IAEA
International Atomic Energy Agency
Atoms for Peace and Development

Discussions on policy interests in the context of "Day 1-3" activities

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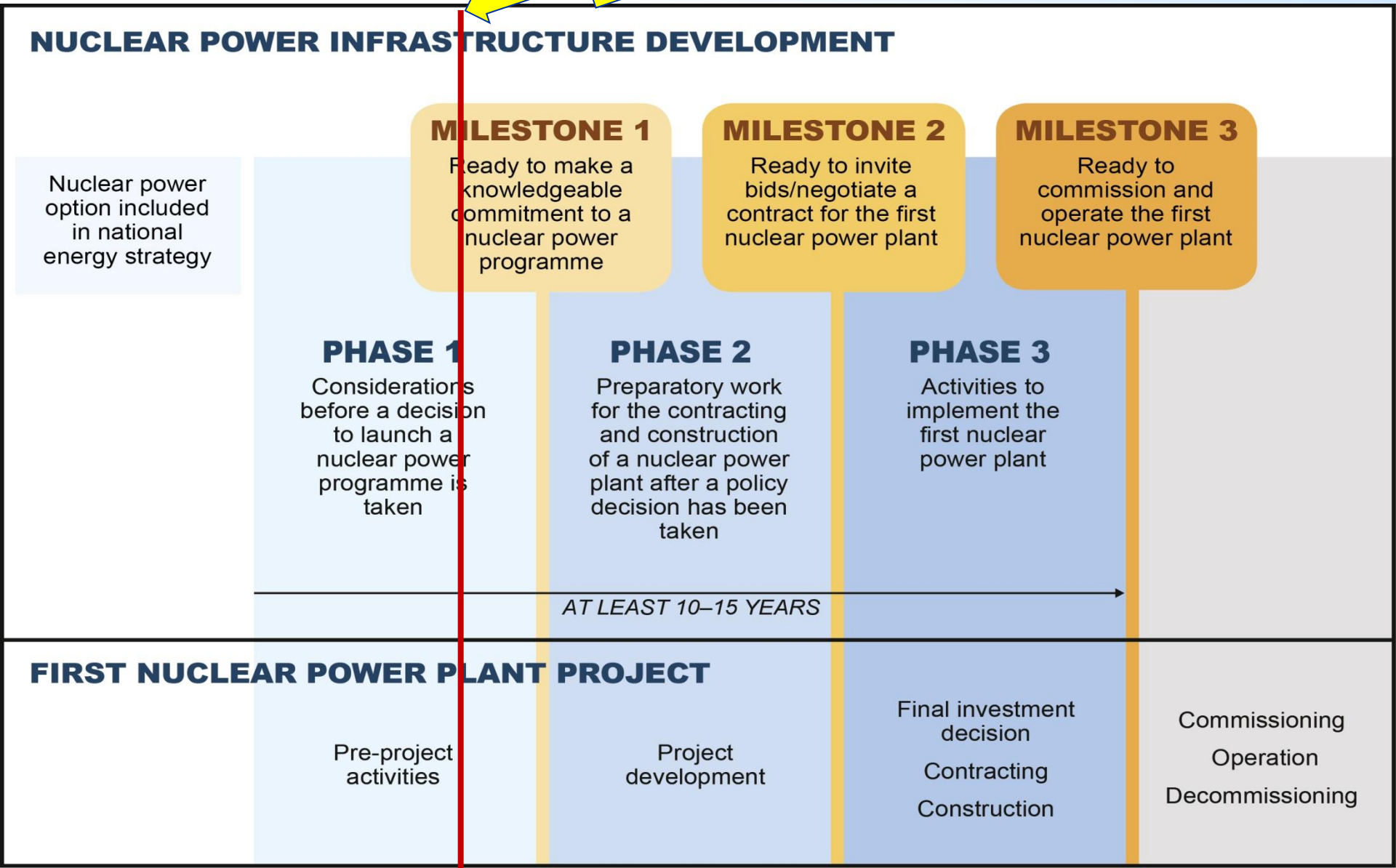
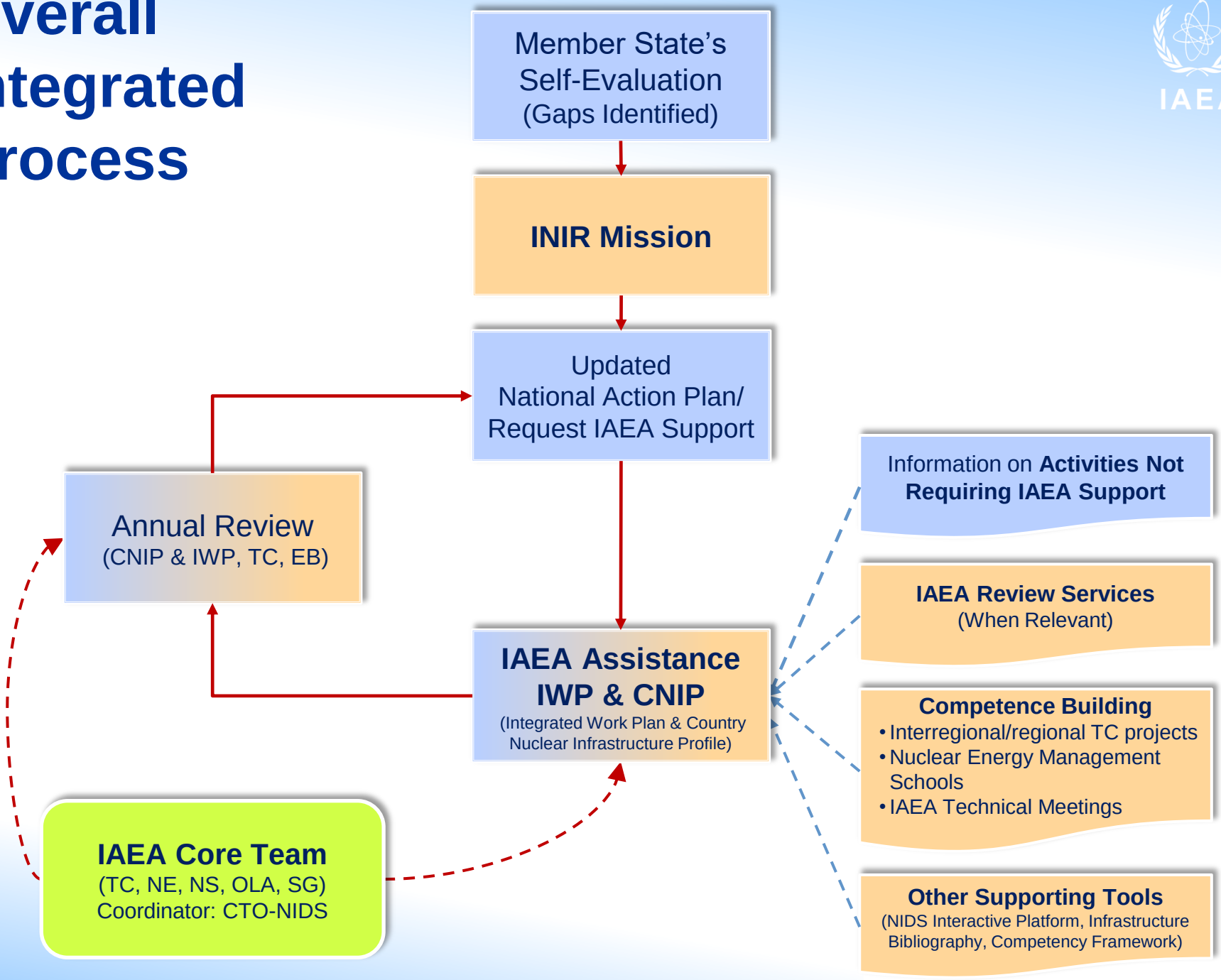
Quick Review for Day1-3

