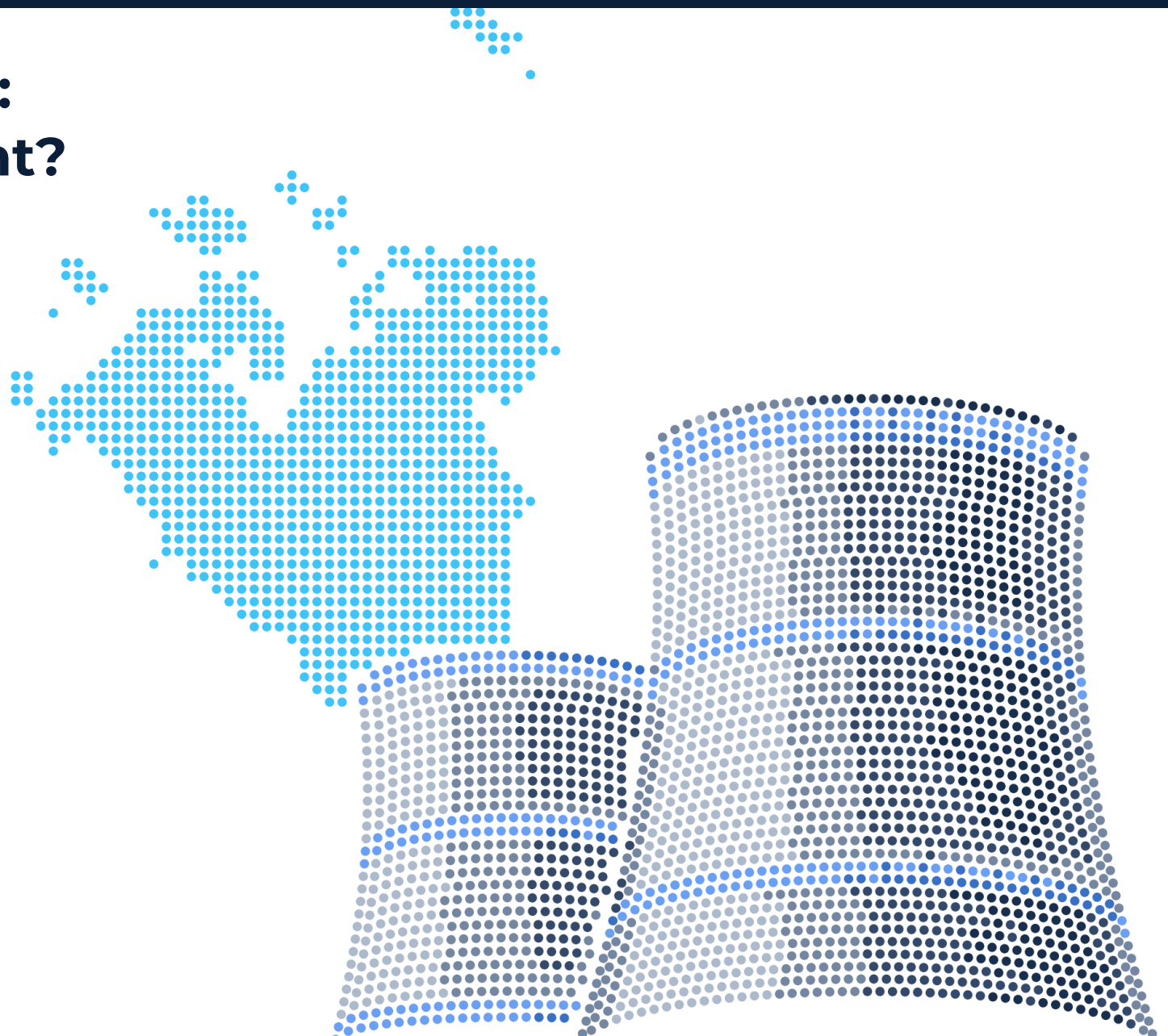


THE NUCLEAR RENAISSANCE:

Is this time really different?

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The Nuclear Renaissance: Is this time really different?



E3 Analytics, November 2026

Authors

Toby D. Couture, MA, MSc
Matthijs van de Wiel, MSc
E3 Analytics

Suggested citation

Couture, T. D. and van de Wiel, M. (2026). The Nuclear Renaissance: Is this time really different? E3 Analytics.

