New Nuclear Plant Construction in Japan and around the World

Akira OMOTO, Commissioner,
Japan Atomic Energy Commission

OUTLINE

1. Short introduction
2. Nuclear Energy in JAPAN's growth strategy
3. Challenges for expansion/introduction of Nuclear Power
4. Conclusions

Atomic Energy Commission of JAPAN

- **Five Commissioners**
  - **Led by the Chairman (Prof. Kondo)**
  - **Four out of five: newly assigned in January 2010**
- **Plan, Deliberate and Decide on basic policies**
  - **R&D**
  - **Use of NE (including nuclear applications)**





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JAPAN's Growth Strategy report and Competitiveness report

- **National "Growth strategy" report**
  - To be announced in June 2010 by the Cabinet
  - Focus on the coming 10 years (by 2020)
  - Two key elements : "Green innovation" and "Life innovation"
  - Policy paper by JAEC on 25th May 2010 "NE strategy to support growth" as an input to the Cabinet

- …Also, a proposal for **structural change in Japanese Industry for competitiveness** (METI's advisory committee, 3rd June 2010)
  - Limited growth of domestic market
  - Five key strategic areas identified

    Infrastructure, Energy & Environment, Medical, Robotics & Space, Creative industry
  - Declining Japan's competitiveness (IMD)…falling off the "flat earth"?

Policy paper by JAEC (25May2010) discusses Contribution by NE to JAPAN's Growth Strategy

1) Contribution of nuclear power to "Green innovation"

- 25% reduction from 1990 level of CO2 emission by 2020, on the condition that all other major emitters agree on ambitious reduction targets
- 1% increase of availability displaces CO2 emission by 3M Tons/Y
- One new unit displaces CO2 emission by 5M Tons/Y

While currently

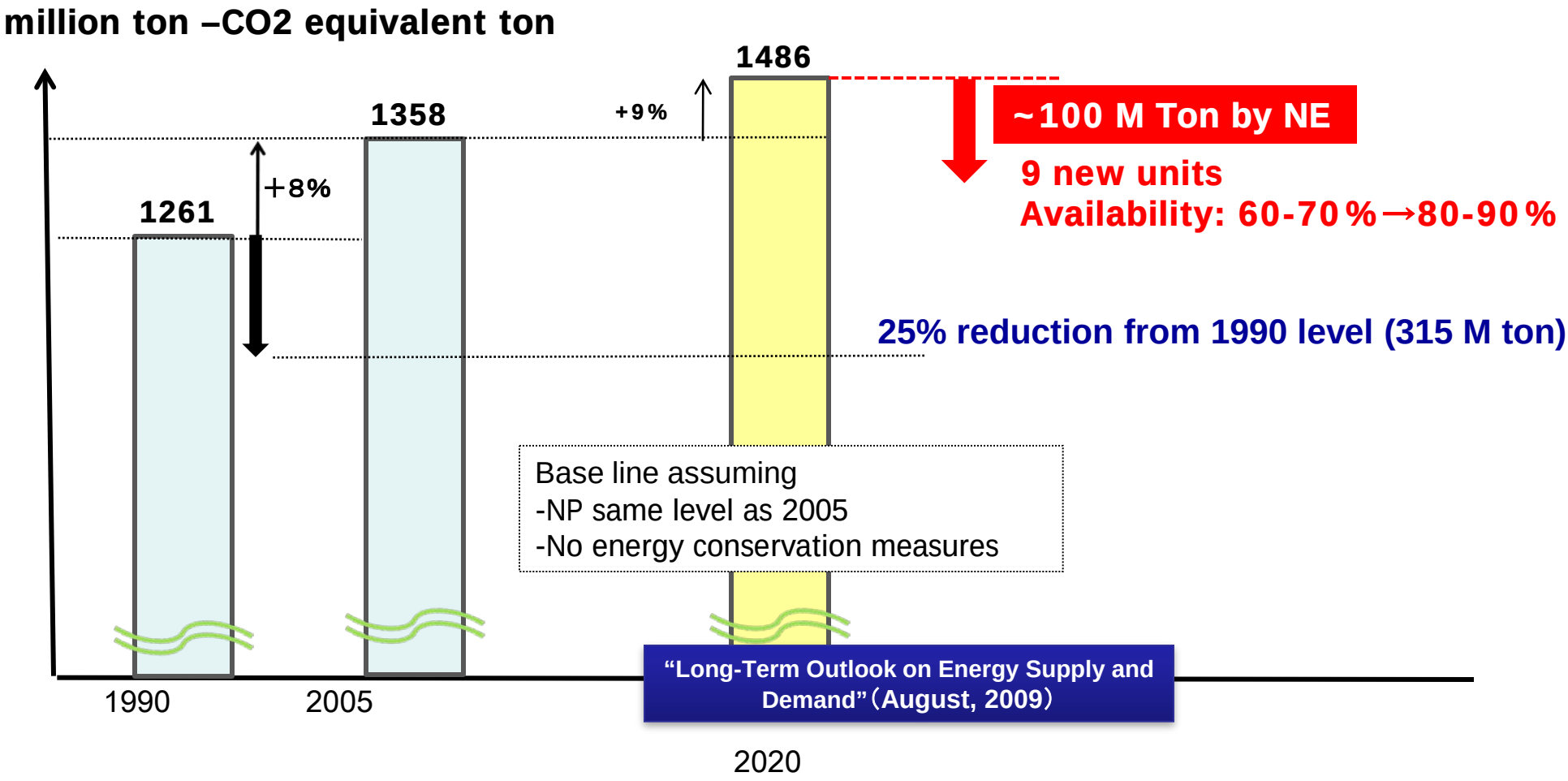
- Current availability of 54 LWRs: 60-70% due to earthquake and other reasons
- 9 units are expected to start operation by the End of FY2019