Milestones Approa

Indonesia



Overall Integrated Process



INIR process

- ✓ The integrated nuclear infrastructure review is comprised of the following **4 steps:**
  - Step 1: Self Evaluation Report (SER) review
  - Step 2: Pre-INIR mission
  - Step 3: INIR mission
  - **Step 4: INIR Follow-up mission**
- ✓ The INIR is conducted upon formal request from the Member State, and consists of all 4 steps
- ✓ The timing of each of the 4 steps is agreed with the Member State

IAEA Milestones Approach: Infrastructure Issues

The Milestones Approach is holistic and considers 19 specific infrastructure issues.

Industrial involvement : Phase 1 (Consider to Decide)

- NEPIO (Nuclear Energy Project Implementation Organization) to Assess;
  - Local industrial capabilities
  - Interest of business / industrial leaders in participating in the NPP project considering the special requirements
  - Investment for intended upgrading of industrial facilities

- NEPIO to Develop;
  - Short term and long term policies on the area/level of local participation that is practical and desired

- NEPIO to Initiate dialogue with potential vendor(s)

Elements for successful Industrial involvement

Receiving countries need to develop/prepare/conduct;

- **Capacity surveys of local industries**
- **Policies for developing industrial capacity**
- **Industrial standards & quality assurance mechanisms**
- **Capacity building activities** such as:
  - ✓ National R&D programme
  - ✓ Partnership w/ competent players for technology transfer
  - ✓ Long-term and low-interest loan for capital investment
- **National/Local investment for the above activities**
- **Negotiation with vendor and/or EPC contractor**

Policy Interests by Indonesia

1) Based on your experiences, how to prepare transfer technology program in order could reach self reliance?
2) What is the key items should be focused for technology transfer for every step?
3) Would you please to elaborate more about the transfer technology contract with base practices in other countries?
4) How to make NPP competitive with fossil (or another) power plant from industrial point of view ? (Ministry of industry)

Q1. How to prepare for Technology Transfer program in order to reach self-reliance?

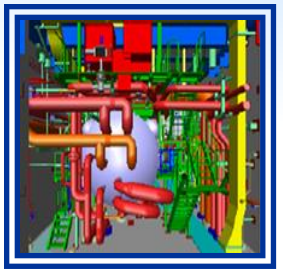
Q2. What is the key items should be focused for technology transfer for every step?

- ✓ To understand “Types”, “Stages”, and “Structure” of TT properly, by learning international case studies. **Recognize where you are & where you want to go…!**
- ✓ It’s good strategy to build multiple channels to negotiate, even in an early phase for Technology Transfer.
- ✓ It’s important that industrial sector makes policy proposals to the gov proactively. Utility & industry know their needs.
- ✓ TT is not only for overall NPP(s), but also for varied types such as component design & manufacturing, software engineering, construction.. **Prioritize your area for TT first!**

Types of TT: Techs can be Transferred

1) Design Tech

- From the R&D stage to the Final Process Design of all the systems comprising NPP.



2) Manufacturing & Construction Tech

- From Design of Equipment to Special Manufacturing Techs & Quality Assurance in the NPP construction.

3) Project Engineering & Management

- Works for the successful execution of the NPP project including Office & On-site Activities.

Stages of TT: Moving toward Self-reliance

1) Initiating Stage
   - Technical dependency as a subcontractor

2) Selective Stage
   - Technical acquisition of the technology as a subcontractor

3) Adaptive Stage
   - Joint design of indigenous products (start modifying the vendor's tech to adapt to specific markets) as a subcontractor or primary contractor

4) Mastery Stage
   - Technical self-reliance as a primary contractor

Structures of TT: Defining the Scope & Nature

1) Inter-governmental Agreements

- Give a framework of TT. Detailed agreements can be among R&D, Standard or Educational Institutions if both parties wish.

