

The role of nuclear energy resources in sustainable development

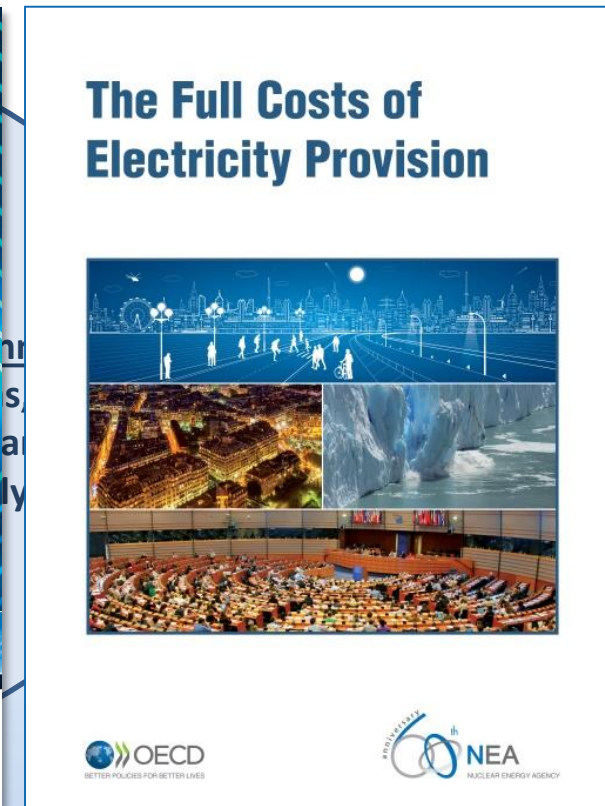
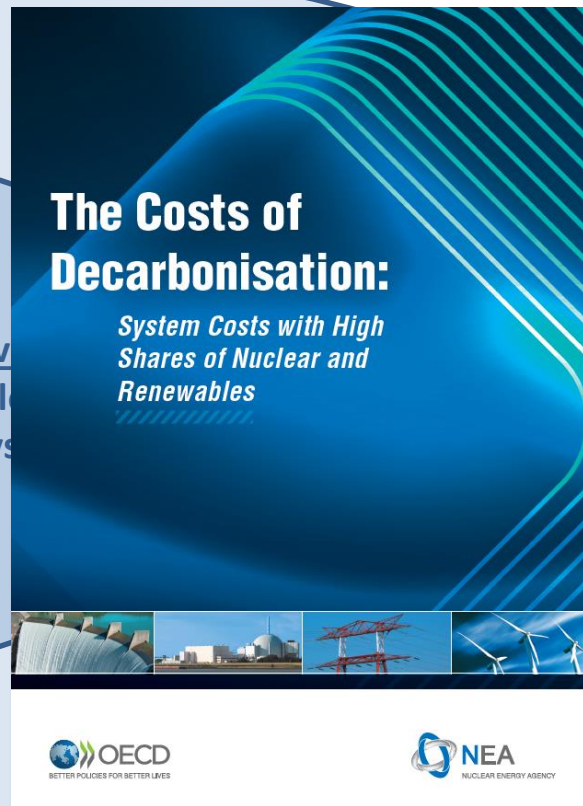
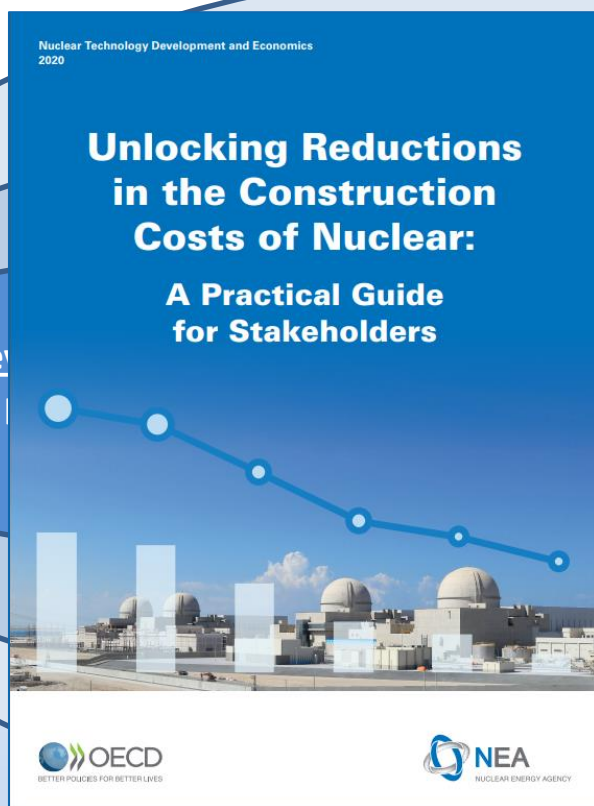
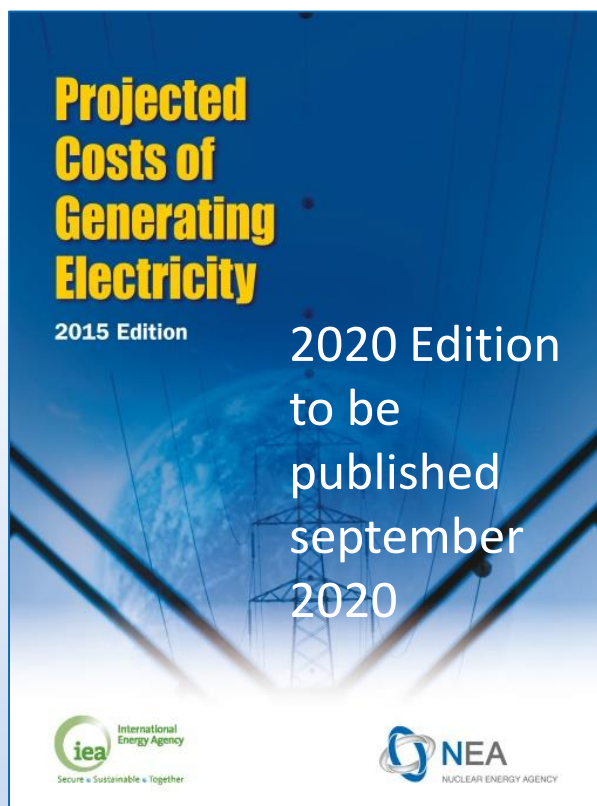
Perspectives on the costs of decarbonization

