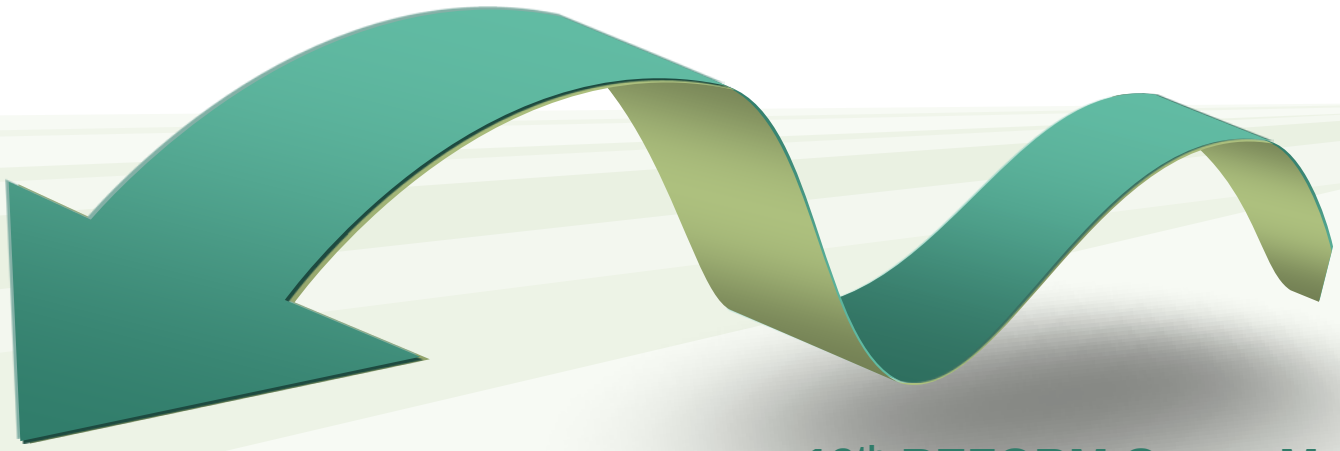

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Nuclear Waste Policy in Korea

Leem, Sung-Jin

Jeonju University, South Korea

Contents

1. Nuclear Power and Waste in Korea

- **Nuclear Power in Korea**
  - 23 reactors with a total installed capacity of 20,716 MW (fifth in the world)
  - 27.6 percent of the total electricity production
  - 5 reactors under construction
  - 6 more reactors in preparation
  - According to the Second Basic Energy Plan, nuclear power will account for up to 29% of electricity power generation by 2035. To meet these electricity needs at least 5 more reactors need to be built.

Nuclear Power Plants in Operation

Reactor	Installed Capacity (MWe)	Reactor Type	Location	Commercial Operation
Kori #1	587	PWR	Gijang, Busan	'78.04.29
Kori #2	650	PWR	Gijang, Busan	'83.07.25
Kori #3	950	PWR	Gijang, Busan	'85.09.30
Kori #4	950	PWR	Gijang, Busan	'86.04.29
Shin-Kori #1	1000	PWR	Gijang, Busan	'11.02.28
Shin-Kori #2	1000	PWR (KSNP+)	Gijang, Busan	'12.07.20
Wolsong #1	679	PHWR	Yangnam, Gyeongju	'83.04.22
Wolsong #2	700	PHWR	Yangnam, Gyeongju	'97.07.01
Wolsong #3	700	PHWR	Yangnam, Gyeongju	'98.07.01
Wolsong #4	700	PHWR	Yangnam, Gyeongju	'99.10.01
Shin-Wolsong #1	1,000	PWR (KSNP+)	Yangnam, Gyeongju	'12.07.31
Hanbit #1	950	PWR	Yonggwang, Jeollanamdo	'86.08.25
Hanbit #2	950	PWR	Yonggwang, Jeollanamdo	'87.06.10
Hanbit #3	1000	PWR	Yonggwang, Jeollanamdo	'95.03.31
Hanbit #4	1000	PWR	Yonggwang, Jeollanamdo	'96.01.01
Hanbit #5	1000	PWR	Yonggwang, Jeollanamdo	'02.05.21
Hanbit #6	1000	PWR	Yonggwang, Jeollanamdo	'02.12.24
Hanul #1	950	PWR	Ulchin, Gyeongsangbukdo	'88.09.10
Hanul #2	950	PWR	Ulchin, Gyeongsangbukdo	'89.09.30
Hanul #3	1000	PWR	Ulchin, Gyeongsangbukdo	'98.08.11
Hanul #4	1000	PWR	Ulchin, Gyeongsangbukdo	'99.12.31
Hanul #5	1000	PWR	Ulchin, Gyeongsangbukdo	'04.07.28
total	20,716			

