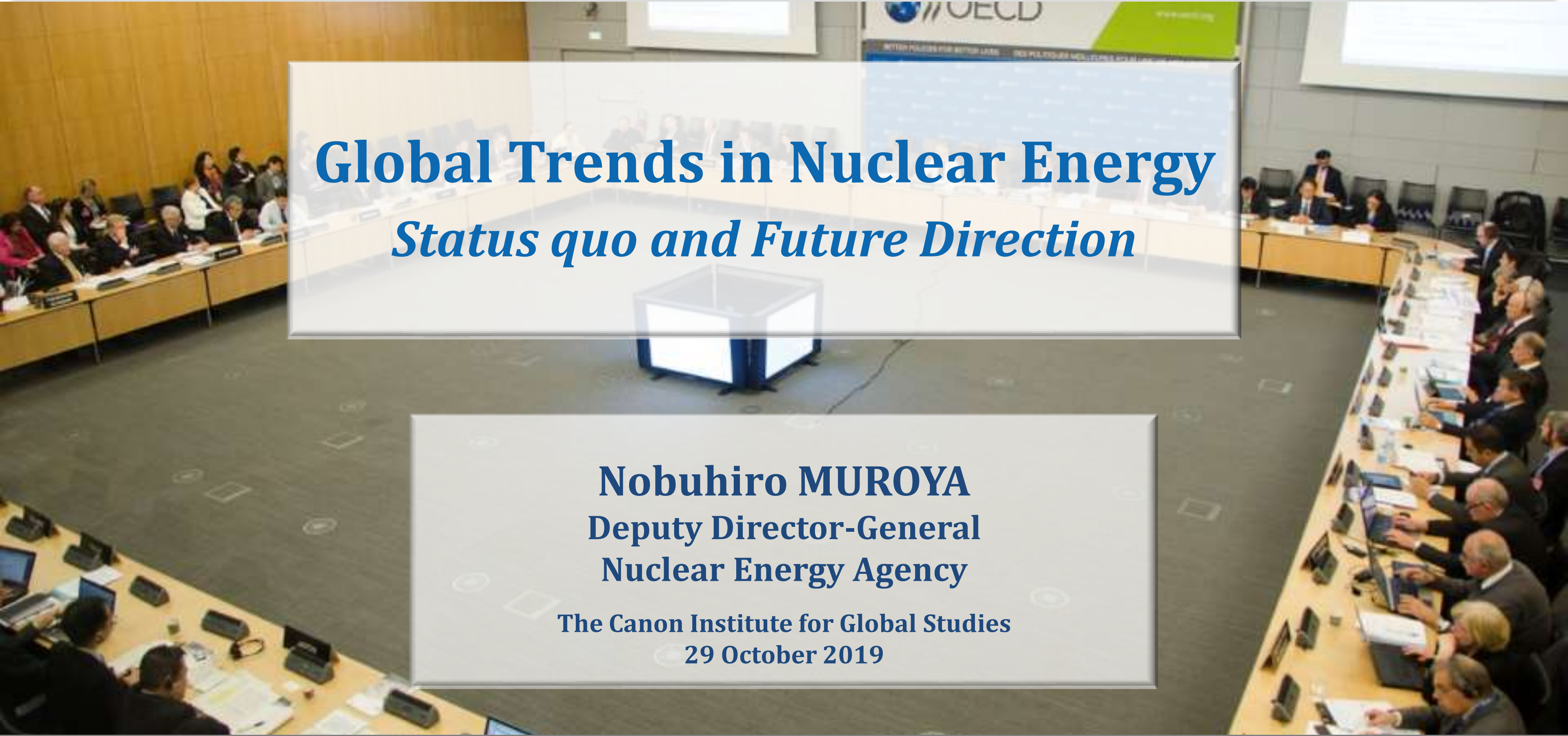


Global Trends in Nuclear Energy

Status quo and Future Direction

Nobuhiro MUROYA
Deputy Director-General
Nuclear Energy Agency

The Canon Institute for Global Studies
29 October 2019

1. **NEA (and IAEA)**
2. Today's Nuclear : A Global Picture
3. Historical Changes in Policy Agenda
4. Where are we going?
5. What is essential now?

The NEA: 33 Countries Seeking Excellence in Nuclear Safety, Technology, and Policy

- 33 member countries + strategic partners (e.g., China, India, etc.)
- 8 standing committees and over 80 working parties and expert groups
- The NEA Data Bank - providing nuclear data, code, and verification services
- 23 international joint projects

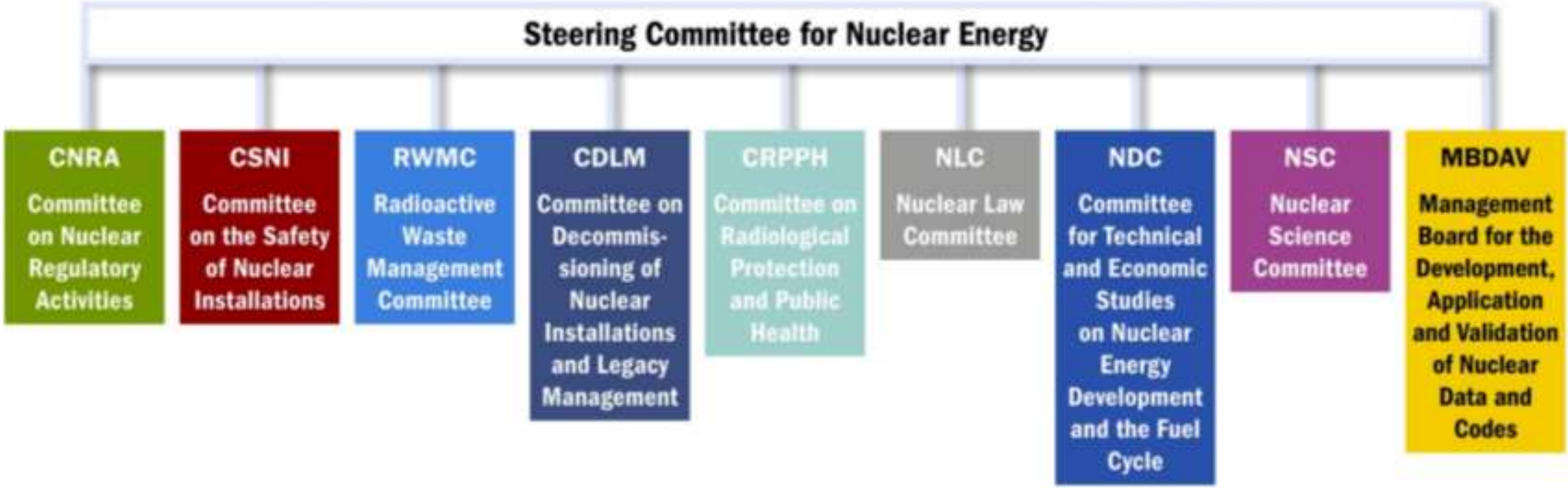
The NEA Serves as a Framework to Address Global Challenges

The Role of the NEA is to:

- **Foster international co-operation** to develop the scientific, technological and legal bases required for a **safe, environmentally friendly and economical use of nuclear energy** for peaceful purposes. ***(No activities related to Non-proliferation)***
- Develop authoritative assessments and forge **common understandings on key issues** as **input to government decisions** on nuclear technology policy.
- Conduct **multinational research** into challenging scientific and technological issues.

33 NEA countries operate more than 80% of the world's installed nuclear capacity

NEA Standing Technical 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 International Collaboratives

NEA Serviced Bodies

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

23 Major Joint Projects

(Involving member and non-member of NEA)

- **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.)

