

NUCLEAR ENERGY'S ROLE IN THE POST-PANDEMIC RECOVERY AND CLEAN ENERGY TRANSITION



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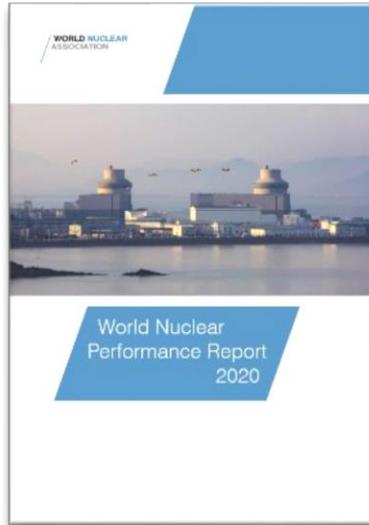
Director General

28 October 2020

SIEW 2020

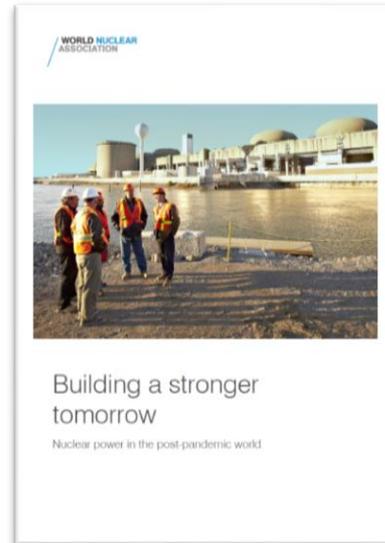
Three publications highlight nuclear contributions

Performance Report



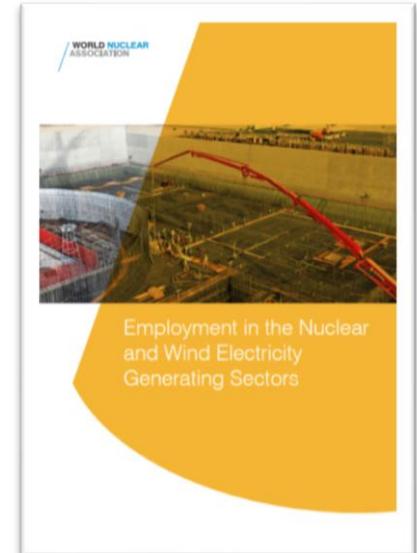
<https://www.world-nuclear.org/our-association/publications/global-trends-reports/world-nuclear-performance-report.aspx>

COVID-19 recovery



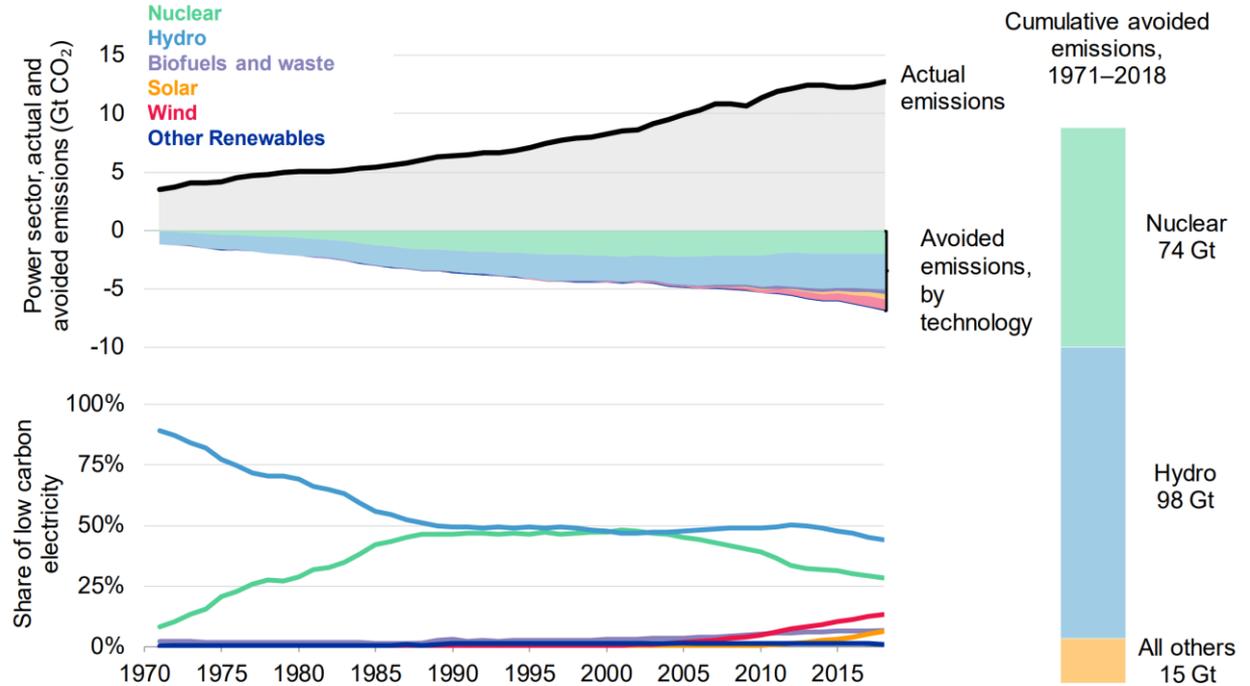
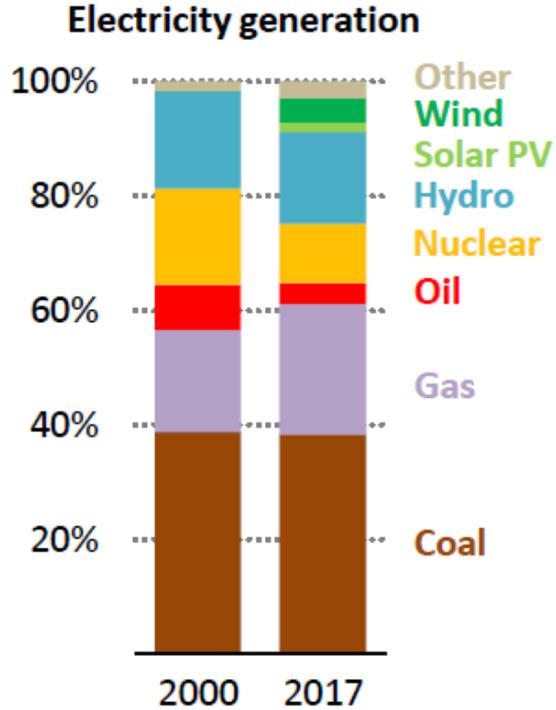
<https://world-nuclear.org/our-association/publications/policy-papers/building-a-stronger-tomorrow.aspx>