2) Contribution of nuclear applications to "Life innovation"

- Improved standard of life (medical use, food irradiation etc)

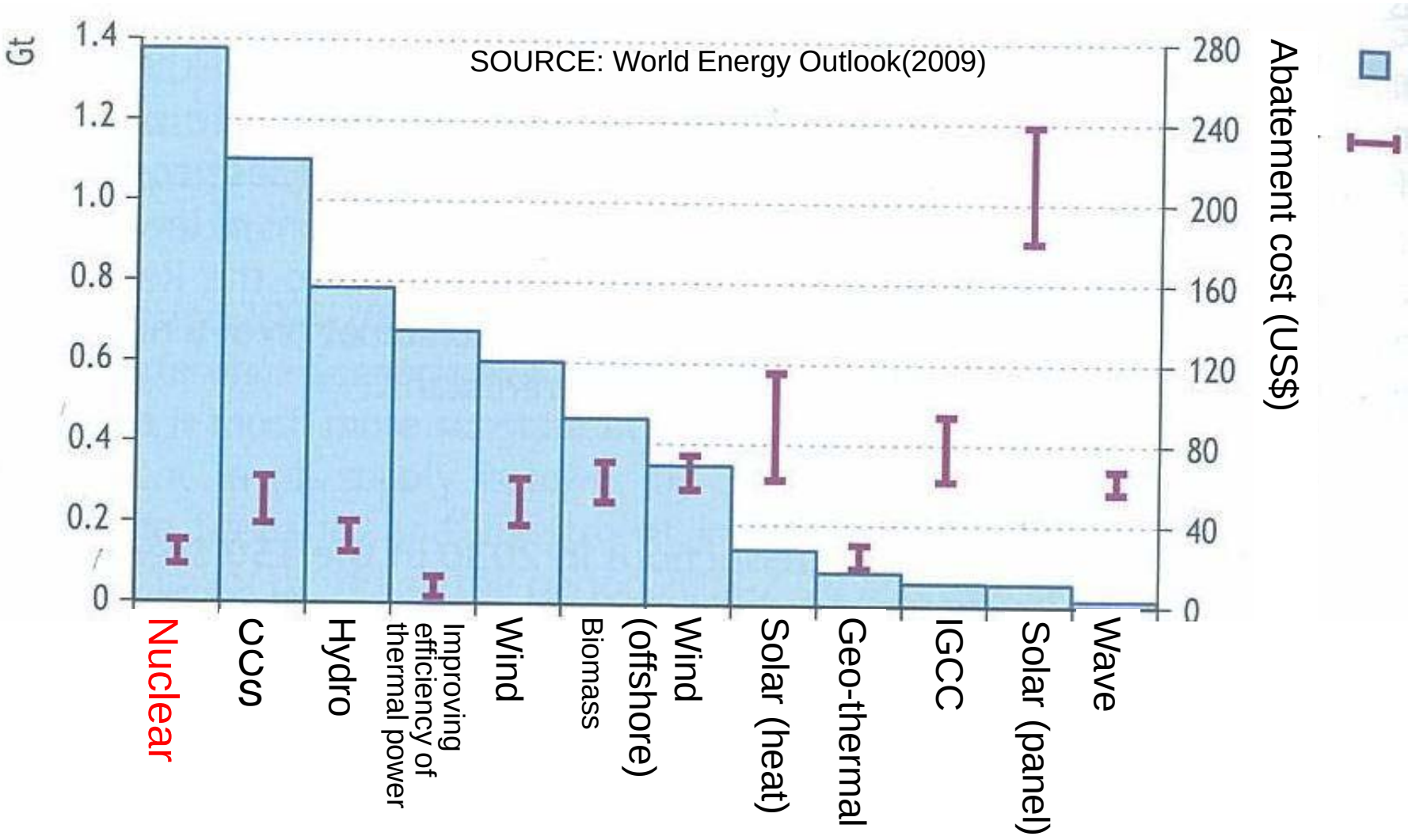
3) NPP projects in & out of Japan leading to job and economy