Nuclear Power Plants under Construction or in Preparation

Unit	Installed Capacity (MWe)	Reactor Type	Commercial Operation	
Shin Wolsong 2	1000 MWe	PWR (KSNP+)	2014	Under construction
Shin Kori 3	1400 MWe	PWR (APR1400)	2014	
Shin Kori 4	1400 MWe	PWR (APR1400)	2014	
Shin Ulchin1	1400 MWe	PWR (APR1400)	2017	
Shin Ulchin2	1400 MWe	PWR (APR1400)	2018	
Shin Kori 5	1400 MWe	PWR (APR1400)	2019	In preparation (permitted)
Shin Kori 6	1400 MWe	PWR (APR1400)	2020	
Shin Ulchin 3	1400 MWe	PWR (APR1400)	2021	
Shin Ulchin 4	1400 MWe	PWR (APR1400)	2022	
Shin Kori 7	1500 MWe	PWR (APR1400+)	2023	In preparation
Shin Kori 8	1500 MWe	PWR (APR1400+)	2024	

Generation of low- and intermediate-level waste in each power plant (May 2014)

Power Plant	Generated (drum)	Storage Capacity (drum)
Kori	41,797	50,200
Hanbit (Yonggwang)	22,493	23,300
Hanul (Ulchin)*	18,130	18,929
Wolsong*	12,426	13,240
Sihn-Kori	464	10,000
total	95,310	115,669

* including waste transported by KORAD outside the plants (1,000 drums in Hanu, 2,536 drums in Wolsung)