Nuclear jobs

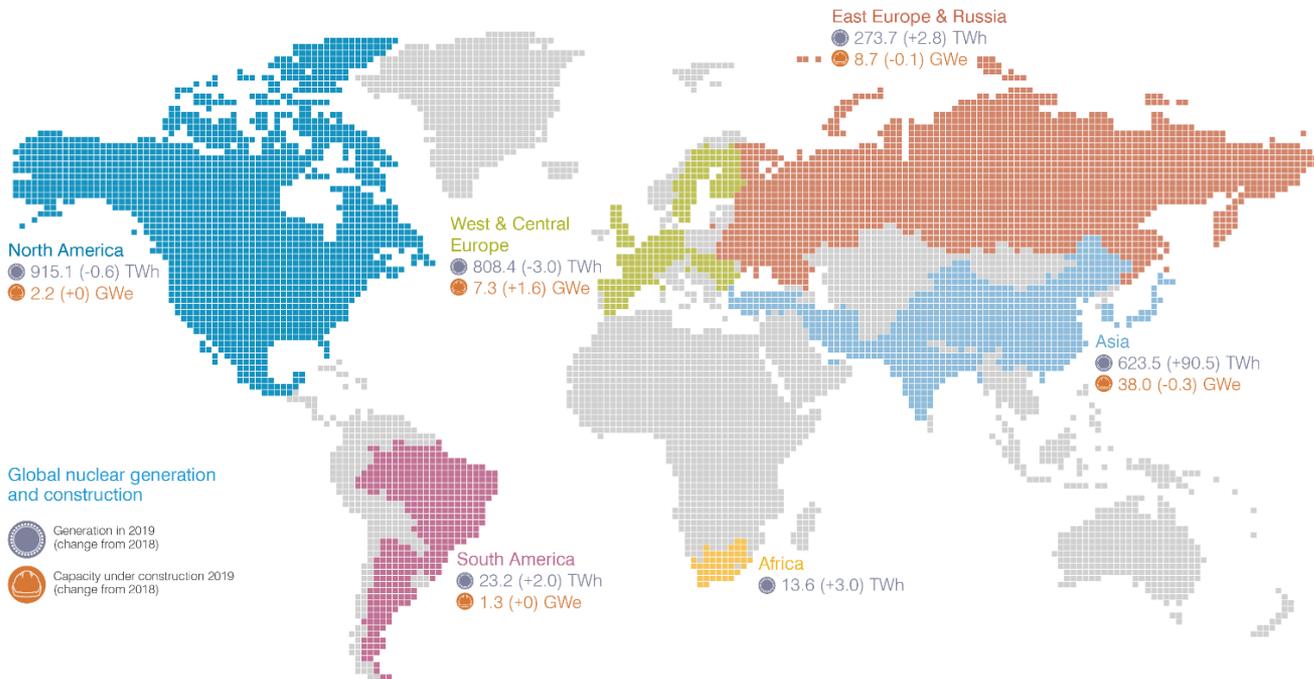


<https://www.world-nuclear.org/our-association/publications/technical-positions/employment-in-the-nuclear-and-wind-electricity-gen.aspx>

Nuclear is the second largest source of low-carbon electricity generation worldwide.