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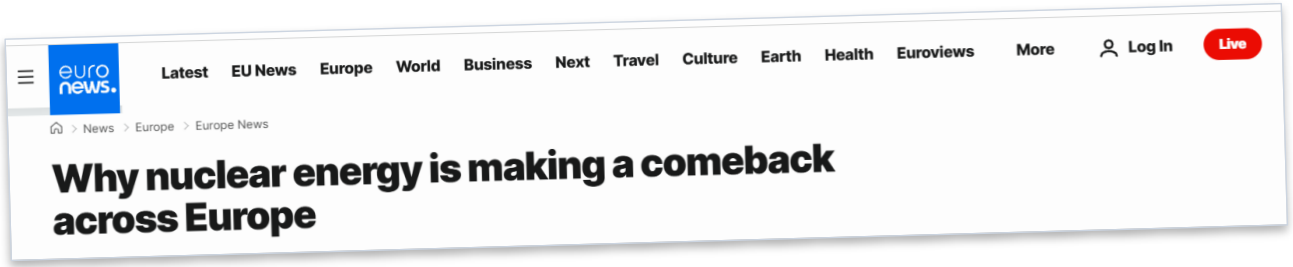
01

PART 1

Understanding the case for nuclear power

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Headlines are heralding a major comeback for nuclear power













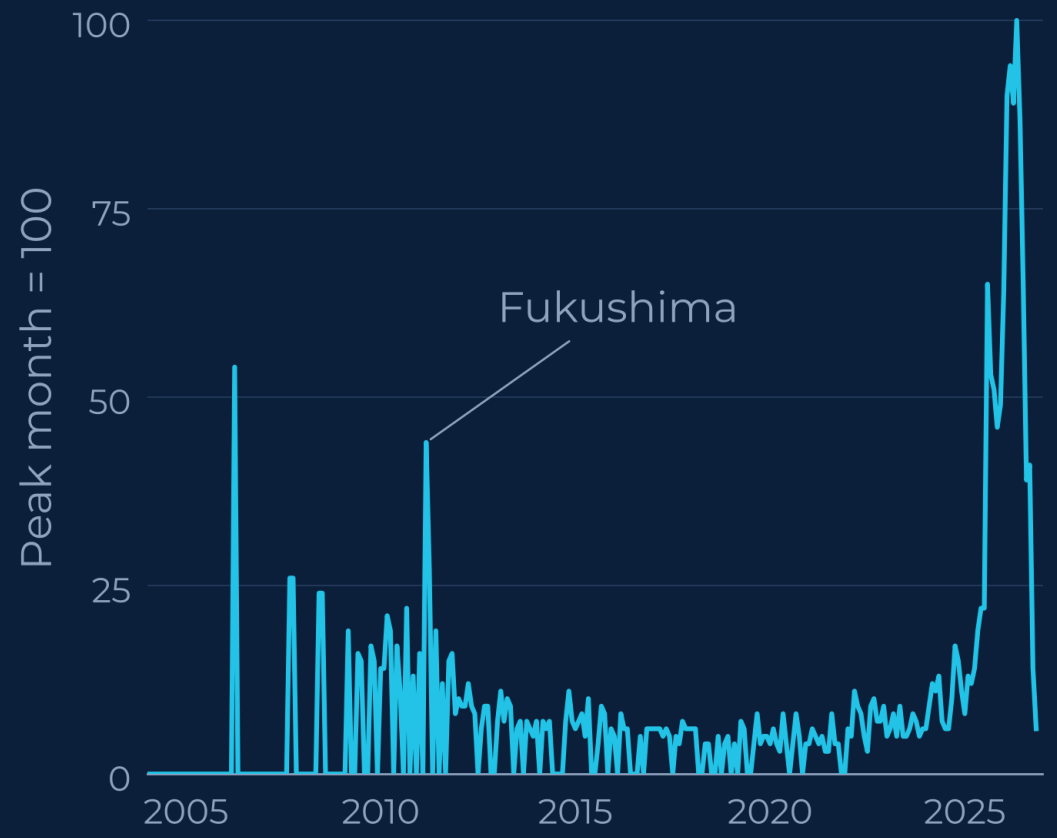
Sources: **24** Euronews (2023, 2025); **67** The Guardian (2025); **58** Reuters (2025, 2026); **41** Los Angeles Times (2016, 2026); **8** Bloomberg (2026)

Interest in nuclear power has surged in recent years

- In 2026, online searches for “nuclear renaissance” are at their **highest** since Google’s records began in 2004[31]
- And yet, there have been similar “hype cycles” in the past that have not panned out

The question now is whether this time is different

Figure 1. Web searches for “nuclear renaissance”, worldwide



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Source: **31** Google (2026)

Five main arguments are often raised in support of a nuclear renaissance

01 Round-the-clock, low-carbon power

Nuclear provides low-emissions power 24/7 and can support grid stability

02 National energy security

Some countries see nuclear as way of increasing their energy security

03 Dark, windless winter days

For northern economies, having supply to cover long, dark and windless spells is considered critical