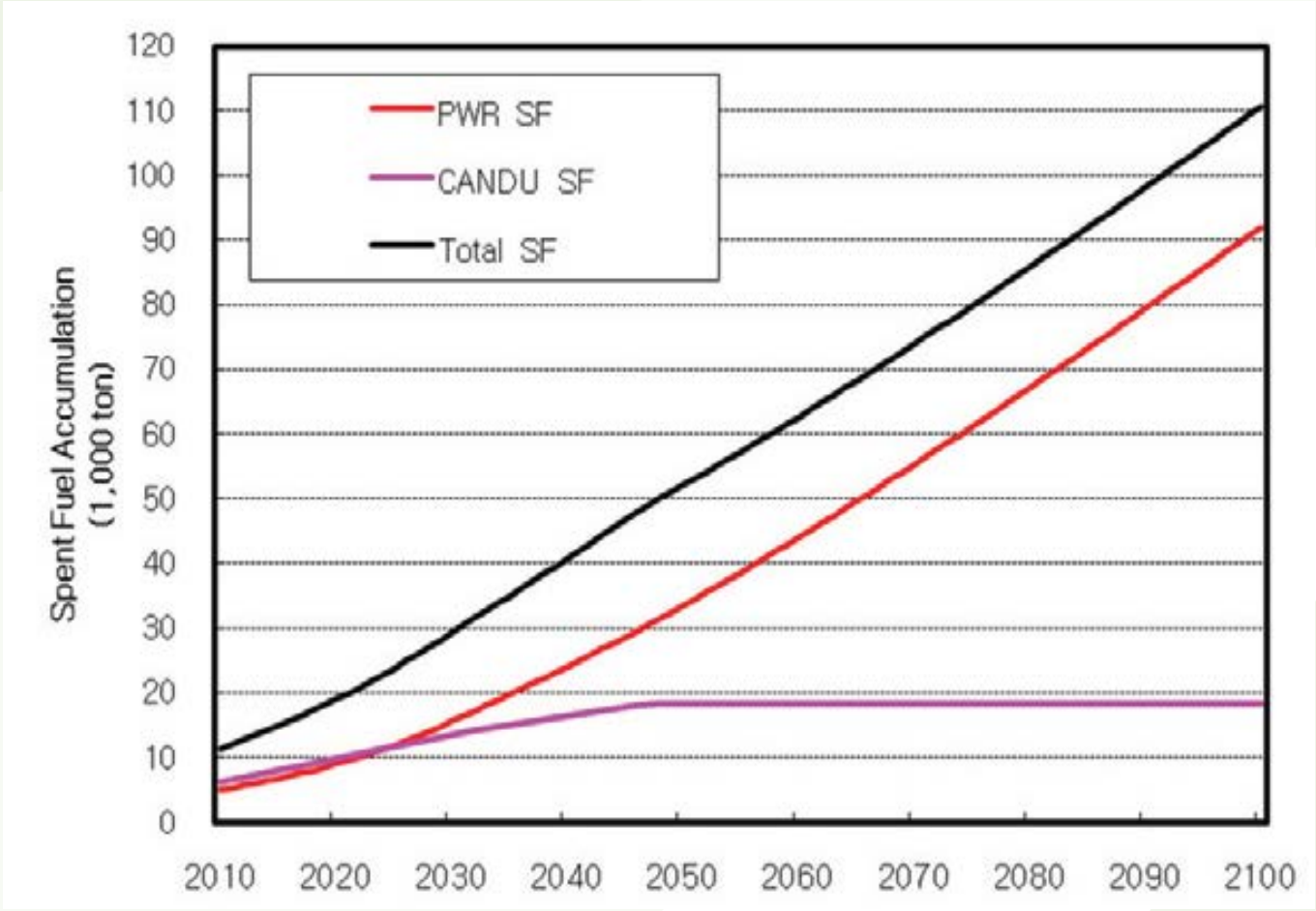
1. Nuclear Power and Waste in Korea

- **Radioisotope waste**
  - 3,095 drums (200 liters each)
  - collected by the Korea Radioisotope Association and transported to a dedicated storage facility of the Korea Radioactive Waste Agency (KORAD)
  - Korean Atomic Energy Research Institute (KAERI) : 21,708 drums (200 liters each)
  - KEPCO Nuclear Fuel Co., Ltd. (KEPCO NF) : 6,456 drums in their own storage facilities
- **Temporarily stored LILW will eventually be transported to and stored in the central nuclear waste disposal facility in Gyeongju.**

1. Nuclear Power and Waste in Korea

- **High-level nuclear waste**
  - annually 700 tons of spent fuels
  - total amount : approximately 13,254 (2013)
  - stored in wet storage facilities of 19 light water reactors (in Kori, Hanbit and Hanul plants),
  - dry storage facilities of 4 heavy water reactors (in Wolsong) :
- **Spent fuels from research reactor HANARO : deposited in the storage facility within KAERI (4.1 tons in 2013)**

Amount of spent fuel generated until 2100 (estimation of government)



Source: Kim, Kyung Su. 2013: 46

Spent fuel storage status in each nuclear power plant site (September 2013)

Power Plant	Storage	Capacity (MTU)	Stored (MTU)	Share of use	Saturation Point	
					present	expanded
Kori Shin-Kori	wet	2,691	2,081	77%	2016	2029
Hanbit (Yonggwang)	wet	3,318	2,146	65%	2019	2024
Hanul (Ulchin)	wet	2,960	1,848	62%	2021	2029*-2039**
Wolsong Shin-Wlosung	dry	9,660	7,179	74%	2018	2026
Total		18,629	13,254	71%		

Source : NSSC 2014a; KORAD Data; Park, Won Jae 2014; Jeong 2014; Kim 2013(*); NARS 2013(**)