25% reduction target from 1990 level of CO2 emission by 2020



Difficult to achieve the emission goal without NE

Abatement cost and potential of emission reduction



Japan's New Nuclear Builds (2009 Power Supply Plan)

Under Construction

Shimane-3

Ohma (Full MOX ABWR)

Kaminoseki-1

Tsuruga-3

Tsuruga-4

Higashidori-1(TEPCO)

Fukushima I-7

Fukushima I-8

Sendai-3

Higashidori-2(TEPCO)

Kaminoseki-2

Hamaoka-6

Namie-Odaka

Higashidori-2(TOHOKU)

PWR

BWR

2005 2010 2015 2020 FY

Further "Basic Energy Plan" (8June2010) and "Action Plan for Nuclear Power" (4June 2010) by METI

1) New build by 2030 : 14 units or more
2) Nuclear electricity by 2030: 50%
3) Low carbon power generation source (renewable and nuclear) by 2030: 70%
4) Practical actions for NP includes;
   - Availability increase and new build
   - Consensus building
   - Fuel cycle and HLW repository
   - Securing stable supply of Uranium
   - International relations

Challenges to achieve the expected role

- New build
  - Loan guarantee?, Economic competitiveness of NP?, Licensing?: No
  - Societal issue: yes for some
- Higher availability of NPPs
  - Need to restart of remaining units at Kashiwazaki-Kariwa
  - Need to change: Operational cycle, Power uprating, outage duration, licensing procedures (pre-approval of standard design and fuel) etc
- In general
  - Consensus on the use of NE
  - Need to revisit gaps from global standard practices such as;
    - Use best practices in the world
    - A number of organizations with similar functions
    - Low mobility of experts among nuclear organizations
    - Relationship with local government
    - Scope of the use of irradiation to food

Comparison of NPP Performance (Japan and the USA)

- **Un-planned Shutdown in JAPAN**
  - Relatively low frequency of un-planned shutdown
  - Nevertheless, once shutdown, longer time before restart
- **Duration of Planned shutdown time in JAPAN**
  - 3 or 4 times longer
  - Extensive preventive maintenance works and inspections
  - Earthquake, Less on-line maintenance, etc.

	Cycle Length (Months)	**Shutdown Frequency** (Event/Reactor-year)	**Ave. Shutdown Period (days)**	**Ave. Inspection Period (days)**	**Plant Availability (%)**
Japan	13. 2	0. 55	37. 2	143. 5	70
USA	18. 9	1. 5	5. 1	42. 3	91

Data: Japan: Cycles ended with the outages in 2007 to 2008
USA: Cycles ended with the fuel exchange outages in 2004 to 2005

SOURCE: Kaino report (RIETI Discussion paper series 09-J-035, 2009) and JANTI report (2009

Potential for contribution to other countries' NE programme

- **Based on experiences of;**
  - Uninterrupted deployment for the last five decades (since 1959)
  - Construction on time and within budget
  - Localization
    - 12 years from conception to start of commercial operation
    - 20 years to complete localization
  - 44 years of operation

- **Three NSSS Suppliers with technologies for;**
  - ABWR, APWR, 4S, (ATMEA, ESBWR)…

Supportive activities and relevant activities….