Global nuclear performance 2019



Global electricity generated:
2657 TWh, up 95 TWh

Global capacity:
392 GWe, down 5 GWe

Average capacity factor:
82.5%, up 2.7%

2019 Construction starts

- Kursk II-2, Russia
- Zhangzhou 1, China
- Bushehr 2, Iran
- Hinkley Point C 2, UK
- Taipingling 1, China

2020 Construction starts

- *to date
- Zhangzhou 2, China
- Akkuyu 2, Turkey

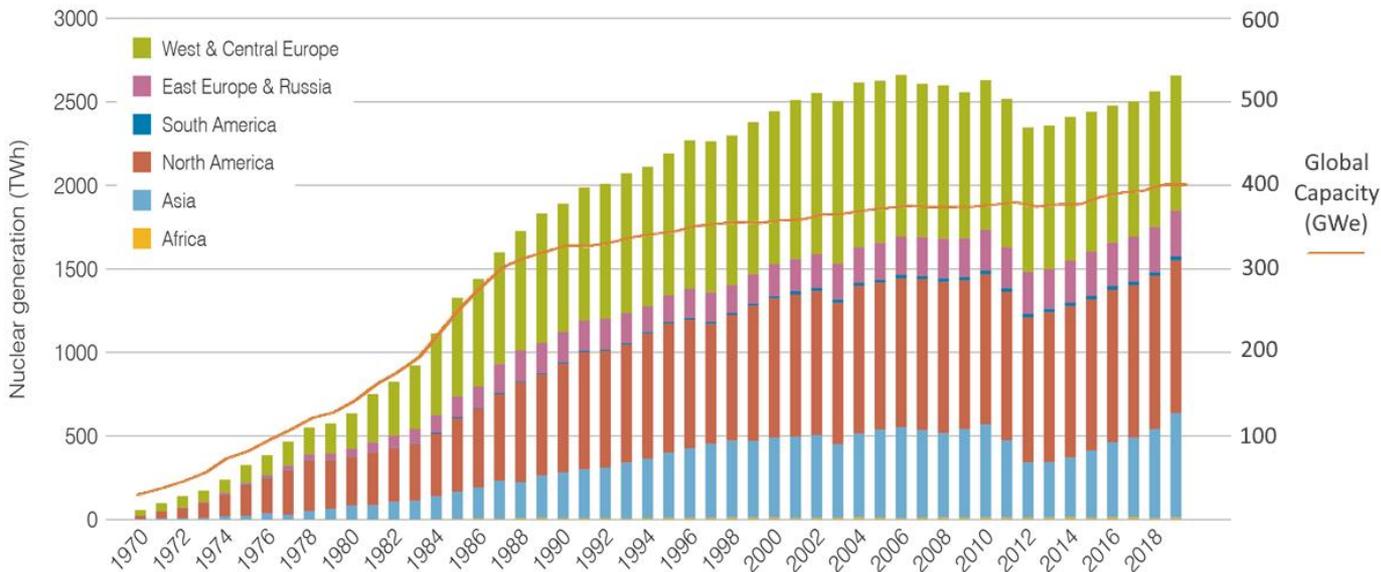
2019 Grid connections

- Akademik Lomonosov 1 & 2, Russia
- Novovoronezh II-2, Russia
- Shin Kori 4, South Korea
- Taishan 2, China
- Yangjiang 6, China

2020 Grid connections

- *to date
- Tianwan 5, China
- Barakah 1, UAE
- Leningrad II-2, Russia

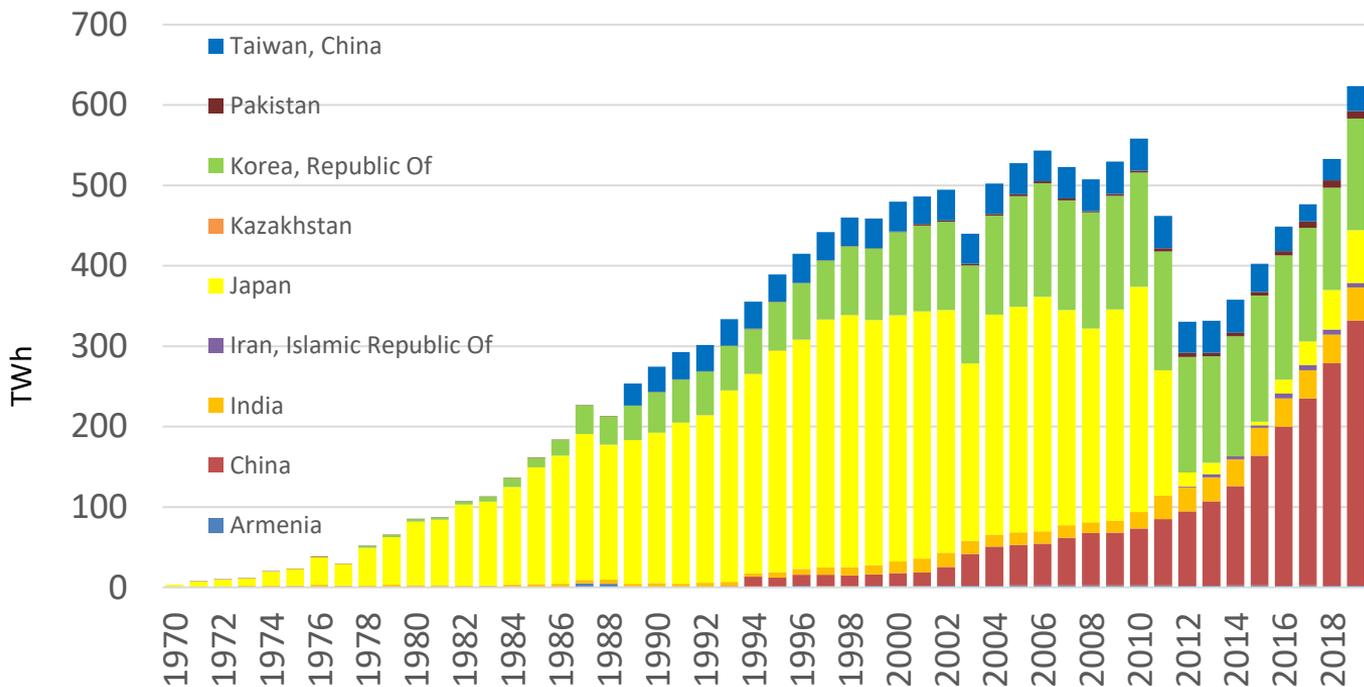
Electricity generation and capacity since 1970