2. Nuclear Waste Storage Policy

Period	Candidate sites	Description	Results
1986-1989	Youngilgun, Ulchingun, Youngduckgun	Top-down decision on the feasible sites through technical & geological investigation	Cancellation of the plan by local resistance (March 1989)
1990	Anmyondo	Connected with the development plan of the local government	Mistrust caused by pursuing the plan secretly;
1991-1993	Taeangun, Youngilgun, Ulchingun, Sanghungun, Gosunggun, Yangyanggun	Selecting the candidate sites provisionally by considering technical and social aspects, and then negotiating with local governments Voluntary application and 6 candidates identified	Aborted due to residents' resistance
1993-1994	Yongsanmyun Janghungun, Gisungmyun Ulchingun	Voluntary application Assistance programs proposed to 3 applying regions	Aborted due to residents' resistance
1994-1995	Gulupdo	Among 10 candidate regions Gulup Island was designated as the site for the disposal facility by the government	Discovery of an active faults
2000-2001	Yeonggwanggun, Gangjingun, Jindogun, Gochanggun, Boryeng, Wandogun, Uljingun	Contest of 46 seaside municipalities Assistance programs proposed to 7 regions .	No application
2003	Youngduckgun, Ulchilgun, Yeonggwanggun, Gochanggun	Announcement of the possible candidate sites and then voluntary application from the related local governments Same priority for the applications from other municipalities else than the 4 candidate sites	No application
2003.7 - 2004.9	Wyudo Buangun	Application from municipality of Buangun	Aborted due to residents' resistance and failure in the local referendum
2005	Gyeongju, Gunsan, Yeongdeok, Pohang	Application from 4 municipalities and local referendum conducted on 2/11/05 Division of low-/intermediate- and high-level waste facility, enactment of supporting law	Selection of Gyeongju as the nuclear waste disposal site by the government.

2. Nuclear Waste Storage Policy

- **Strategic change after repeated failure**
  - local referendum in 2005
  - new strategy of trying to gain public consensus, through discussions
- **Specialized Committee on Conflict Management** : submit a recommendation in 2008
- **Radioactive Waste Control Act** (2009) to provide legal grounds to the public discussion
- **Spent Nuclear Fuel Policy Forum** (November 2011 - August 2012) : consisted of experts from various fields

2. Nuclear Waste Storage Policy

- **Public Engagement Commission on Spent Nuclear Fuel Management (PECOS)**
- in 2013 as advisory body of MOTIE
- 13 members from the fields of the humanities and technology, local stakeholders etc.
- submitted a plan in February 2014 including guidelines for the public discussion

Public Engagement Commission on Spent Nuclear Fuel Management

- **The conservative government is passive in communication and governance with NGOs.**
- **NGOS**
  - criticize government for insincerity,
  - claim that the opinions of the civil society are not reflected enough,
  - decline to participate in public discussion by the government
- **Public discussion is mostly being one-sidedly conducted by the government.**

Important announcements regarding spent nuclear fuel management

Date	Title	Made by	Content
02.19.1992	Declaration of Korean Peninsula Denuclearization	The South-North Korea High-Level Talks	1.The South and North do not test, produce, seize, possess, distribute and use any nuclear weapons 2.The South and North use the nuclear energy only for peaceful purpose 3.The South and North do not possess *nuclear reprocessing and* uranium enrichment facilities
09.30.1998	National Nuclear Waste Management Policy	The 249th Atomic Energy Commission	1.Construction of permanent disposal facility for low- and intermediate-level waste and interim storage facility for spent fuel at the same time - Construction of the disposal facility for low- and intermediate-level waste by 2008 - Construction of the interim storage facility for spent fuel by 2016
09.18.2004	4 principles for peaceful use of nuclear energy	National Security Council (NSC)	1.No intention to develop or possess nuclear weapons 2.Steadfast pursuit of principle of nuclear transparency 3.Compliance with international nuclear non-proliferation regulations, NPT and the Declaration of Korean Peninsula Denuclearization 4.Expanding the scope for peaceful use of nuclear energy
12.17.2004	National Nuclear Waste Management Policy	The 253rd Atomic Energy Commission	-Priority to the construction of the permanent disposal facility for the low- and intermediate nuclear waste by 2008 -Pursuit of the spent fuel management policy under public acceptance and consideration of the national policy and technology development in- and outside of the country
12.22.2008	Long-term Plan for R & D of future nuclear system	The 255th Atomic Energy Commission	Nuclear fuel development plan through Pyroprocess and SFR(Sodium-cooled Fast Reactor) plan to use it
04.2008	Spent nuclear fuel public discussion TF	National Energy Commission	-Establishment of various alternatives for the disposal of the spent nuclear fuel -Avoiding an arbitrary decision of some experts group -Social acceptance based on objectivity and transparency