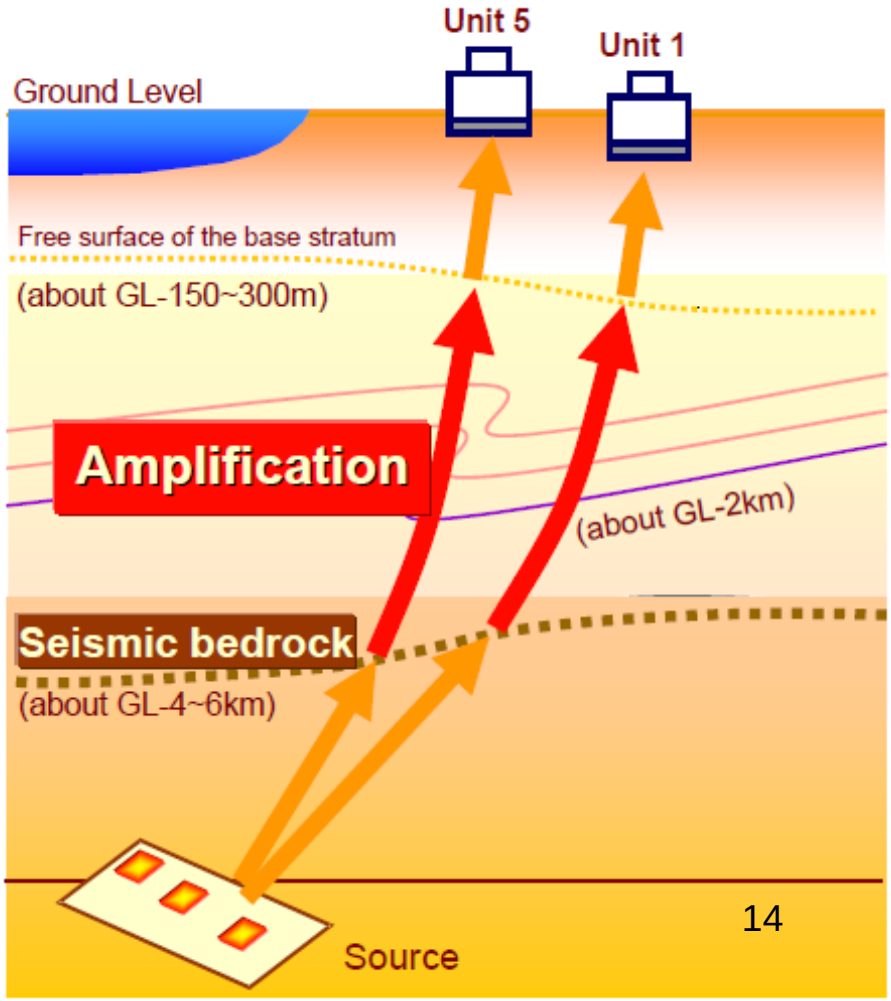
- Proposal by JAIF to the PM (2010 April 20)
  1) Establish national focal point for competitive NPP Projects
  2) Timely action for bilateral cooperation agreement
  3) Reduce financial risk both for Suppliers and Recipients etc.
- "Integrated Cooperation" (SPC) by Utilities/Suppliers (2010 Autumn-)
- JBIC (project financing in case Japanese company invests) and NEXI (trade insurance) applicable to NPP exports

- Support to IAEA's activities in newcomers' capacity building
- Cooperation : Design against natural hazard, Integrated safeguard
  - Workshops on earthquake engineering
  - Setting model case for integrated safeguard: Recent (2010April) NNSA-MEXT MOC (Memorandum of Cooperation) includes "collaboration to establish nuclear safeguards and security infrastructure in the third countries"
- FNCA in Asia

Lessons Learned from 2007 earthquake to be reflected on new builds

- To pay attention to relative displacement between non-safety grade & safety grade structures (Business continuity issue)
- To consider the inclination of a nearby fault to the NPP (Anisotropical release of energy)
- To consider amplification effect underground geological structural irregularity in evaluating the propagation of seismic wave (Local amplification)

- Others;
  - Emergency preparedness
  - Indicator of energy applied to equipments



FNCA (Forum for Nuclear Cooperation in Asia)

- Since 1990 by 10 (Japan, Australia, Bangladesh, China, Indonesia, RoK, The Philippines, Malaysia, Thailand, Vietnam) + 2 new countries (Kazakhstan, Mongolia)