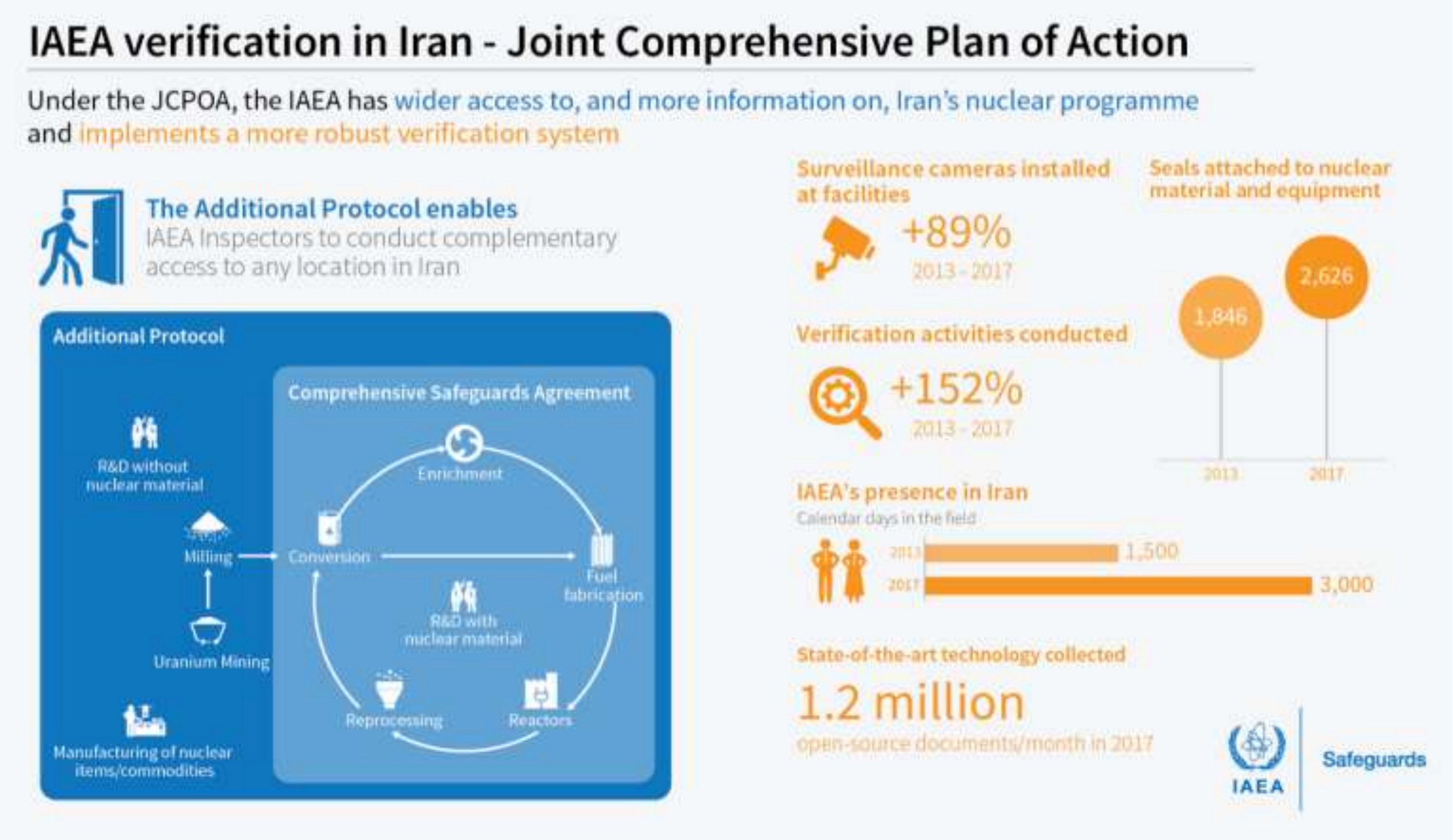
International Atomic Energy Agency (IAEA)

3 thematic priorities:

Peaceful Uses of Nuclear Technology / Safety and Security / Non-proliferation

IAEA main figures	
Year Founded	1957
Member States	170
Number of Employees	ca. 2,500
Laboratories	14
Headquarters	Vienna, Austria
Liaison Offices	Geneva, New York
Regional Offices	Toronto, Tokyo
Regular Budget	€362.5 million

"IAEA AT A GLANCE" (August 2018)


IAEA verification in Iran - Joint Comprehensive Plan of Action
Under the JCPOA, the IAEA has wider access to, and more information on, Iran's nuclear programme and implements a more robust verification system
The Additional Protocol enables
IAEA Inspectors to conduct complementary access to any location in Iran
Additional Protocol
Comprehensive Safeguards Agreement
R&D without nuclear material
Milling
Uranium Mining
Manufacturing of nuclear items/commodities
Enrichment
Conversion
Fuel fabrication
R&D with nuclear material
Reprocessing
Reactors
Surveillance cameras installed at facilities
+89%
2013 - 2017
Verification activities conducted
+152%
2013 - 2017
Seals attached to nuclear material and equipment
1,846
2,626
2013
2017
IAEA's presence in Iran
Calendar days in the field
2013
1,500
2017
3,000
State-of-the-art technology collected
1.2 million
open-source documents/month in 2017
IAEA
Safeguards

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Nuclear Energy : Global Picture

- **454 Operation Reactors (December 2018)**
- **10.2% of world gross electricity by nuclear (2017)**
- **9 New connection to grid (2018) :**
  China : 7 (Including AP1000, EPR), Russia : 2
- **5 New construction (2018)**
  Korea, Russia, Turkey, UK, Bangladesh
- **52 Under construction (2019-10-07) :**
  China (9), India (7), Russia (6), Korea (4), UAE (4)

(2018 NEA Annual Report)
(IEA Electricity information: Overview 2019)

Nuclear power in major countries

UK July 2019, WNA	▪ 15 Reactors in operation. Nuclear generates 72TWh(21%)of electricity(2016) ▪ Construction at Hinkley Point C (EPR) ▪ Plans at Sizewell (EPR), Bradwell (HPR1000), Wylfa (ABWR), Oldbury (ABWR)
France June 2019, WNA	▪ 58 Reactors in operation. Nuclear generates 403TWh(72%) of electricity(2016) ▪ Construction at Flamanville 3 (EPR) ▪ New Energy Strategy (November 2018) confirms share of nuclear electricity from 75% to 50% by 2035. 14 of 58 reactors to be shut down.
Germany March 2019, WNA	▪ 7 Reactors in operation. Nuclear generates 85TWh(12%) of electricity(2016) ▪ Phase-out plan and close all reactors by 2022.
US August 2019, WNA	▪ 98 Reactors in operation. Nuclear generates 807TWh(19%) of electricity(2016) ▪ Construction at Vogtle 3&4 (AP1000) ▪ Active development activities for next generation reactors are going on.

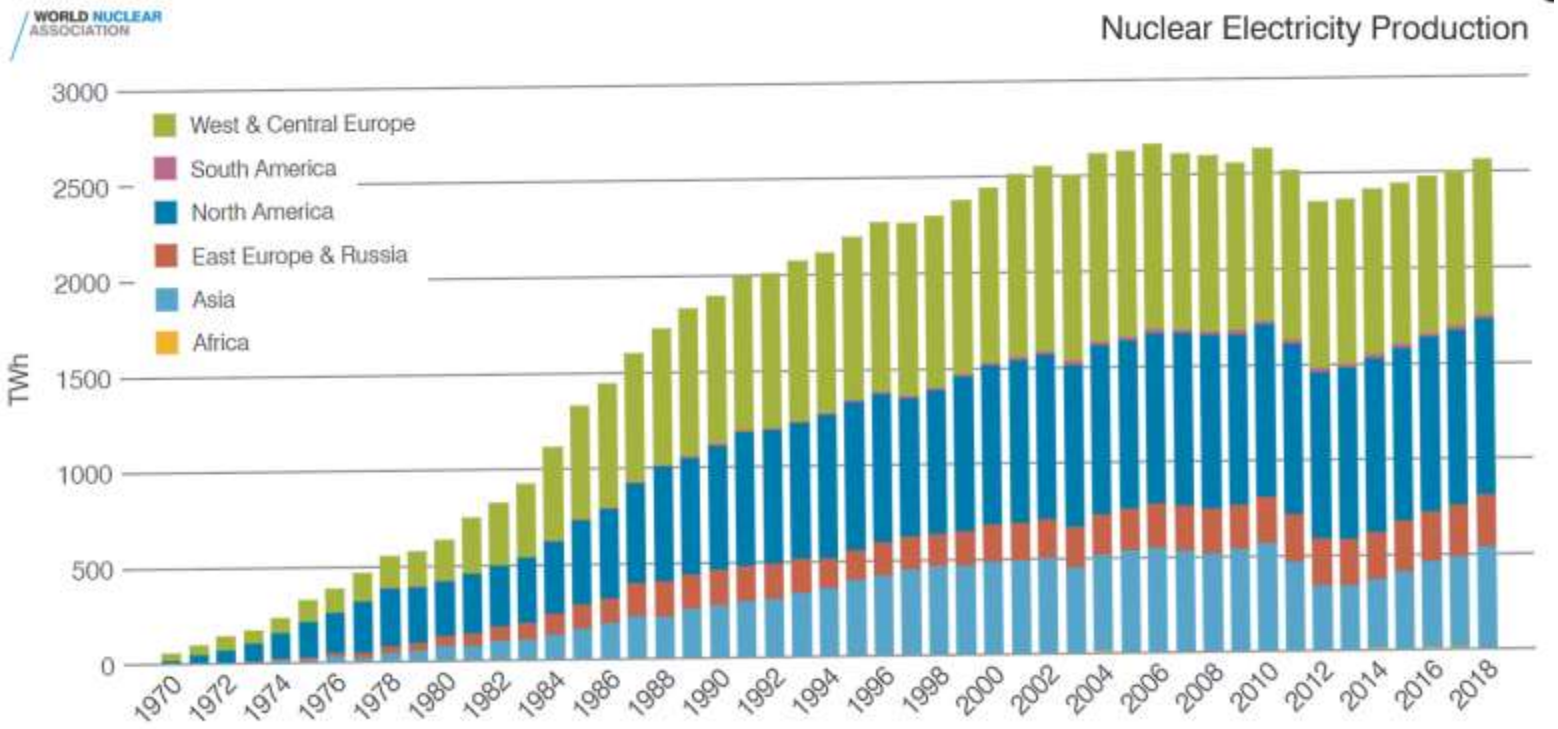
❖ **Japan**: 9 Reactors in operation. Nuclear generates 18TWh (1.7%) of electricity (2016)