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UNECE ENERGY WEEK 2020

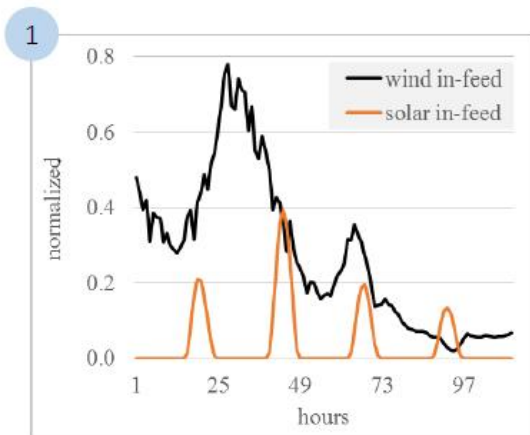
24 September 2020

NEA Work on the Future of Electricity



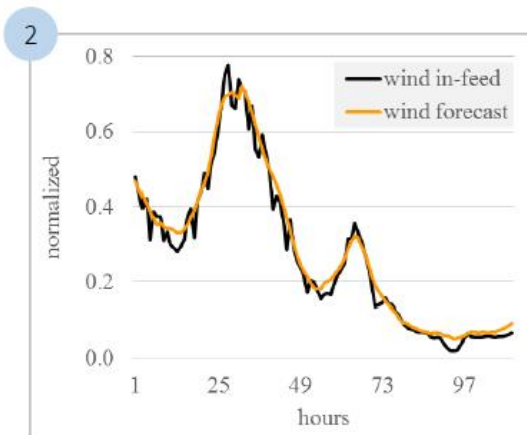
Assessing the System Costs of Electricity