04 Industrial development

Many emerging economies see nuclear power as a key step to becoming a major industrial power

05 Strategic and dual-use capability

In a more fractious world, some governments see nuclear power as a way to secure nuclear weapons and bolster their “hard” power

Countries that voted against nuclear in previous decades are now starting to legislate it back

15 May 2025

Belgium

Parliament scrapped the 2003 law that set a phase-out and banned new reactors

Mar 2026

Finland

Government put forward a new Nuclear Energy Act to ease licensing; expected to enter into force from 2027

4 Jun 2026

Italy

Chamber passed a key enabling law. Italy shut its last reactor in 1990, partly in reaction to the Chernobyl accident

Jun 2026

Estonia

Parliament passed its first nuclear law in a country with no reactors

38 countries have endorsed a pledge to triple global nuclear capacity by 2050, and over 50 have plans, targets or interest in new reactors[37]

Sources: **29** Foro Nuclear (2025); **49** NucNet (2025, 2026); **20** Eduskunta (2026); **2** AGI (2026); **6** ANSA (2026); **59** Riigikogu (2026); **77** World Nuclear News (2017, 2020, 2023, 2024, 2025, 2026); 37 IEA (2026)

The world's largest companies are signing up too

Table 1. Nuclear deals signed by large technology companies

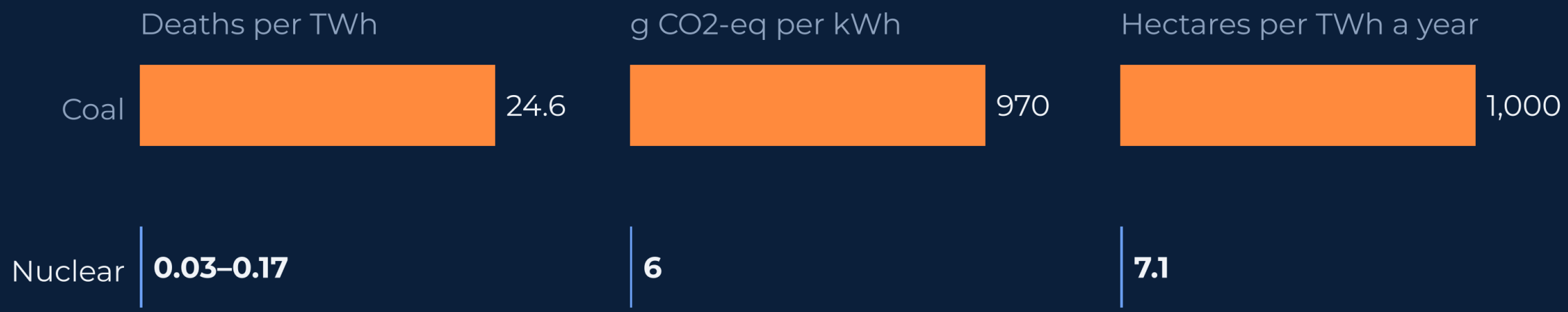
Company	Main nuclear agreements	Size	Supply from	Price
Meta	Clinton and Vistra plants; TerraPower and Oklo SMRs	Up to 6.6 GW by 2035	Plants: 2027 SMRs: 2030s	**Not disclosed**
Amazon	Susquehanna plant; X-energy SMRs	1.9 GW; SMR target of 5 GW by 2039	Plant: 2029 SMRs: 2030s	**Not disclosed**
Google	Duane Arnold restart; Kairos Power SMRs	0.6 GW restart; 500 MW SMRs by 2035	Restart: 2029 SMRs: 2030s	**Not disclosed**
Microsoft	Crane restart (Three Mile Island 1)	0.8 GW, 20-year contract	Restart: late 2027	**Not disclosed**

Growing interest from data centres and large tech companies signals a new set of stakeholders interested in buying low-carbon, round-the-clock power

Sources: **77** World Nuclear News (2017, 2020, 2023, 2024, 2025, 2026); **73** Utility Dive (2025); **56** POWER (2026); **39** Kairos Power (2024)

Despite major accidents, millions of people consider nuclear to be safe, clean and compact

Figure 2. Deaths, lifecycle emissions and land use per unit of electricity, coal and nuclear



In addition, many academics and policymakers see nuclear as important to replace an ageing global coal-fired power fleet

