KOREA NUCLEAR INTERNATIONAL
COOPERATION FOUNDATION

Comparative Study of National Nuclear HRD Policy between Korea and Japan

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Introduction – Research Object

This research attempts to approach diachronic examination for nuclear human resources development policy between the Republic of Korea and Japan.

Discussion will center around finding the key to define what make national nuclear HRD policy different from each other.

This also attempts to arouse attention on the necessary of maintaining government engagement on the nuclear human resources.

The effort allows following up study to extend further analysis about other cases in the context of nuclear human resources development policy.

Introduction – Conceptual Framework

Nuclear Human Resources, critical component in sustainable uses of nuclear S&T

Building and maintaining the necessary human capacity to run both nuclear programmes and public sector nuclear-related institutions is a critical component in the development of safe, secure and sustainable civil nuclear programmes. *

According to the IAEA report, HRD is one of 19 'key infrastructure issues' that most of other 18 critical issues - establishing regulatory framework, waste management, emergency planning – are influenced by competent human capital. **

Challenges in Nuclear HR

1. ***Workforce Planning***
   (based on systematic approach – i.e. analysis on the gap between HR supply and demand)
2. ***Generation Shift***
3. ***Recruitment, Education and Training, Knowledge management***
4. ***Stakeholder Engagement***

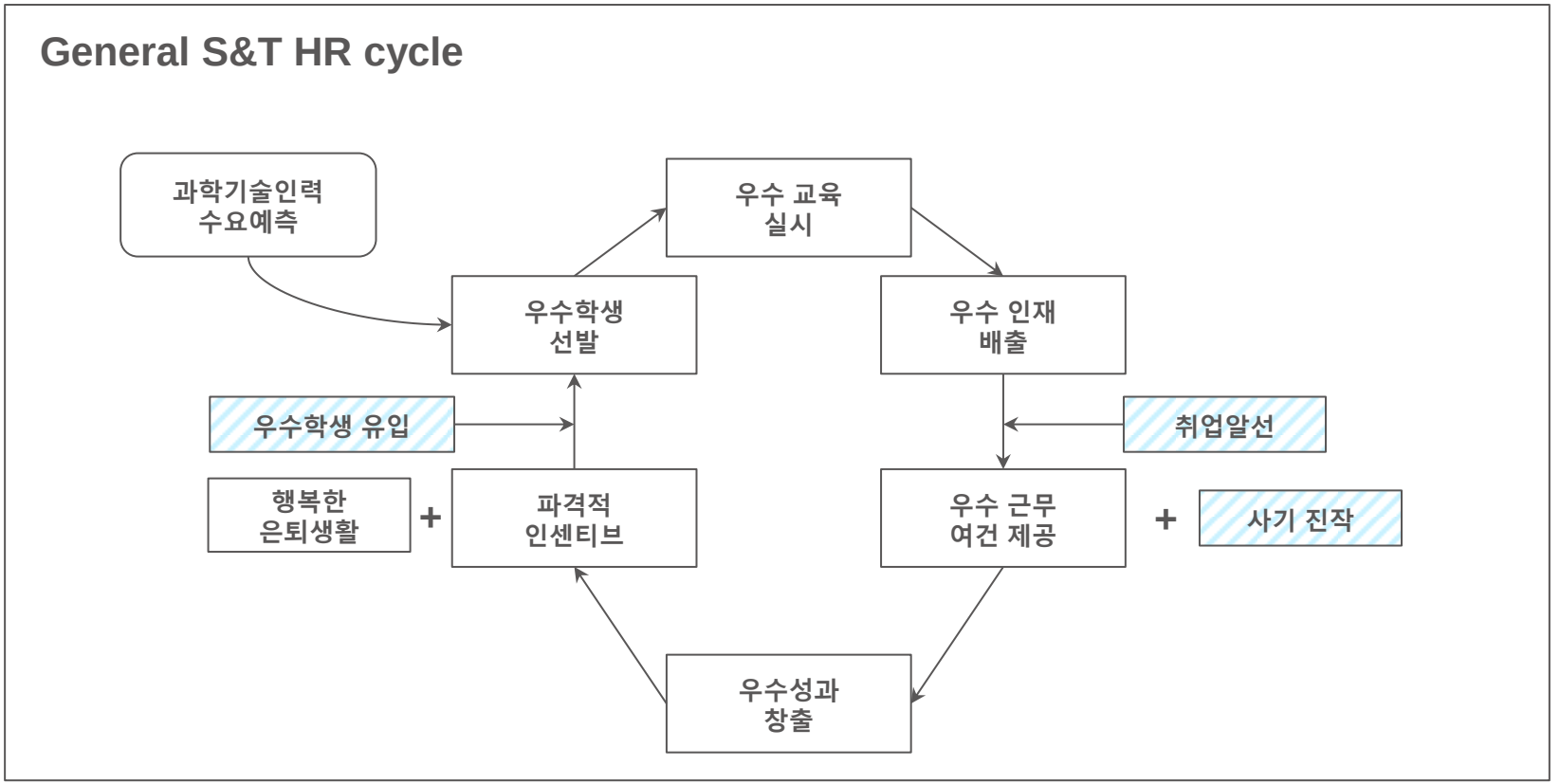
Nuclear HR Policy

- **Long-term Plan**
- **Multilateral Approach**
- **Governance**

Source: * "Milestones in the Development of a National Infrastructure for Nuclear Power," International Atomic Energy Agency, September 2007
** Banks, John and Massy, Kevin (2012) Human Resources Development in Nuclear Energy States: Case Studies from the Middle East. Brookings Policy Brief 12-02. 1