- 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



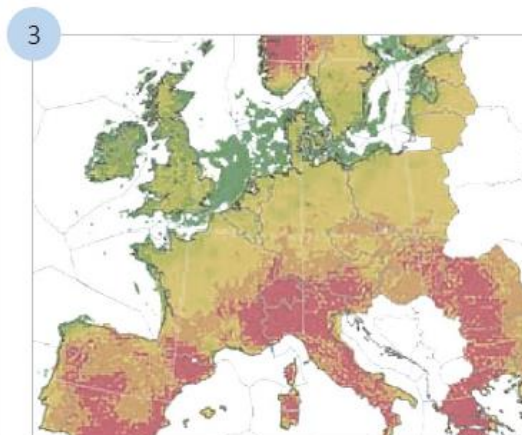
VREs are not always available

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

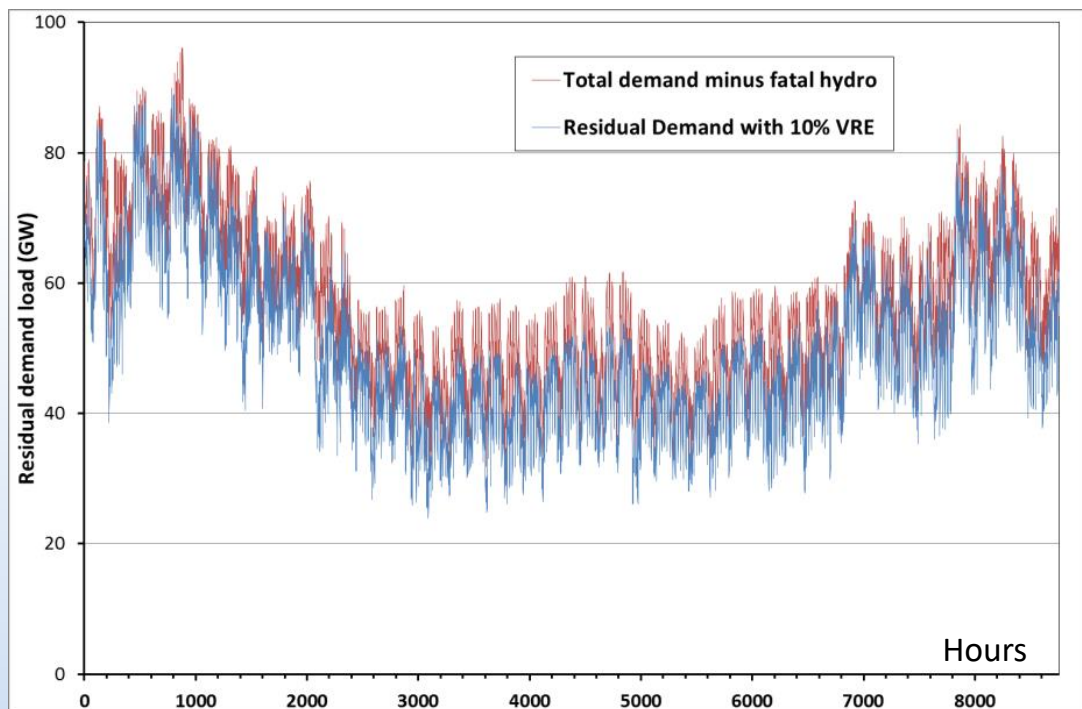
System costs depend on:

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

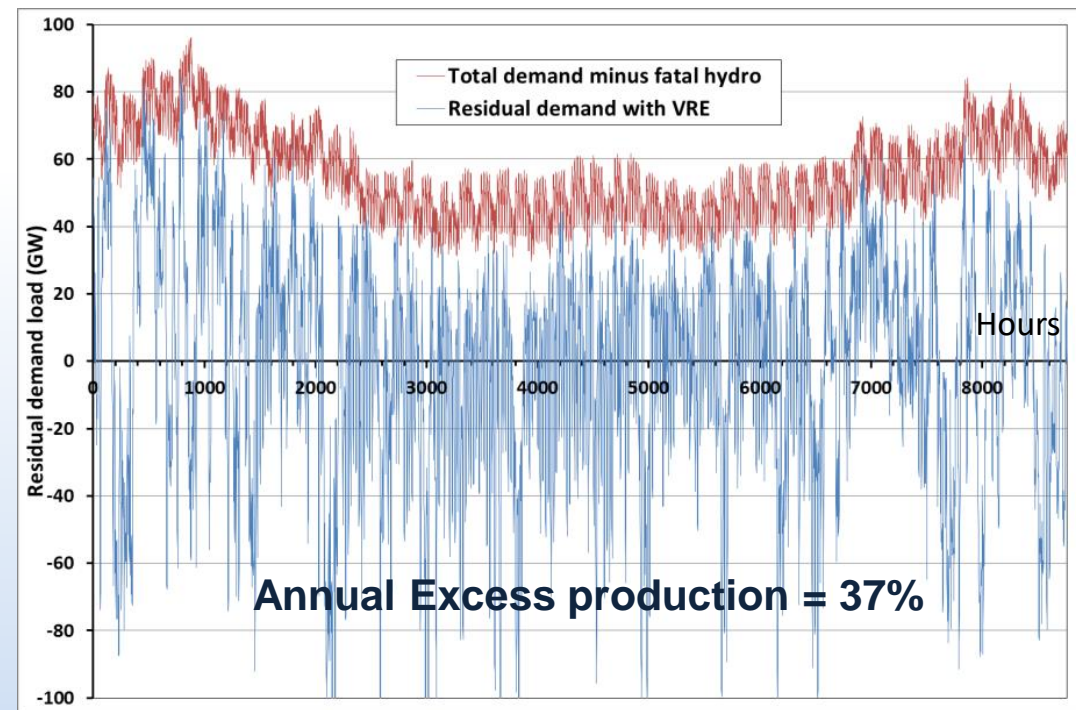
Additional impacts on load factors of dispatchable generators and prices.