Nuclear power in Emerging countries

China September 2019, WNA	▪ 45 Reactors in operation. Nuclear generates 213TWh(3.5%)of electricity(2016) ▪ 15 reactors under construction (including the ones about to start) ▪ Connecting 7 reactors to grid in 2018 (The first AP1000 and EPR) ▪ “Energy Development Strategy Action Plan 2014-2020” : 58GWe capacity (2020) with 30GWe more under construction.
Russia July 2019, WNA	▪ 36 Reactors in operation. Nuclear generates 197TWh(18%) of electricity(2016) ▪ 6 reactors under construction ▪ Actively exporting reactors. According to Roatom forecast, after 2020, global construction of about 16 units per year, with 4-5 of these potentially from Rosatom.
India February 2019, WNA	▪ 22 Reactors in operation. Nuclear generates 38TWh(2.6%) of electricity(2016) ▪ 7 reactors under construction ▪ Outside of NPT, India has been excluded from the trade, and indigenous technology.

❖ **Japan**: 9 Reactors in operation. Nuclear generates 18TWh (1.7%) of electricity (2016)

Nuclear Energy Agency



Source: World Nuclear Association and IAEA Power Reactor Information Service (PRIS)

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Outline History of Nuclear Energy

1895-1945:	The **science of atomic radiation, atomic change and nuclear fission** was developed (much of it in the last six of those years)
1939-45:	Most development was focused on the **atomic bomb**.
1945-:	Attention was given to **harnessing this energy in a controlled fashion** for naval propulsion and for making electricity.
1956-:	The prime focus has been on **the technological evolution of reliable nuclear power plants**.

World Nuclear Association (April 2019)

Change of Environment and Agenda of NEA

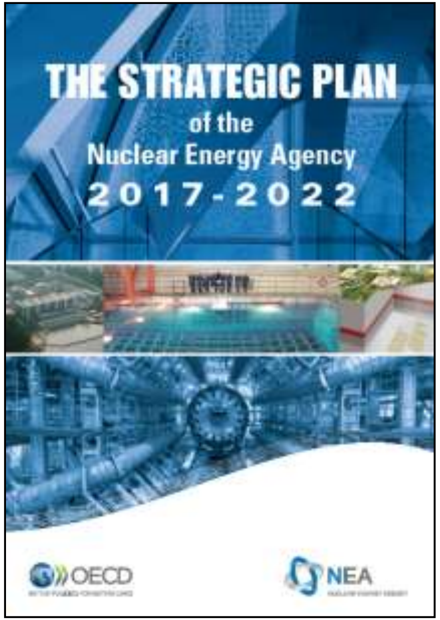
1960s ***Experimental phase of nuclear energy*** *evolved into commercial, industrial development.*	▪ Laying the **foundations** for nuclear co-operation. ▪ Focused on launching several **joint R&D undertakings: Halden and Dragon reactor** projects, and the prototype Eurochemic plant (reprocessing) .
1970s-80s *Increasing pressure to give greater* ***priority*** *to the* ***environmental*** *aspects and to the* ***safety*** *and regulation.*	▪ Emphasis on **providing a forum for co-ordinating the national nuclear programmes** of member countries, particularly in the health, safety and regulatory areas.
1990s- *Dissolution of the Soviet Bloc. Additional countries with reactors of Soviet design have become members.*	▪ Agency initiated a limited programme of outreach, focusing primarily on **the countries of Central and Eastern Europe and the former Soviet Europe**.
2011- *Fukushima-Daiichi-Accident and further enhancement of safety.*	▪ Agency initiated new activities based on **lesson-learnt from Fukushima**, including **human and cultural** aspect of nuclear safety.

The NEA Mission as of Today

- To assist its member countries in maintaining and further developing, through **international co-operation, the scientific, technological and legal bases** required for a safe, environmentally friendly and economical use of nuclear energy for peaceful purposes.

- To provide authoritative assessments and to forge **common understandings** on key issues, as **input to government decisions on nuclear energy policy**, and to broaden OECD policy analyses in areas such as energy and sustainable development.

The Strategic Plan of the Nuclear Energy Agency: 2017-2022



www.oecd-nea.org/general/about/strategic-plan2017-2022.pdf

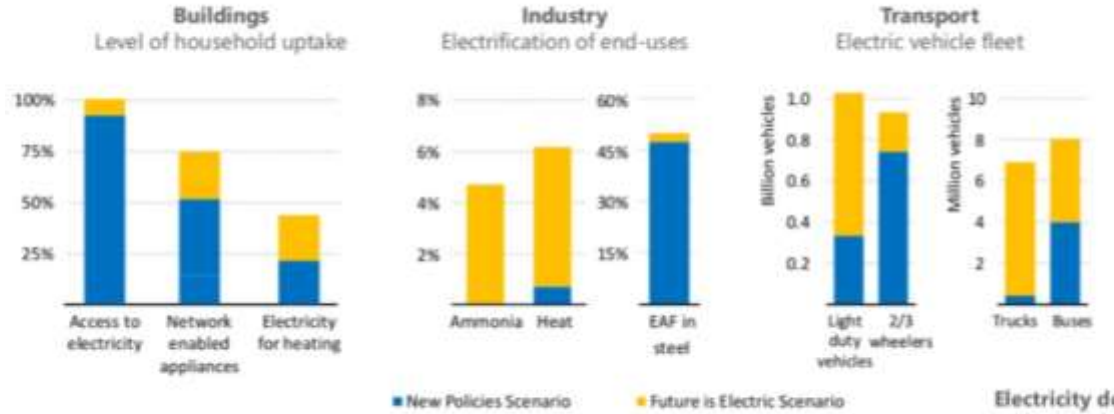
Major Agenda of NEA of Today

Policy Context	Agenda of NEA
Climate Change	Nuclear in the energy mix
Electricity Marketization / ***Economy of Nuclear***	Innovative cost analysis, such as "Full Costs of Electricity Provision", "Costs of Decarbonisation"
Safety *after Fukushima-Daiichi-Accident*	Safety improvement, Operating experience / risk-informed decision making, Enhancement of regulation framework, Long-term learning based on safety study, Human reliability to ensure safety, Resource for emergency response, Public communication/ stakeholder involvement, International cooperation for improving safety
Advancement of ***Technologies***	Nuclear innovation (Advanced Reactor System, SRM, etc.)
Maturing Nuclear Utilization: ***waste management***	Radioactive Waste Management Approaches and Strategies, Repository Safety and its Safety Case, Decommissioning and legacy waste management
Knowledge management	Need for international co-operation in the area of Knowledge Management (KM)