Introduction – Conceptual Framework
Comparative views on HRD Policy between General S&T and Nuclear S&T

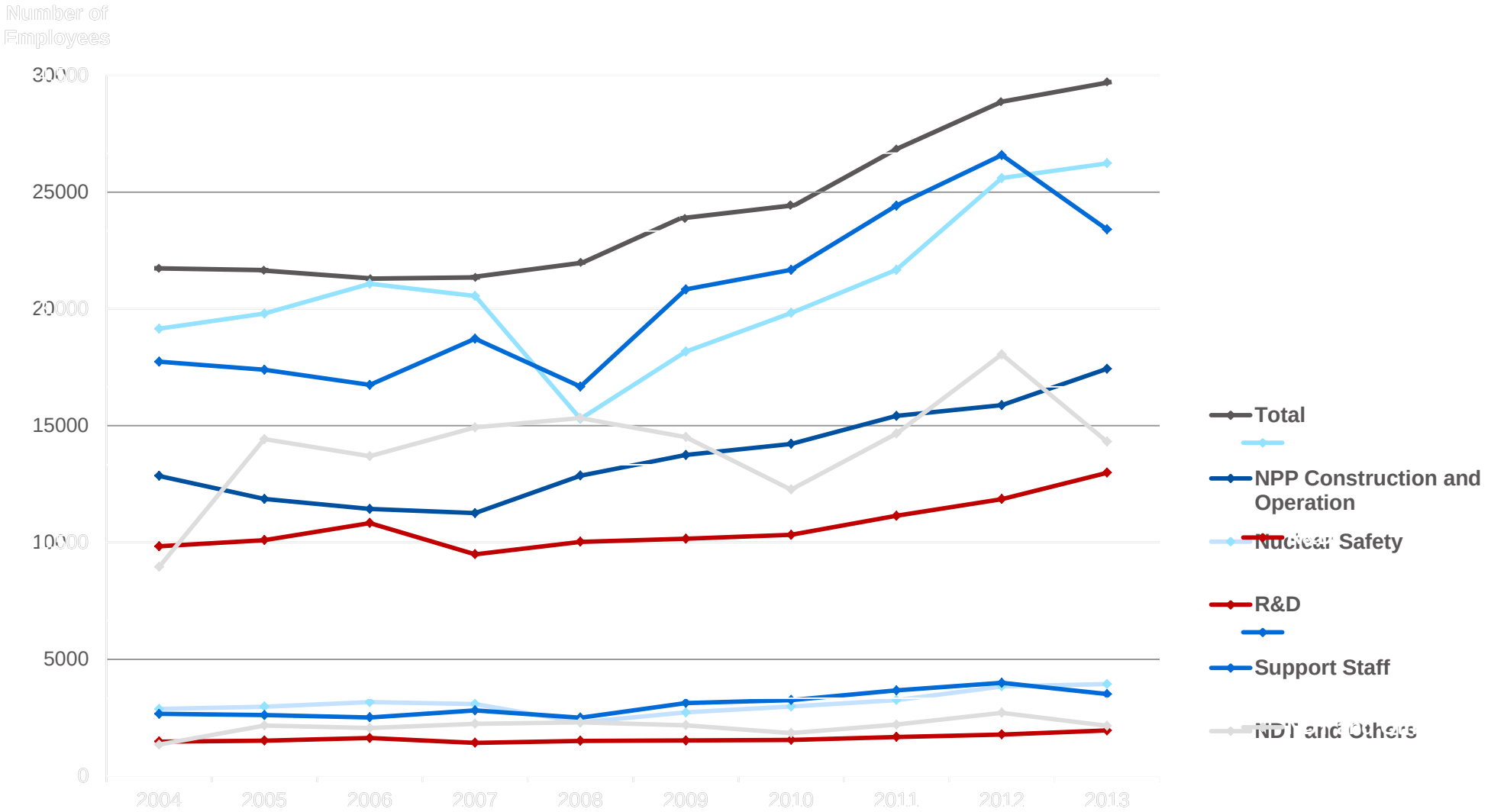
Nuclear HRD Issues



In-house Education and Training	*Knowledge management*	*Stakeholders Engagement*	*Public Acceptance*

Source: 최석식, "과학기술정책론," (서울: 2011), 시그마프레스, p.74.

