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## Status & Prospects of Nuclear Power Generation and Fuel Cycles in Korea

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1. Introduction

- Overview of Korean nuclear power technology

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## **Brief History of Nuclear Power in Korea**





**Status of Electric Power** 

## □ Installed Capacity

#### **Electricity Generation**



### **Status of Nuclear Power Plants**

#### Units (MW)





### **Nuclear Power Plants in Operation**

### **20 units (17,716 MW)**

Plant		Reactor Type	Capacity (MW)	NSSS Supplier	Plant A/E	Commercial Operation
Kori (KRN)	#1 #2 #3 #4	PWR PWR PWR PWR	650 587 950 950	W/H W/H W/H W/H	Gilbert Gilbert Bechtel/KOPEC Bechtel/KOPEC	'78.04 '83.07 '85.09 '86.04
Wolsong (WSN)	#1 #2 #3 #4	PHWR PHWR PHWR PHWR	679 700 700 700	AECL AECL/DOOSAN AECL/DOOSAN AECL/DOOSAN	AECL AECL/KOPEC AECL/KOPEC AECL/KOPEC	'83.04 '97.06 '98.06 '99.09
Yonggwang (YGN)	#1 #2 #3 #4 #5 #6	PWR PWR PWR PWR PWR PWR	950 950 1,000 1,000 1,000 1,000	W/H W/H DOOSAN DOOSAN DOOSAN DOOSAN	Bechtel/KOPEC Bechtel/KOPEC KOPEC KOPEC KOPEC KOPEC	'86.08 '87.06 '95.03 '96.01 '02.05 '02.12
Ulchin (UCN)	#1 #2 #3 #4 #5 #6	PWR PWR PWR PWR PWR PWR	950 950 1,000 1,000 1,000 1,000	Framatome Framatome DOOSAN DOOSAN DOOSAN DOOSAN	Framatome Framatome KOPEC KOPEC KOPEC KOPEC	'88.09 '89.09 '98.08 '99.12 '04.07 '05.06

NSSS : Nuclear Steam Supply System, A/E : Architect Engineering



## **Operating Performance**





### **Evolution of Project Contract Scheme**







## **Development of Standard Model**





## **Benefits of Standardization**





## **Prospect of Energy Demand**







### **Prospect of Electric Power (until 2015)**







### **Nuclear Power Development Plan**



### **6 units (6,800 MW)**

Plant		Reactor Type	Capacity (MW)	NSSS & TG Supplier	Plant A/E	Commercial Operation
Shin-Kori	#1	PWR	1,000	DOOSAN	KOPEC	2009. 12
(Shin-KRN)	#2	PWR	1,000	DOOSAN	KOPEC	2010. 10
Shin-Wolsong	#1	PWR	1,000	DOOSAN	KOPEC	2011. 09
(Shin-WSN)	#2	PWR	1,000	DOOSAN	KOPEC	2012. 09
	#3	PWR	1,400	DOOSAN	KOPEC	2012.06
Shin-Kori	#4	PWR	1,400	DOOSAN	KOPEC	2013.06



## **Fuel Cycle Facilities in Korea**

# **Nuclear Fuel Supply**

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- Uranium for fuel comes from Australia, Canada, the U.K, France, Russia, the U.S and South Africa
- Conversion and enrichment services come from the U.S., the U.K., France

Canada and Russia by long-term contracts

- Fuel fabrication services are fully localized to meet domestic needs
  Korea Nuclear Fuel Company(KNFC)
- KNFC has supplied PWR fuel since 1990 and Candu PHWR fuel since 1987
- KNFC has capacity of 550 t/yr for PWR fuel and 700 t/yr for Candu
  PHWR fuel



## **Projected Waste Management Plan in Korea**

#### **Construction and Operation of Facility for Disposal of Low and Intermediate** Level Radioactive Wastes

-Disposal capacity: initial 100,000 drums (final 800,000 drums)

-Operation start year: 2008



-Main Host : Korea Hydro & Nuclear Power Co.,Ltd. (KHNP)

#### **Construction and Operation of Interim Storage Facility for Spent Fuels**

- -Storage capacity: initial 2,000 tons (final 20,000 tons)
- -Operation start year: 2016
- -Storage type: to determine later after considering the site condition and the technology development trend (wet or dry type)
- -Main Host : Korea Hydro & Nuclear Power Co.,Ltd. (KHNP)



## **Projected Waste Management Plan in Korea**

# **Establishment of New Law for LLW Disposal Repository**

- Spent fuel storage site separated
- Put in force on June 2005
- More transparent and new process
- Voluntary application of Local government with endorsement of residents through popular referendum
- Incentive offer valued of U.S\$300 Million(and \$8.5million annual fee's)
- Construct proton high energy accelerator near the site
- Headquarters of KHNP will be moved
- Currently 4 local government applied
  popular referendum is planned on Nov. 2
- **Spent fuel storage site**

-will be determined after public consensus



## **Korean NPP Plan and Spent Fuel Arisings**

#### • Spent Fuel Arisings (End of 2004)

- PWR : 3,397 ton
- CANDU: 3,889 ton

NPP Sites		Storage Capacity (tLl)	Accumulation	
Site name	# of units	Clorage Capacity (10)	(tU)	
Kori	4	2,007	1,415	
Yonggwang	6	2,094	1,140	
Ulchin	6	1,990	842	
Wolsong	4	4,336	3,889	
tota	al	10,427	7,286	



## **Korean NPP Plan and Spent Fuel Arisings**

#### **Prospect of Spent Fuel Generation**





#### **Back-End Fuel Cycle Options in Korea**

#### • Options for back-end fuel cycle in the future

- **1** Direct disposal
- (2) **DUPIC**  $\rightarrow$  waste disposal
- **③** Pyroprocessing/Transmutation  $\rightarrow$  waste disposal







# Prospect of Advanced Nuclear Fuel Cycle : KIEP-21

"K : Korea, I : Innovative, E : Environmentally friendly, P : Proliferation resistant"



## **Projection of Nuclear Electricity Generation up to 2050**

#### **Main Assumptions**

• Electricity demand per capita : ~6,500 kWh/man/year in 2004

in 2100 : 11,000kWh/man/year(reference), 10,000kWh/man/year(Low), 13,000kWh/man/year(High)

• Nuclear Share : 46.7% in 2020 continues up to 2050

Population : about 50 million in 2020 from the database of Korea National Statistical Office (http://www.nso.go.kr).
 Population increase rate after 2021 is "Zero"







#### Projection of Nuclear Spent Fuel: (DUPIC+FR) Closed Fuel Cycle Option



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#### Review

- Excellent Nuclear Power Generation Capability and Experience
- Current issue
  - : Siting for LLW Disposal Repository and Spent Fuel Storage Problem

"Clean" Korea