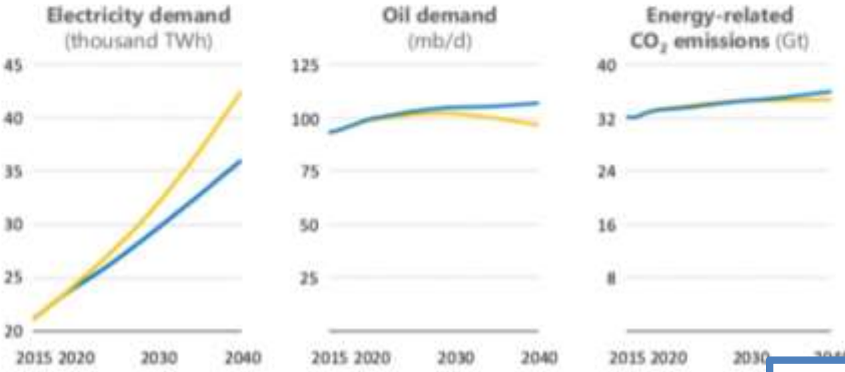
COP 21 and Energy Production

- UN-sponsored meeting concluded with 195 countries agreeing to develop approaches to limit global warming to below 2° C.
- Energy represents 60% of global CO_2 emissions - ¾ of global electric power production today is based on fossil fuels.
- Many countries – including China and India indicate that nuclear will play a large role.

Electrification of all Energy Sectors



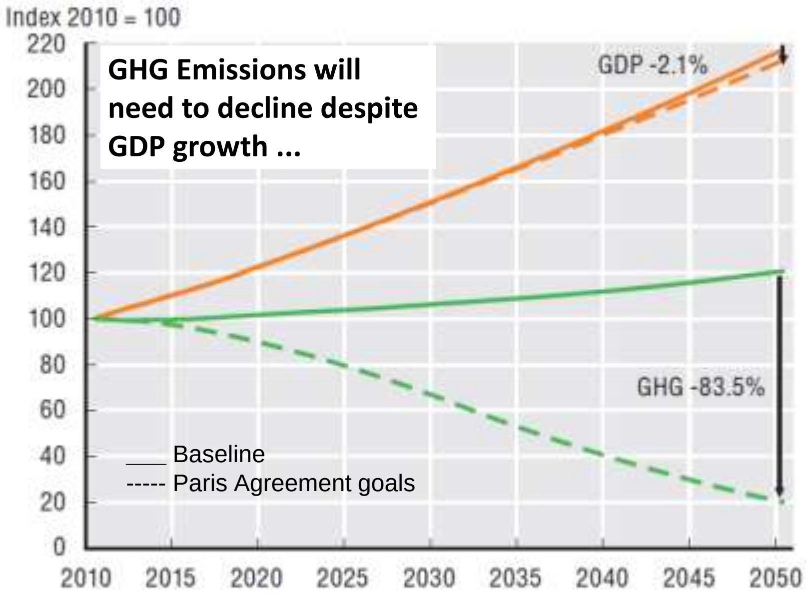
- ❖ Increased global access to electricity
- ❖ Increased electrification of all end uses



- ❖ Need for improved infrastructures to ensure interconnectivity
- ❖ Need flexibility - interconnectivity is not enough
- ❖ Need market signals fostering investment in new flexibilities & capacity
- ❖ Co-ordination in policy and regulation

Source: OECD/IEA WEO 2018

Paris Agreement Implies a 50 gCO2/kWh Target

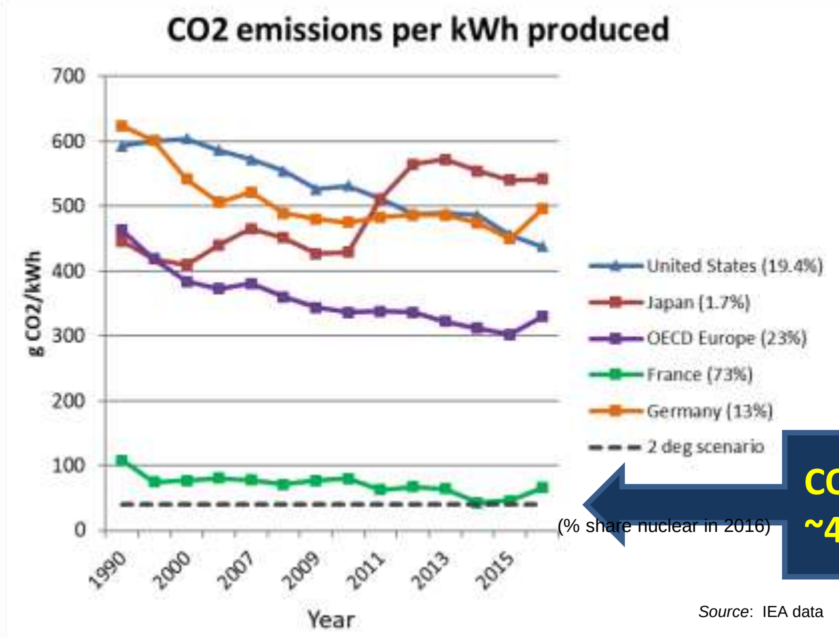


- Paris Agreement is intended to hold "increase in global average temperature to well below 2°C".
- Current emission intensity is 570 gCO2/kWh - target is 50 gCO2/kWh
- Electricity contributes 40% of global CO2 emissions and will play key role. Annual emissions from electricity will need to decline 73% (global) and 85% (OECD countries).

Source: OECD Environmental Outlook

Electricity Mix and Carbon Footprint

(g CO_2 per kWh produced)



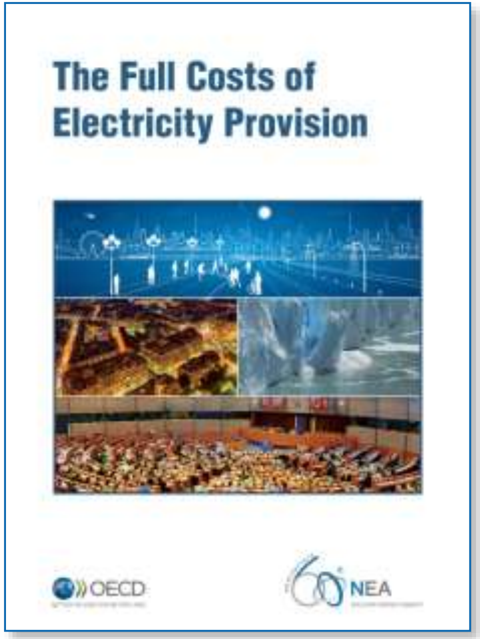
Source: IEA data

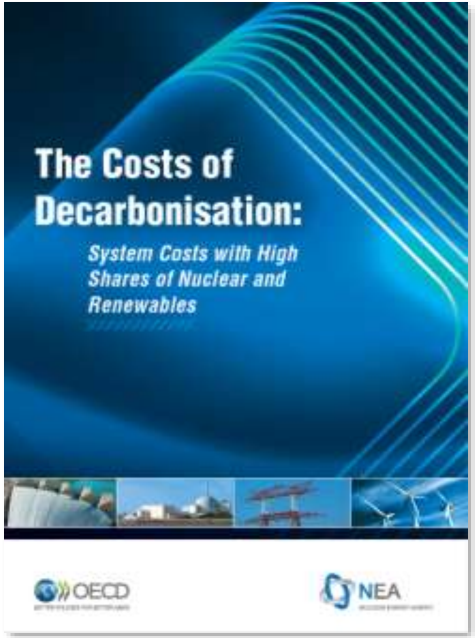
COP 21 Objective: ~40g CO_2 /kWh

Main trends:

- US: coal to gas switch
- Japan: long period to restore nuclear capacity, increased use of fossil fuels
- France: reduced use of fossil fuels, increased VRE
- Germany: reduced nuclear, increased fossil fuels and VREs