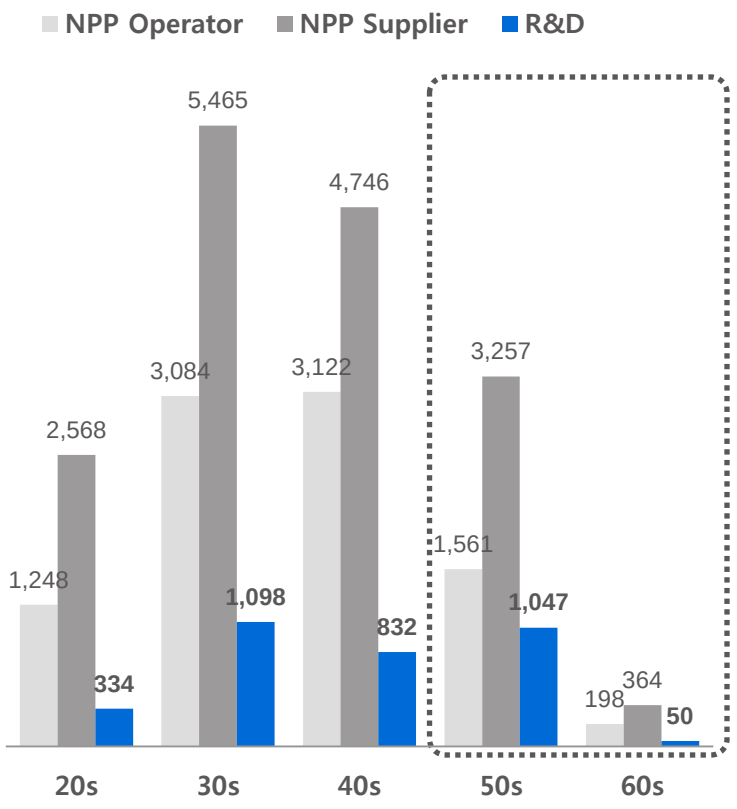
Republic of Korea's Nuclear Manpower in Nutshell – nuclear manpower by field



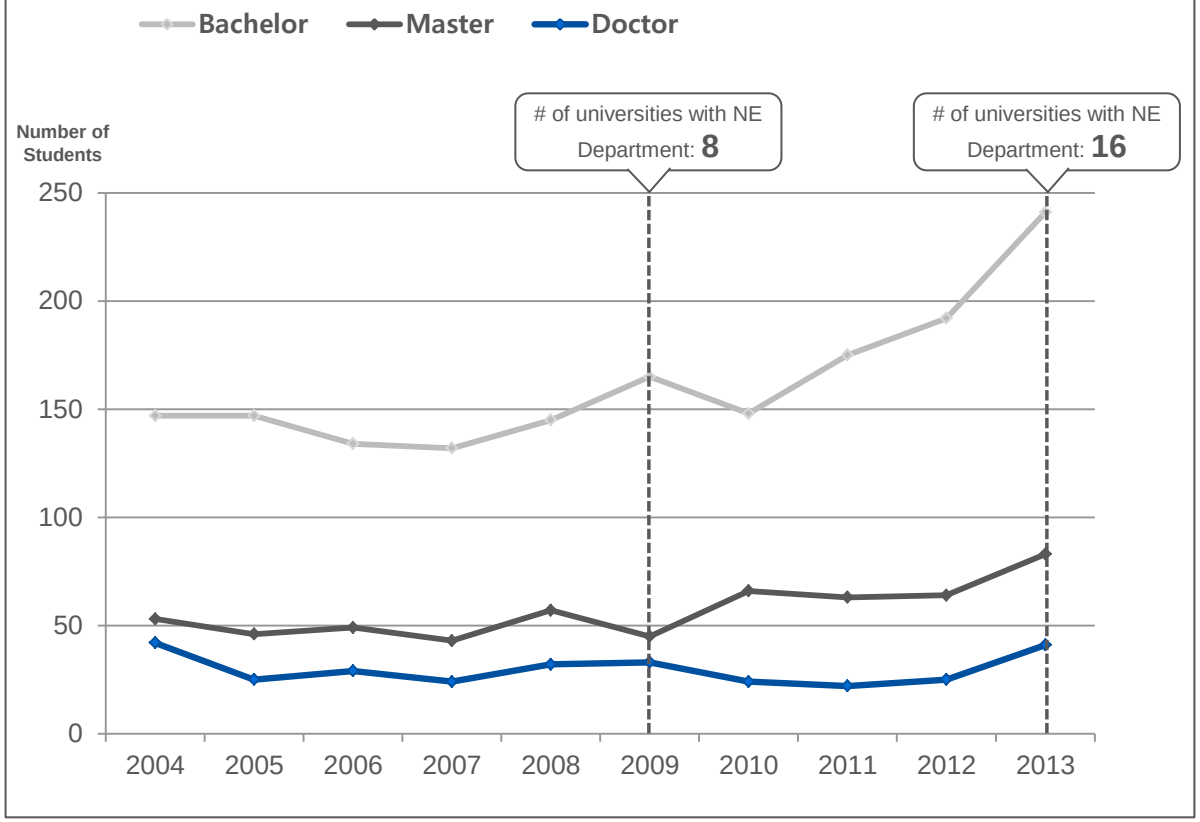
Source: Korean Statistical information Service (KOSIS)

Republic of Korea's Nuclear Manpower in Nutshell – Nuclear Manpower by Age and Academic background

