

Korean Perspective on Nuclear Energy after Fukushima Accident

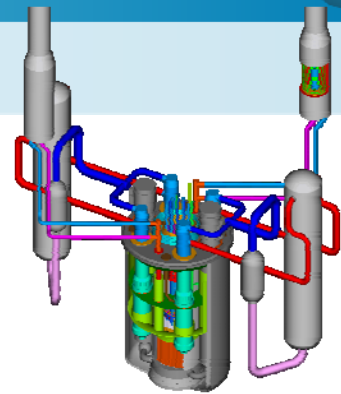
Global 2011 Tsuruga Session

December 16, 2011

Dohee Hahn

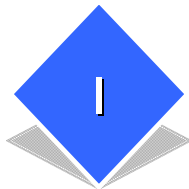


**Korea Atomic Energy
Research Institute**



Outline

- I Status of Nuclear Energy in Korea
- II Impact of Fukushima Accident
- III Major Nuclear R&D Programs
- IV Summary



Status of Nuclear Energy in Korea

Why is Nuclear Energy needed in Korea?

- ◆ **Limited domestic energy resources**
 - ✓ No crude oil and natural gas, limited coal
- ◆ **Limited potential of renewable energy**
 - ✓ Poor wind condition, small land



- ◆ **Large-scale, self-reliance energy resource needed**
- ◆ **Nuclear Energy is a major source of electricity as a clean, economical and technology-driven energy with sustainability**

Status of Energy Supply in Korea

96.2 % of energy were imported in 2009

Year 2008

Korea's Energy Consumption

9th World Ranking

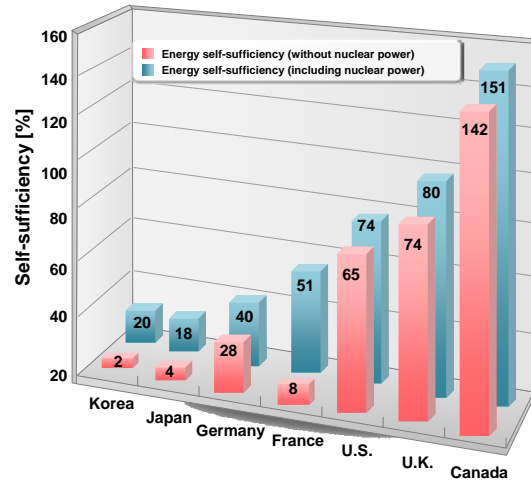
• Energy Consumption : 240 Mtoe

* Ref. BP (2009), Statistical Review of World Energy

Korea's Energy & Oil Import

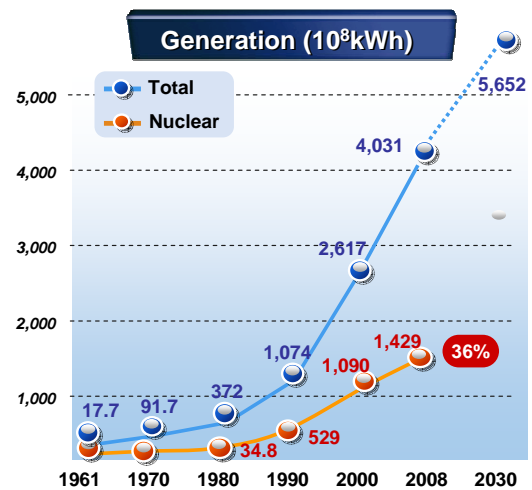
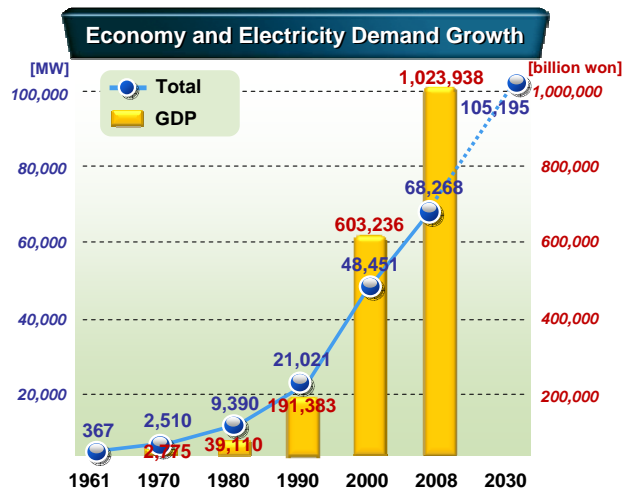
- Energy Import : 231 Mtoe
(USD 141 Billion, 33 % in total import)
- Oil Import : 159 Mtoe = 865 Million bbl
(USD 86 Billion)