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

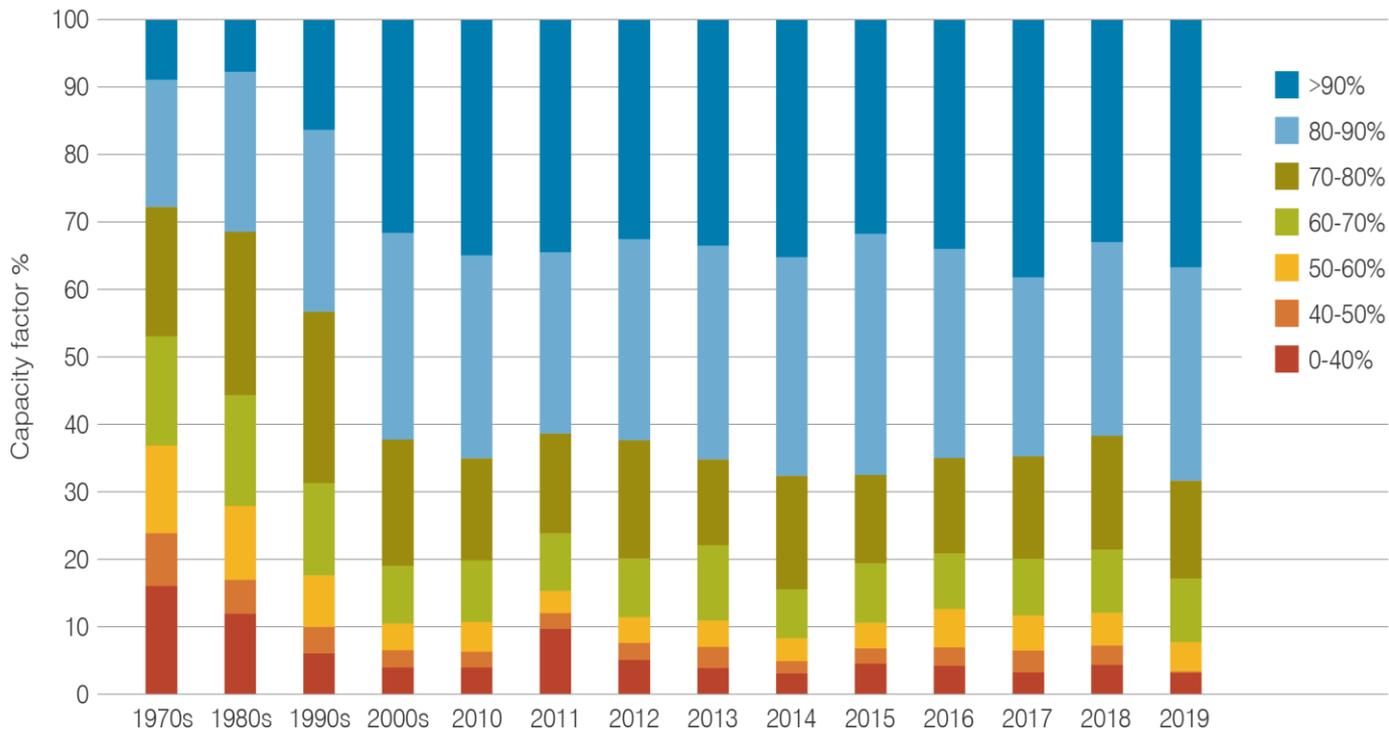
- Rapid expansion of capacity in 1970s and 1980s
- Continued growth in generation in 1990s with improved reactor performance
- Sharp decline in output in 2012 due to start of German phase out and Japanese outages
- Fast 2010s growth in Asia leads to near record global output after seven years of growth.