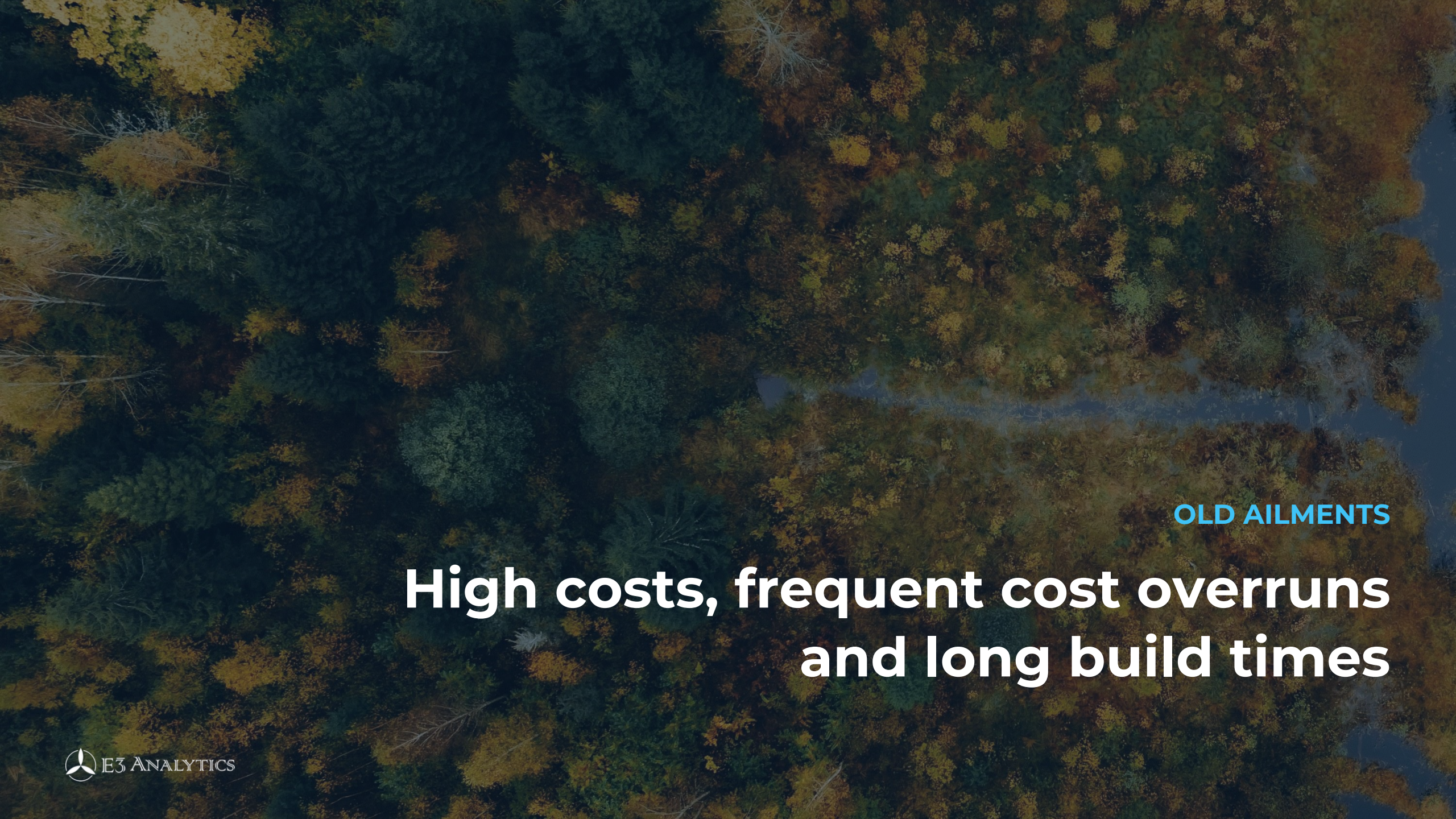
Sources: **53** Our World in Data (2026); **60** Ritchie (2020); **11** Cardis et al. (2006); **57** Reconstruction Agency (2026); **42** Lovering et al. (2022)