05.2009	Project on detailed program to conduct public discussion over spent nuclear fuel management	Consortium of Kyunghee University	-Investigation on the stored amount of the spent nuclear fuel and the saturation point -Alternatives and scenarios for short-term management of spent nuclear fuel -Development of a model for public discussion on the spent nuclear fuel and its operation method
07.17.2009	Establishment of the spent nuclear fuel public discussion committee	Ministry of Knowledge Economy	-Press release on the inauguration of the spent nuclear fuel public discussion committee on July.29. -President of the committee: Myung-Ja Kim, the formal minister of Environment
08.03.2009	Postponing establishment of the public discussion committee	Ministry of Knowledge Economy	-Indefinite postponement of inauguration ceremony (originally set for Aug.3) of the spent nuclear fuel public discussion committee
08.2011	Development of alternatives and road map for the spent nuclear fuel management	Consortium of the Korean Nuclear Society	-Saturation point of temporary storage facilities for the spent nuclear fuel is 2024 -Securing a disposal site parallel with establishment of the spent nuclear fuel policy -Social acceptance through negotiation between stakeholders -Recommending the amendment of regulations and establishment of a committee on the spent nuclear fuel management policy
08.2012	Recommendation for management policy and public discussion for the spent nuclear fuel	Spent nuclear waste policy forum	-Classification of spent nuclear fuel management policy into interim storage and permanent disposal categories - Guideline-Setting for interim storage methods for the spent nuclear fuel and devising the right methods -Legislation of regulations needed for the construction and operation of the interim storage facility -Fast decision on the storage period and procedure -Construction of the interim storage facility by 2024
02.2013	Major government projects of Park Geun-hye administration	The 18th Commission on Presidential Transition	-Establishment of PECOS for spent nuclear fuel management (04.2013) -Based on the discussion results conducting site selection and beginning construction during president Park's term in office