* Ref. Korea Energy Economics Institute (2009)



* IEA, Energy balance of OECD countries 2009

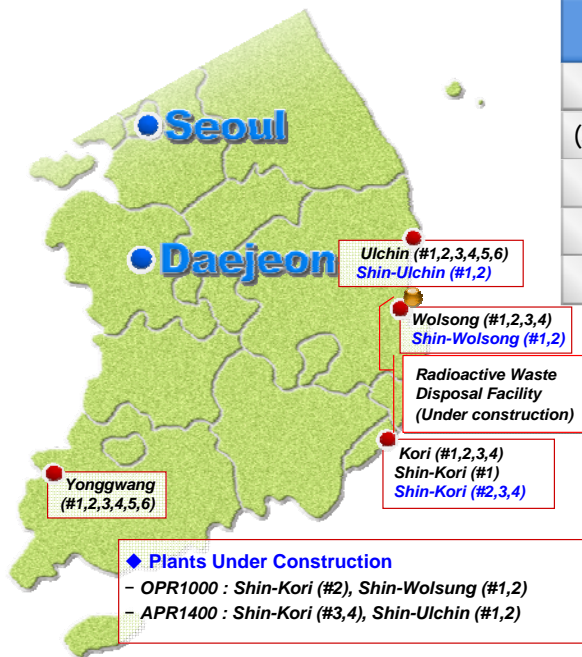
Energy Demand and Electricity Generation



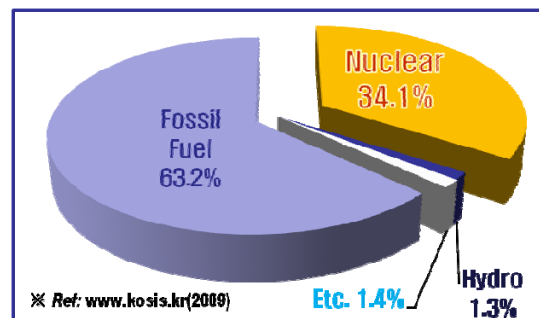
* Ref. National Energy Committee (2008.8.27)

- ◆ As the economy grows, the energy and electricity consumption increase rapidly
- ◆ Nuclear power plays a major role for electricity generation

