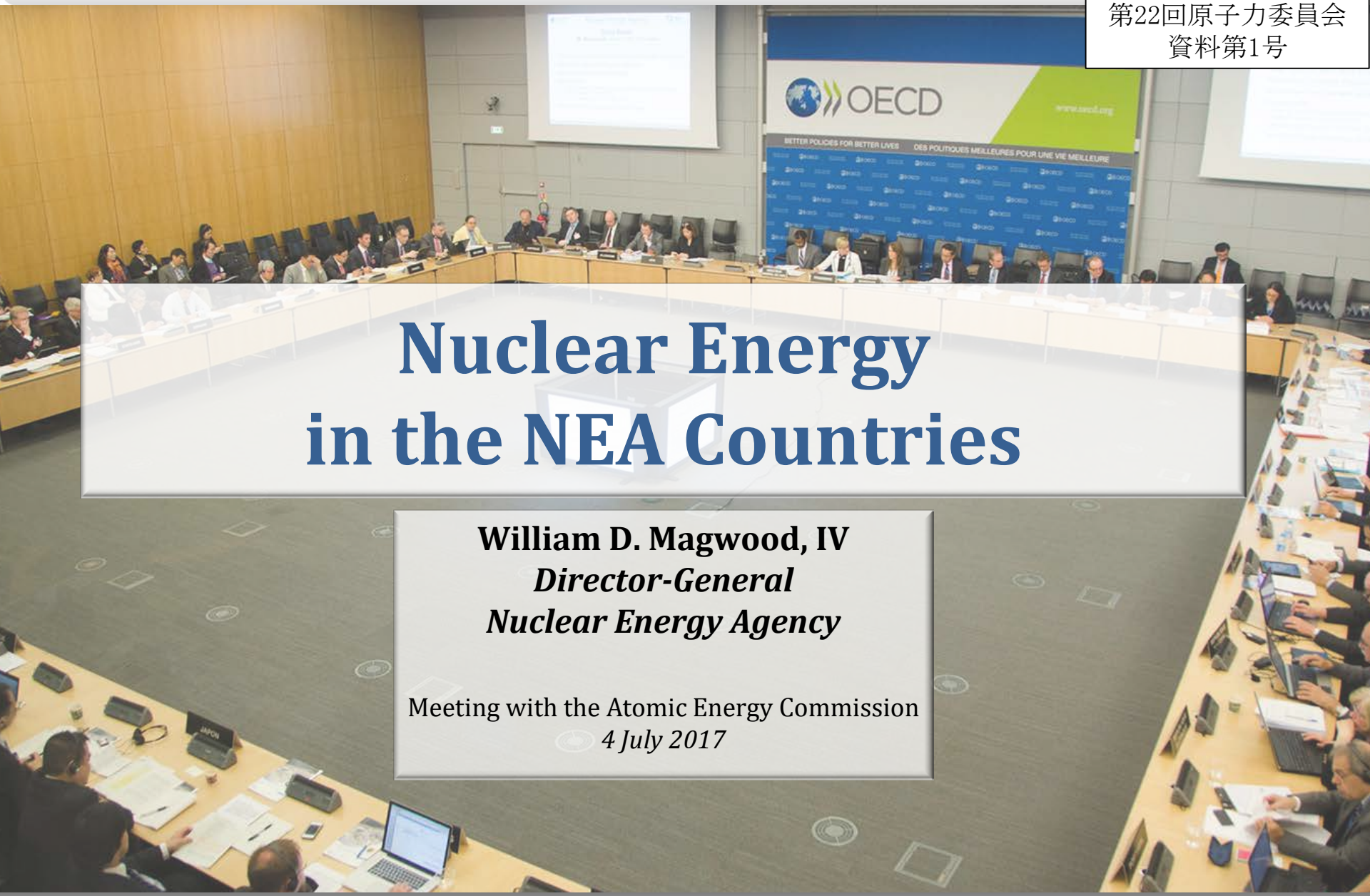
OECD
BETTER POLICIES FOR BETTER LIVES

Nuclear Energy Agency

NEA
NUCLEAR ENERGY AGENCY

第22回原子力委員会
資料第1号



Nuclear Energy in the NEA Countries

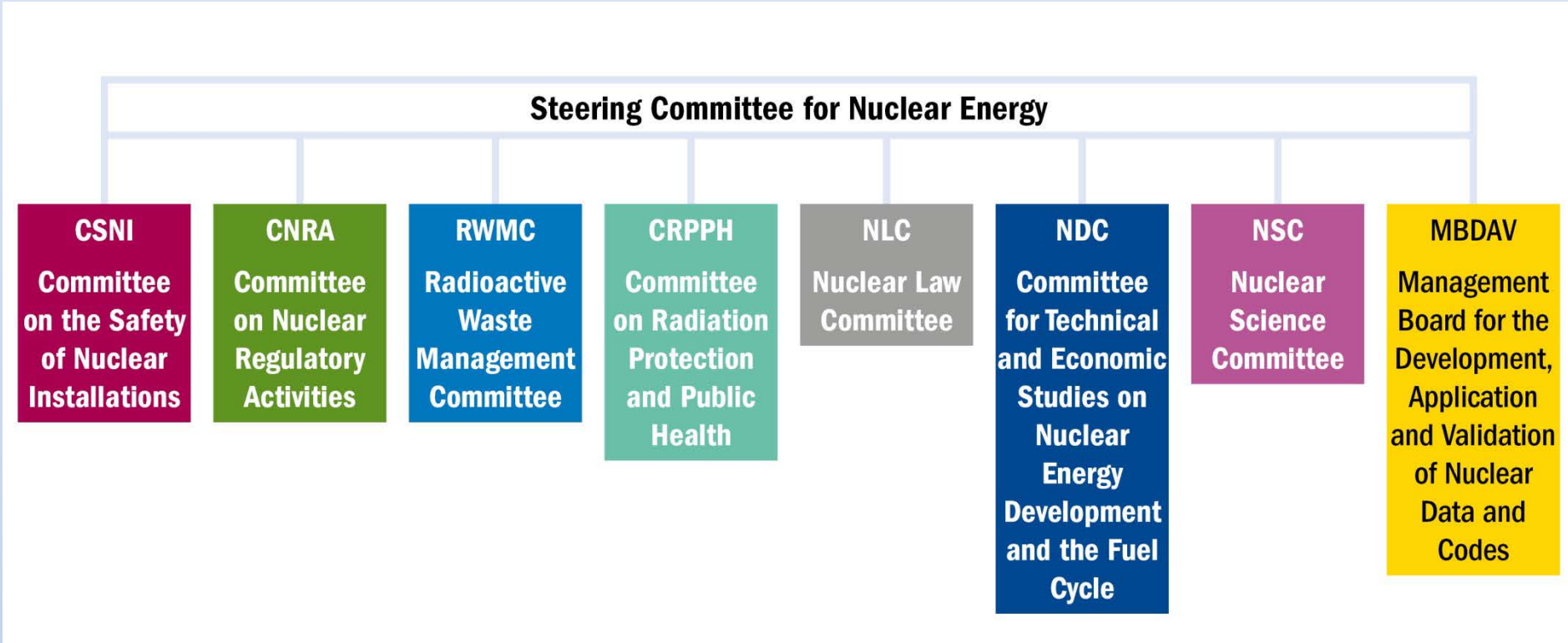
William D. Magwood, IV
Director-General
Nuclear Energy Agency

Meeting with the Atomic Energy Commission
4 July 2017

The NEA: 31 Countries Seeking Excellence in Nuclear Safety, Technology, and Policy

- 31 member countries + key partners (e.g., China)
- 7 standing committees and 75 working parties and expert groups
- The NEA Data Bank - providing nuclear data, code, and verification services
- 21 international joint projects (e.g., the Halden Reactor Project in Norway)

NEA Standing Committees



The NEA's committees bring together top governmental officials and technical specialists from NEA member countries and strategic partners to solve difficult problems, establish best practices and to promote international collaboration.

Major NEA Separately Funded Activities

NEA Serviced Organisations

- **Generation IV International Forum (GIF)** with the goal to improve sustainability (including effective fuel utilisation and minimisation of waste), economics, safety and reliability, proliferation resistance and physical protection.
- **Multinational Design Evaluation Programme (MDEP)** initiative by national safety authorities to leverage their resources and knowledge for new reactor design reviews.
- **International Framework for Nuclear Energy Cooperation (IFNEC)** forum for international discussion on wide array of nuclear topics involving both developed and emerging economies.

