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EIFFEL: Energy Initiative for Future Engineer Leaders

The Need for Nuclear

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Revisit to Nuclear

- **A large increase in the use of nuclear power would help keep global warming to below 1.5°, according to a United Nations (UN) report published October 8. The Intergovernmental Panel on Climate Change (IPCC) special report “Global Warming of 1.5 degrees” was commissioned by governments at the Paris climate talks in 2015 and will inform the COP24 summit in Katowice, Poland this December.**
- **Sanmen in China is home to the world's first AP1000 reactor achieved grid connection in August (Image: SNPTC).**
- **The report considers the impacts of global warming of 1.5° above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. Under all scenarios compatible with 1.5° outlined in the report, the contribution of nuclear power increases.**

Nuclear Share

- The shares of nuclear and fossil fuels with carbon capture and storage in electricity generation are modelled to increase in most 1.5° pathways.
- Nuclear power increases its share in most 1.5° pathways by 2050, but in some pathways both the absolute capacity and share of power from nuclear generators declines. There are large differences in nuclear power between models and across pathways. One of the reasons for this variation is that the future deployment of nuclear can be constrained by societal preferences assumed in narratives underlying the pathways. Some 1.5° pathways no longer see a role for nuclear fission by the end of the century, while others project over 200 EJ yr of nuclear power in 2100.
- An increase in the use of nuclear can be realized through existing mature nuclear technologies or new options referring to Generation III/IV reactors, new fuel cycles, small reactors or nuclear cogeneration.

Political Debates

- Even though historically scalability and speed of scaling of nuclear plants have been high in many nations, such rates are currently not achieved anymore. In the 1960s and 1970s, France implemented a program to rapidly get 80% of its power from nuclear in about 25 years, but the current time-lag between the decision date and the commissioning is 10-19 years.
- The current deployment pace of nuclear energy is constrained by social acceptability in many countries owing to concerns over risks of accidents and radioactive waste management.
- Though health risks are low per unit of electricity production, and land requirement is lower than that of other power sources, the political processes triggered by societal concerns depend on the country-specific means of managing the political debates around technological choices and their environmental impacts.

Public Guarantees

- Such differences in perception explain why the 2011 Fukushima accident resulted in a confirmation or acceleration of phasing out nuclear in five countries while 30 other countries have continued using nuclear, of which 13 are building new nuclear capacity including China, India and the UK.
- The costs of nuclear have increased over time in some developed nations principally due to market conditions where increased investment risks of high-capital expenditure technologies have become significant.
- The UK works with public guarantees covering part of the upfront investment costs of newly planned nuclear capacity. This dynamic differs in countries such as China and South Korea, where monopolistic conditions in the electric system allow for reducing investment risks, deploying series effects and enhancing the engineering capacities of users due to stable relations between the security authorities and builders.

1.5° v. 2°

- Limiting global warming to 1.5° compared to 2° would require rapid, far-reaching and unprecedented changes in all aspects of society. With clear benefits to people and natural ecosystems, limiting global warming to 1.5° compared to 2° could go hand in hand with ensuring a more sustainable and equitable society. We are already seeing the consequences of 1° of global warming through more extreme weather, rising sea levels.
- Nuclear economics have been improved in countries where the electricity system allows for reduced investment risks, the realization of benefits from series build or through stable relations between regulators and industry. However, in some other countries market conditions have increased investment risks of high-capital expenditure technologies, such as nuclear. The current deployment pace of nuclear energy is constrained by social acceptability in some countries.

The IPCC Report Highlights

- The proven qualities of nuclear are a highly effective method of reducing greenhouse gas emissions, as well as providing secure, reliable and scalable electricity supplies. To maximize nuclear energy's contribution, markets need to acknowledge these benefits. We also need more effective harmonized regulatory processes to facilitate significant growth in nuclear capacity and an effective safety paradigm where the health, environmental and safety benefits of nuclear are better understood and valued by society.
- The IPCC's target to generate 70-80% electricity from renewables is ambitious, and there is a need to look at the broader picture and focus on reducing the carbon intensity of the whole electricity system.
- We have very limited options for more hydro power, batteries do not yet provide the type of storage needed and other options like liquid air and hydrogen storage are still early in their development stages.

There Shall Be Nuclear..

- Currently renewables are backed up by gas when they are not generating and, gas is backed up by coal. Carbon capture and storage may help to some extent, but this infrastructure runs the risk of locking us into a fossil fuel-based system. We are not yet in the position to create enough long-term storage from environmentally friendly sources to fill the supply gap when renewables are not generating.
- Another option to reduce the carbon intensity of the electricity system is to take a more certain approach to nuclear by planning a long-term rolling program of development that grows the supply chain and required skills. Going beyond the electricity system, we should explore the relationship between nuclear and producing hydrogen through electrolysis to provide decarbonized fuel for heat, transport and industry.