Nuclear generation in Asia



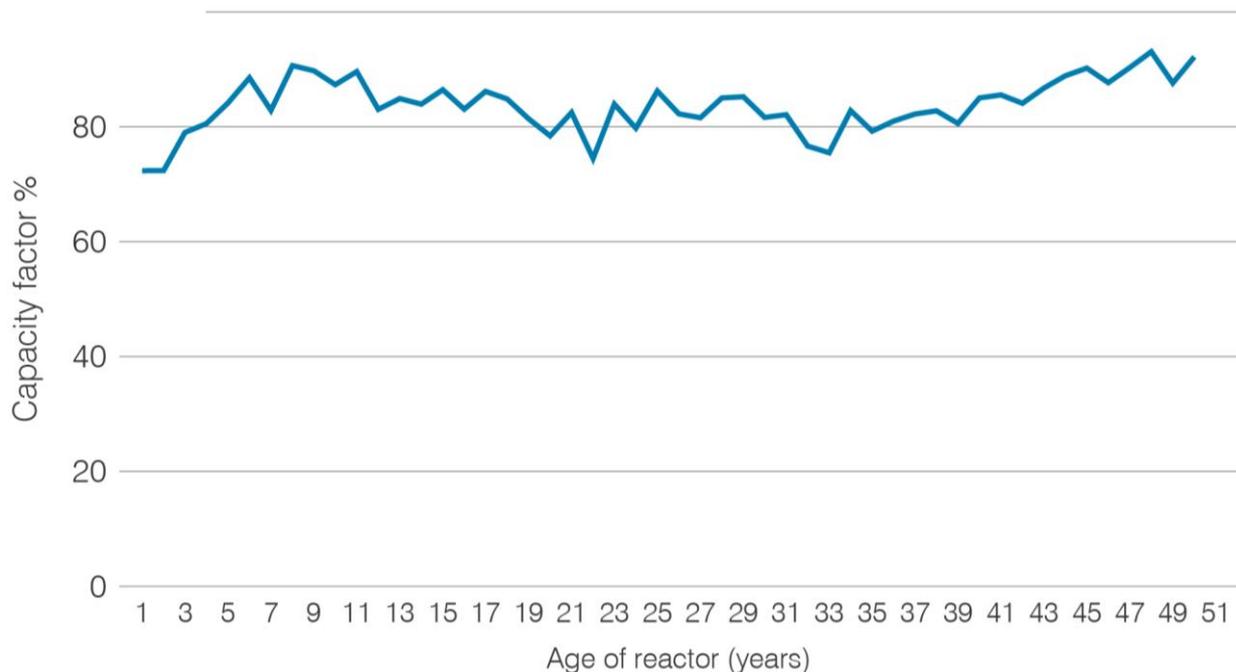
- Historic growth in Asia nuclear generation first led by Japan, then South Korea and, most recently, China.
- Huge potential for growth in China
- Turkey, UAE, Bangladesh will soon join Asian nuclear energy nations.
- Others, such as Philippines and Uzbekistan "seriously considering" nuclear.

Improvements in reactor operations



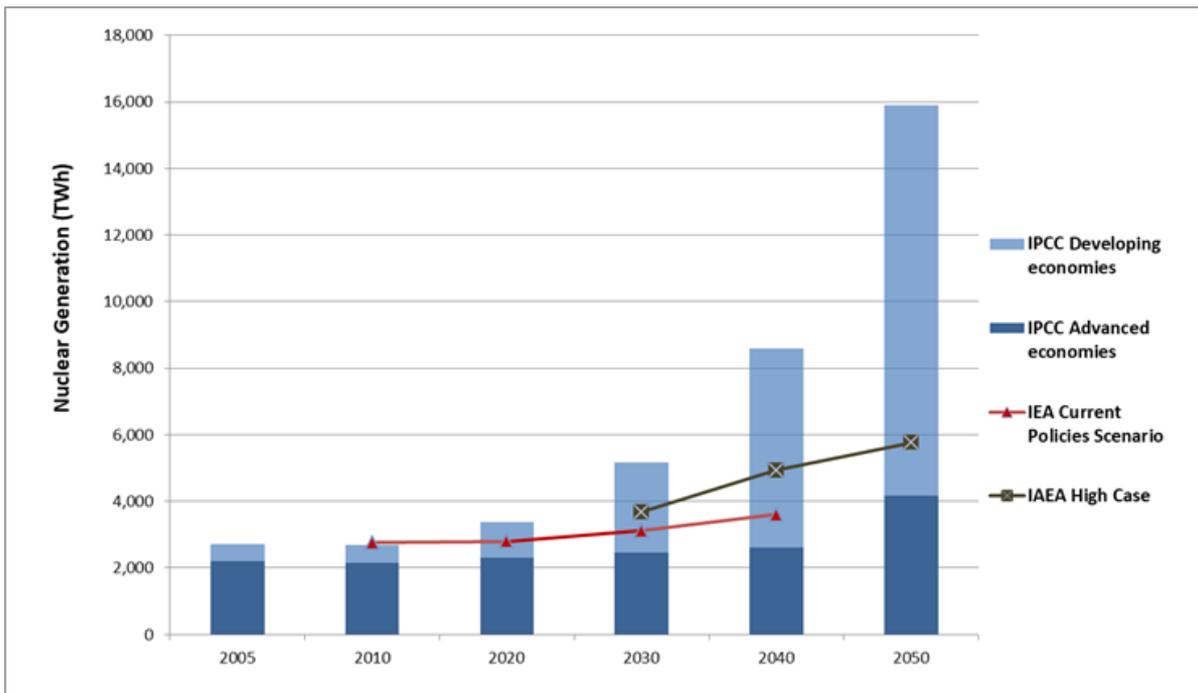
- Improved reactor performance has seen capacity factors rise significantly.
- In 1970s fewer than 3 in ten reactors had capacity factors over 80%.
- In 2019 nearly 7 in ten reactors had capacity factors over 80%.