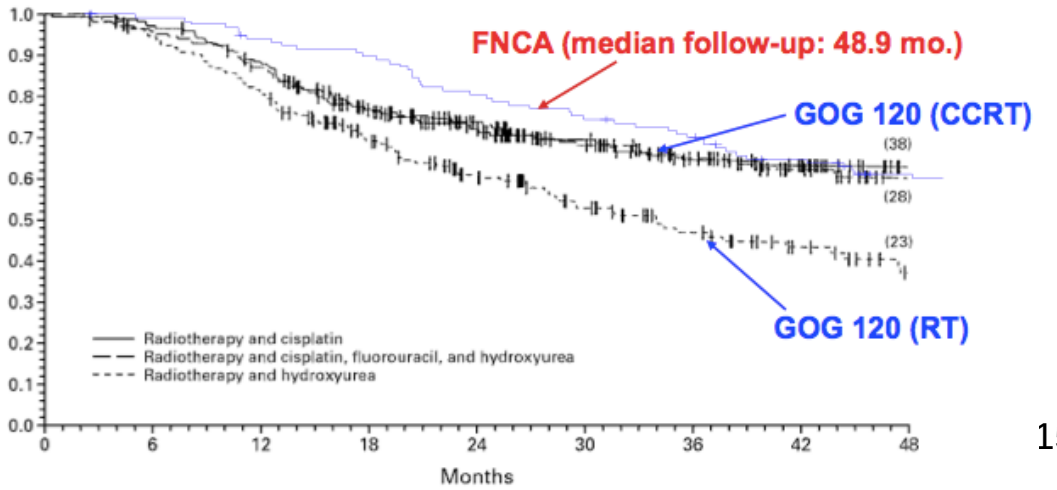
- Eight areas of cooperation
  - Research Reactor/Agricultural use of radiation/ Medical use of radiation
  - Industrial use of radiation/Human resources development/
  - Radiation safety and control/Safety Culture/Public communication

  ……for the well-being of the people in Asia

- Achievements

Jointly establishing protocol CERVIX-III for cervical cancer treatment, methods for the use of radiation for bio-organic fertilizer and for plant growth promoter in agriculture, study on lifting nuclear exclusion from JI/CDM etc

- Further to include area of Nuclear Power



(Overall survival curves in GOG 120 (USA) and FNCA Cervix-III)

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IAEA member states considering introduction or expanded use of nuclear power

- **More than 100% increase of NP capacity projected for 2030**
  - Most of the growth in existing 30 NP countries; China, India, USA..
  - Newcomers operating NPPs : 2(Lo)-6(Hi) by 2020

- **More than 60 Member States considering introduction of NP**
  - Growing energy demand
  - Global energy security and low-carbon economy

Challenges, especially with the newcomers

1) Responsible supply and responsible use

- Review of Supplier's safety design
- Newcomer's progressive capacity building, including culture for safety, ownership and transparency
- How to motivate to fill in the gap in the Newcomers
- Code of conduct (Suppliers & Newcomers)
- Excessive government-to-government deal

Leading to International confidence building on the nation's programme (safety, security, non-proliferation, sound infrastructure)

2) International/multi-lateral/regional cooperation

- Coordination among players (IAEA, EC, WANO, bilateral...)

International/regional/multi-lateral cooperation in NE benefits all

1. Sharing information and LL for mutual benefit of the “nuclear” community
   - IAEA Networking, WANO
2. Efficient use of resources such as;
   - Regional network for RR utilization
   - Nuclear educational network
3. Technology transfer, resources mobilization, helping each other
   - From North to South
   - Supply network (such as in Mo-99)
4. Standardization for efficiency in production
   - MDEP for design evaluation and harmonization of code and standards
5. Enabling large projects and risk sharing
   - Grid inter-connection to use large NPPs
6. Confidence building
   - Watching each other

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Concluding remarks

1. NE's contribution to Japan's growth strategy has been clarified and proposed to the Cabinet from JAEC
   - Carbon-free growth is impossible without NE option
   - Reduction of 100M tons-CO2 by NE, out of 315 M tons-CO2 target by 2020

2. Japan is willing to contribute to global expansion of NE

3. Challenges on our own soil
   - Change practices for O&M
   - Consensus building
   - Revisit gaps from global standard practices


Thank you for your attention