2) Company Agreements

- Give a definition of “which” and “how” techs are to be transferred. Basically they forms four types of structure:

1. Licensing Agreements
2. Technical Cooperation Agreements
3. Joint Ventures
4. Consultancies

Q3. elaborate more about the TT contract with base practices in other countries?

1945 Defeat in WWII: 60-70% of production capacity damaged

1952 Hitachi negotiated with potential partners in gas turbine:
1) AEG@German, 2) EE@UK, 3) GE@US

1953 Hitachi decided GE (= gave up doing by herself) and proposed policies (subsidies & tax merit for investment)

1966 Hitachi and GE agreed tech-partnership in nuclear power
⇒ System License: 1) design documents & analysis tools, 2) dispatched engineering staff to GE San Jose site

1974 “Shimane Unit.2” localized in 94% mainly by Hitachi

A Case of TT in History: 1960-70s, Japan

Name of NPP	**Tsuruga Unit 1** (1st Operated LWR)	**Fukushima Unit 1** (3rd Operated LWR)	**Shimane Unit 1** (5th Operated, and 1st "Localized" LWR)
Main Contractor	GE	GE	Hitachi
Capacity (Net)	341 MWe	439 MWe	439 MWe
Ratio of Domestic Production	55%	56%	94%
Start of Construction	1966	1967	1970
Start of Operation	1970	1971	1974
Supplier of Reactor System	GE	GE	Hitachi
Supplier of Steam System	GE	GE	Hitachi
Supplier of Turbine System	GE / Toshiba	GE	Hitachi

Source: JAIF "World Nuclear Power Plant" (2017), et al.

Analysis: Why did Japan succeed in TT?

1) Industry-wise

- Technology Matured in Hydroelectric Power since 1940s
- Experienced in Gas Turbine (Alliance of GE & Hitachi signed 1953)
- Catch-up as a Subcontractor under the Licensing Contract
- Structured Supply-chain (366 companies involved in NPP in 1972)

2) Utility-wise

- Led R&D Projects w/ Domestic Manufacturers for Localization
- Well-Judged in the 1st Localized NPP (e.g. Chose Conventional Type of Reactors; Classified Components for Localization*)

* Utility decided to import hi-spec components such as I&C, Circulation Pumps, Control Rods

Analysis: Why did Japan succeed in TT?

3) Government-wise

- National Program (1st Long-term Plan Published in 1956)
- Subsidy for R&D ($0.9M in 1967FY, mainly for Manufacturers)
- Finance
  - ✓ Long-term & Low-Interest Loan by Japan Development Bank
  - ✓ Export Credit Finance by US Exim Bank
- Tax Benefit
  - ✓ Exemption from Tariff
  - ✓ Special Depreciation

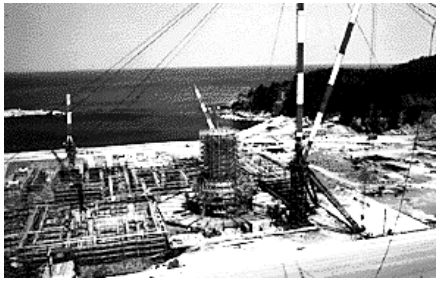
"Japan Power Demonstration Reactor"
(BWR provided by GE, operated for 1963-1976)

Analysis: Why did Japan succeed in TT?

4) Market-wise (External Factors)

- **In the Early Stage of the NPP Technology**
  - ✓ Dawn of “Generation II” Reactors
  - ✓ Favorable “Buyer’s Market” ⇒ Room to Negotiate
  - ✓ US Vendors (WH, GE) were positive for TT
  - ✓ Not Yet Experienced TMI, Chernobyl, Fukushima