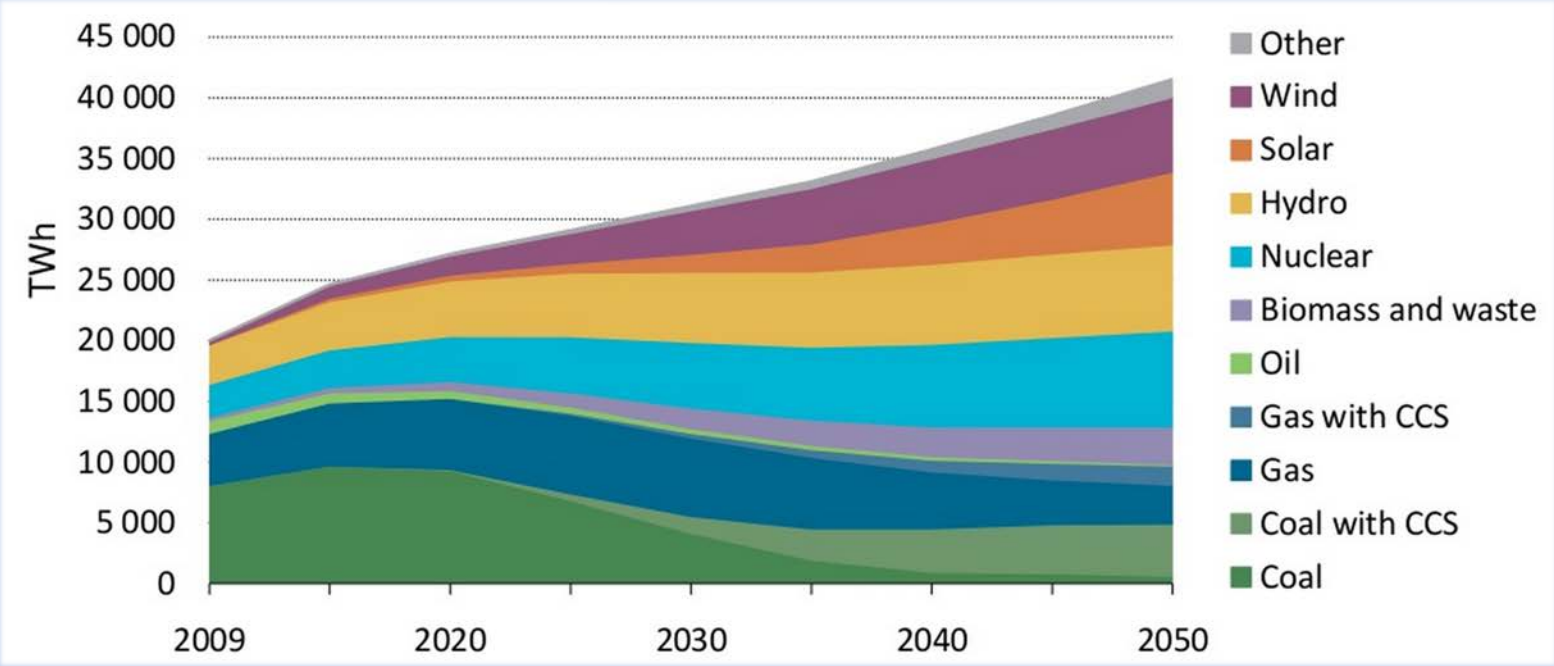
21 Major Joint Projects

(Involving countries from within and beyond NEA membership)

- **Nuclear safety research** and experimental data (e.g., thermal-hydraulics, fuel behaviour, severe accidents).
- **Nuclear safety databases** (e.g., fire, common-cause failures).
- **Nuclear science** (e.g., thermodynamics of advanced fuels).
- **Radioactive waste management** (e.g., thermochemical database).
- **Radiological protection** (e.g., occupational exposure).
- **Halden Reactor Project** (fuels and materials, human factors research, etc.)