02

PART 2

Talk of a “nuclear renaissance” is surfacing challenges, both old and new





OLD AILMENTS

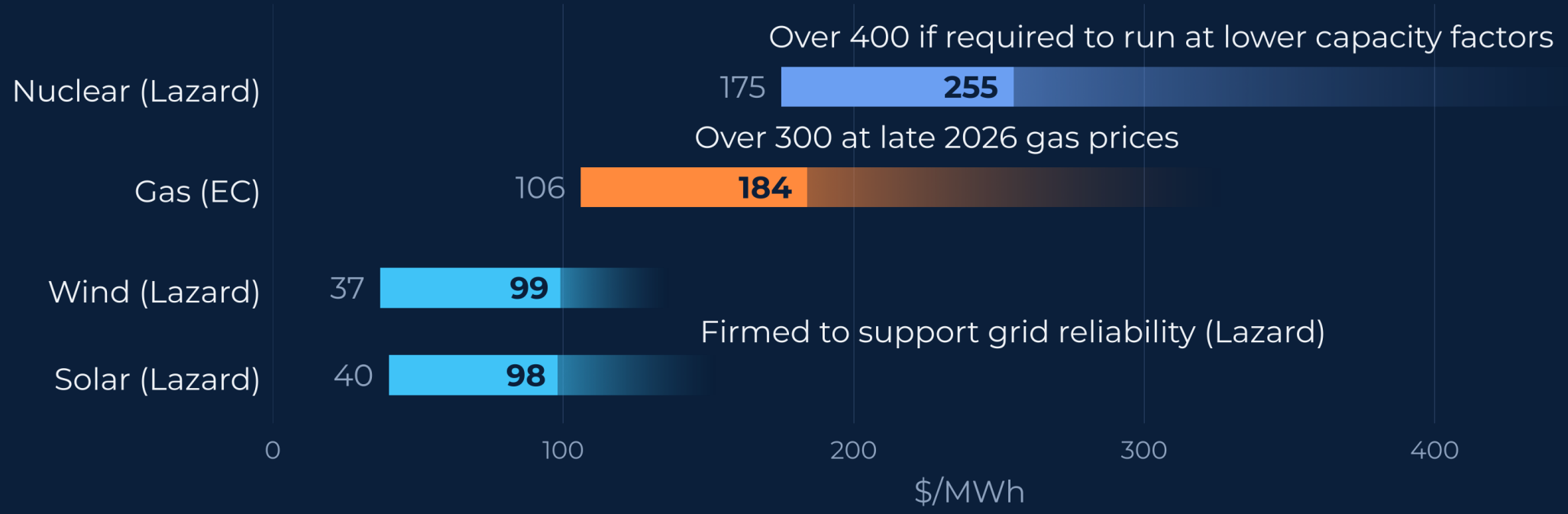
High costs, frequent cost overruns and long build times

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UPFRONT COST

Nuclear ranks among the highest-cost sources of electricity generation

Figure 3. Levelised cost of power from new plants, US; gas at 2025 European prices, $/MWh



At its core, a nuclear reactor is a high-cost (but low-carbon) way of boiling water. The boiling water generates steam, which is ultimately used to turn turbines.

Sources: **40** Lazard (2025, 2026); **25** European Commission (2026)

Fifty years and no discernible learning curve

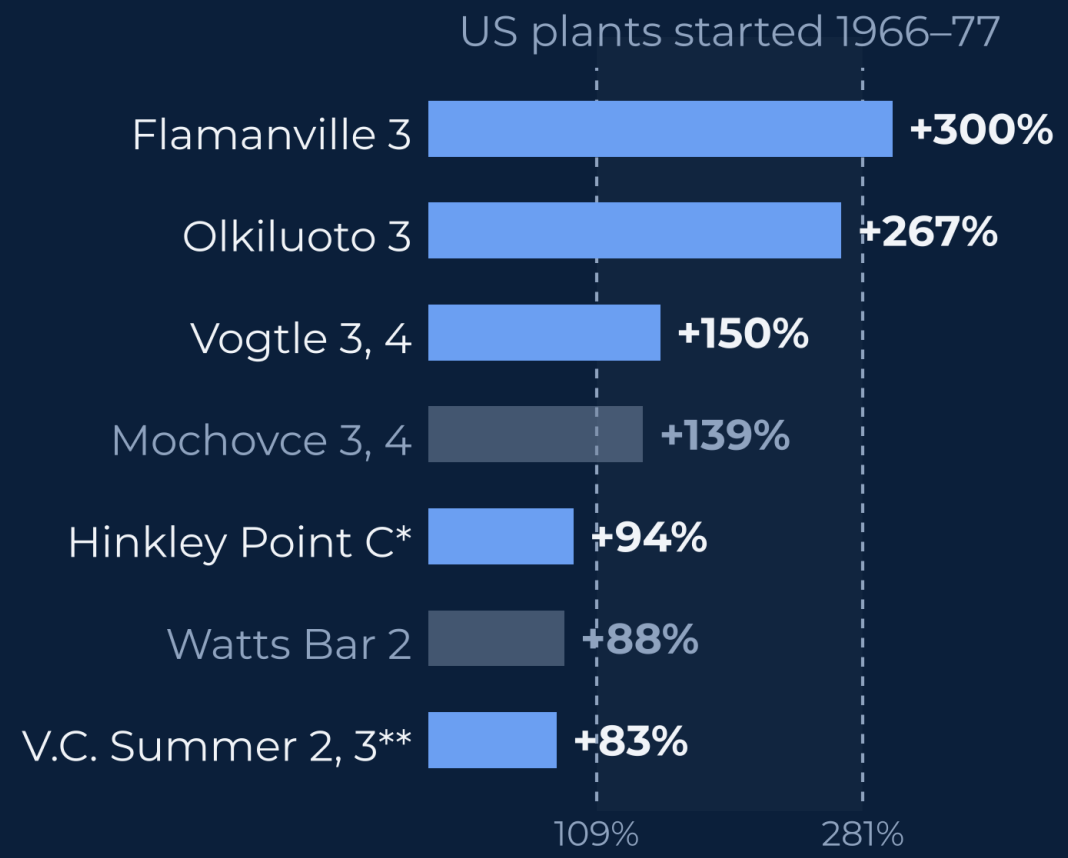
- 75 US plants started in 1966–77 cost **2.1 to 3.8 times** their initial estimate, after inflation[23]
- Five Western projects started since 2000 overran by about **180%** on average[7,16,17,19,24]
- Sizewell C's estimate went from $26bn in 2020 prices to $50bn in 2024 prices[33,43]