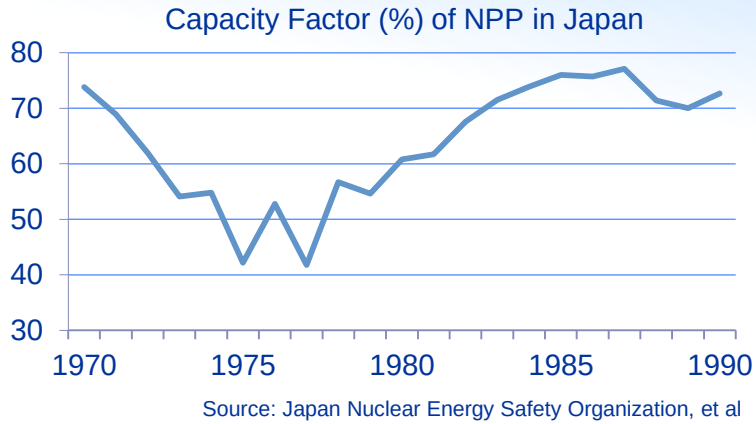
- **In the Period of High Economic Growth**
  - ✓ High Demand for Electricity
  - ✓ Lack of Domestic Energy Resources



“Shimane” Unit 1
(At the time under Construction)

Analysis: Issues after the 1st Localization
⇒ "Self-reliance" is difficult than it looks…!

- Troubles/Accidents in NPPs
  - ⇒ Lower Capacity Factor
  - ⇒ Higher Cost



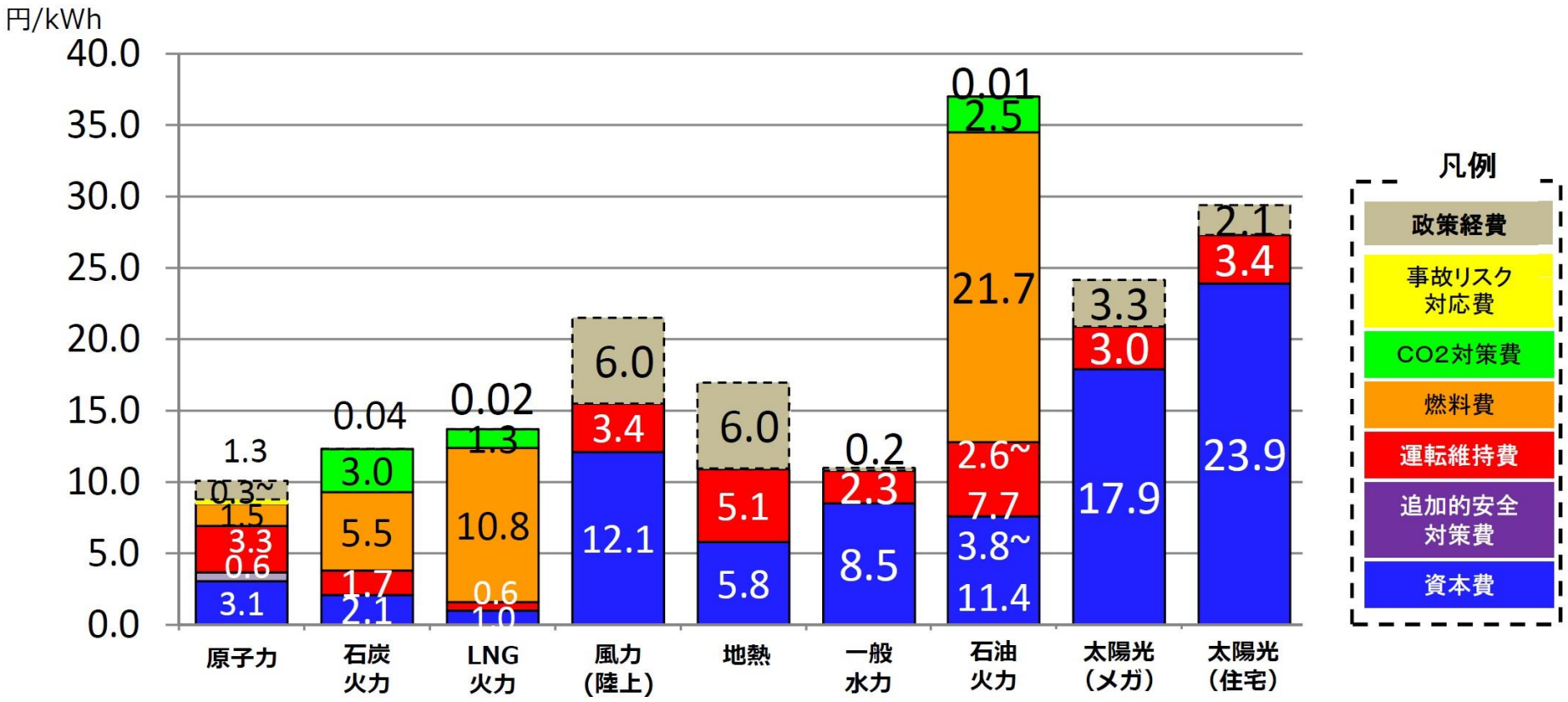
Source: Japan Nuclear Energy Safety Organization, et al