High VRE Shares Result in Large Inefficiencies

10% Variable Renewables



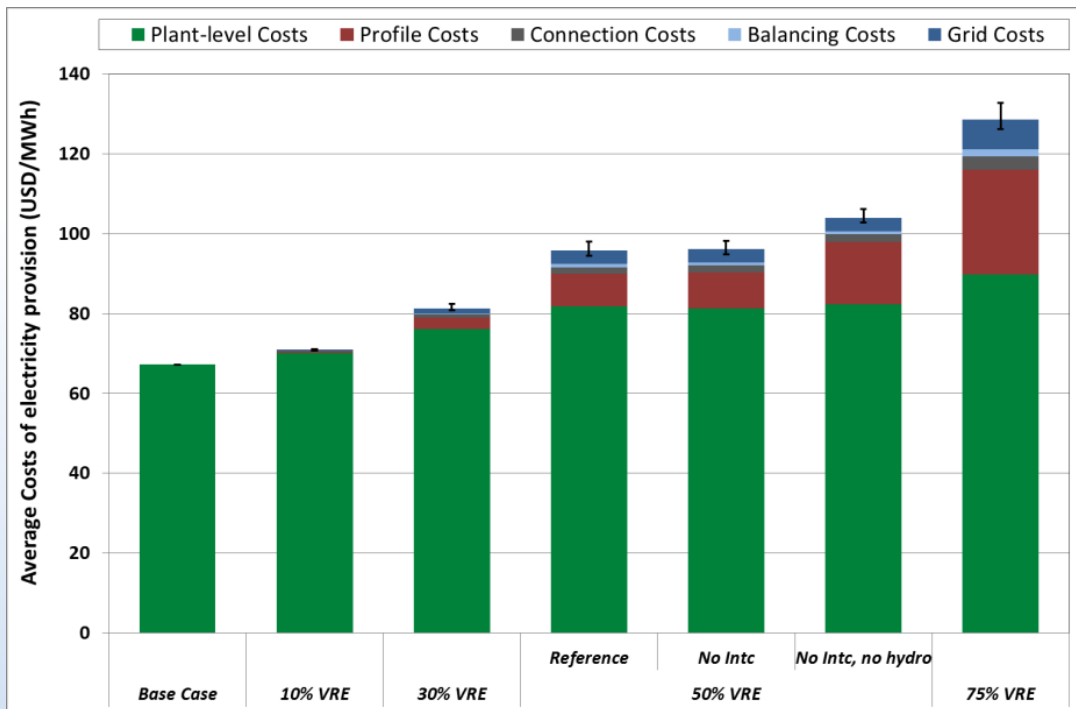
75% Variable Renewables



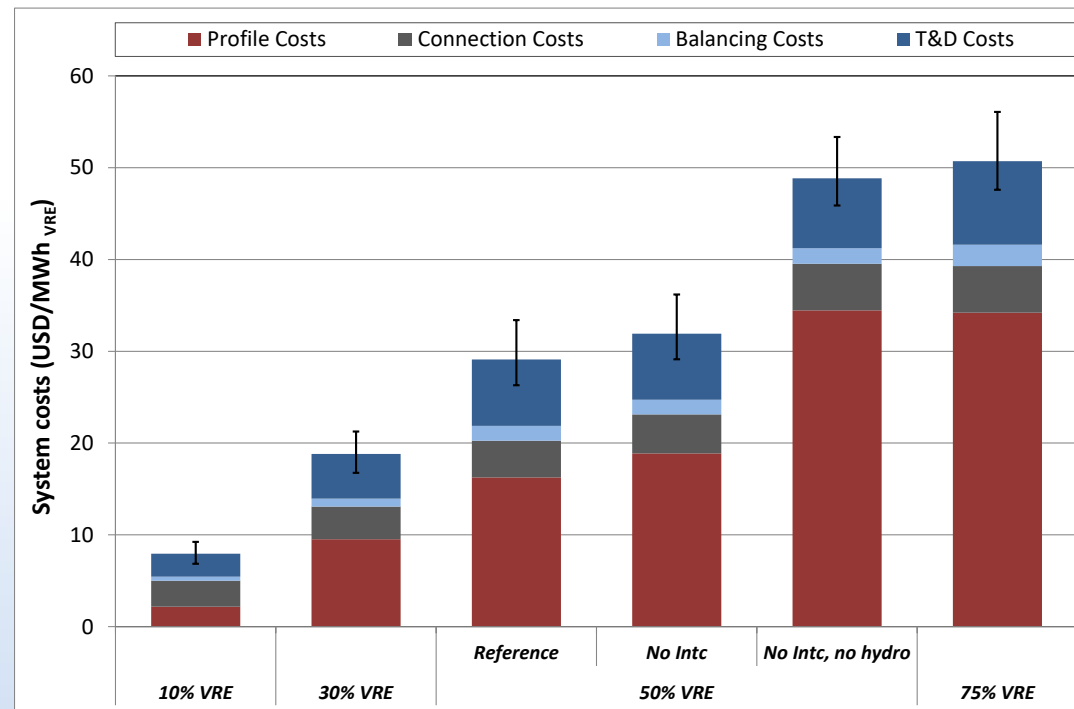
- High VRE penetration result in challenges for system management.
- Residual demand (**BLUE** line) – the available market for dispatchable generation becomes volatile and unpredictable.