Recent builds overrun as much as in the 1970s, or more

Sources: **72** Urgewald (2026); **75** WNA (2020, 2025, 2026); **19** EDF (2022, 2023, 2025, 2026); **7** AP (2024); **16** CRS (n.d.); **33** HM Government (2025, n.d.); **43** NAO (2026); **77** World Nuclear News (2017, 2020, 2023, 2024, 2025, 2026); **23** EIA (1986, 2016); **17** Cour des comptes (2012, 2025, 2026); **24** Euronews (2023, 2025)

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Figure 4. Cost overrun of recent Western nuclear projects, % above the first estimate



*Under construction. **Abandoned in 2017; estimate at abandonment. Grey: construction suspended for decades, not in the average.

Recent Western reactors cost around $8,000–20,000 per kW to build

Table 2. Reported cost of recent Western reactors

Reactor	Online	Cost as reported	Capacity	Per kW in USD	Times over budget
Olkiluoto 3, Finland	2023	About €11bn	1.6 GW	$7,800[24]	~3.7x
Flamanville 3, France	2024	€13.2bn excluding financing; €23.7bn including it	1.6 GW	$9,300–16,700[17]	~4x
Vogtle 3 and 4, US	2023–24	About $35bn	2.2 GW	$15,900[7]	~2.5x
Hinkley Point C, UK	2030 (planned)	£35bn in 2015 prices; about £49bn at current values	3.26 GW	$14,200–19,800[19,32]	~1.9x (est.)

At these prices, a single project ties up $10–65bn of capital depending on the size

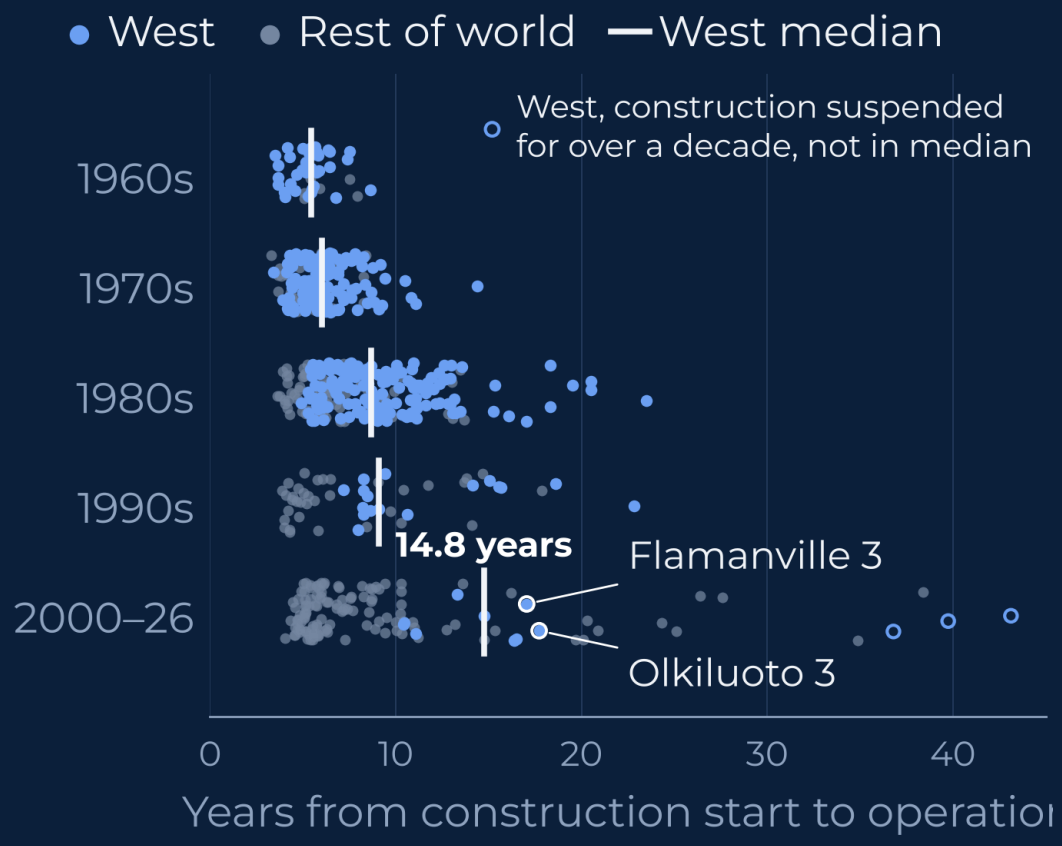
Sources: **24** Euronews (2023, 2025); **17** Cour des comptes (2012, 2025, 2026); **7** AP (2024); **19** EDF (2022, 2023, 2025, 2026); **32** Hargreaves Lansdown (2026)