Lee, H. S. 2013

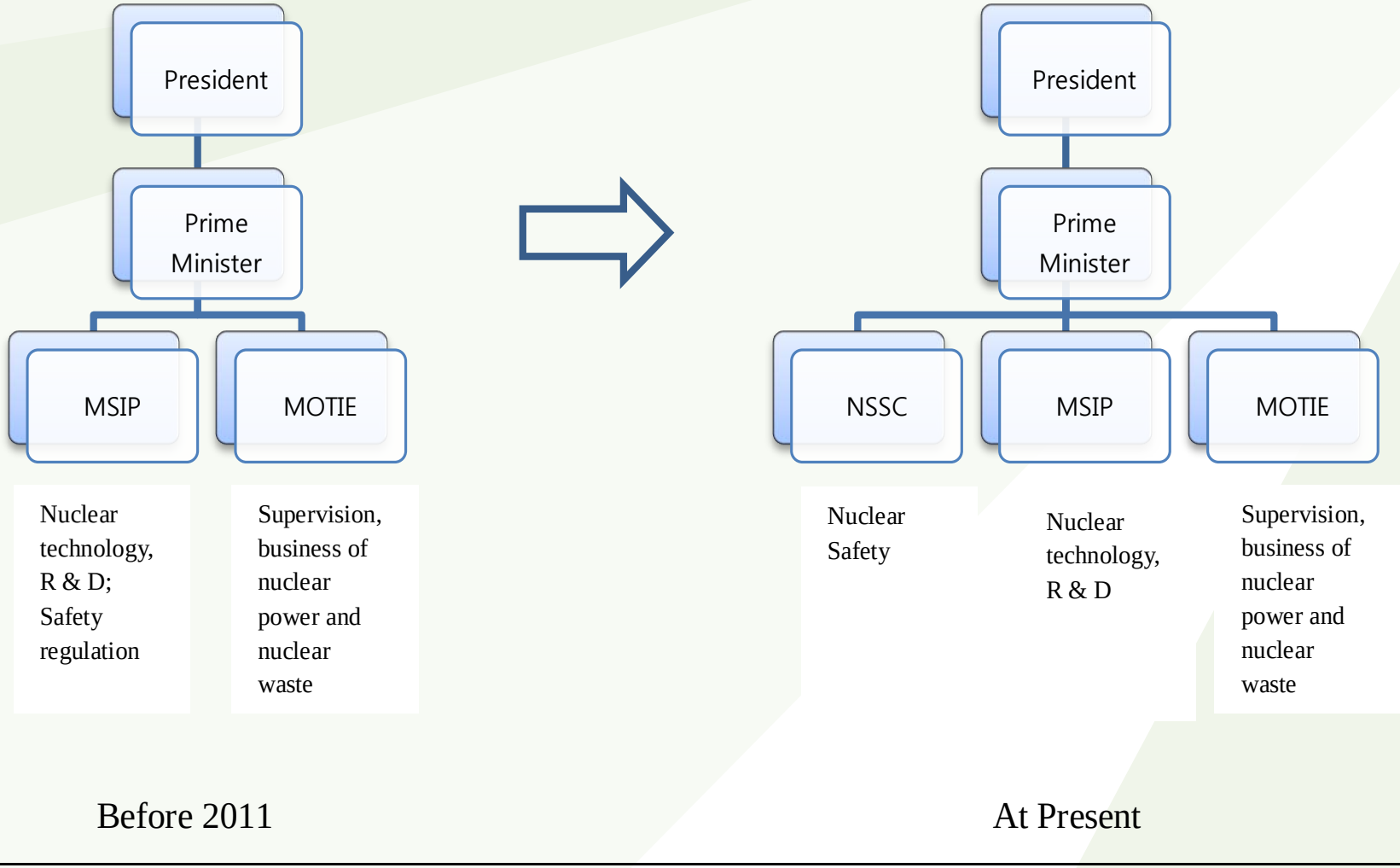
3. Legal and Institutional Framework

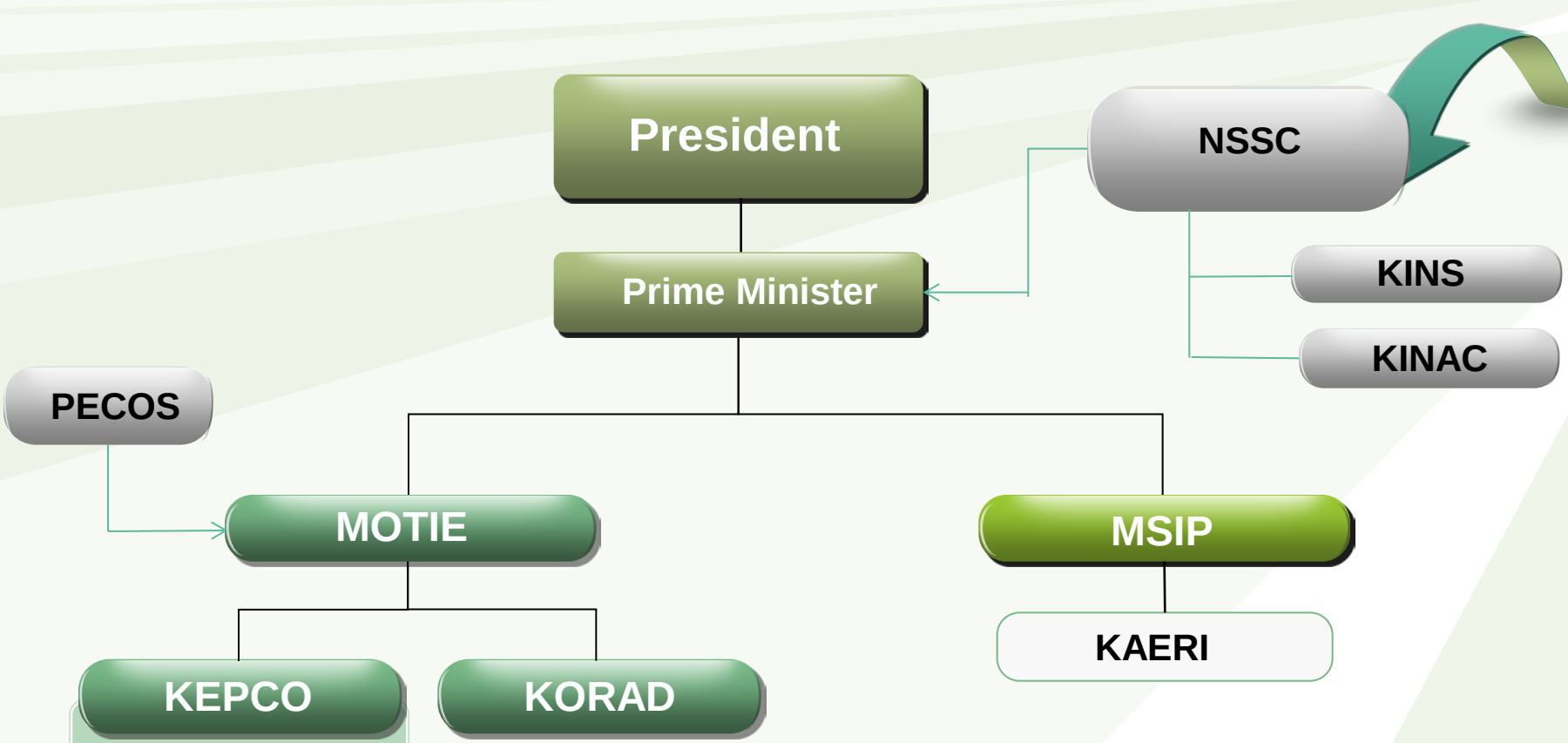
- **Korea Radioactive Waste Agency (KORAD)**
  - January 2009
  - semi-government agency affiliated to the Ministry of Trade, Industry and Energy (MOTIE)
  - in charge of nuclear waste management : transportation, storage, treatment, and disposal of nuclear waste including spent fuel
  - disposal facility : selection of the site, construction, operation, and post-closure management of the nuclear waste disposal facility

3. Legal and Institutional Framework

- **Atomic Energy Law : divided into the Atomic Energy Promotion Act and the Atomic Energy Safety Act (July 2011)**
- **Atomic Energy Safety Act : regulations on the spent fuel processing business, construction permit, operating license of disposal facility, transportation of nuclear waste etc.**
- **Nuclear Safety and Security Committee (NSSC)**
  - October 26, 2011
  - executive office of the President → Prime Minister (2013)
  - manages the overall tasks related to nuclear power safety, nuclear security, nuclear non-proliferation
  - safety regulations such as license giving and inspection of reactors and related facilities, radioactive materials, and nuclear waste disposal facilities
  - creates general plans for nuclear power safety

Institutional Change on Nuclear Administration in Korea





- NSSC : Nuclear Safety and Security Commission
- KINS : Korea Institute of Nuclear Safety
- KINAC **:** Korea Institute of Nuclear Nonproliferation and Control
- MOTIE : Ministry of Trade, Industry and Energy
- MSIP : Ministry of Science, ICT and Future Planning
- KEPCO : Korea Electric Power Corporation
- KORAD : Korea Radioactive Waste Agency
- KAERI : Korea Atomic Energy Research Institute
- KHNP : Korea Hydro & Nuclear Power Corporation