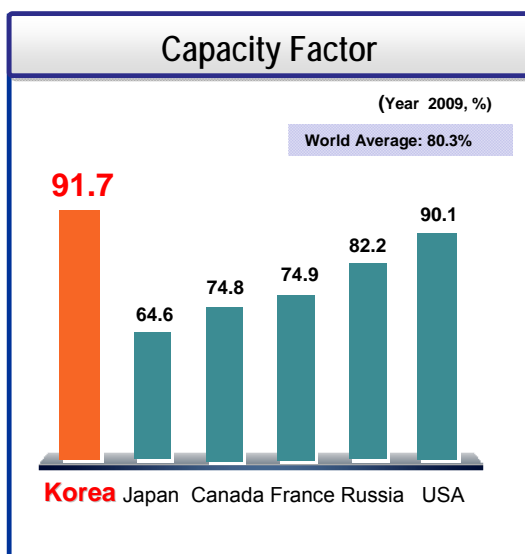
Nuclear Power Plants in Korea



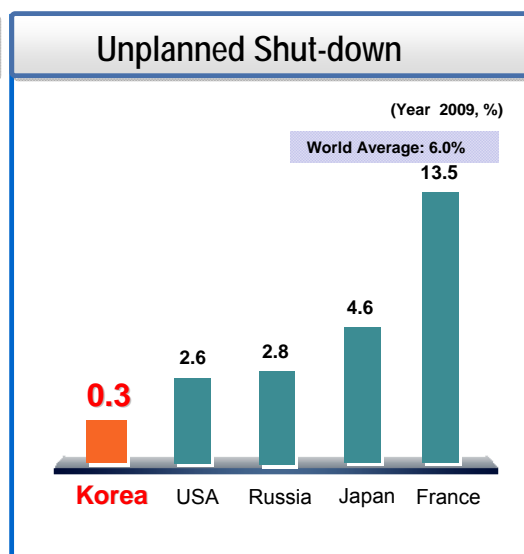
Site	In Operation	Under Construction	Total (2016)
(Sin)Kori	5 (4,137)	3 (3,800)	8 (7,937)
(Sin)Wolsong	4 (2,779)	2 (2,000)	6 (4,779)
Yonggwang	6 (5,900)	-	6 (5,900)
Ulchin	6 (5,900)	2 (2,800)	8 (8,700)
Total	21 (18,716)	7 (8,600)	28 (27,316)



Operating Performance of Nuclear Power Plants

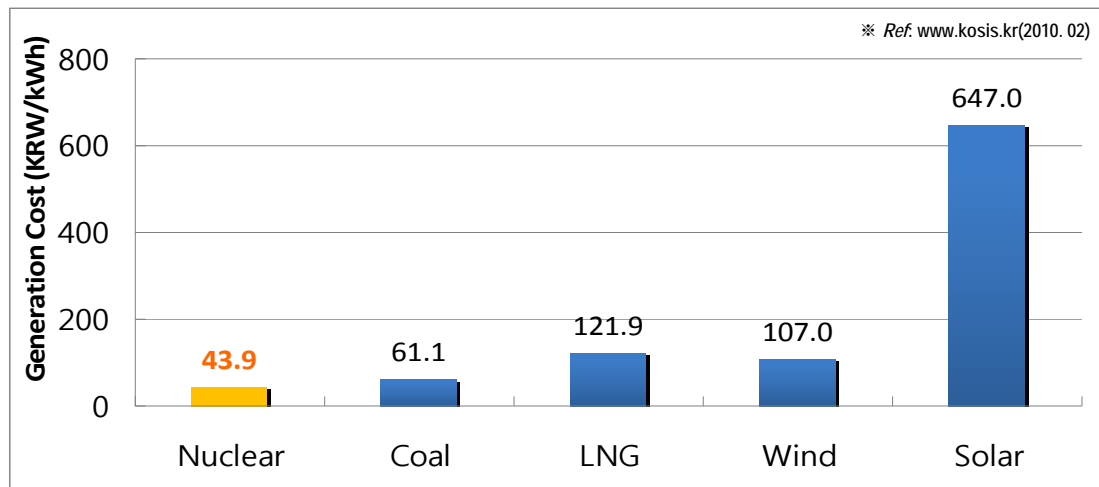


※ Ref: IAEA, PRIS (2010. 6)

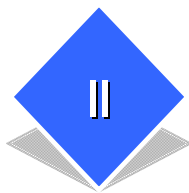


※ Ref: IAEA, PRIS (2010. 6)

Electricity Generation Cost in Korea



- ◆ Nuclear Energy supports Renewable Energy development through electricity generation subsidy program
- ◆ Wind and Solar costs include the subsidies