Western reactors take about three times as long to build as in the 1960s

- Build times in the West have grown longer, making new projects more vulnerable to inflation and cost overruns
- Olkiluoto 3 (Finland) took 18 years to build; Flamanville 3 (France) took 17 years[75]

China's reactors have also tended to run late: projects started in 2010–20 finished on average about 45% longer than planned[37]

Figure 5. Build time per reactor, by decade of entering operation (one dot per reactor)



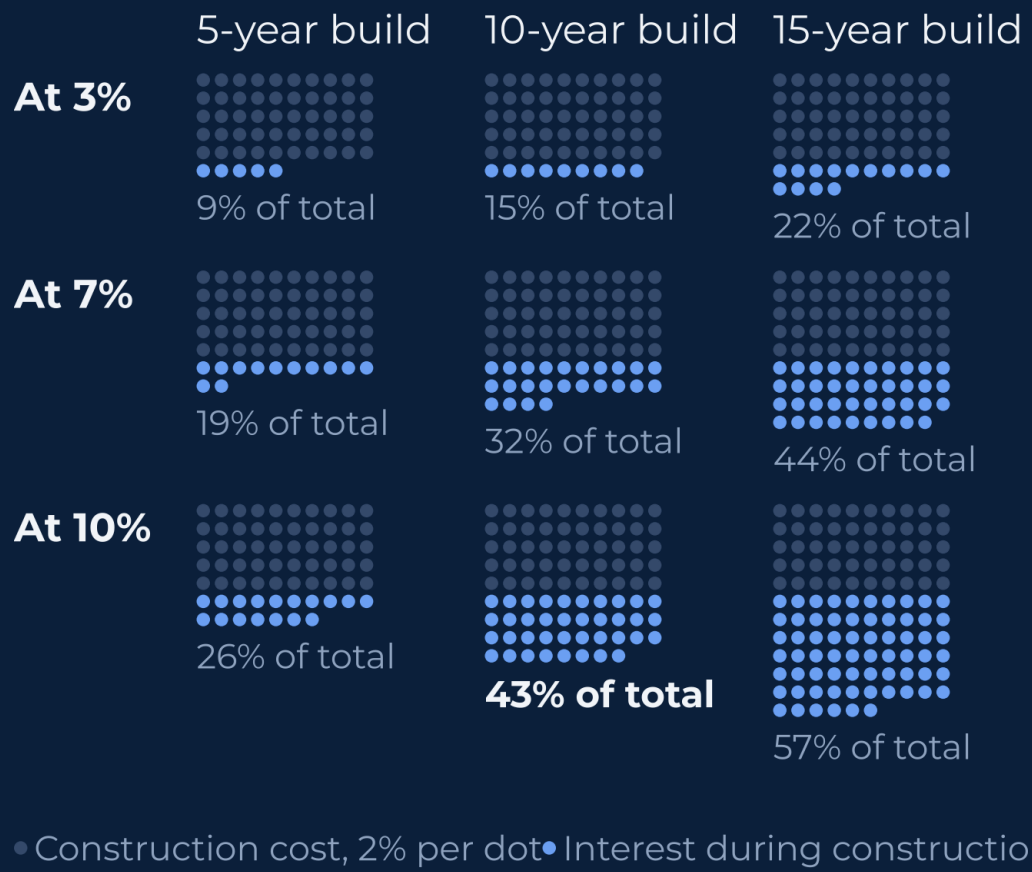
Sources: **30** GeoNuclearData (2024); **22** Enerdata (2023); **75** WNA (2020, 2025, 2026); **77** World Nuclear News (2017, 2020, 2023, 2024, 2025, 2026); **37** IEA (2024)