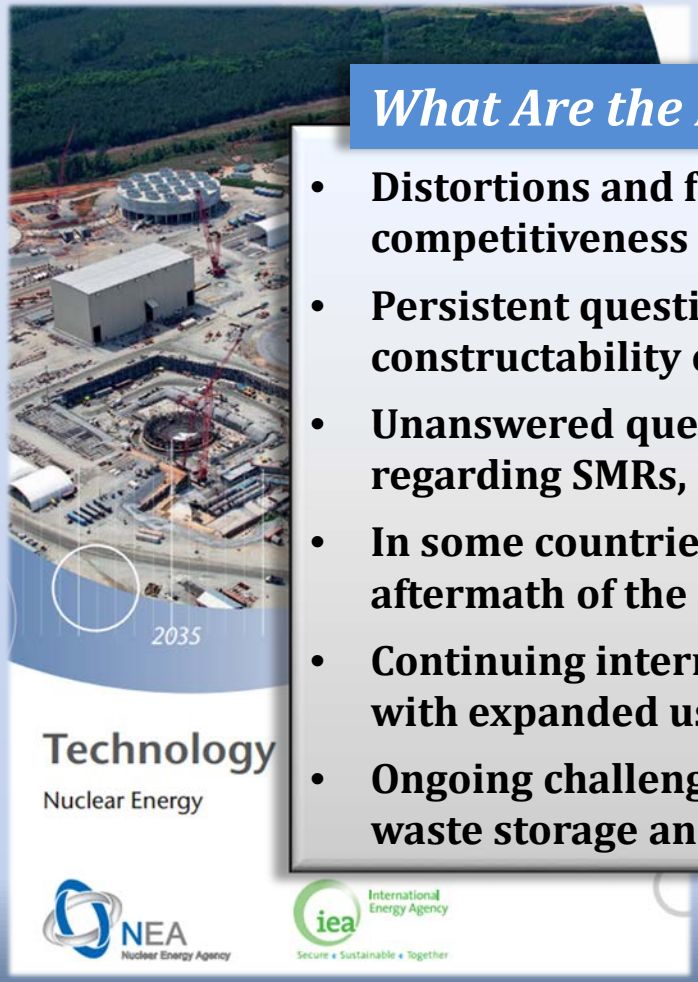
The Shared Worldwide Background

IEA 2°C Scenario:
Nuclear is Required to Provide the Largest Contribution to Global Electricity in 2050