Impact of Fukushima Accident

Actions after Fukushima Accident

◆ Immediate Response to Fukushima Accident

- ✓ Emergency Response Team
- ✓ Crisis Communication with Public and Media
- ✓ Strengthened Environmental Monitoring
- ✓ Special Safety Inspection on Nuclear Facilities

◆ Actions for Safety Enhancement

- ✓ Establishment of an Independent Regulatory Body: Nuclear Safety and Security Commission (NSSC)
- ✓ First IRRS Mission after Fukushima Accident
- ✓ Implementation of Action Items Identified by Special Safety Inspection
- ✓ Planning for Strengthened Nuclear Safety Research

Special Safety Inspection by Regulatory Body

◆ March 23 ~ April 30, 2011; 73 Experts

◆ 21 Operating NPPs, 1 Research Reactor, and Emergency Medical System

◆ Main Focus on Unlikely Worst Case Scenarios, including

- ✓ Extreme natural disaster (earthquake + tsunami)
- ✓ Loss of off-site power and failure of emergency DGs (SBO)
- ✓ Severe accident

◆ Objectives

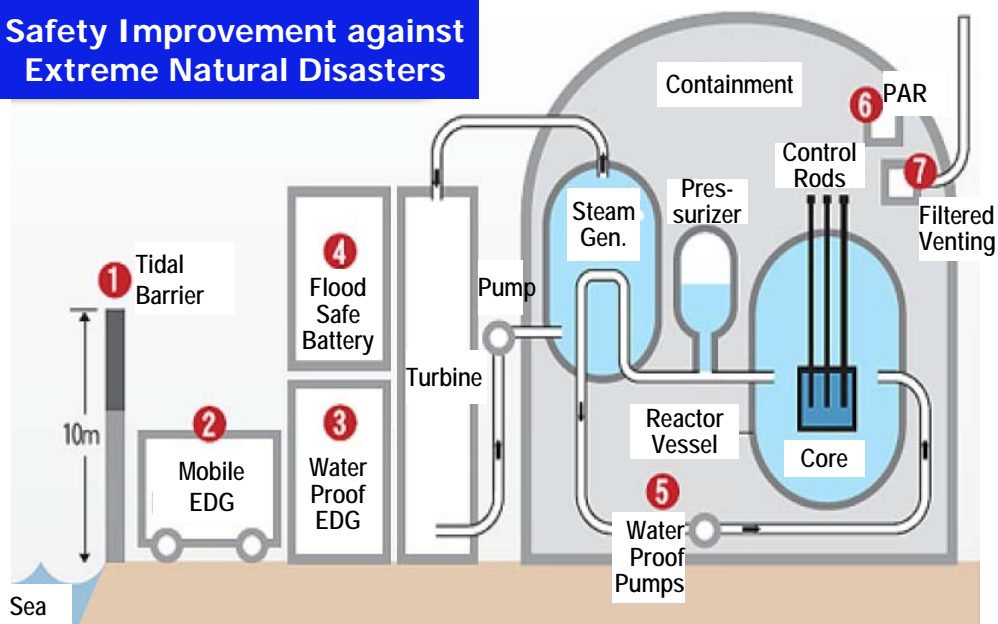
- ✓ How well the NPPs are designed against natural disasters ?
- ✓ How well they can mitigate the severe accident ?
- ✓ How effective is the emergency response system ?

