

NEA ADVANCED TECHNOLOGY AND NUCLEAR COSTS INITIATIVE

NEA Workshop on Advanced Construction and Manufacturing Methodologies for New Nuclear Build

16-17 March 2022, 14h00 – 17h30 CET

Virtual event via Zoom

[To register, please click here](#)

Background

Under the oversight of the Nuclear Development Committee (NDC), the Nuclear Energy Agency (NEA) continues to work on collecting and analysing the latest technical evidence and industrial experience to support construction costs and risk reductions of new nuclear builds. Accordingly, the NEA published in July 2020 [“Unlocking Reductions in the Construction Costs of Nuclear: A Practical Guide for Stakeholders”](#) (REDCOST) in an attempt to develop strategies and governing guidelines on how to unlock meaningful cost reductions in the deployment of large Gen-III reactors over the next decade and beyond within OECD countries.

Building on past and recent construction experience, this study identifies eight technological, organisational, regulatory and policy levers to incrementally drive positive learning in new nuclear builds. In particular, two main technology approaches could be rapidly implemented to deliver cost reductions in the short-term:

- Digital transformation;
- Advanced construction and manufacturing methods.

The NEA has launched the Advanced Technology and Nuclear Cost (ATNC) initiative with the objective to provide decision makers with a clear understanding of the development stage of these technology approaches, their cost reduction potentials and the challenges that may preclude their large-scale deployment. A first workshop was organised in May 2021 to assess [the opportunities and challenges associated with digital transformation of the nuclear sector](#). The present workshop – the second of the ATNC initiative – will address recent developments in construction and manufacturing methods for both large and small modular reactors, while exploring potential ways to accelerate their implementation.

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NEA Workshop on Advanced Construction and Manufacturing Methodologies for New Nuclear Build

Final Agenda

Day 1 – (14h-17h30)

Opening remarks (30')

The construction phase of nuclear power plants drives the overall economics of nuclear power. Even if the overnight construction costs represent only around 10-15% of the generation cost of a new nuclear facility¹, this phase carries most of the project risks (e.g. potential cost overruns and delays), which can eventually lead to a high cost of capital considered by investors, and thus undermine the economic viability of the new nuclear projects. Building a nuclear power plant is also a labour-intensive endeavour in which most of the efforts are concentrated in the construction of the nuclear island, and in activities involving large quantities of concrete, rebar and cabling. Recent research suggests that the increased thicknesses of the main structures of the containment buildings in Gen-III designs, combined with lower productivity levels in nuclear construction as compared to other sectors, have been important contributors to cost overruns observed in some recent nuclear projects.² At the same time, new design, construction and manufacturing techniques exist and could improve, not only productivity and commodity usage levels, but also the predictability in the delivery of new nuclear projects in the near term. Many advanced nuclear designs also unlock opportunities to further constructability improvements.

This workshop aims at assessing how new construction and manufacturing techniques, along with new design and project management approaches, can reduce overall construction risk and costs, focusing on three main aspects covered in the different workshop sessions:

1. Recent nuclear new build have been “living laboratories” where new construction and manufacturing techniques have been tested. The experience gained could also inform design optimisations to enhance the constructability of forthcoming projects.
2. Reducing the size of nuclear reactors, combined with the inherent safety features of some advanced concepts, creates opportunities for the introduction of new construction and manufacturing techniques, as well as design choices. Consequently, alternative delivery models – that are not suited to traditional large reactors – can be explored with innovative designs in order to accelerate the construction phase.
3. The introduction of new construction and manufacturing techniques, even if already proven valid and reliable in other sectors, will require adaptations implementation of new codes and standards to meet nuclear regulatory expectations.

Speakers:

- **William D. Magwood, IV**, Director General, NEA
- **Michel Heijdra**, Director of the Electricity Department and deputy Director-General of Climate Policy and Energy, Dutch Ministry of Economic Affairs and Climate Policy

¹ Nuclear power generation costs are dominated by financing costs.

² Eash-Gates, Ph., Klemun, M.M., Kavlak, G., et al, “*Sources of Cost Overrun in Nuclear Power Plant Construction a Call for a New Approach to Engineering*”, Joule, Volume 4, Issues, 11, November 2020, pp 2348-2373, <https://doi.org/10.1016/j.joule.2020.10.001>

Session 1: Panel on lessons learned from the construction of past and recent large nuclear projects (14h30-16h00)

This session will include a series of presentations that provide an overview of past and recent nuclear construction experience in large reactors in order to assess the current status of advanced construction and manufacturing techniques, and their potential to reduce construction risks in the near future. Main learnings and subsequent constructability optimisations in current designs will also be explored.

Key questions:

- What are the main construction and manufacturing techniques being used to reduce construction risk in large reactors?
- Can effective project management mitigate most of the construction risks experienced in recent build or are new techniques needed?
- What are the main constructability optimisations that could be expected based on recent construction experience?