Source: IEA

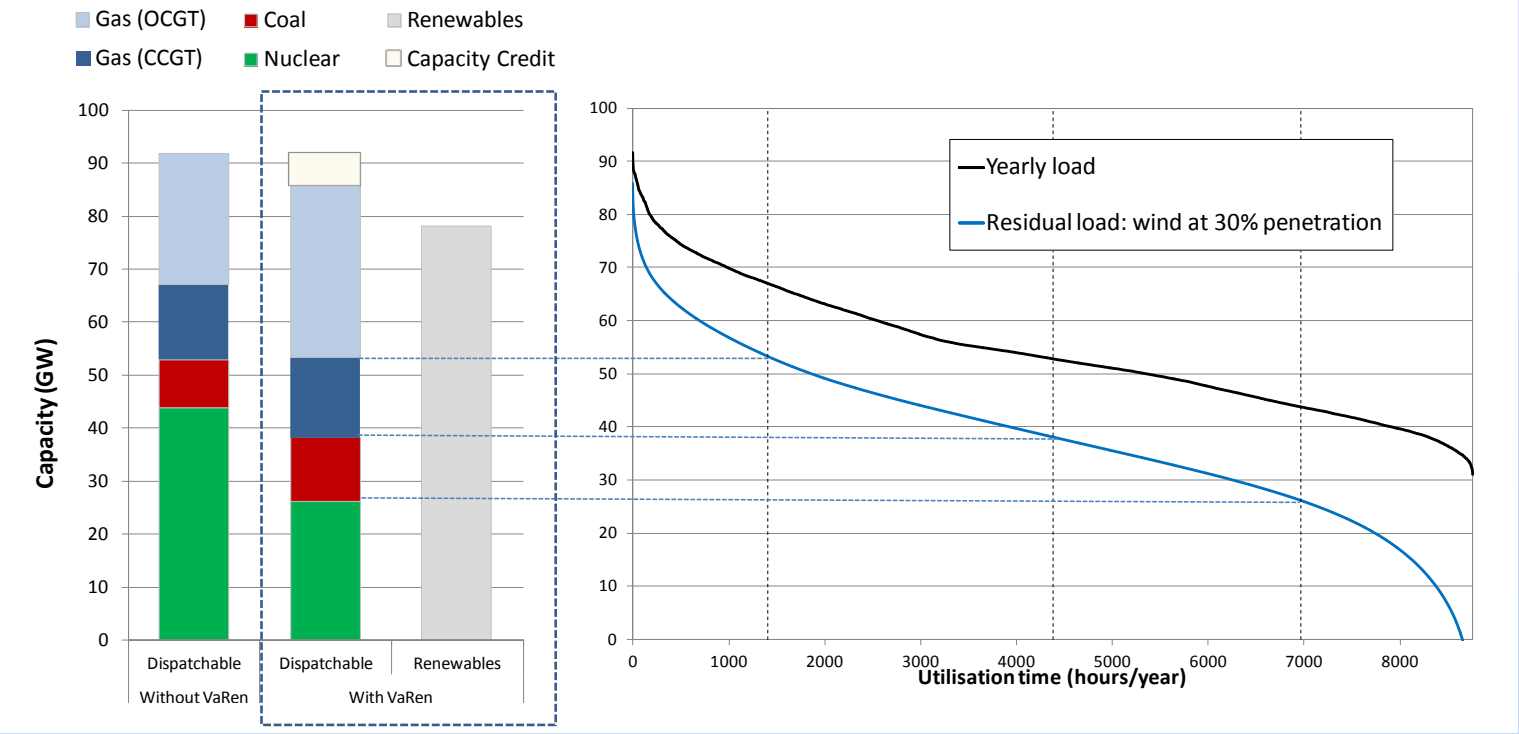
2015 NEA/IEA Technology Roadmap



What Are the Barriers to Large Global Expansion?

- **Distortions and failures in electricity markets that impact financial competitiveness of baseload plants**
- **Persistent questions about long-term operation of current plants and constructability of Gen III/Gen III+ plants**
- **Unanswered questions about technology, cost, and regulatory issues regarding SMRs, Gen IV reactors, and other advanced technologies**
- **In some countries, public acceptance concerns about safety in the aftermath of the Fukushima accident**
- **Continuing international concerns about non-proliferation associated with expanded use of civilian nuclear power**
- **Ongoing challenges in many countries regarding long-term high level waste storage and disposal**

VREs Restructure the Residual Mix with Uncertain Impacts on CO_2 Emissions



- Due to lower load hours, dispatchable technologies with high fixed costs (e.g., nuclear) will be displaced by technologies with low fixed costs (e.g., gas).
- The resulting system may become **more carbon-intensive** with uncertain impacts on overall emissions as well as **more expensive due to higher system costs.**

Source: NEA

A worldwide question: Nuclear, enabler for or victim from variable renewables?

- In numbers of countries with growing/high penetration of VRE
  - Higher system costs; decrease of the value created by VRE due to a strong correlation of their production; growing needs of flexibility generating higher cost for capitalistic generators…
- Risk of the present power market
  - Phasing out of dispatchable generators like nuclear
  - Collapse of the investments dynamic in an unpredictable market
  - ↗ of low capital intensive generators (gas) and ↗ CO_2 for nuclear countries
  - Grid stability and power quality at stake (safety issue for nuclear)
- Nuclear can mitigate these risks: CO_2-free baseload; provides the needed inertia to the grid; improve the security of supply…
  - But innovation is needed to assure that nuclear fits in the future, as yet uncertain, global energy framework

Future: Multinational collaboration to *Identify Key Nuclear R&D Needs and build Innovation Pathways*

NEA Nuclear Innovation 2050:

- Improve the progression from R&D to the successful deployment of innovation
- Develop a broad, common agenda for nuclear technology innovation to contribute to the sustainability of nuclear energy in the short/medium (2030) and long term (2050)
- Identify and find solutions to barriers or delays to innovation
- Identify infrastructure requirements and share global R&D assets
- Establish plans of action to enable deployment of technology innovations
- Consider multilateral approaches to obtain early regulatory insights without compromising regulatory independence

NI2050 Process: Example – Deployment of New Fuels

- Shared vison on the objective: improving safety/effectiveness through innovative fuel
- Develop multilateral consensus on innovation target areas and identify opportunities, bottlenecks, areas benefiting from collaborative approach
- Develop multilateral approaches to reduce cost/risk/timeline for fuel development

Today: cladding Development/ Qualification Time: Minimally 20 years!