Outcomes of the Special Safety Inspection

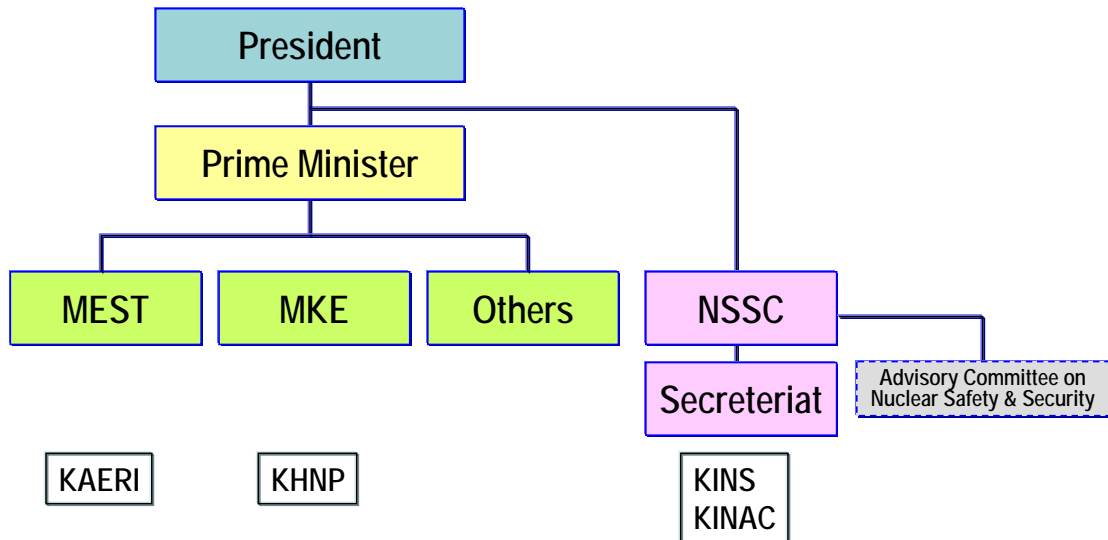
- ◆ No Imminent Risks to Operating Nuclear Facilities
- ◆ 50 Action Items to Further Strengthen Defense in Depth
 - ✓ To minimize the impact of extreme natural disaster
 - ✓ To make available emergency power and ultimate heat sink
 - ✓ To ensure containment building integrity and emergency response capability
- ◆ Examples of Action Items
 - ✓ Re-evaluation of seismic capability of safe shutdown system
 - ✓ Installation of a mobile emergency generator and battery
 - ✓ Installation of passive hydrogen removal equipment
 - ✓ Modification of 'radiological emergency plan' considering multiple emergency, etc.

Safety Improvement Measures

Safety Improvement against Extreme Natural Disasters



Nuclear Safety and Security Commission



Future Tasks for Enhanced Nuclear Safety

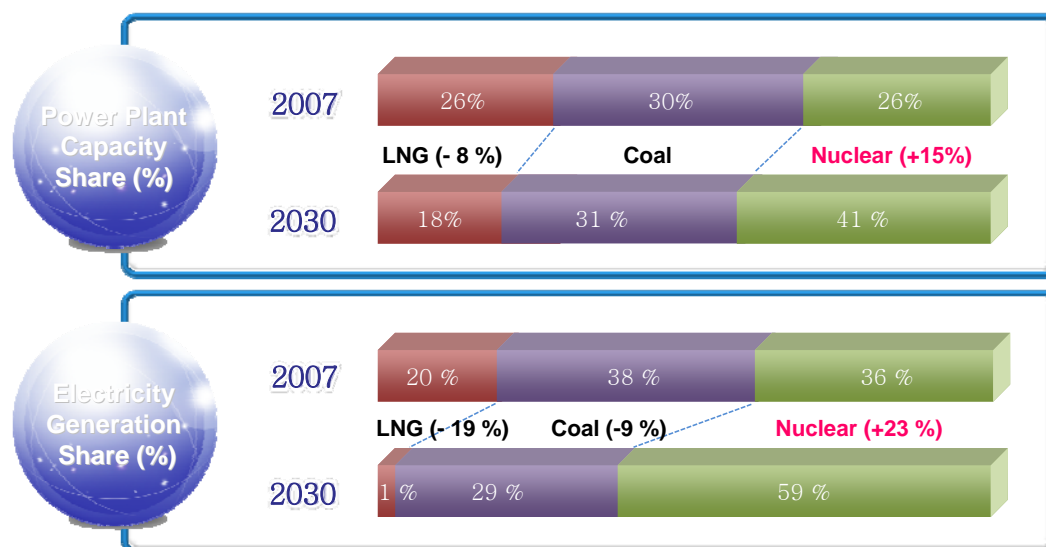
- ◆ **Thorough Implementation of 50 Action Items**
 - ✓ In-depth analyses on methodology and outcomes
 - ✓ Delivery of information on the progress to public
- ◆ **Development of New Reactors**
 - ✓ Reflection of Fukushima lessons and recent R&D findings
- ◆ **Leadership of Nuclear Safety & Security Commission**
 - ✓ Expertise & function allocation
- ◆ **Strengthened Initiatives by NPP Operator**
 - ✓ High-quality operators; nuclear safety experts
- ◆ **Focused Nuclear Safety Research**
 - ✓ Best knowledge; information exchange/transfer
- ◆ **Stronger Nuclear Safety Culture**
- ◆ **Communication on Nuclear/Radiation Safety**
- ◆ **Effective International Collaboration**

