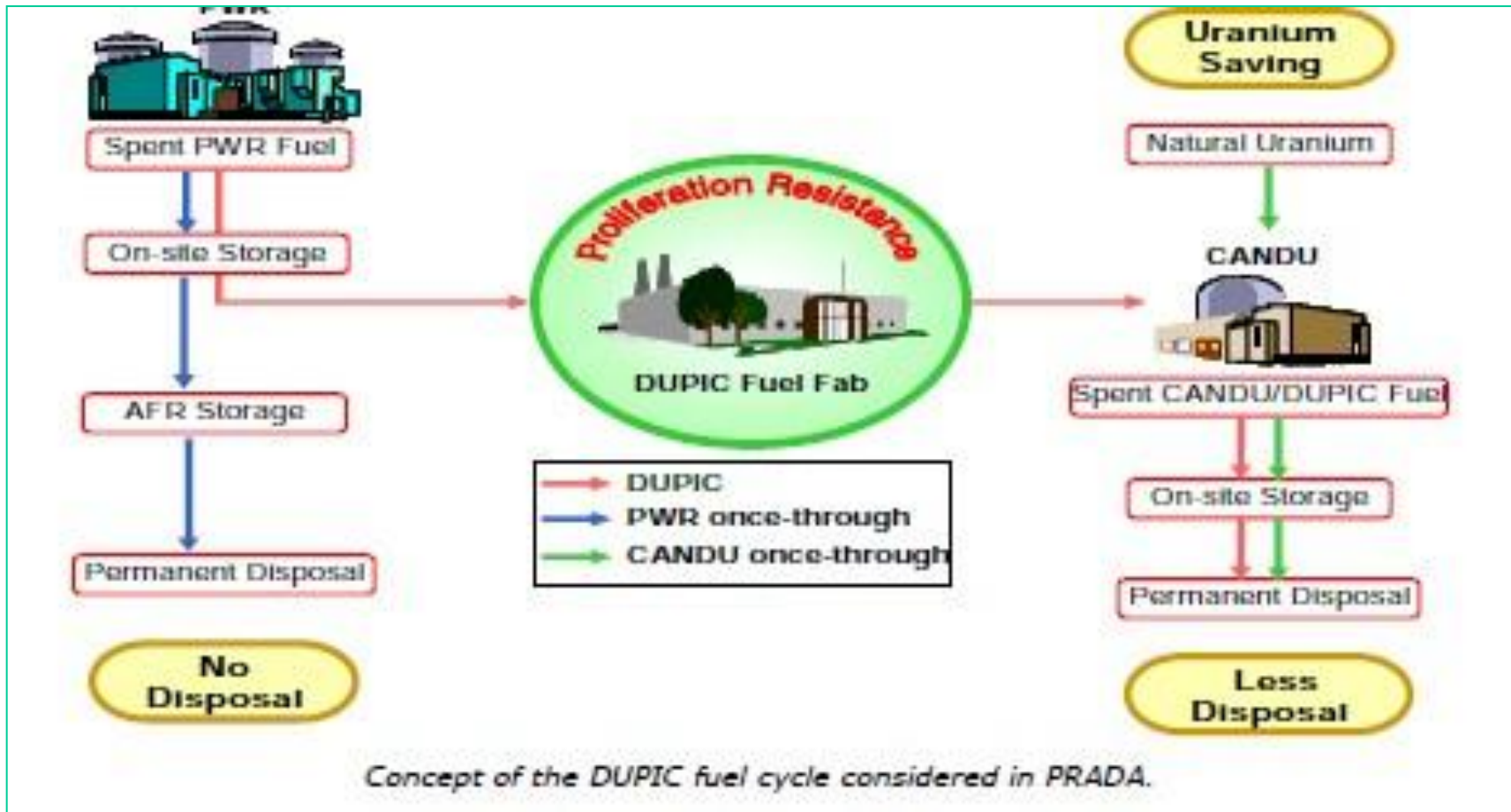
Pyroprocess Fuel Development in Korea

- Development through international collaboration
- Reduction of waste volume by a factor 100
- Utilization of U by a factor of 100



Participation in INPRO

Korea participated in INPRO in 2001
Shared experience of DUPIC fuel cycle development
in PRADA



Participation in GIF

- Korea joined GIF as a charter member in 2001
- Korea participated in development of SFR & VHTGR



Participation in IFNEC(GNEP)

- Korea joined GNEP (IFNEC) as a member.

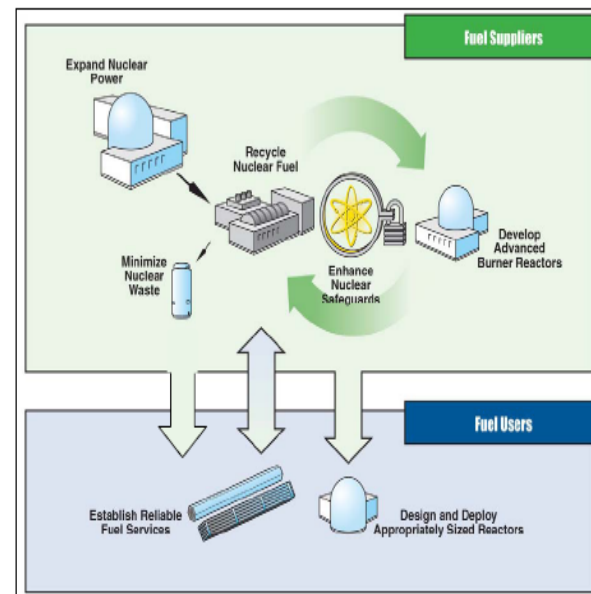
OPENING REMARKS OF THE SEPTEMBER 16 GNEP MINISTERIAL