Enabler
Advanced modelling & testing

Game changer
Multilateral testing & qualification, based on modelling and a streamlined approach to licencing

Impact
Reallocation of safety margins

Benefit
Improved safety & economy

Another Example of International Collaboration: GIF

Now, how to accelerate the implementation?

(date indicates signature of GIF Charter)

	Canada (2001)	China (2006)	France (2001)	Japan (2001)	Korea (2001)	Russia (2006)	RSA (2001)	Swiss (2002)	USA (2001)	EU (2003)
SFR		●	●	●	●	●			●	●
VHTR		●	●	●	●			●	●	●
LFR*				●	●	●				●
SCWR	●	●		●		●				●
GFR			●	●						●
MSR*			●			●		●	●	●

*All activities, except LFR and MSR (under a MoU), are carried out under a system arrange-ment.

Australia (2016)

Australia signed the Charter on 22 June 2016, and plans to sign the GIF Framework Agreement and become active in VHTR and MSR.

Argentina (2001) Brazil (2001) UK (2001)

Currently inactive GIF members

The Current Situation in Various Countries

Few Examples of Contrasted Situations

- North America, UK: welcoming the emergence and deployment of new technologies
- Russia and China: a strong national commitment supporting innovation and long-term competitiveness
- France: the inertia of a large and effective existing program
- Western Europe: dysfunctional electricity pricing, general ambivalence toward nuclear
- Eastern Europe: continued nuclear construction, significant financial challenges in some countries
- Latin America: continued interest in new build
- Japan and Korea: nuclear has been at the centre of energy security, but now experiencing significant public opposition
- Other Asia, Africa, Middle East: strong aspirations, unclear paths to deployment in most countries

Thoughts and Observations: *The Case of Japan* (1/4)

- **In the two decades leading up to 3/11, the Japanese Program was one of the most diverse and ambitious of all nuclear technology programs, with:**
  - Strong support from national leadership
  - Stable planning and funding over many years
  - Many highly trained scientists and engineers
  - Excellent infrastructure
  - Excellent international cooperation
  - Excellent non-proliferation and safeguards practices

Thoughts and Observations: *The Case of Japan* (2/4)

- **This is the right time to reflect on the next steps, noting:**
  - Japan imports about 95% of its primary energy
  - Japan relies on oil for 40% of primary energy, 80% of which comes from the Middle East
  - Variable renewables are growing (currently about 7% of electric generation today, up from 1% in 2010) and are expected to increase to 20% by the mid-2020s
  - Japan plans to reduce CO_2 emissions to 26% below 2013 levels (~18% below 1990 levels) by 2030

Thoughts and Observations: *The Case of Japan* (3/4)

- **Japan must do what is best for Japan, but should:**
  - Consider the issues and uncertainties regarding the cost, reliability, and stability of electricity generated by non-baseload capacity
  - Recognise that once lost, nuclear research capabilities are very difficult to restore
  - Recognise that electrification of energy use is very likely to grow considerably
  - Consider long-term competitiveness and the large investments in nuclear energy infrastructure and research made by fast-developing economies

Thoughts and Observations: *The Case of Japan* (4/4)

- **And be aware of Japan's unique role internationally:**
  - As a strong and respected voice in international nuclear technology fora such as the NEA
  - As a key partner for many countries and multilateral efforts such as GIF
  - As a leading source of many technology and manufactured components for nuclear facilities around the world
  - As a uniquely powerful voice in the arena of nuclear weapons non-proliferation

Closing Thoughts

- Electrification of energy use is very likely to grow considerably
  - Concerns about security of supply, reliability, stability of electricity may grow substantially in the coming years
- Regarding Japan and nuclear
  - Regaining public trust after 3/11 will take many years, but it can happen – as we saw in the US after the TMI accident
  - Japan's voice and leadership in nuclear can contribute shaping the future
- Nuclear is entering in a new world :
  - Current used nuclear technologies developed in the 60's / 70's by domestic organisations driven by a national strong strategy
  - Nowadays, developing future needed technologies requires an improved innovation process, with organisations working in an open market driven by a confidence to be continuously built worldwide

Thank you for your attention

More information @ www.oecd-nea.org

All NEA reports are available for download free of charge.

Follow us: