Nuclear Research and Innovation: Successes and Accomplishments Looking to the Future

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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 75* working parties and expert groups
- The NEA Data Bank - providing nuclear data, code, and verification services
- 24* international joint projects

*as of December 2018

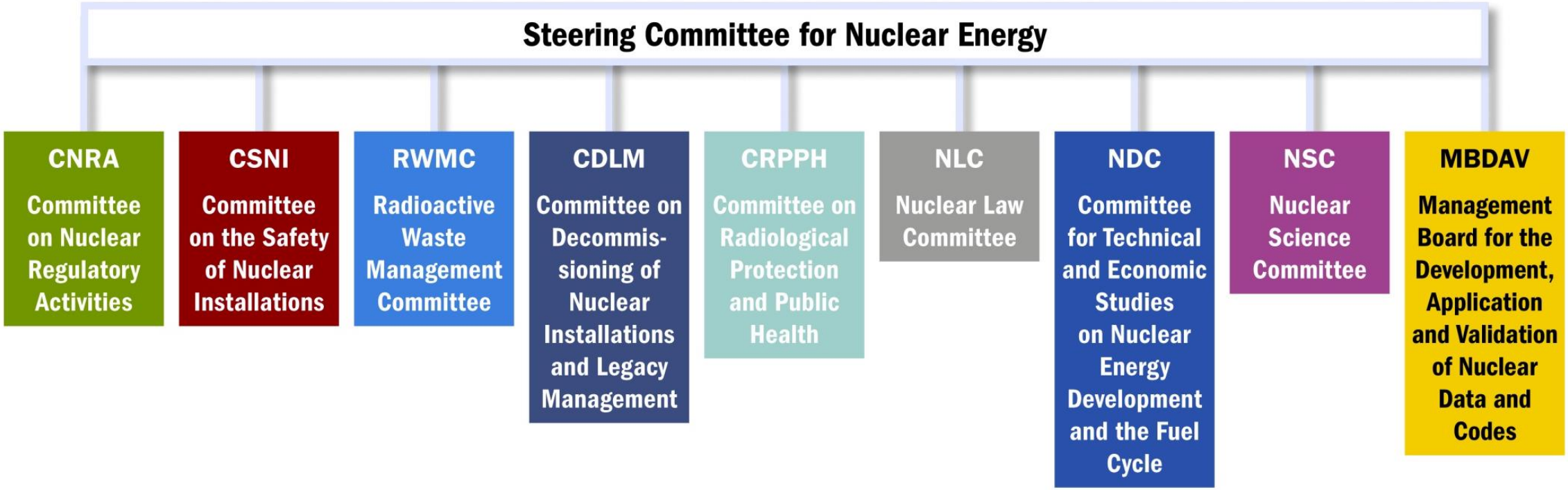
The NEA Serves as a Framework to Address Global Challenges

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.
- 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 nearly 82% 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 Separately Funded Activities

NEA Serviced Organisations

- **Generation IV International F**
  with the goal to improve sustai
  effective fuel utilisation and mi
  economics, safety and reliabilit
  resistance and physical protect
- **Multinational Design Evaluat**
  (MDEP)
  initiative by national safety aut
  their resources and knowledge
  design reviews.
- **International Framework for**
  Cooperation (IFNEC)
  forum for international discussi
  nuclear topics involving both d
  emerging economies.

24 Major Joint Projects

ntries from within
EA membership)

and experimental data (e.g.,
haviour, severe accidents).

s (e.g., fire, common-cause

rmodynamics

gement (e.g., thermochemical

e.g., occupational exposure).

fuels and materials, human

Ongoing Joint Projects

- **BSAF,** applying the scientific information gained from the Fukushima Daiichi accident to improve nuclear analysis tools
- **SAREF,** which will sample water from Fukushima Daiichi reactors and assess fuel debris characteristics

NEA: leading the way towards a robust nuclear energy future

An overview of current NEA projects/initiatives:

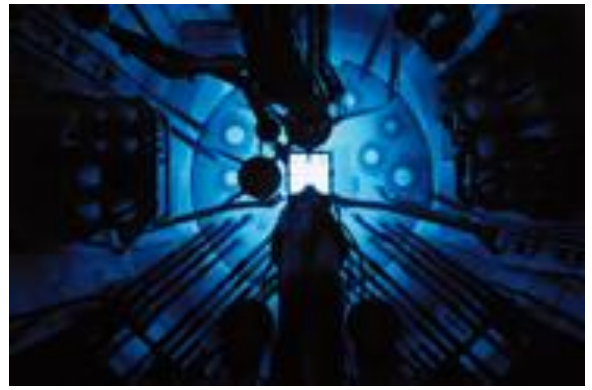
- **Nuclear Innovation 2050 (NI2050)**:
  focussing on increasing momentum in R&D and market deployment of new nuclear technologies

- **Multinational NEA Framework for In-pile Fuel and Material Testing**: focussing on future experimental capabilities

- **Nuclear Education, Skills and Technology (NEST) Framework**: focussing on the future generation

Nuclear Innovation 2050: moving ideas into reality

- Need for new nuclear technologies which are:
  - able to compete in future global energy markets
  - cheaper
  - more flexible and faster to deploy



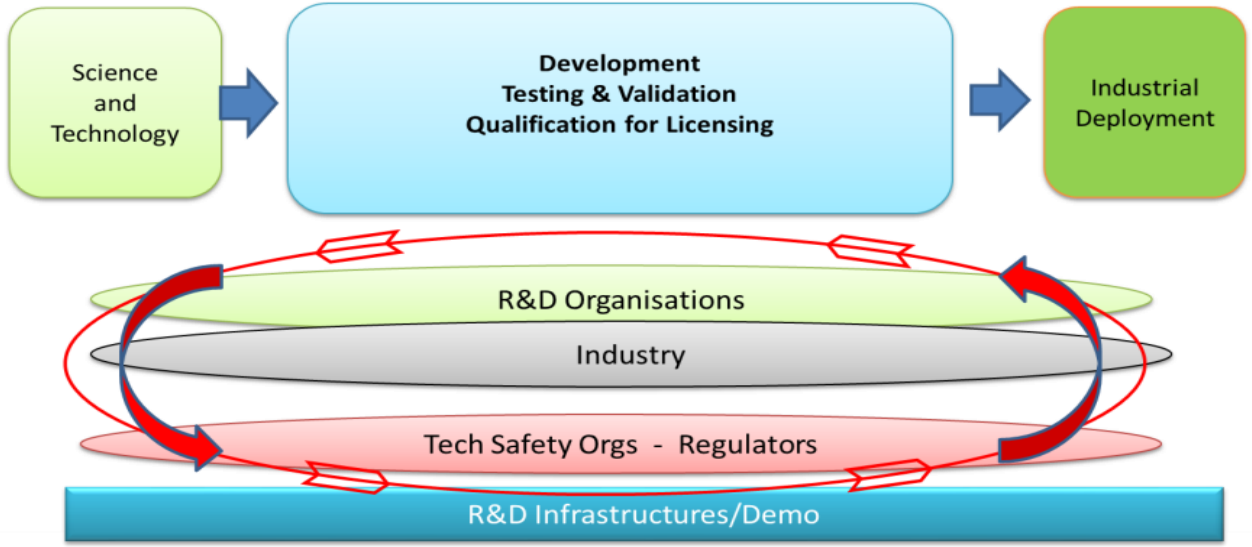
- NI2050 involves industry and safety authorities to facilitate the transformation of R&D to market readiness → **all stakeholders need to be on board**

Three major barriers to overcome:

- Financing: nuclear innovation timeline is long; industry and private investors need to contribute
- Regulatory framework: not active in the technology development process; national dimension of regulatory processes can hinder wider market deployment
- Availability of infrastructure to support nuclear technology development

NEA "Nuclear Innovation 2050" (NI2050) Initiative

- **Goals and added value**
  - building a cooperative framework enabling innovative fit-for-purpose nuclear fission technologies
  - applying multilateral strategies to support more effective deployment of innovative nuclear technologies
- **Selected topical areas**
  - **accident-tolerant fuels**
  - **advanced fuels and materials**
  - **advanced modelling and simulation**
  - severe accident knowledge management
  - passive safety systems
  - management of ageing structures
  - heat production and cogeneration, etc.
- **NI2050 is supported by other NEA initiatives in the development, safety and science areas**



New Multinational NEA Framework for In-pile Fuel and Material Testing

- **Motivation**
  - Strengthen fuel- and material-related experimental capabilities for the benefit of industry, safety and science
  - Address the post-Halden situation
  - Develop a coordinated approach and a new paradigm for experimentation
- **Goals and added values**
  - Create and maintain awareness regarding experimental capacities
  - Perform key experiments using facilities around the world using mechanism of NEA Joint Projects
  - Coordinate the analysis, preservation and management of experimental data
  - Enable training and education via NEST project

Proposed Framework Structure

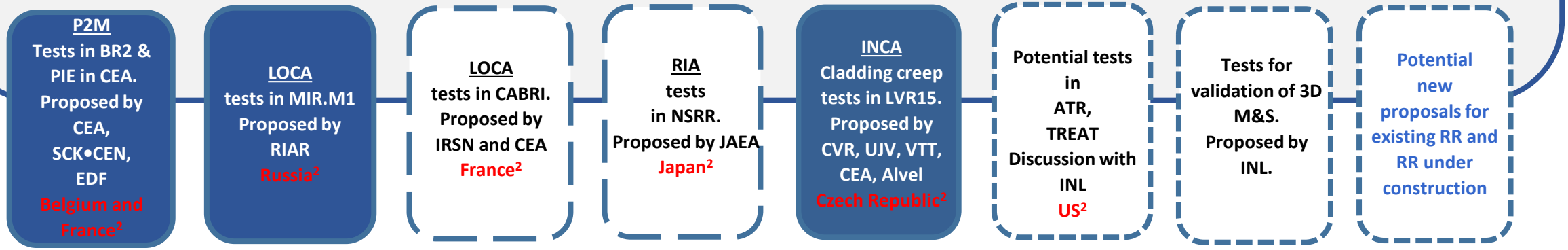
Pursuant to Article 5 of the NEA Statute, the Framework will be established as an international joint undertaking

Framework for IrraDiation ExperimentS – FIDES[1]

- Being designed to provide stable, sustainable, reliable platform and an incentive for innovations for fuels and materials testing
- Encompasses **Joint Experimental Programmes** and the **Cross-cutting Activities**

Joint ExpErimental Programmes (JEEPs)

- **Enable in-pile experiments in test reactors and PIE**



[1] Fides (Latin: Fidēs) was the goddess of trust and bona fides (good faith)

[2] Country of the host organisation

New NEA Framework: Added value and cross-cutting activities

The Framework is currently being established in order to

- provide continuity and sustainability in the strategic field
- build a collective awareness of needs and capabilities
- identify gaps requiring investments and facilitate related implementations
- create opportunities for cross-cutting activities
  - State-of-the-art instrumentation and modelling & simulation
  - **Preservation and quality management of experimental data**
  - Professional development and educational activities
- in collaboration with IAEA, address collectively practical issues of nuclear fuel transport and waste management

NEA Nuclear Education, Skills and Technology (NEST) Framework

NEA member countries together represent the world's best nuclear expertise in the use of nuclear technology…

HOWEVER

…the scientists, engineers and technologists needed to ensure the safe and efficient use of nuclear technologies are declining in many countries leading to a potential loss of nuclear expertise and knowledge.

NEST Framework aims to:

- Attract, train and facilitate skills development of students and young professionals through transmission of practical knowledge and hands-on training
- Aid countries to maintain and strengthen academic nuclear-related education programmes by establishing international exchanges and collaborative activities between universities and other organisations (e.g., research institutions, regulatory bodies, etc.)

NEST: an investment in the next generation

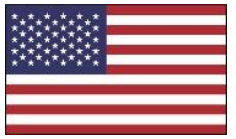
Tacit knowledge needs to be preserved, transferred and shared with the next generation

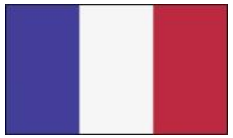
To achieve this:

- Young generation needs to be exposed to challenging projects and real-world problems through hands-on training
- Leading experts in the field will work alongside the NEST Fellows (Masters, PhD, Postdoc students and young professionals)
- NEST Fellows will work within a network of organisations encouraging cross-fertilisation of ideas and development of new projects to advance new innovative nuclear technology

Photo Credit: Dean Calma / IAEA

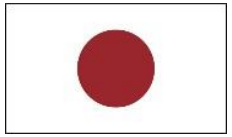
Entry into force of the NEST Agreement: 15 February 2019





10 Countries
15 Parties

Ispettorato nazionale per la sicurezza nucleare e la radioprotezione



NEST current projects

NEST HYMERES (HYdrogen Mitigation Experiments for Reactor Safety, Phase 2) project:

- addresses safety relevant phenomena in containments during accidents; hands-on training at PANDA, one of the world's most advanced containment test facilities

SMR project:

- aims to integrate SMR research projects from individual participating organisation countries into a broader and more impactful program

NEST-CLADS (Collaborative Laboratories for Advanced Decommissioning Science) project:

- dedicated to advanced remote technology for decommissioning under intense gamma-ray radiation environments (e.g robotics, virtual reality).

NEST-PDC UGR (Pilot & Demonstration Center for Decommissioning of Uranium-Graphite Nuclear Reactors) project:

- addresses main issues of i-graphite management, including characterisation, decontamination and disposal

Global issues require global solutions

What we know:

- Clima
- Nucle **UT** it need
- Much gies. Innov

What c

- Increas pertise has more value than a go-it-alone approach

The NEA can help lead the way

The NEA offers an ideal forum to advance the future of nuclear bringing together international experts who share and disseminate state-of-the-art knowledge in the field of nuclear energy.

The NEA's existing framework supports expertise and resources needed to enable multilateral co-operation.

Thank you for your attention

More information @ www.oecd-nea.org

All NEA reports are available for download free of charge.

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