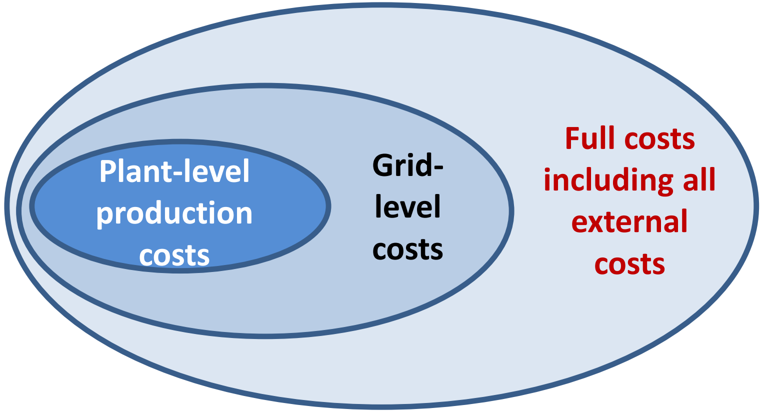
Recent NEA Analyses: The Electricity Markets Must Be Modernised

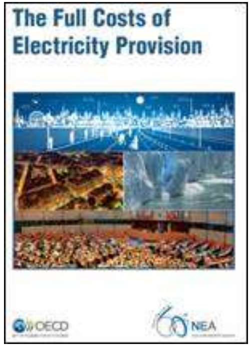




All Costs Should be Reflected in Decisions

- **Market prices and production costs account for an important share of the overall impacts of electricity.**
- **However, the market value of electricity is not the whole story:**
  - System or "Grid-level" Costs
  - Atmospheric pollution, climate change risks and land-use
  - Impacts on security of supply and societal costs
- **The price of electricity in today's markets does not accurately reflect the FULL COSTS of electricity, which include the impacts on society and the environment.**



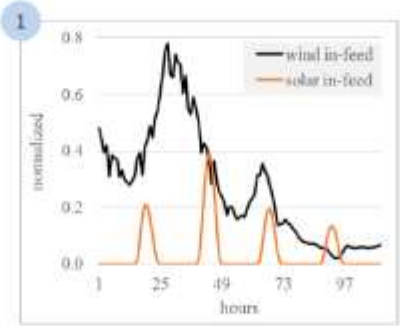


http://www.oecd-nea.org/ndd/pubs/2018/7298-full-costs-2018.pdf

Assessing the System Costs of Electricity

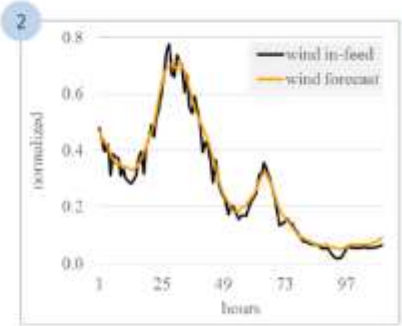
- **Total system costs are the sum of plant-level generation costs and grid-level system costs**
- **System costs are mainly due to characteristics intrinsic to variable generation**

Source: L. Hirth



VREs are not always available

Profile costs (Changing mix)



VREs are difficult to predict

Balancing costs (Short-term variations)

Good VRE sites are distant from load centers

Transmission and distribution costs

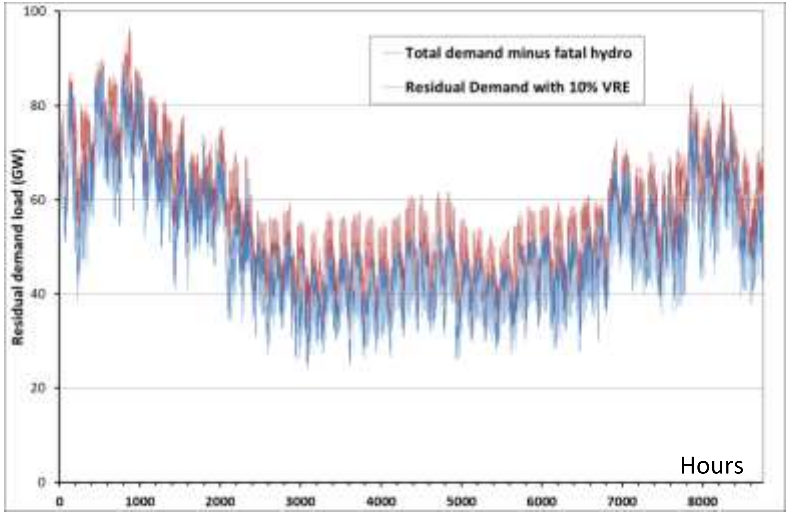
System costs depend on:

- Local & regional factors and the existing mix
- VRE penetration and load profiles
- Flexibility resources (hydro, storage, interconnections)

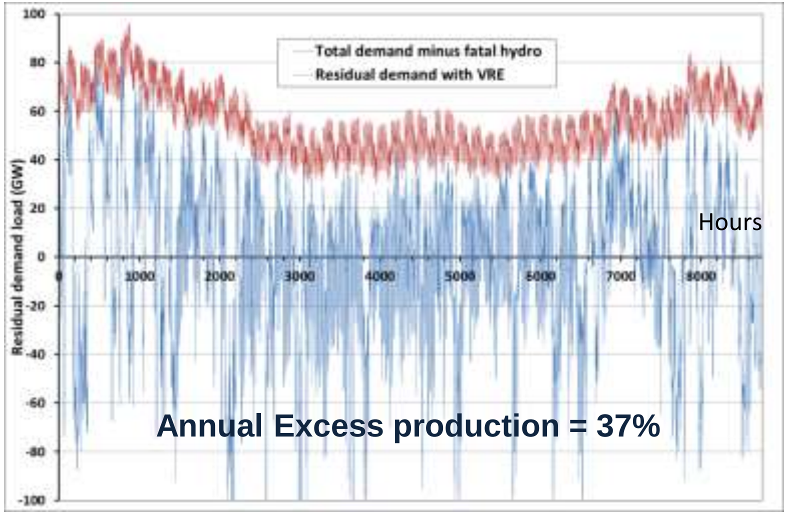
Additional impacts on load factors of dispatchable generators and prices.

High VRE Shares Result in Large Inefficiencies

10% Variable Renewables

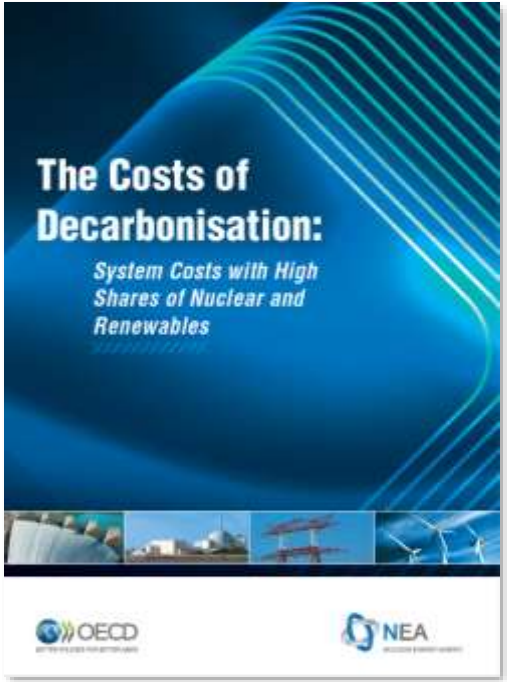


75% Variable Renewables



- **High VRE penetration result in challenges** for system management.
- Residual demand (**BLUE** line) – the available market for **dispatchable generation becomes volatile and unpredictable.**

Policy Recommendations for Cost-efficient Decarbonisation



Decarbonising the electricity sector in a cost-effective manner while maintaining security of supply requires:

- **Recognising and allocating system costs** to the technologies that cause them
- Encouraging **new investment in all low-carbon technologies** by providing stability for investors
- Enabling **adequate capacity, transmission and distribution, and flexibility**
- Implementation of **carbon pricing** – the **most efficient approach** for decarbonising electricity

Key Observations (1)

- Large deployment of VRE will occur around the world and provide important benefits.
- The contribution of VRE in each country will depend on the cost of available resources – **low cost for VREs can offset system costs and allow greater deployment.**
- However, **significant questions remain as to whether VRE penetration above 40-50% is realistic** without major technological development.

Key Observations (2)

- According to Eurostat, CO_2 emissions in the EU increased **1.8 percent in 2017** despite a 25 percent increase in wind power and 6 percent growth in solar.
- The IEA finds that energy-related CO_2 emissions reached a historic high of 33.1 Gt in 2018, up 1.7% on 2017.
- **Nuclear energy can be a large part of the solution**—if the markets can be modernized and nuclear technology adapts to future, still-evolving energy framework.