- Needed to localize for larger/newer NPPs
  (e.g. Localization ratio of "Tokai-2" (1,056MW, operated since 1978) is 51%)

- Needed to improve the level of technologies including Operating and Maintenance (O&M)

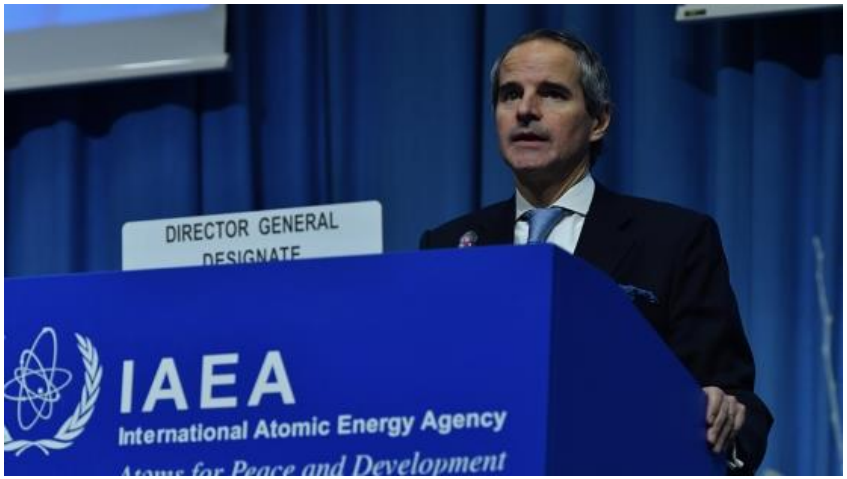
- Needed to have opportunities of learning repetitively

Q4. How to make NPP competitive with fossil (or another) power plant from industrial point of view?



https://www.enecho.meti.go.jp/about/special/tokushu/nuclear/nuclearcost.html

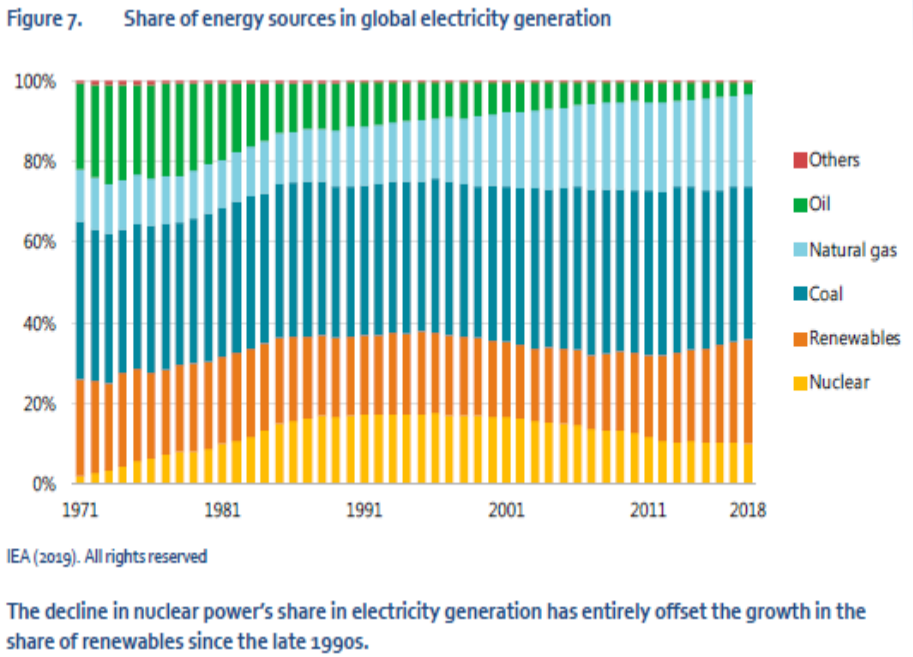
Trend 1: Nuclear Power as a Clean Energy Option