Mean capacity factor by age of reactor (2015-19)



- Improved performance has been achieved with existing fleet as well as new reactors.
- There is no age-related downward trend in average capacity factors by age of reactor.
- This gives confidence in extended operations beyond 60 years.

The expectations on nuclear energy are growing



Data Source: IPCC Special report on the impacts of global warming of 1.5 °C, 2018, IEA World Energy Outlook 2019, IAEA Electricity and Nuclear Power Estimates for the Period up to 2050, 2020

Nuclear energy needs to grow rapidly if we are to satisfy energy demand, achieve climate targets and help the world meet the sustainable development goals.

The projections from the IPCC 1.5°C Report Middle of the road scenario see nuclear energy grow six-fold by 2050, with 2243 GWe capacity, representing 25% of electricity generation

COVID-19 pandemic reveals the importance of electricity

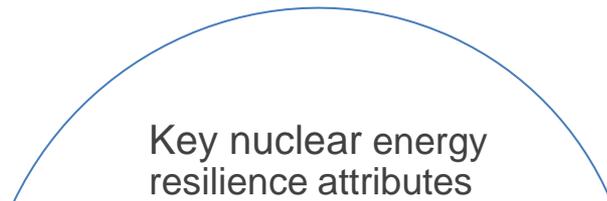
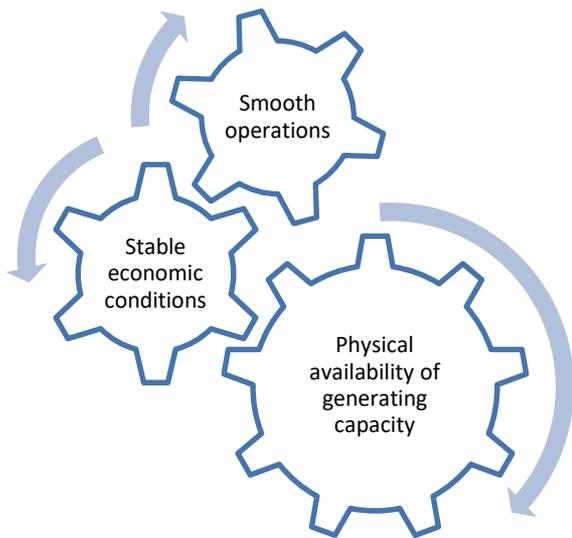
“The coronavirus crisis reminds us of electricity’s indispensable role in our lives. It’s also providing insights into how that role is set to expand and evolve in the years and decades ahead.”

Fatih Birol, IEA – March 2020



Nuclear energy helps build resilience at many levels

Three dimensions of a resilient electricity system



Technical Design

Defence In depth, high standards, multiple layers

Energy system

Dispatchable and flexible, provides grid stability, onsite strategic fuel stockpiles

Organisational

Emergency preparedness, safety culture, continuous learning, international cooperation

Socio-economic

Low and stable operating costs, local high paying jobs, taxes and revenues, education

Stabilising the grid with nuclear energy

Nuclear plants are reliable baseload energy sources

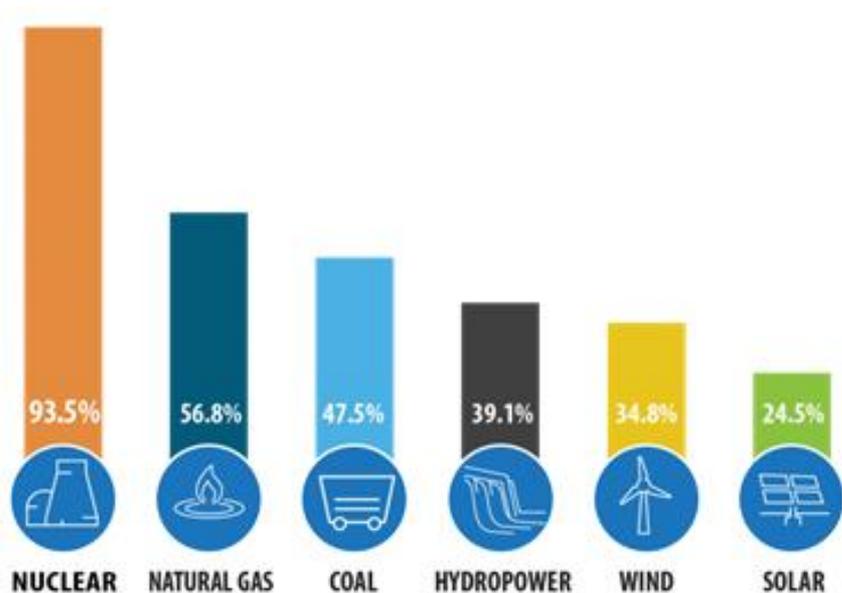


Chart showing capacity factors of different electricity sources in the USA for 2019. Source: US Department of Energy

...but can also operate flexibly if required!

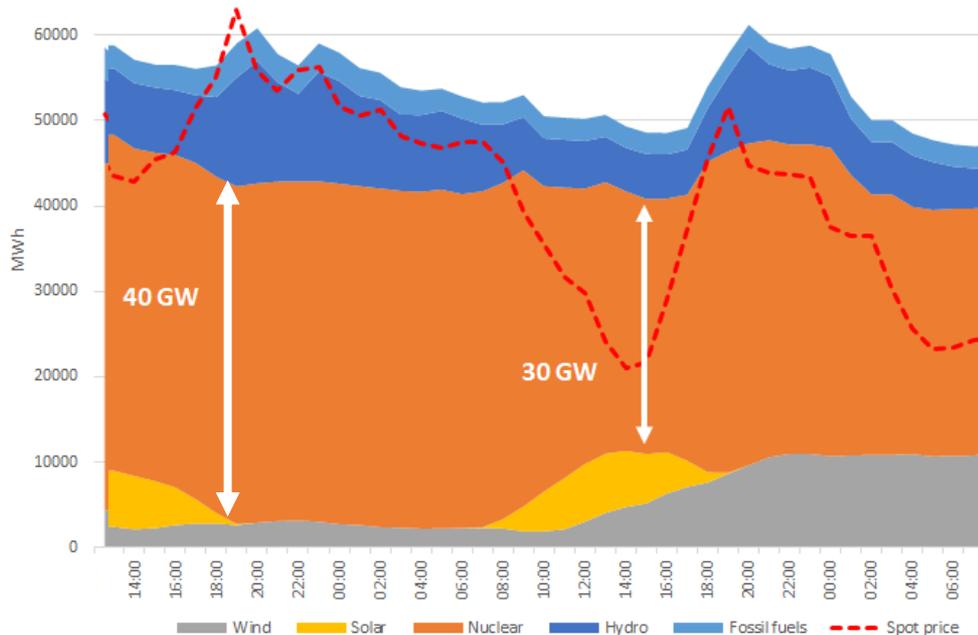
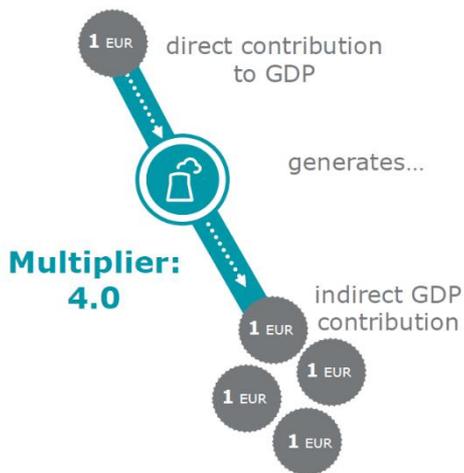


Chart showing load following of French nuclear plants on 27 – 28 March this year. Source NEA LTO report (forthcoming) based on data from RTE and Nord Pool

Empowering the economy and workforce with nuclear energy

Nuclear projects provide many socio-economic benefits throughout the wider economy



Impact of the Nuclear sector on the EU economy in 2019.
Source: Foratom, Impact Report -Vision to 2050

Nuclear sector pay is typically the highest for any energy technology

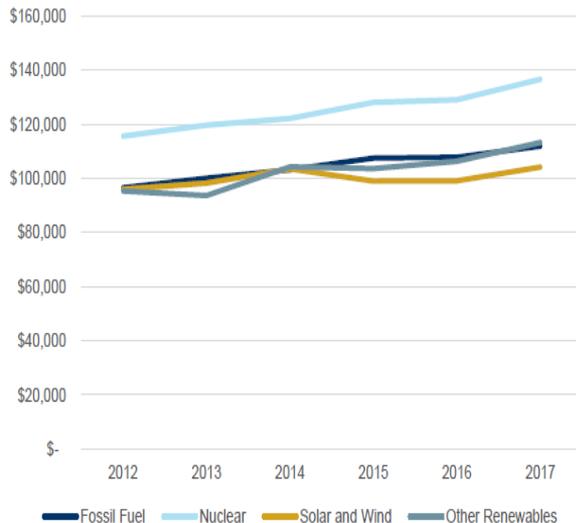


Figure. Average US energy worker pay trends.
Source: Oxford Economics, 2019, Nuclear Power Pays

Thousands of nuclear jobs from one power project

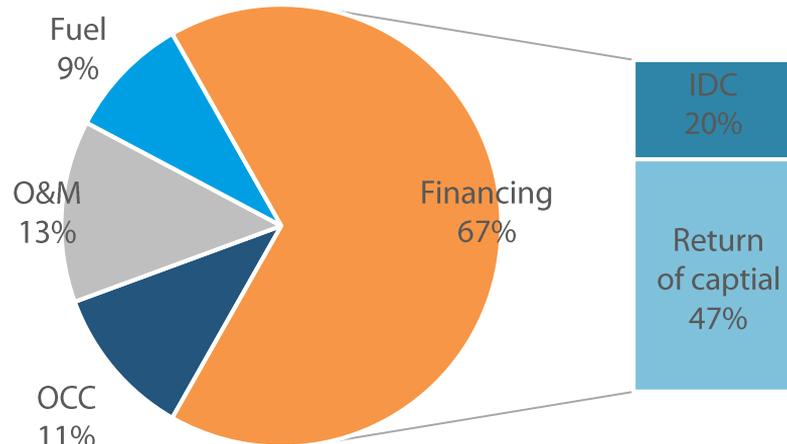


Source: Building a stronger tomorrow
<https://world-nuclear.org/our-association/publications/policy-papers/building-a-stronger-tomorrow.aspx>

Affordable financing is key for new nuclear projects - Governments can support financing through a range of financial mechanisms

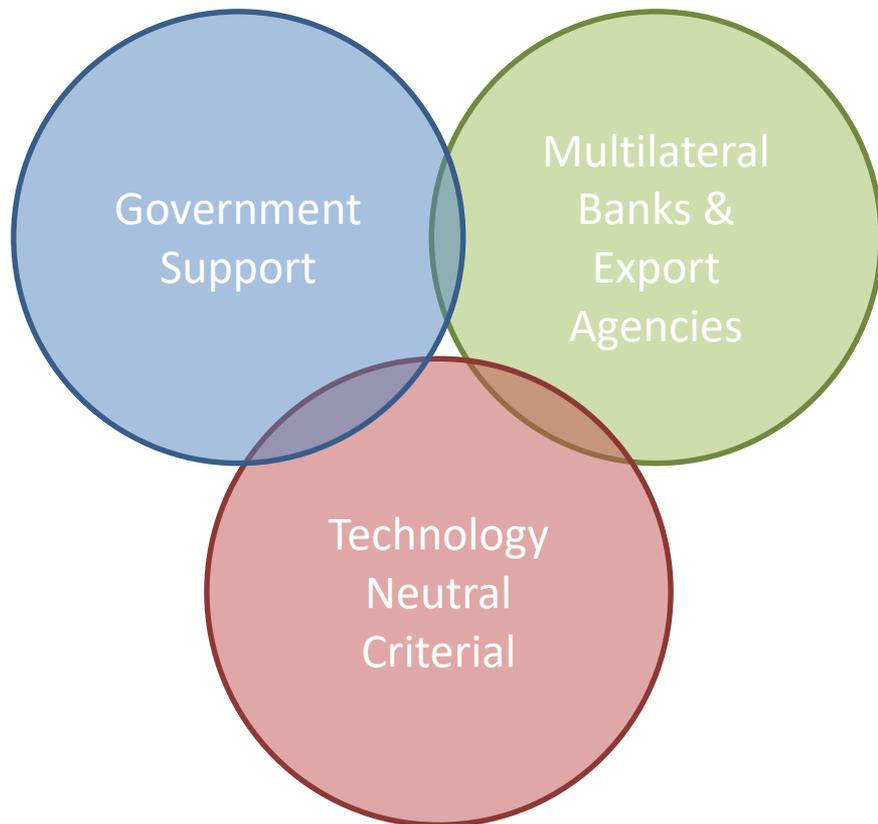
Direct Financial support	Indirect financial support	
	Power purchasing agreements	Regulated assets
Equity, debt, ECAs, loan guarantee	Contract-for-difference (UK), Mankala model (Finland)	Rate-of-return (US), Regulated Asset Base (UK)
Equity stake can be transitional as additional sources of financing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

Investment costs could represent 78% of nuclear production costs



Source: NEA, 2020 https://www.oecd-nea.org/jcms/pl_30653
 Note: Calculations based on OCC of USD 4 500 per kilowatt of electrical capacity (/kW_e), a load factor of 85%, 60-year lifetime and 7-year construction time at a real discount rate of 9%.

Newcomer countries need cost-effective financing to deploy nuclear energy for sustainable development



- Government support needed to instil confidence and incentivise long term planning and investment
- Important role for multilateral banks and national export agencies
- Development of technology neutral criteria for financial support is key to allow countries make their own choices

World Nuclear Association calls upon policymakers to:

- Ensure that the socio-economic, environmental and public health benefits of nuclear energy are realized by enacting policies that recognize and value these benefits.
- Accelerate the transition to zero carbon energy systems by taking advantage of the readiness of the 108 reactors that are already planned by governments and potential long-term operations at 290 reactors that have been operational for 30+ years.
- Incentivise investment, generate jobs and provide better long-term value for consumers by facilitating the appropriate frameworks to unlock finance for new nuclear build.