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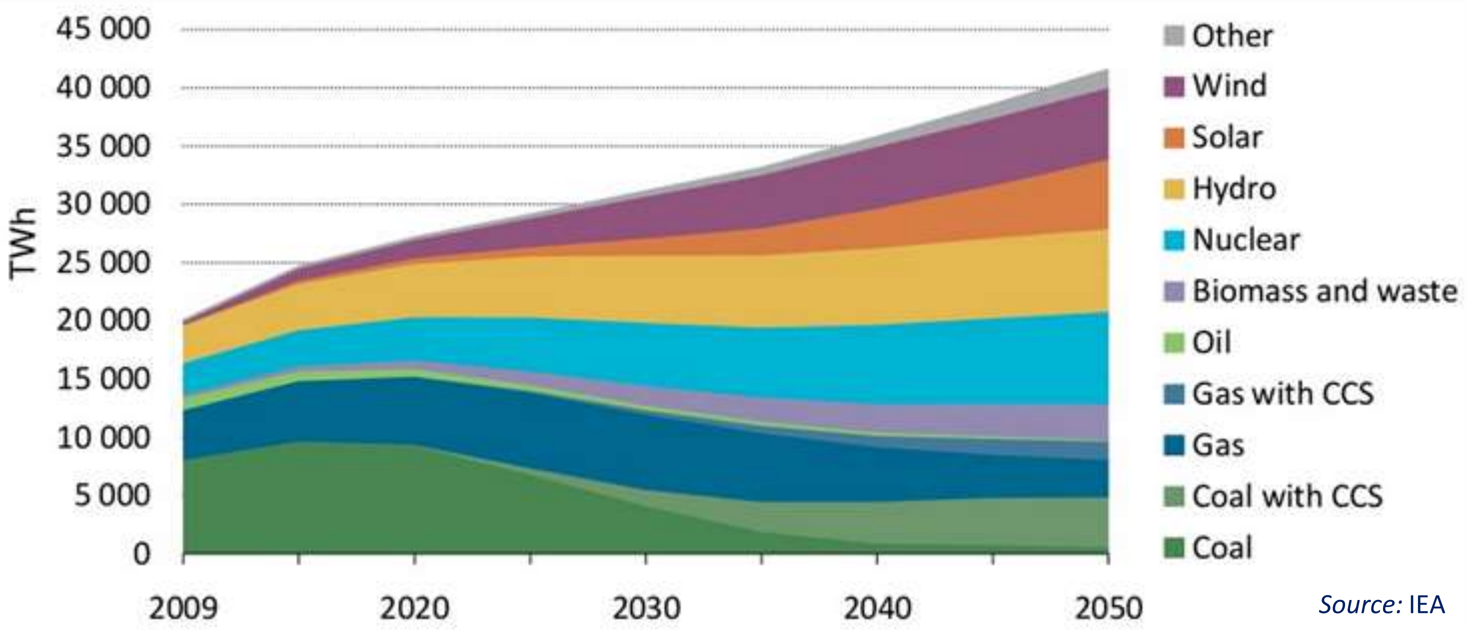
IEA 2°C Scenario:

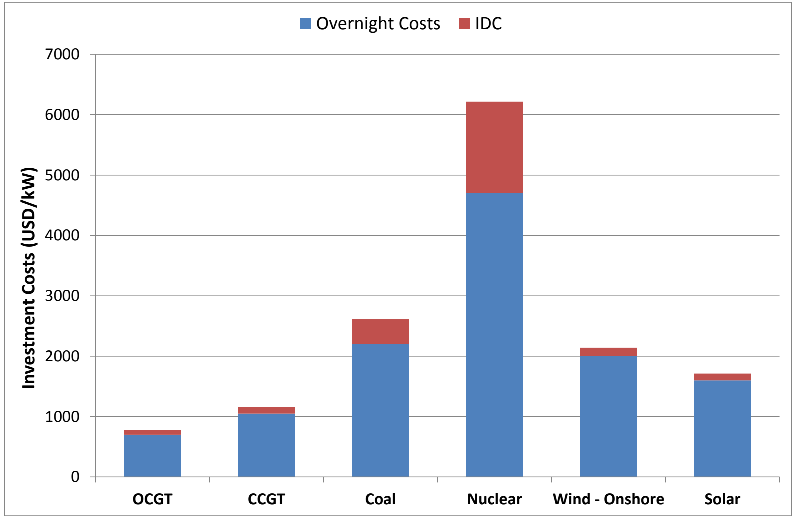
Global Nuclear Capacity is Required to More Than Double by 2050



Source: IEA

If Markets are Repaired

Is Nuclear Cost Competitive?



Overnight Construction Costs for Plants Built in 2020

Source: NEA

- In today's market, the **capital cost of nuclear power is a major issue.**
- **Lack of construction experience** and weak supply chains make construction costs uncertain.
- As the **costs of alternatives drop, these high costs become unsustainable.**

Small Modular Reactors

- **New Deployment Models** : Low cost modules can be installed as needed
- **Higher Flexibility** : Small reactors may load-follow and be deployed in niche markets
- **Manufacturability** : Enables factory construction, increasing quality and reducing cost, uncertainty, and schedule risk
- **Safety** : SMRs typically have small potential source term and large water inventories; potential for no need for offsite emergency response

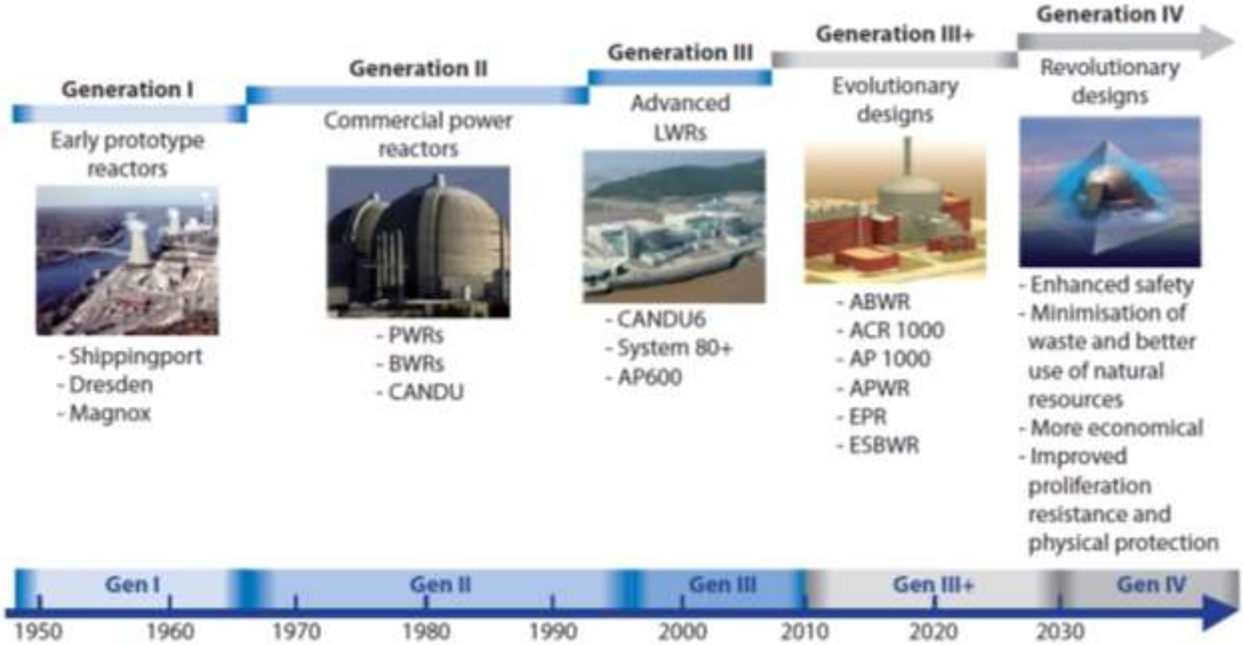
Growing Global Interest

- First technologies now nearing regulatory approval
- Major technology projects underway in US, France, UK, and other countries
- High interest in both OECD countries and developing economies

NuScale Conceptual Design

Generation IV:

20 Years of R&D Activity But No Demonstrations in OECD Countries



Nuclear Innovation Headwinds:

Little Progress in the Last 25 years

INFRASTRUCTURE

- Unlike many other areas of innovation, nuclear technology often requires the availability of special facilities (test reactor, hot cells, test loops, etc.) and nuclear-skilled workers.
- Tests using fissile materials require appropriate facilities, trained workforce, security and licencing.
- Much of the global infrastructure was built more than 40 years ago and is shrinking steadily.