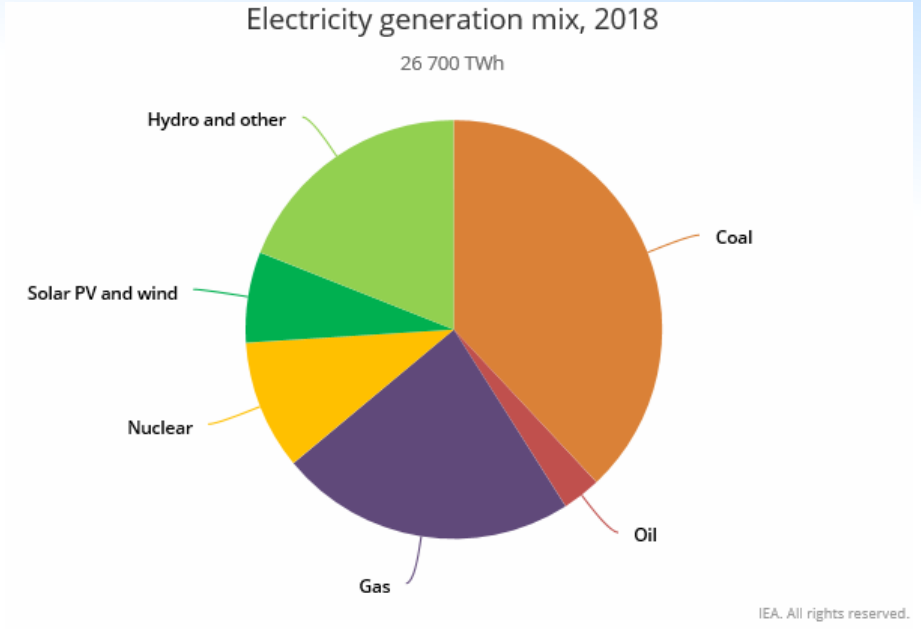


"The challenges of climate change and ensuring sufficient supplies of energy for the future are issues on which the Agency's voice must be heard. I will take our message... to COP 25, in Madrid next week."

"For many countries, nuclear power is a proven, clean, safe, and economical technology. And for many countries, it can play an increasingly important role in achieving energy security, reducing the impact of volatile fossil fuel prices, and mitigating the effects of both climate change and air pollution."

What are the available options?





- Nuclear power makes a significant contribution to electricity generation, providing 10% of global electricity supply in 2018.

- Despite the impressive growth of solar and wind power, the overall share of clean energy sources in total electricity supply in 2018, at 36%, was the same as it was 20 years earlier because of the decline in nuclear.

Benefits of Localization

- For **EPC Contractor**
  - Secure supply chain
  - Efficient employment
  - Effective logistics

- For **Government**
  - Job creation
  - Support to high skilled jobs
  - Impact on GDP growth

- For **Local Industries**
  - Technology transfer
  - Strengthen Partnerships
  - Access to world market for nuclear/non-nuclear areas


Thank you so much!
Terima kasih banyak!