As VRE Share Increases System Costs Grow Quickly

Total Costs



Breakdown of System Costs



- System costs are large and increase with VRE generation share - Profile costs are the dominant component.

Recent NEA Work: *Broad Conclusions*

The Full Costs of Electricity Provision



The Costs of Decarbonisation:

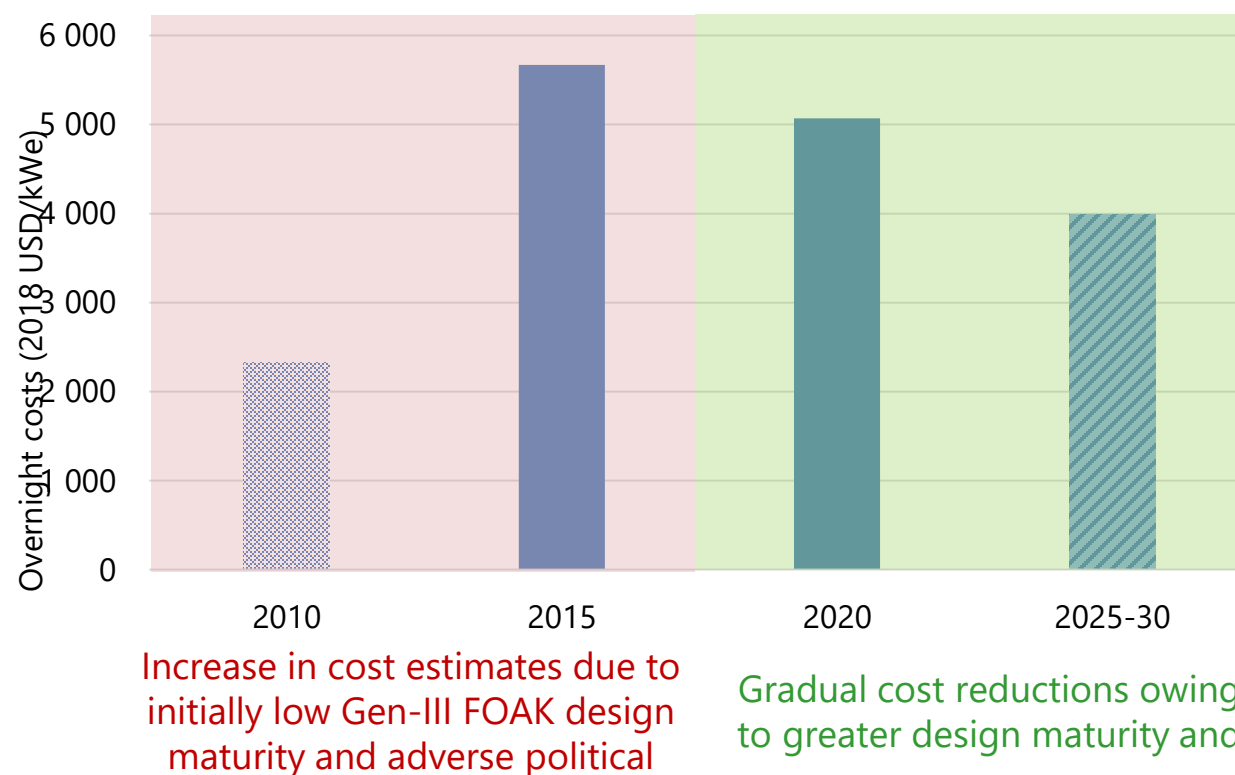
System Costs with High
Shares of Nuclear and
Renewables



- To meet global energy and environmental requirements, all low-carbon technologies must be optimally applied—with all costs accurately allocated.
- The electricity markets must be modernized. Existing market structures make investment in any unsubsidised low-carbon technology very difficult.
- Large deployment of VRE will occur around the world – but the contribution of VRE in each country will depend on the cost of available resources.
- To the degree dispatchable capacity is needed, nuclear can serve a large role—if it is economically compatible with evolving markets.

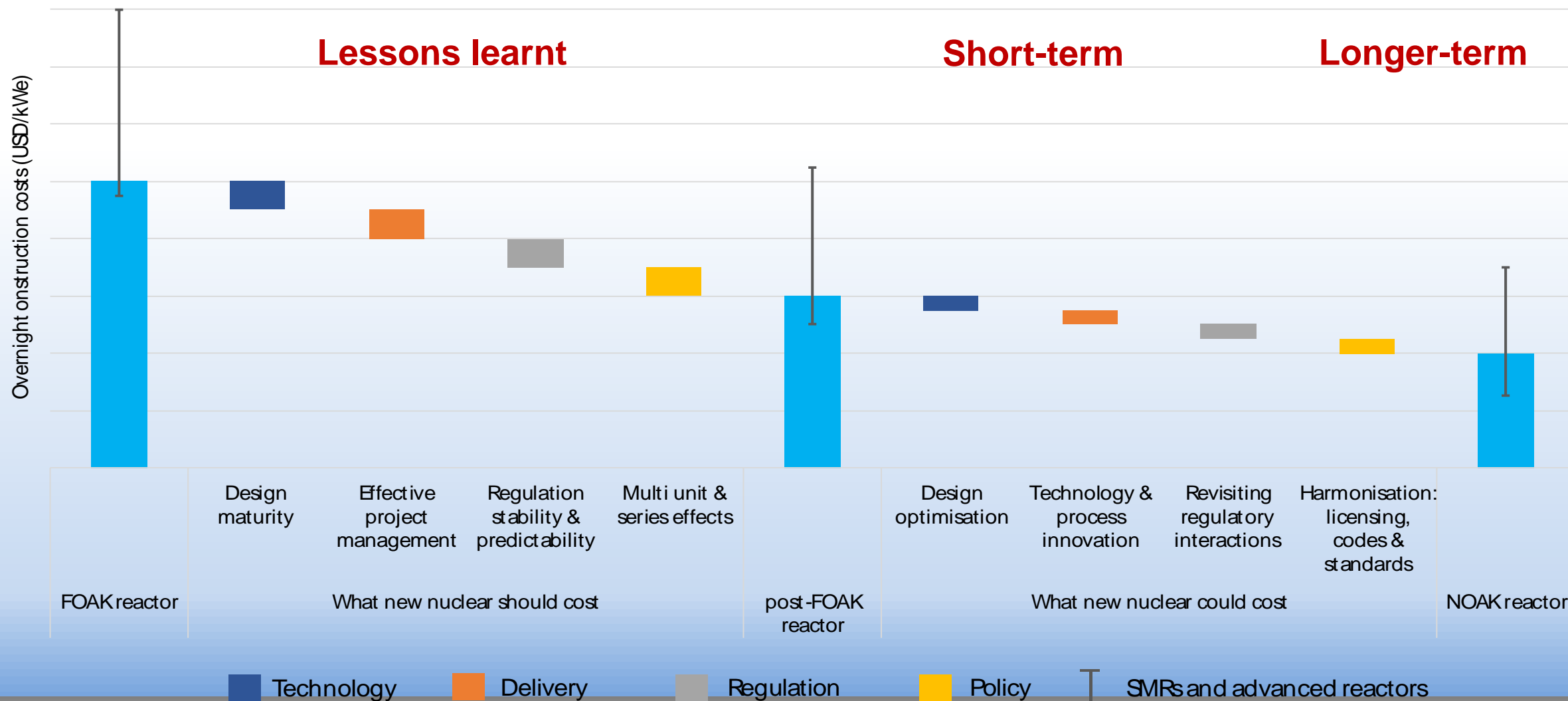
The nuclear industry is at a critical juncture with the completion of FOAK Gen-III reactors

- Gen-III initial costs estimates driven by **low level of design maturity** and the **specific political context** of announced budgets
- Recent trend in projected costs reflects **increased design maturity** and **lessons learned** for post-FOAK projects
- Gap between two sets of projections has impacted overall **perceived investment risks** and has potential to impact **public acceptance**



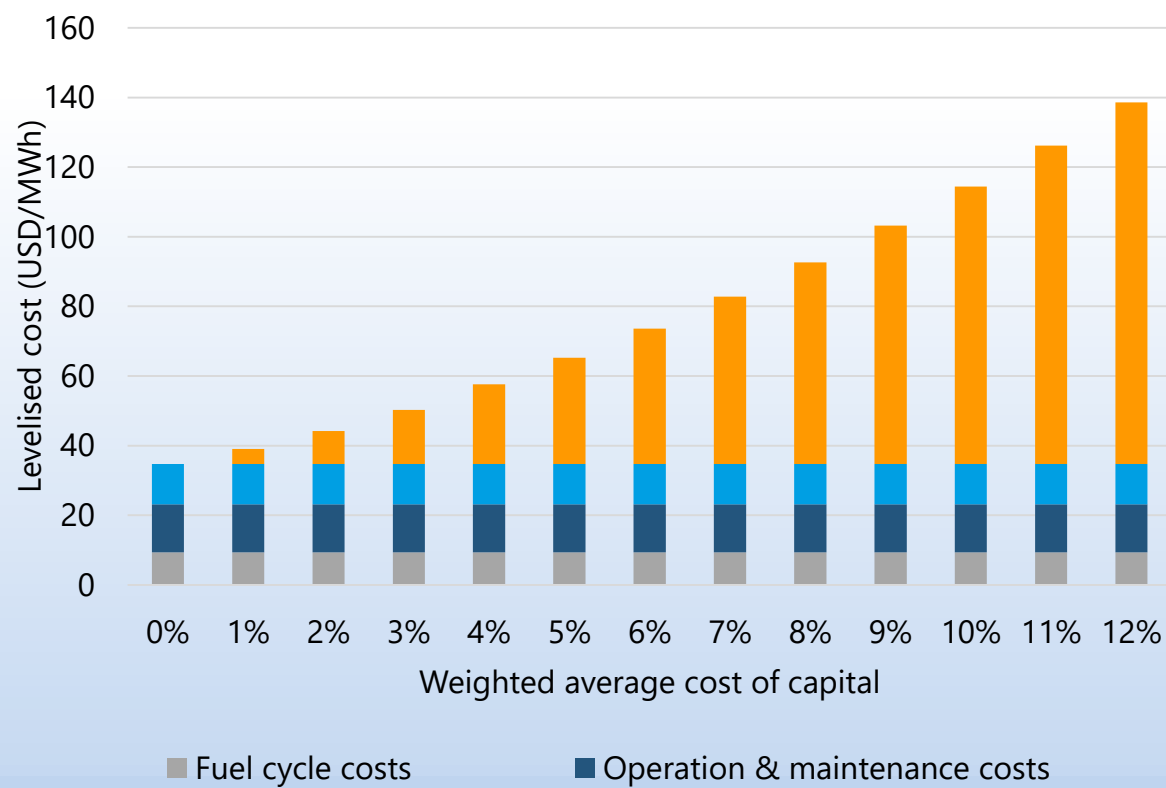
Notes: 2010, 2015 and 2020 OECD average overnight construction cost data based on 2005, 2010 and 2015 NEA/IEA Projected Cost of Generating Electricity reports, adjusted for USD inflation using OECD statistics. NEA average estimate for 2025 based on preliminary data from the forthcoming NEA/IEA Projected Costs of Generating Electricity 2020 report.