Fukushima Lessons for Promotion of Nuclear Energy

- ◆ Securing a high level of safety is a pre-requisite for development and utilization of nuclear technology
- ◆ Very high level of safety is expected by incorporating the lessons learned from Fukushima accident
- ◆ Honest, sincere, continuous communication on nuclear/ radiation safety is important

Nuclear Promotion Policy Remains Unchanged in Korea

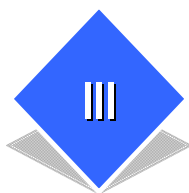
National Energy Basic Plan



※ Ref: National Energy Committee (2008.8.27)

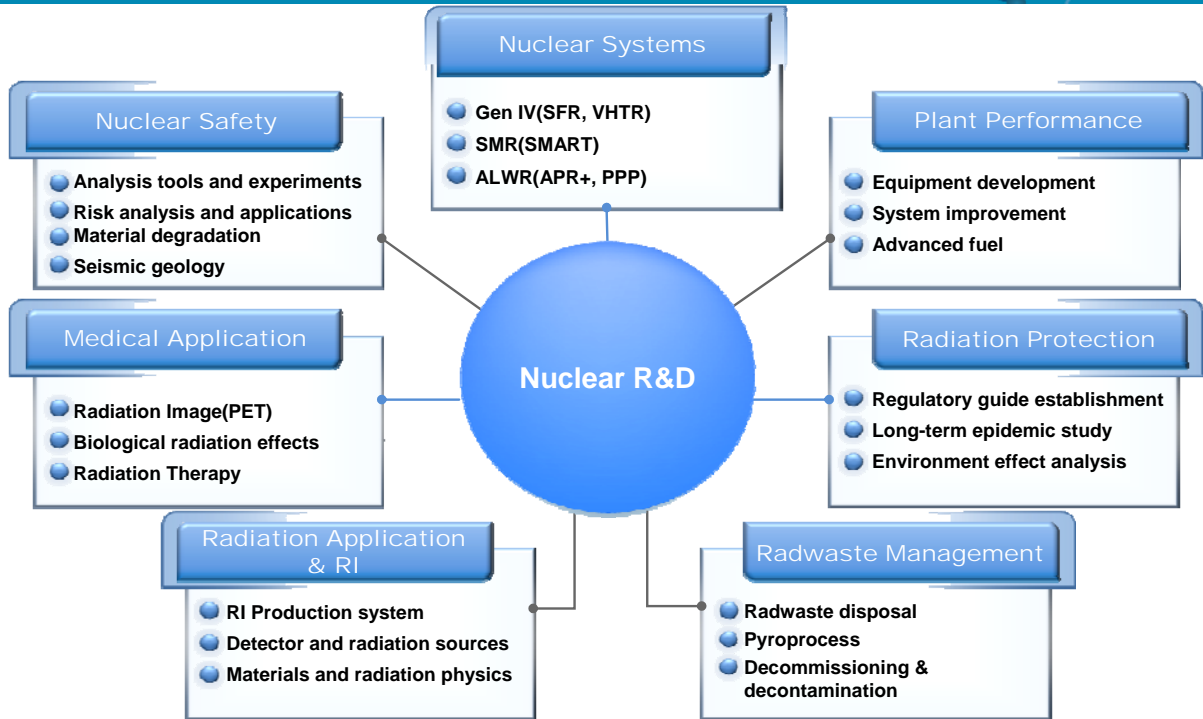
Nuclear Promotion Policy

- ◆ **Development of Nuclear Energy as Driver for Economic Growth**
 - ✓ Development of Small and Medium Reactors and Research Reactors
 - ✓ Non-electricity applications including hydrogen production
- ◆ **Development of Advanced Technologies**
 - ✓ Spent fuel recycle technologies
 - ✓ Environmentally friendly decommissioning technologies
- ◆ **Enhancement of Safety**
 - ✓ Safety against extreme natural disasters
 - ✓ Center of excellence for safety R&D
- ◆ **Higher Standard of Living**
 - ✓ Medical application of radiation
 - ✓ Stable supply of medical isotopes
- ◆ **Expansion of Infra-structure**
 - ✓ Man-power development
 - ✓ International cooperation