Moderator:

- **Diane Cameron**, Head of Division for Nuclear Technology Development and Economics, NEA

Panelists:

- **Harry Chang**, Vice President - New Nuclear Business Department, KHNP
- **Didier Noël**, Methods-Temporary Works Lead for Hinkley Point C, Bylor JV
- **Gregory Preston Barnett**, Oversight Manager, Georgia Power Company

Session 2: Panel on insights into advanced construction and manufacturing techniques (16h00-17h30)

In this session, advanced construction and manufacturing techniques will be assessed in detail to get a better understanding about their associated time, labour and commodity usage savings in nuclear build. Some of these techniques can already be deployed in new projects but may face some limitations depending on the geometry and size of the components.

Key questions:

- What are the main productivity and commodity usage improvements associated with the use of advanced construction and manufacturing techniques? Are there other potential benefits?
- What is the technology readiness of these techniques? What are the main challenges that could prevent their large-scale adoption?
- What innovations are needed to extend the applicability of these techniques to a larger spectrum of component geometries and sizes?

Moderator:

- **Hasan Charkas**, Principal Technical Leader, EPRI

Panelists:

- **Bassam Burgan**, Director, Steel Construction Institute
- **Guillaume Hervé-Secourgeon**, Senior Engineer Researcher, EDF

- **Steve Jones**, Chief Technology Officer, Nuclear Advanced Manufacturing Research Centre
- **Ashley Finan**, Director of the National Reactor Innovation Center, INL

Day 2 – (14h-17h30)

Opening remarks (15')

This opening session will cover will explore new paradigms of delivery and deployment of nuclear power, drawing on learnings from other sectors.

Speaker:

- **Kirsty Gogan**, Managing Partner, LucidCatalyst and Co-founder, TerraPraxis

Session 3: Panel on improving constructability with small, modular and innovative nuclear designs (14h15-15h45)

This session will analyse potential constructability enhancements associated with small, modular and innovative nuclear designs. The shipbuilding and aviation sectors are often regarded as successful delivery models that could be explored with small modular reactors. More innovative and design approaches could lead to significant design simplifications and reclassification of safety-related components, further improving constructability.

Key questions:

- What are the cost and risks associated with modularisation strategies? What are main implications for the supply chain?
- Can the construction experience from other sectors be rapidly adopted for the construction of new nuclear designs? What kind of adaptations may be needed?
- What new construction approaches could be envisioned for more innovative nuclear designs?

Moderator:

- **Chirayu Batra**, Nuclear Project Officer (SMR), IAEA

Panelists:

- **Giorgio Locatelli**, Full Professor, Politecnico di Milano
- **Andrew Sowder**, Senior Technical Executive, EPRI
- **Jaimie Johnston** MBE, Head of Global System, Bryden Wood
- **Eric Ingersoll**, Founder and Managing Director, TerraPraxis

Session 4: Panel on enabling the implementation of new construction and manufacturing techniques in the nuclear sector (15h45-17h15)

This session will cover recent efforts being undertaken to accelerate the implementation of new advanced construction and manufacturing approaches. Some techniques are already used in other sectors but may require specific adjustments to meet nuclear regulatory requirements. In parallel, the development of new industrial codes and standards should take place to ensure that advanced construction and manufacturing techniques can be reproduced

and widely deployed while meeting the highest quality standards. To illustrate these aspects, specific pilot projects, and the vision from regulators and code and standards development organisations will be discussed.

Key questions:

- What are the main regulatory considerations to be taken into account to enable the wide adoption of new construction and manufacturing techniques in the nuclear industry?
- How can pilot projects involving relevant stakeholders accelerate the adoption of new manufacturing techniques? What are main learnings from first joint endeavours?
- Can the nuclear sector benefit from the implementation of codes and standards of new manufacturing techniques developed in other industries? What adaptations may be needed? In which areas effective harmonisation could take place?

Moderator:

- **Christopher Fong**, Deputy Head of Division for Nuclear Safety Technology and Regulation, NEA

Panelists:

- **Julien Niepceron**, Engineer, EDF and Codification Leader of Steel Concrete Structures, AFCEN
- **Carolyn Fairbanks**, Senior Materials Engineer, US Regulatory Commission
- **Stephanie Smith**, President and CEO, CANDU Owners Group
- **Ronan Tanguy**, CORDEL Project Manager, World Nuclear Association
- **Mark Tipping**, Global Power to X Director, Lloyd's Register

Closing remarks (15')

This concluding session will summarize the main findings of the workshop and provide industry insights about the main opportunities and challenges ahead in the field of advanced construction and manufacturing techniques.

Speakers:

- **Sama Bilbao y León**, Director General, World Nuclear Association