Eight priorities to unlock nuclear construction costs reduction



Affordable financing key for the economic performance of nuclear: A range of government support can be envisaged

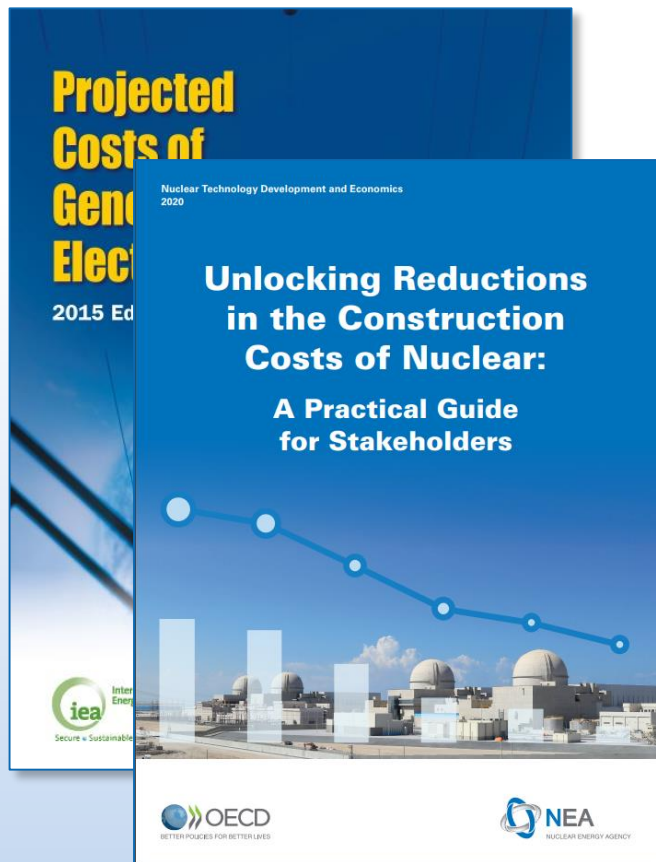
LCOE of a new nuclear power plant project
according to the cost of capital



Note: Overnight cost of 4500 USD/kWe, a load factor 85%, 60-year lifetime and 7-year construction time

Direct Financial support	Indirect financial support	
	Power purchasing agreements	Regulated assets
Equity, debt, ECAs, loan guarantee	Contract-for-difference (UK), Mankala model (Finland)	Rate-of-return (US), Regulated Asset Base (UK)
Equity stake can be transitional as additional sources of financing should become available once the plant is operational	PPAs focus on market risks but often do not address explicitly construction risks, which impact risk premium	Specific conditions can be specified for the allocation of certain risks (e.g. cost sharing and cap with hybrid RAB model)

Recent NEA Work: *Broad Conclusions*



- Building on the lessons learned from Gen-III FOAK, governments have a window of opportunity for cost reductions in the early 2020s. Commitment to a standardised nuclear programme is the most promising route to realise these cost reductions.
- Governments can support cost reductions with SMR and advanced reactors by ensuring timely licensing and construction of demonstrators that will be built in the late 2020s. These reactors will benefit from the supply chain capabilities of large Gen-III.
- The governance framework is essential to support competitive new nuclear construction. (Transitional) targeted financial support is currently required in Western OECD countries to deliver cost-competitive new nuclear and address risk perception.

Thank you for your attention



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