REGULATORY

- The job of today's nuclear regulatory organisations is to assure public safety, not to promote innovation.
- Regulators in most countries will not actively participate in technology development – but will wait for the finished technology to be presented for approval.
- Regulators are often viewed by researchers and industry as a barrier to innovation.

COST

- Nuclear technology research budgets have been under pressure in most countries for the last decade.
- Nuclear technology often requires an order-of-magnitude increase in funding to transition between research and engineering-scale demonstration.
- The cost and risk of nuclear technology innovation has become prohibitive in many countries.

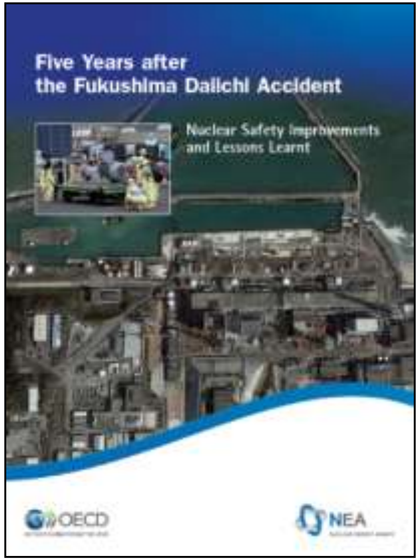
NEA's activities on Post Fukushima Accident

NEA 2013 Report: Nuclear Safety Response and Lesson Learnt

- Safety review on nuclear power plants in NEA's member country, and the further safety improvement

NEA 2016 Report: Nuclear Safety Improvements and Lessons Learnt

- Safety improvement (Operating experience and study)
- Operating experience and risk-informed decision making
- Enhancement of regulation framework
- Long-term learning based on safety study
- Human reliability to ensure safety
- Resource for emergency response
- Public communication and stakeholder involvement
- International co-operation for improving safety



NEA's activities on Contributing to Fukushima Decommissioning

BSAF Joint Research Project: Evaluation and Analysis on Accident Progression

- Phase 1: 2012-2014
- Phase 2: 2015-2018

SAREF: Safety Research Opportunities Post-Fukushima

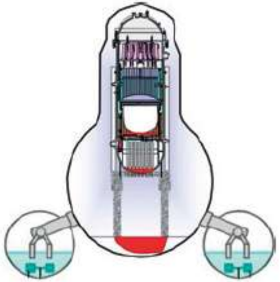
- Study based on 1F data to identify prioritization on safety study and decommissioning

SAREF Near-term join research project

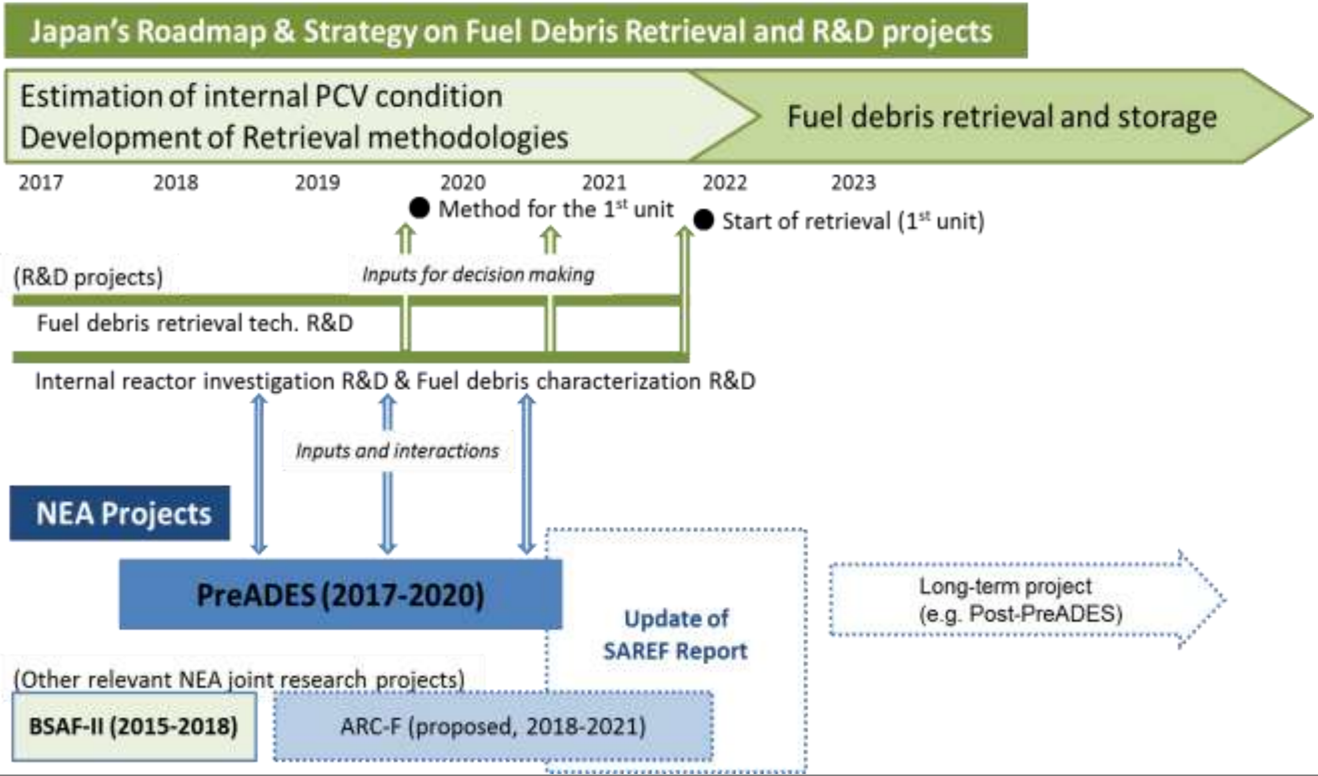
- PreADES: Preparatory Study on Analysis of Fuel Debris
- ARC-F: Collection, compilation and management of data and information coming from examinations inside reactor buildings & containment vessels & water sampling


Safety Research Opportunities Post-Fukushima

Initial Report of the Senior Expert Group


Source: NEA (2015).

Support for Fuel Debris Strategy Planning



NEA countries' shared vision

Building up talented individuals is a long term investment, for every country, requiring strategic vision and involvement

Need for ***international co-operation*** in the area of **Knowledge Management (KM)**

- To guarantee the worldwide sustainability and availability of necessary skills in the nuclear area, not just safety

- To preserve, transfer, share and create **knowledge** for the next generation and address both ***Explicit*** and ***Tacit*** knowledge

NEA Nuclear Education, Skills and Technology (NEST) Framework

- *Fast-track process* to create the next generation of nuclear **experts and professionals** through transfer of practical experience and expertise.
- International **co-operation** allows access to a critical mass of capacities (infrastructures, construction projects, decommissioning activities) available within the NEST membership to NEST Fellows.
- Platform to raise **awareness** and address collectively shared concerns and **challenges** about nuclear **knowledge** management (including Education and Training).

NEST current projects

NEST Management Board

Safety

PAUL SCHERRER INSTITUT PSI

- Safety relevant phenomena in containments during accidents.
- It offers hands-on training opportunity during the experimental test campaigns carried at the PSI PANDA facility, one of the most advanced containment test facility.
- In parallel, it also aims to develop exploratory research projects under the guidance of experts at Participating Organisations, in particular within the universities.

SMRs

McMaster University

- Integrate SMR research projects from the individual Participating Organisation countries into a broader and more impactful program.
- It will includes elements of technology assessment and development, regulatory framework, societal Issues, spent fuel management and SMR economics.

Robotics for Decommissioning

CLADS Collaborative Laboratories for Advanced Decommissioning Science

- Advanced remote technology for decommissioning under intense gamma-ray radiation environments.
- Seminars, site tours, and practical exercise.
- At JAEA Nahara Remote Technology Development Centre where NEST Fellows can use virtual reality to understand the circumstances inside a reactor building, virtual operations by simulated remotely operated robot. A longer program will include also R&D tasks.

i-graphite RWM

РОСАТОМ

- Main issues of i-graphite management, including characterization, decontamination and disposal.
- Hands-on training will consist of several activities which will make use of the fully-fledged infrastructure, pilot & experimental facilities present at the POCATOM site.
- Manufactured equipment for i-graphite remote sampling, graphite incineration facility, and RW repository mock-up models for investigation of geological barriers.