September 16, 2007



Reliable Fuel Service is an Essential Part of National and Global Security



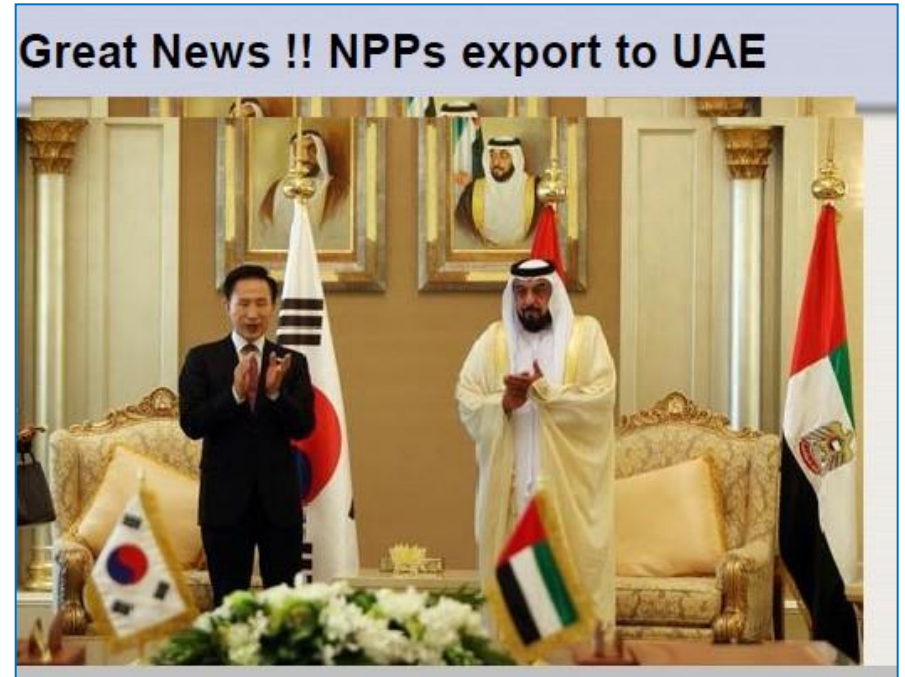
February 12, 2007

- **Fuel Suppliers:** operate reactors and fuel cycle facilities, including fast reactors to transmute the actinides from spent fuel into less toxic materials
- **Fuel Users:** operate reactors, lease and return fuel.
- **IAEA:** provide safeguards and fuel assurances, backed up with a reserve of nuclear fuel for states that do not pursue enrichment and reprocessing



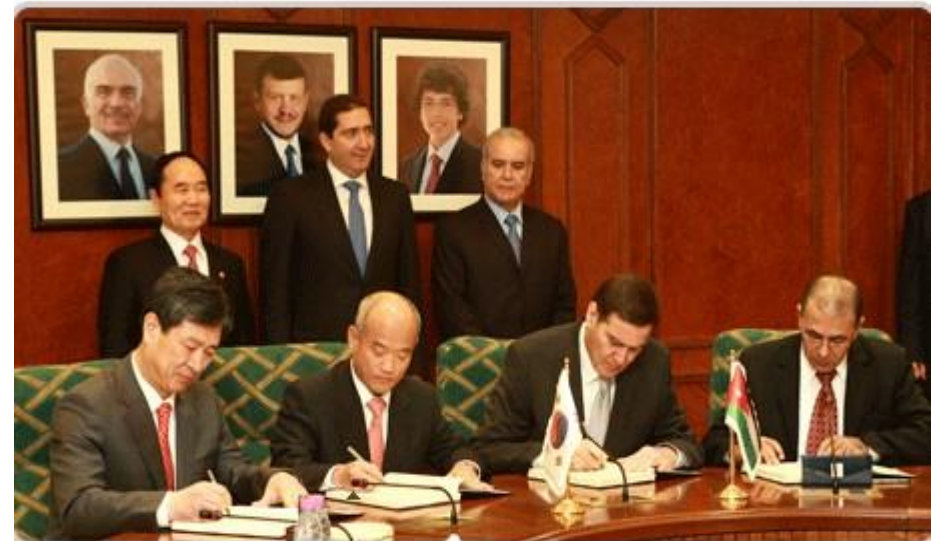
Export of APR-1400 to UAE

- On 27 December, 2009, UAE Picked ROK as Nuclear Partner:
 - Emirates Nuclear Energy Corporation (ENEC) signed contract with Korea Electric Power Corporation (KEPCO) to built 4 APR-1400.



Export of Research Reactor to Jordan

- Jordan & ROK signed on 30 March 2010 to build 5 MWth Research Reactor (JRTR) at the Jordan University of Science and Technology.



JRTR Project Summary

Scope of Supply	Reactor Construction and Training of Jordanian Staffs
Owner	Jordan Atomic Energy Commission (JAEC)
Contractor	KAERI-DAEWOO Consortium
Project Period	2010. 8. 1 ~ 2015. 3. 31 (56 months)
Site	Jordan University of Science and Technology (Irbid)

Thank you for your kind attention !