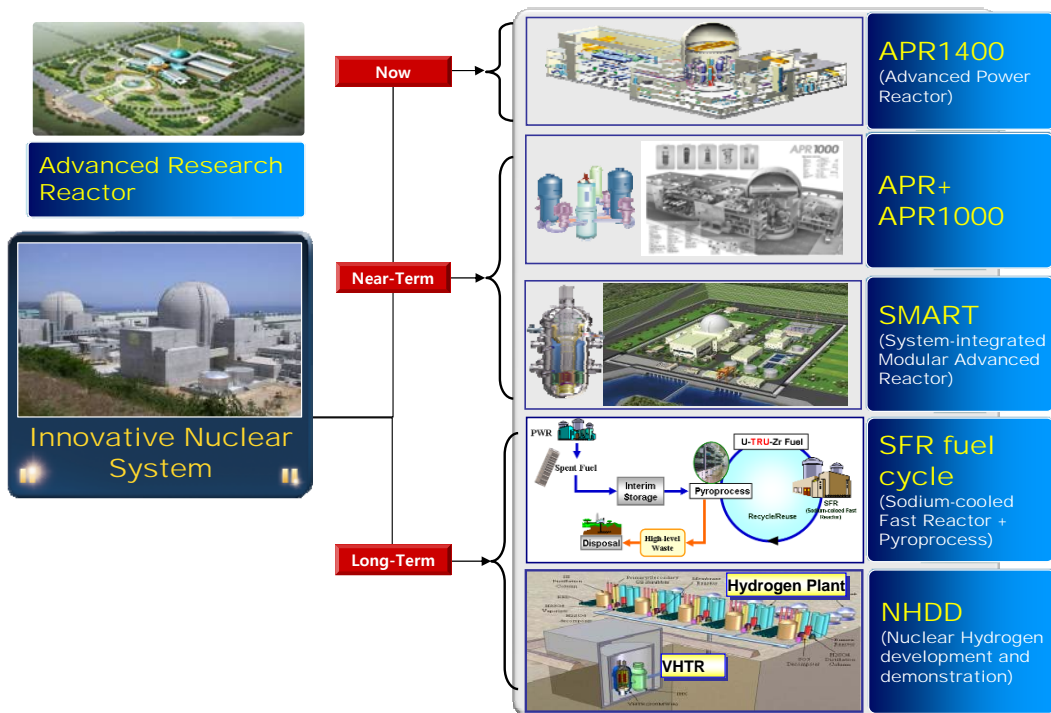


Major Nuclear R&D Programs

Comprehensive Nuclear Energy Promotion Plan for 2012-2016

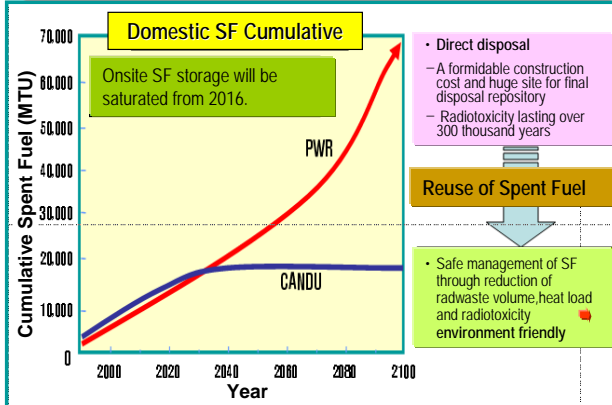


Development of Advanced Nuclear Systems

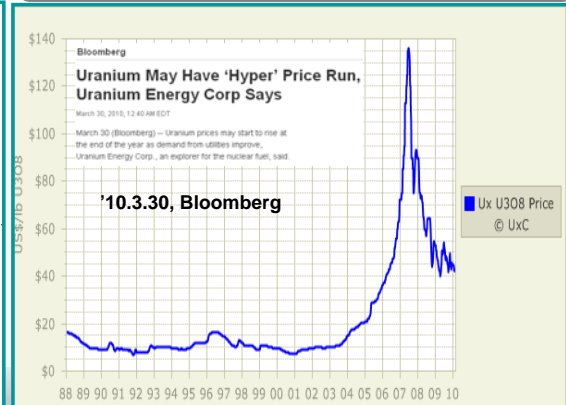


Why Fast Reactor?

Reduction of Spent Fuel Disposal Reduction of Radiotoxicity



Efficient Utilization of Uranium Resources

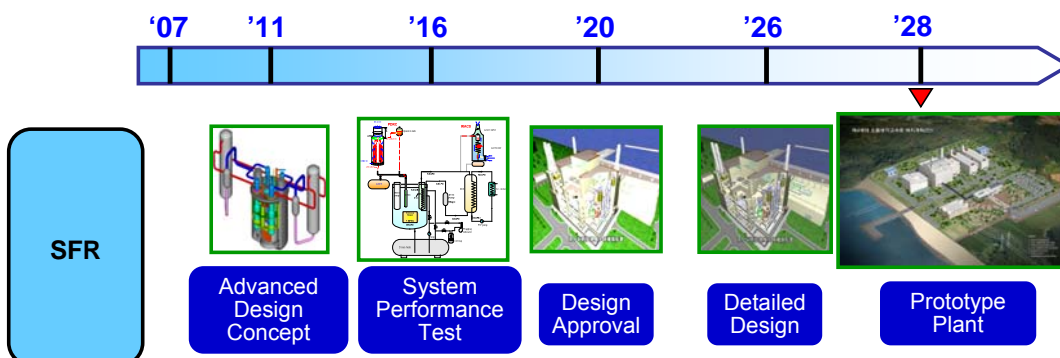


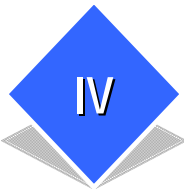
Sustainability of Nuclear Energy

Fast Reactors

Long-term Plan for SFR Technology Development

- ◆ 2012: Conceptual design for prototype reactor
- ◆ 2017: Safety Analysis Report (SAR) for Specific design
- ◆ 2020: Specific design approval
- ◆ 2028: Prototype reactor construction





Summary

Summary

- ◆ **Korea needs nuclear energy in order to meet increasing demand for energy**
 - ✓ Energy security under poor energy resource situations
- ◆ **Nuclear Promotion Policy remains the same after Fukushima accident**
 - ✓ Higher level of safety should be ensured for expansion of nuclear energy utilization
- ◆ **Nuclear R&D activities provide a firm basis for the promotion of nuclear energy**
 - ✓ Safety R&Ds and advanced reactor systems development