NEA NEST Secretariat

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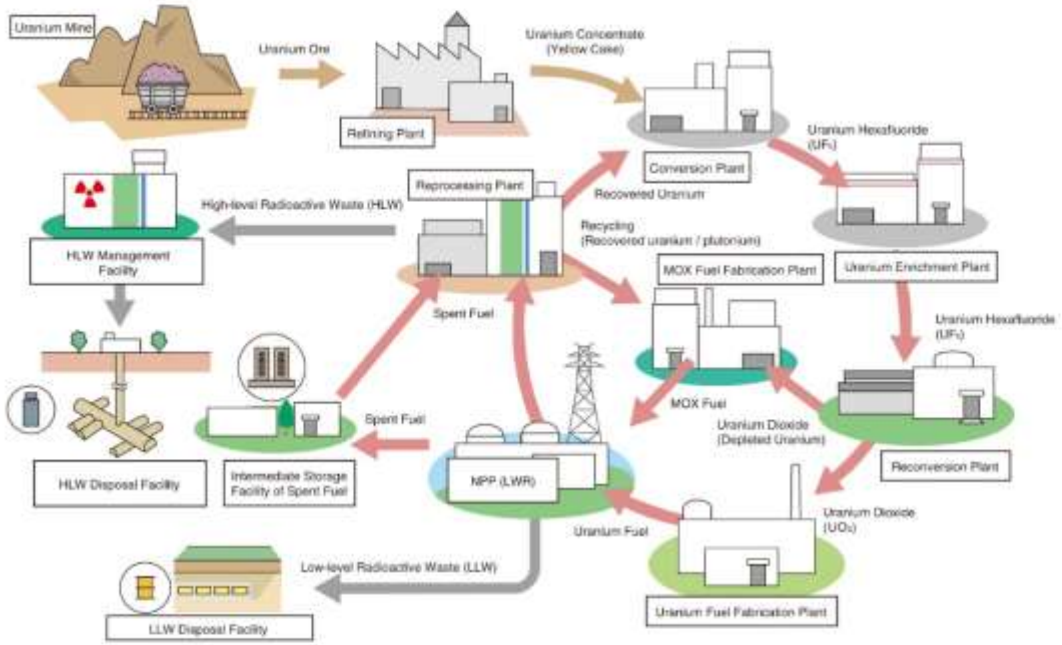
Nuclear Fuel Cycle



(Note) MOX Fuel: Uranium-Plutonium mixed oxide fuel

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Japan Atomic Energy Relations Organization (JAERO) homepage

Reference

"Basic Policy for Nuclear Energy"

JAEC adopted on July, 20, 2017, and the cabinet decided on July 21, that government will respect it (for the first time in 12years since the formulation of the Framework of Nuclear Energy)

1. Changing Environment Surrounding Nuclear Energy

- A need exists to **sincerely address the public distrust and anxiety** about nuclear energy and **rebuild social confidence**
- **A new competitive electric power market has emerged** with full liberalization of the retail electricity market
- **Further substantial reduction of CO2 emissions over a long term** will be **difficult to achieve simply by applying existing countermeasures**
- Increased use of thermal power stations and introduction of a feed-in tariff (FIT) system for renewable energy have led to higher electricity tariffs, which have had **a major negative impacts on people's livelihood and economic activities**

2. Fundamental issues ingrained in nuclear energy-related organizations

- The unique mindset and groupthink in Japan, the pressure to conform tacitly or **forcibly to the opinion of the majority**, and the tendency to maintain the status quo are all very strong, and they can be a problem.
- Another tendency within organizations is to lapse into **sub-optimization**. Creating a culture in which people can exchange a variety of opinions based on solid grounds, regardless of their standing inside or outside the organization, is necessary.

3. Basic objectives and important initiatives of nuclear energy use

- Appropriate use of nuclear energy with thorough risk-management by responsible organizations is necessary.
- It is important to proceed with the use of nuclear energy with peaceful use and safety assurance as basic preconditions, winning the confidence of the people and bearing in mind both benefits and costs that nuclear technology can bring to the environment, people's livelihood, and economic activities.

1. ***Seriously reflect on the Fukushima accident and learn lessons therefrom***
   - **Establish a safety culture that overcomes weakness** of traditional Japanese organizations and national cultures.
   - **Shift in safety assurance of a "culture of prevention"** by promotion of risk management.
2. ***Pursue nuclear energy use addressing global warming issues and people's livelihood and the economy***
   - The National Government needs to **clarify the role that nuclear power generation can play over a long term and examine necessary measures** therefor.

3

(Japan Atomic Energy Commission HP)

Reference
"Basic Policy for Nuclear Energy"

JAEC adopted on July, 20, 2017, and the cabinet decided on July 21, that government will respect it (for the first time in 12years since the formulation of the Framework of Nuclear Energy)

3. Basic objectives and important initiatives of nuclear energy use

3. Nuclear energy in the global context

- Collect and share international knowledge and experiences; improve international awareness

4. Peaceful use of nuclear energy: enhancing non-proliferation and security regimes

- Take steps to assure the international community of Japan's peaceful use of plutonium; Ensure the plutonium balance and responsible plutonium management; consume plutonium in the form of MOX fuel for light water reactor

5. Rebuilding public trust, as a major precondition

- Create an information base for people to be able to deepen their understanding of the circumstances surrounding nuclear energy use in Japan based on scientifically accurate information and objective facts (evidence)

6. Steadily pursuing decommissioning and radioactive waste disposal

- The resolute implementation of disposal of radioactive waste by the current responsible generation.

7. Expanded use of radiation and radioisotopes

- Develop necessary infrastructure to enable further use of radiation and radioisotopes including the use of quantum beams.

8. Strengthening the foundations for the use of nuclear energy

- R&D institutions and nuclear industry should collaborate and develop a deep and broad knowledge base.
- Securing qualified human resources and improving human resources development including on-the-job training

(Japan Atomic Energy Commission HP)

In light of the fact that the environment surrounding nuclear energy will keep changing substantially in the coming years, "Basic Policy for Nuclear Energy" is to be reviewed and revised, as necessary, basically every five years or roughly every five years.

Outline of Nuclear White Paper (2018) by JAEC

「平成30年度版原子力白書」の構成

「原子力利用に関する基本的考え方（平成29年7月原子力委員会決定）」の構成に基づき、特集、各章（1章～8章）の構成とし、関係各省の協力により作成。

【特集】:原子力施設の廃止措置とマネジメント

原子力分野において重要度が増す**研究開発施設等の廃止措置、放射性廃棄物への対応**について、**海外の先進事例の紹介**や**工程・技術、信頼等の強化に資する管理手法を分析**。

【本文】

- 第1章「**福島の着実な復興・再生**と教訓を真摯に受け止めた**不断の安全性向上**」
- 第2章「地球温暖化問題や国民生活・経済への影響を踏まえた**原子力のエネルギー利用の在り方**」
- 第3章「**国際潮流**を踏まえた国内外での取組」
- 第4章「**平和利用と核不拡散・核セキュリティ**の確保」
- 第5章「原子力利用の前提となる**国民からの信頼**」
- 第6章「**廃止措置**及び**放射性廃棄物**への対応」
  ※「特集」と異なり、東電福島第一原発事故後の廃止措置や高レベル放射性廃棄物の地層処分等の廃止・処分の現況を記載。
- 第7章「**放射線・放射性同位元素**の利用の展開」
- 第8章「原子力利用の**基盤強化**」

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(Japan Atomic Energy Commission HP)

What is essential now : Japan

- Japan's policy covers **all, globally recognised as important, aspects of nuclear energy**.
- However, Japan's **uniqueness is highly complicated Nuclear Fuel Cycle (NFC)** as Non-Nuclear Weapon State.
- Hence, it is **essential to continuously review validity of NFC**, particularly about **Pu-separation and its use**, and necessary action to be triggered.
- **Environment completely changed** since decision made for NFC.
- Urgent necessity of addressing **decommissioning and waste management**. Delayed decision and action will cause limited options and higher cost.
- Time for **revisiting nuclear policy** and clear decision is awaited.

Thank you for your attention

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