Nuclear Manpower by Age ('13)*



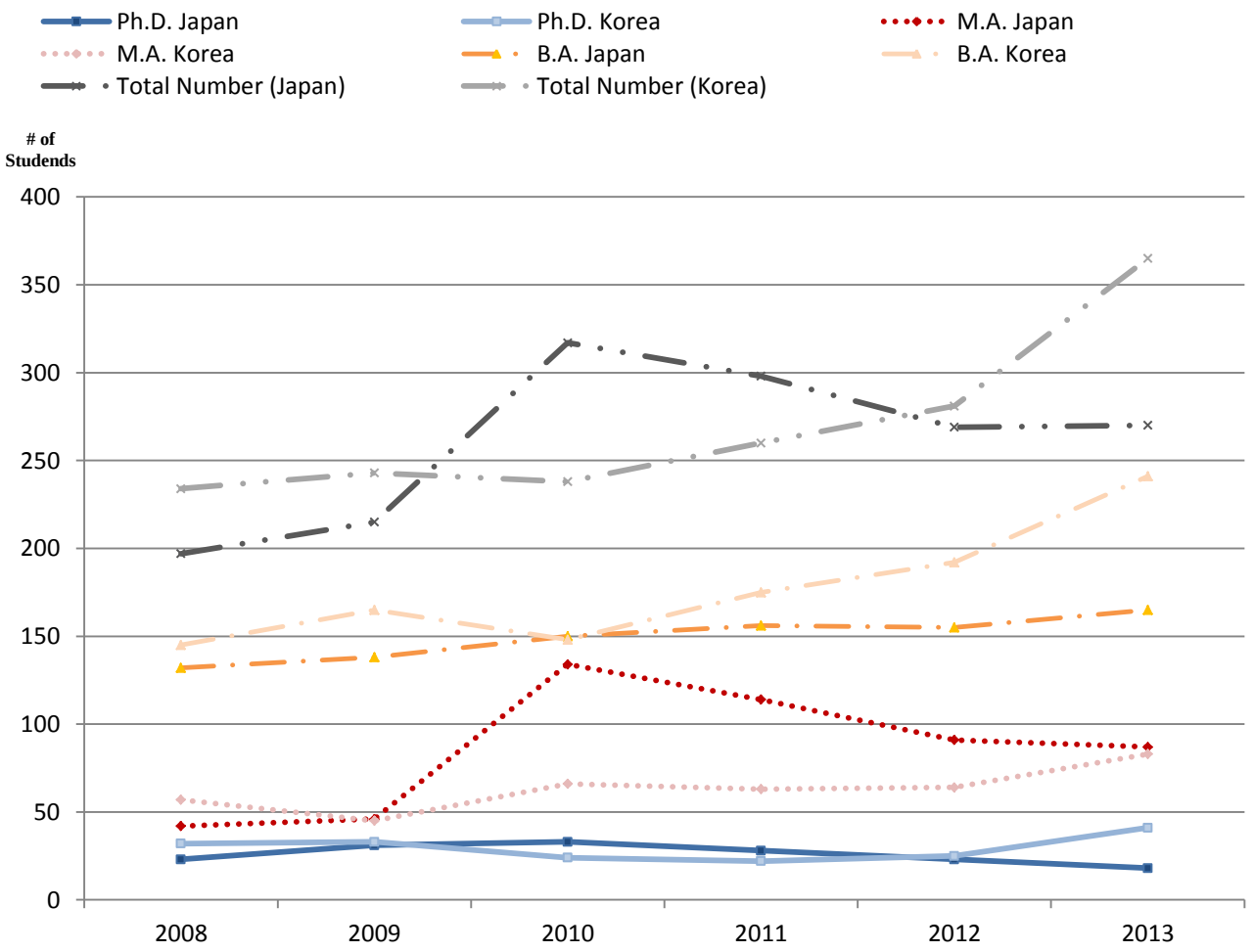
Number of Nuclear Engineering Student Graduated by Degree ('13)**



Source: * MSIP (2015). 18th Survey on the Status of Nuclear Industry, April 2015
** MSIP (2015). Nuclear HRD White Book, November 2015

Human resource securement is ongoing issues in both countries.

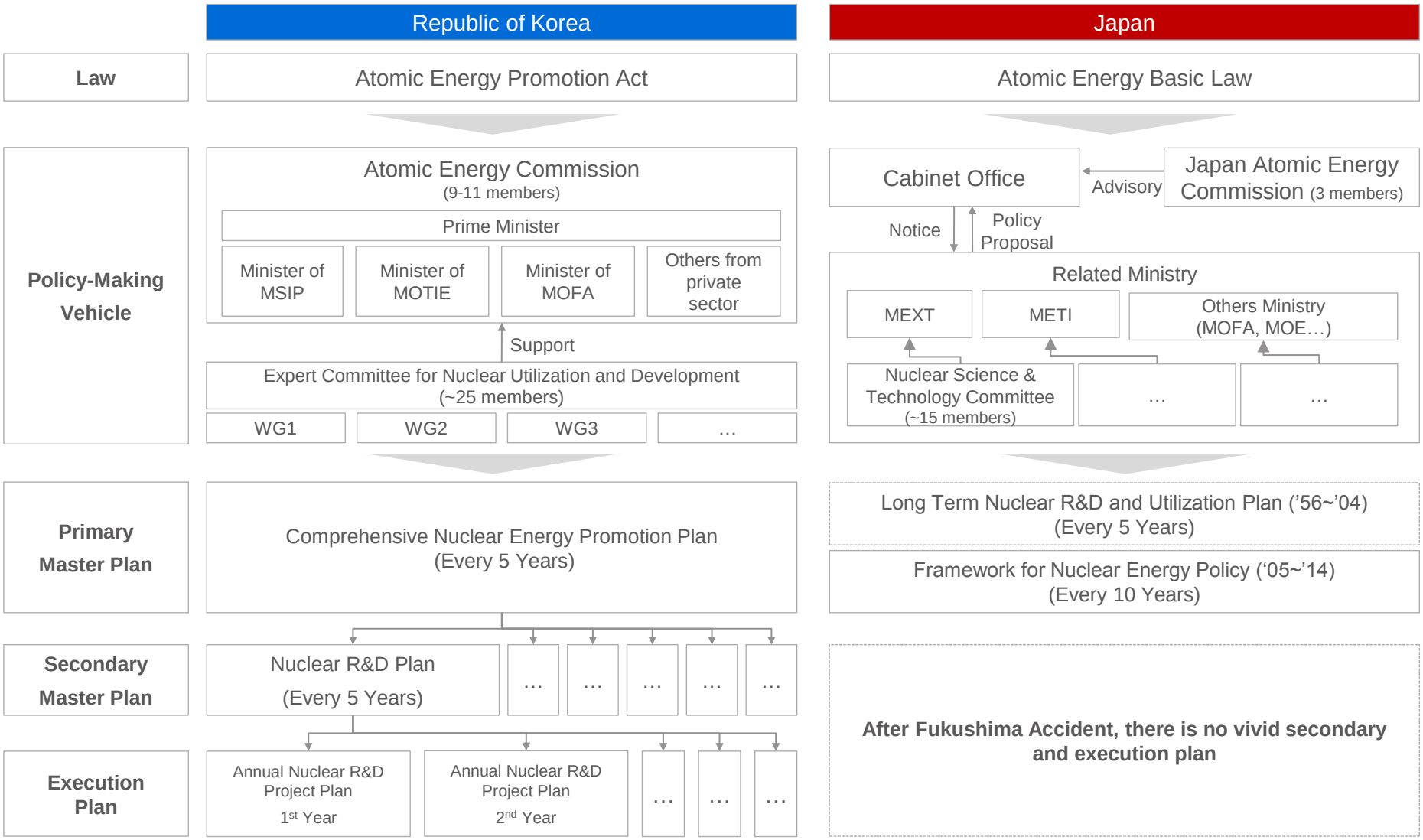
Trend of the number of students entering (Japan) / graduating(Korea) nuclear engineering department



Source : Nuclear Education Whitepaper in Korea (2015)
Basic Statistics for Academia in Japan (2015)

National R&D plan based HRD strategy is strongly required

Comparative Study between Korea and Japan: Nuclear R&D Policy-Making Process



Comprehensive Nuclear R&D and HRD plan in Japan

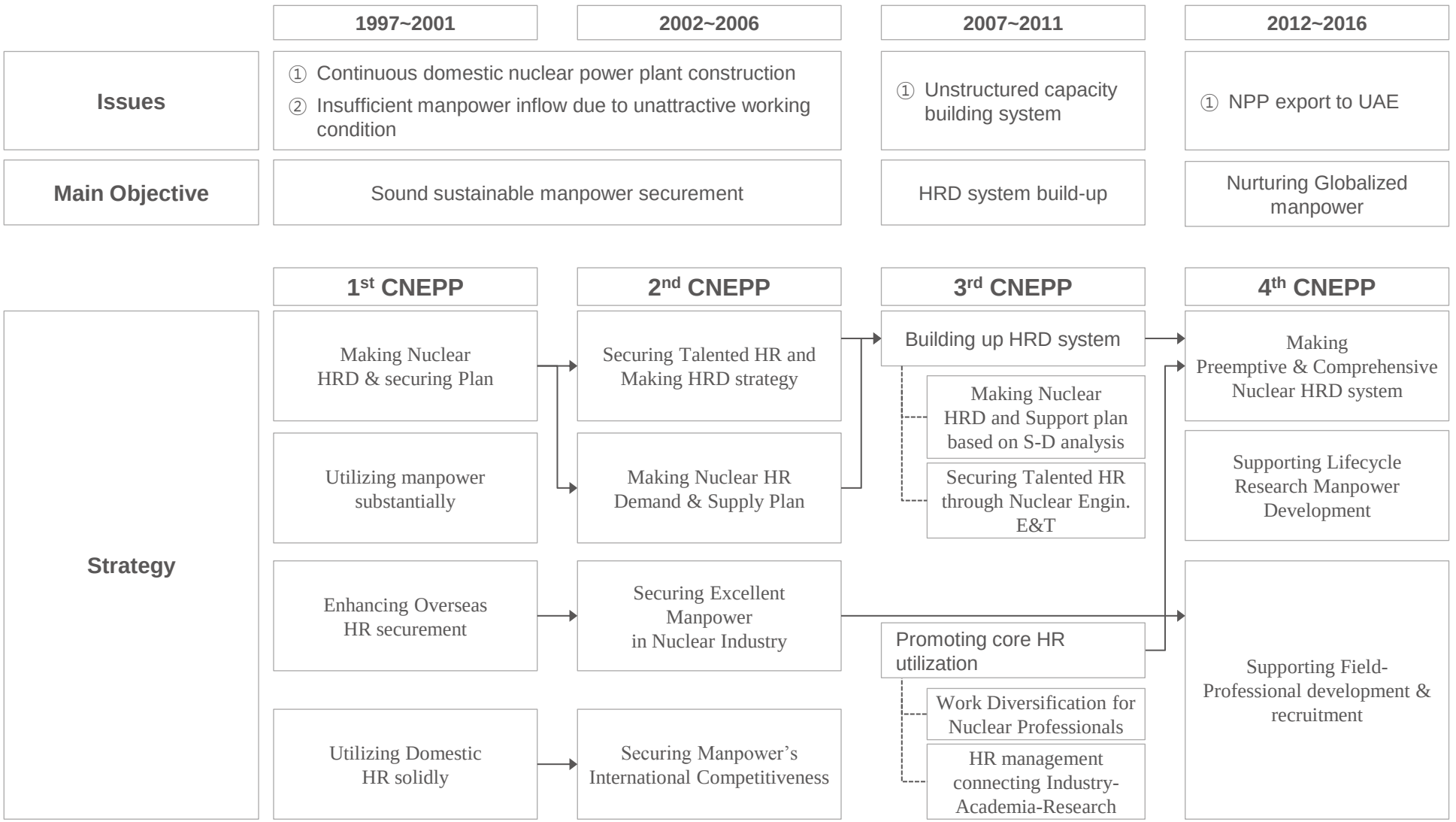
	Long Term Nuclear R&D and Utilization Plan ('56~'04) (Every 5 Years)	**Framework for Nuclear Energy Policy ('05~'14)** (Every 10 Years)
Drafting	**9 times** (1956, 1961, 1967, 1972, 1978, 1982, 1987, 1994, 2000)	**Once** (In 2005, it developed as an alternative to nuclear power development and utilization long-term plan)
Objective	Presenting specific guidance and promotion measures of nuclear energy R&D and utilization	Presenting the basic objectives to nuclear R&D and utilization and the basic concept of the future initiatives for major challenges
Characteristics	**After the Atomic Energy Commission decision, it is reported to the Cabinet** In Article 3, Atomic Energy Commission Establishment Act It said, *the Prime Minister shall respect the decision when he received a report from the committee about the decision set forth in the preceding paragraph. **	**After the Atomic Energy Commission decision, it is reported to the Cabinet and the Cabinet treats the report as a basic policy of nuclear energy** Provisions relating to "respect the decision" is removed when the government reorganization in 2001.
Chairman	Minister of Science and Technology being concurrent to the Chairman of JAEC	Since government reorganization in 2001, Prime minister appoints the chairman from academia

Note: * After it has been revised as "the Atomic Energy Commission and the Nuclear Safety Commission Establishment Act" in 1978, the provision is surviving in Article 23

Korea and Japan have government controlled Atomic Energy Commissions which decide comprehensive R&D and HRD strategy.

	Korea	Japan
Name	Atomic Energy Commission (AEC)	Japan Atomic Energy Commission (JAEC)
Scope of authority and function	– Comprehensive adjustment for nuclear R&D plan – Commission led by Prime Minister – Authority to request information and attendance on meeting from relevant Ministry and experts.	– Decision-making for nuclear R&D plan (Except for safety regulation) – Report decisions to Prime Minister as an advisory organization from Cabinet Office. – Authority to request information from relevant Ministry in case of needed
Agenda	– Integration and coordination about the utilization of nuclear energy – Making comprehensive plan for promotion of nuclear energy – Making Estimation and allocation plans of nuclear-related budget – Promoting experimentation and research about the utilization of nuclear energy – Fostering and training of researchers, engineers and technicians for the utilization of nuclear energy – Managing radioactive wastes disposal plan – Managing spent fuel disposal plan	– Planning and making a decision about basic policies and strategies for the promotion of R&D and utilization of nuclear energy – Making Estimation and allocation plans of nuclear-related budget
Commission member and Term	– Total number : 9~11 (Commission Chairman, Official member(4), commissioned member from public sector (4~6)) – Chairman : Prime Minister – Official member : Minster of MSPI, MOTIE, MOFA, – Term : 3year – Advisory Committee & Working Group can be established for technical support	– Total number: 3 (Commission Chairman, Deputy Chairman, and one member) – Member of Commission appointed by Prime minister with National Assembly agreement – Term : 3 year – Advisory Committee & Working Group can be established for technical support
Meeting	– Held by chairman as-needed with condition of over 50% of member's attendance	– Once a week
Advisory committee	– Member : Within 25 participants including Committee president and part-time member of committee – Term : Not Decided	– Member : Within 25 participants appointed by Prime Minister – Term: 2years
Transcript of Meeting	– Not open to the public	– Available on the websites
Others	– Commission should notice CNEPP (Primary Master Plan) to relevant Ministries – The Ministries should establish Secondary Master Plan in alignment with CNEPP – Annual Execution Plan would be made based on Secondary Master Plan	– NA

Time Series analysis: Korea Nuclear HRD policy has been shifting from quantity to quality after 1st NPP export.



Time Series analysis: Japan has been focusing on education networks, still quantity securement issues remain.

Framework for Nuclear Energy Policy
(2006~2015)

Creating great workplace environment with learning cycle

Industry	Academia	R&D Institute	
Establishment of technical qualification system and development educational network	Providing various nuclear education program and development fusion education program	Creating new technology and knowledge	Cooperation in HRD between Industry-Academia-R&D institutes

Evaluation of Basic Concepts for Initiatives to Develop and Secure Human Resources *as Defined in the Framework for Nuclear Energy Policy*
(2010)

Improving workplace environment

Improving Education in institutes of higher education

Developing and Securing Human Resources

Industry	Universities and R&D Institutes	International Cooperation	Capable of working in International Organizations	Regulatory Bodies

Promotion of Measures to Secure and Develop Human Resources for Nuclear Energy
(2012)

Prospective analysis of demand-supply gaps of nuclear human resources

Education

Enhancing opportunities for nuclear education	Lessons from Fukushima Daiichi Nuclear Power Plant	Mid-career experts	Energy and environment issues	Radiation Risk

Developing and Securing Human Resources

Safety, Security and Safeguard	Maintaining the operation of domestic nuclear power plant	International development of nuclear energy and technology

10 Year Nuclear HRD Roadmap
(2014~2023)

University Students	Young Engineers	Mid-Career Engineer	Engineers from emerging Countries

Japanese 10-Year nuclear HRD roadmap: University Students

University Students

Items	Contents	Groups			0	1	2	3	4	5	6	7	8	9	10	……(Year)
		Gov.	Indus.	Aca.												
Conveying Appeal	Issuing Strategic Energy Plan	G			▼			▼			▼			▼(Every 3 years)		
	Demonstrating appeal and challenging attitude		I		Demonstrating challenging attitude and conveying appeal											
	Investing HR supply-demand trends		I	A	Investigating HR supply and demand trends periodically and publishing results											
General Education including Liberal Arts	Development of scientific literacy			A	Science education at the elementary and junior-high levels											
	Energy and environment education			A	Energy and environmental education											
	Liberal arts education			A	Introduction to nuclear/radiation topics including societal and political aspects other than technical											
				A	Liberal arts minded person											
	Engineering ethics			A	Engineering ethnics (safety culture)											
Nuclear Education	Securing human teaching resource			A	Securing positions/improving working conditions											
				A	Cutting-the edge research											
	International Standardization of curriculums			A	Producing model curriculum											
				A	Replacing corresponding subjects in previous curriculums											
				A	Implementing standard curriculums											
	Effective, efficient education through inter-university & international Cooperation			A	Inter-university cooperation in basic & fundamental education, and experiment education											
				A	Credit transferability											
	Maintaining education & research facilities and joint use of facilities internationally	G		A	Maintaining, updating and new construction of experiment facilities for education and research											
				A	Promoting international joint use of experiment facilities for education and research											
Contribution from the Industry	Internships, etc.		I		Providing opportunities to see and experience nuclear-related work, etc., including facility tours and internships											

Source : 原子力人材育成ネットワーク(2015). 原子力人材育成の課題と今後の対応 - 原子力人材育成ロードマップの提案. 1-18.

Japanese 10-Year nuclear HRD roadmap: Young Engineers

Young Engineers

Items	Contents	Groups			0	1	2	3	4	5	6	7	8	9	10	……(Year)
		Gov.	Indus.	Aca.												
-	Issuing Strategic Energy Plan	G			▼			▼			▼			▼(Every 3 years)		
Decommissioning damaged reactors	Continuing decontamination & decommissioning technology through actual on-site work	G	I		Fostering HRs and continuing technological abilities through actual decommissioning work at damaged reactors											
	Fostering decommissioning experts & specialists	G	I	A	Fostering specialists & experts through R&D on decommissioning work at damaged reactors											
			I		Fostering specialists & experts through actual decommissioning work											
Safe operation & ensuring safety	Standardizing professional knowledge and technology		I		Clarifying knowledge and technological requirements											
						Standardizing										
								Reflecting this standardization in each company								
	Continuing technology through actual on-site work		I		Fostering HRs through construction of nuclear plants and actual operation, continuing and accumulating technology											
		G			Fostering HRs in the area of regulation through actual work granting permits and licenses for nuclear power plants and actual inspections											
	Fostering specialists & experts	G	I	A	Fostering specialists & experts through carrying out safety research in industry-government-academia cooperative projects (ex. Nuclear Risk Research Centre (NRRC))											
			I		Fostering specialists & experts through actual work											
Nuclear fuel cycle (back-end)	Clarifying professional knowledge and technology		I		Clarifying knowledge and technological requirements necessary to operate fuel cycle back-end facilities											
	Continuing technology through actual on-site work		I		Fostering HRs through actual cycle back-end work, continuing and accumulating technology											
			I	A	Fostering HRs and accumulation of technology through R&D on cycle back end											
	Fostering specialists & experts		I		Fostering specialists / experts through actual work											
Common	Instilling safety culture		I		Continuous fermentation of safety culture											
International Business development & Contribution	International business development and international Contribution	G	I		Developing international careers through sending personnel systematically to international organizations, international conferences, overseas offices, and so on											
		G	I	A	Running Japan-IAEA Joint nuclear management School											

Source : 原子力人材育成ネットワーク(2015). 原子力人材育成の課題と今後の対応 - 原子力人材育成ロードマップの提案. 1-18.

Japanese 10-Year nuclear HRD roadmap: Mid-Career Engineers

Mid-Career Engineers

Items	Contents	Groups			0	1	2	3	4	5	6	7	8	9	10	……(Year)
		Gov.	Indus.	Aca.												
-	Issuing Strategic Energy Plan	G			▼			▼			▼			▼(Every 3 years)		
Decommissioning damaged reactors	Maintaining & continuing technological abilities	G	I		Accumulating experience through actual decommissioning work at damaged reactors											
	Fostering abilities to manage projects under international cooperation	G	I		Fostering abilities to manage international projects through actual work on projects under international cooperation											
		G	I		Fostering abilities to cope with international situations by sending personnel to international organizations, stationing them at overseas offices and so on											
	Fostering specialists & experts	G	I	A	Fostering specialists & experts through R&D on decommissioning damaged reactors											
			I		Fostering specialists & experts through actual work											
Safe operation & ensuring safety	Maintaining & continuing technological abilities through actual on-site work		I		Accumulating experience through actual construction and operation of nuclear plants											
		G			Accumulating experience through actual issuance of permits an licenses for nucelar power plants and inspection of them											
	Fostering ability to see the entire picture, insight, judgement and leadership		I		Fostering abilities to see the entire picture, insight, judgement and more through actual work and training											
		G	I	A	Fostering specialists & experts through carrying out safety research in industry-government-academia cooperative projects											
	Fostering specialists & experts		I		Fostering specialists & experts through actual work											
Nuclear fuel cycle (back-end)	Maintaining & continuing technological abilities through actual on-site work		I		Maintaining technological abilities through actual cycle back-end work											
		G	I	A	Accumulating technology through R&D on cycle back-end											
	Fostering specialists & experts		I		Fostering specialists & experts through actual work											
Common	Instilling safety culture		I		Continuous fermentation of safety culture											
	Fostering managerial abilities		I		Fostering managerial abilities through actual work, training and so on											
	Risk communication		I		Fostering risk communicators											
International Business development & Contribution	Developing international careers, forming personal relationships and becoming influential voices	G	I		Developing international careers through sending personnel systematically to international organizations, international conferences, overseas offices and so on											
	Fostering code engineers		I		Fostering code engineers (ensuring international personal relationships and influential voices through sending personnel systematically to international organization etc.)											

Source : 原子力人材育成ネットワーク(2015). 原子力人材育成の課題と今後の対応 - 原子力人材育成ロードマップの提案. 1-18.

Japanese 10-Year nuclear HRD roadmap: Engineers from emerging countries

Engineers from emerging countries

Items	Contents	Groups			0	1	2	3	4	5	6	7	8	9	10	……(Year)
		Gov.	Indus.	Aca.												
Developing educational curriculums	International standardization of curriculums (content deemed satisfying in basic & fundamental education)	G	I	A	Producing model curriculums											
						Replacing corresponding subjects in previous curriculums										
								Implementing standard curriculums								
	International cooperation				Activities for international recognition of curriculums in cooperation with IAEA											
Development of system	[Control Tower] Unified managerial and operational system				Addressing System		Establishing Control Tower			Developing overseas HRs consistently / carrying out international contribution activities						
	Nuclear generation academy (benchmarking KINGS, Korea)				Addressing establishment		Preparation		Establishment		Recruiting new students					
					Japan-IAEA joint nuclear management school, Tokyo Institute of Technology's Nuclear Workshop, activities of JAEA etc.											
Implementing strategically	Clarifying knowledge & technological requirements corresponding to development phase of a country introducing nuclear generation, and developing HRs	G	I		Clarifying requirements											
								Application to nuclear HRD in countries newly introducing or planning to introduce								
	Understanding the needs of the counterparty country and making strategic proposals	G	I		Understanding the needs of the counterparty country and making strategic proposals											

Source : 原子力人材育成ネットワーク(2015). 原子力人材育成の課題と今後の対応 - 原子力人材育成ロードマップの提案. 1-18.

Conclusion:
After comparative research, there are three implication derived.

1 Nuclear HRD policy shall be independent, sustainable, and long-term guided.

- *As considering its uniqueness – i.e. features as a big science, impacts such as in socio-politics, nat'l safety and security, etc.*

2 Research-Education nexus model is widely applied in nurturing strategic human capital.

- *R&D has to take a responsible for educating next generation*

3 Multilateral approach in defining and solving issues in nuclear HRD .

- *Collaboration between government and civil industry*
- *Inter-government cooperation among related ministries*
- *Alliance among industry, academy, and think tanks*

Reference

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