<Organization chart of nuclear energy management in Korea>

Organization chart of nuclear energy management in Korea

Atomic Energy Promotion Act	research, development, production and use of nuclear energy, Nuclear energy promotion commission, Plans for promotion of nuclear energy, nuclear energy R&D fund	Ministry of Science, ICT and Future Planning (MSIP)
Radioactive Rays and Radioisotope Use Promotion Act	promoting the use and R&D of radiation and radioisotopes; supporting related industries	
Nuclear Safety Act	safety management in the research, development, production and use of nuclear energy, in order to ensure the prevention of disasters caused by radiation	Nuclear Safety and Security Commission
Act on Establishment of the Nuclear Safety and Security Commission	contribution to public safety and environmental conservation by establishing the Nuclear Safety and Security Commission	
Act on Measures for the Protection of Nuclear Facilities	establishing a system for physical prevention and protection against radioactivity and nuclear disasters	
Nuclear Damage Compensation Act	prescribing matters concerning compensation for nuclear damage resulting from the operations related to nuclear reactors	
Electric Utility Act	Establishing a basic system and promoting competitiveness of the electric utility	Ministry of Trade, Industry and Energy (MOTIE)
Electric Source Development Promotion Act	propelling the electric source development business effectively.	
Radioactive Waste Control Act	improving the safe and efficient management of radioactive waste	

3. Legal and Institutional Framework

- **The Fund for Nuclear Follow-up Management:**
  - low- and intermediate-level management cost
  - spent fuel management cost
  - reserve funds for dismantling nuclear power plants
- **The former two costs are administered by the Korea Radioactive Waste Agency (KORAD), while KHNP is in charge of managing the latter.**
- **The sum of nuclear waste management cost : 1,136,140 million KRW (831.9 million EUR) in 2013**
- **A big part of the money is used for asset management.**

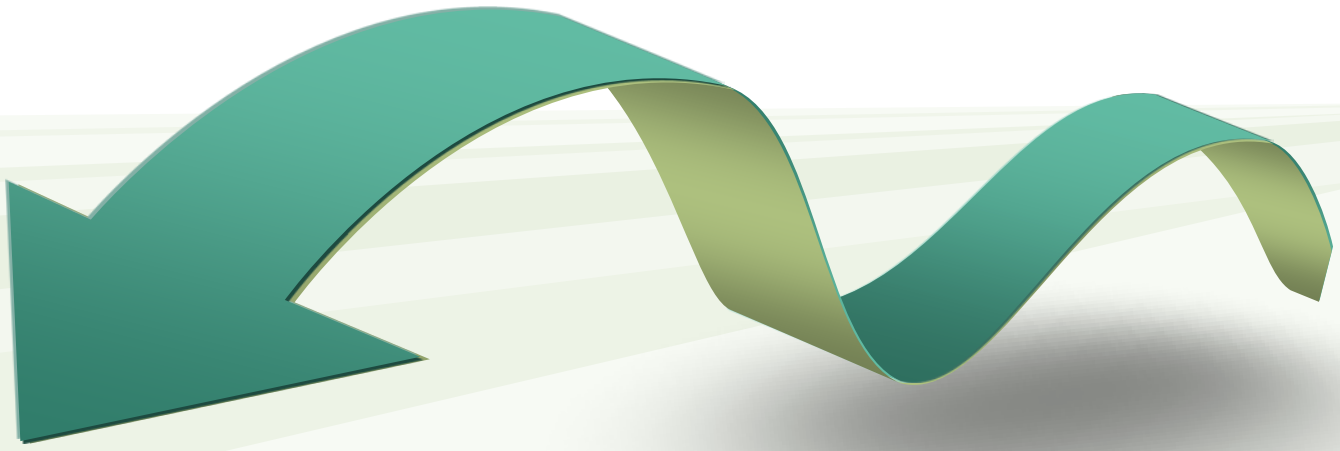
4. Conclusion

- **Social conflict, criticism of NGOs**
- **limited discussion on spent fuel to the site selection of the interim storage facility**
  - The range of the discussion should be extended to include various related subjects.
- **Reprocessing?**

- Korea-U.S. Nuclear Agreement of 1956
- Reprocessing is economically less effective than that of direct disposal of nuclear waste.
- new problems concerning security, heavy investment, and inter-Korean relations etc.

4. Conclusion

- **To achieve social consensus on nuclear waste management, it is important for the government to gain public trust.**
- **In-depth conversation of the government with local residents and the civil society**
- **Expansion and reorganization of the Public Engagement Commission**
- **Comprehensive discussion on nuclear policy in general, including the life extension of reactors**
- **Only based on the social consensus and a wide-range and open discussion, new governance mechanisms oncan be designed.**
- **Eventually towards a transition of Korea’s energy policy.**



Thank You!

Leemcho@naver.com