Decade-long build times leave nuclear exposed to rising interest costs

- When interest rates rise, interest payments on debt come to represent a greater share of total project expenditures

Each year of delay adds interest payments on higher construction costs, which pushes the break-even price higher

Figure 6. When build times get longer and interest rates rise, the economics of nuclear get worse



Source: **51** NEA (2020, 2025)

Approximately nine in ten nuclear projects run over budget, with average cost overruns of over 100%

Figure 7. Average cost overrun by type of energy project, real terms, %

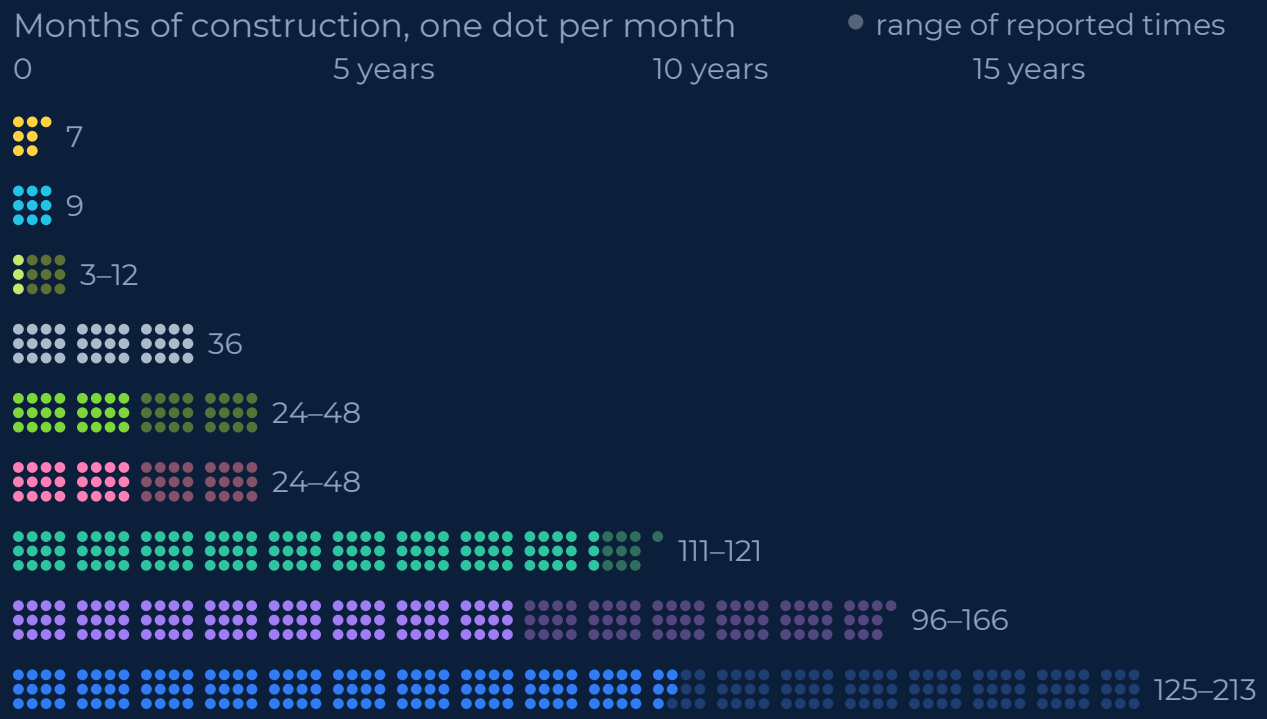


This is the reference class that decision-makers need to have in mind when weighing up the decision whether to invest more ratepayer and taxpayer money into nuclear power

Sources: **28** Flyvbjerg & Gardner (2023); **65** Sovacool & Ryu (2025)

What else could a country, or utility, buy for $10bn?

Option	What $10bn buys
Solar	12.2–15.0 GW
Four-hour batteries	7.5 GW
Onshore wind	5.8–10.2 GW
Transmission lines	6,100–7,500 km
Offshore wind	2.4–3.4 GW
Geothermal	1.5–1.9 GW
Hydropower	4.3 GW
Pumped hydro	1.4–3.4 GW
New nuclear	**0.5–1.3 GW**



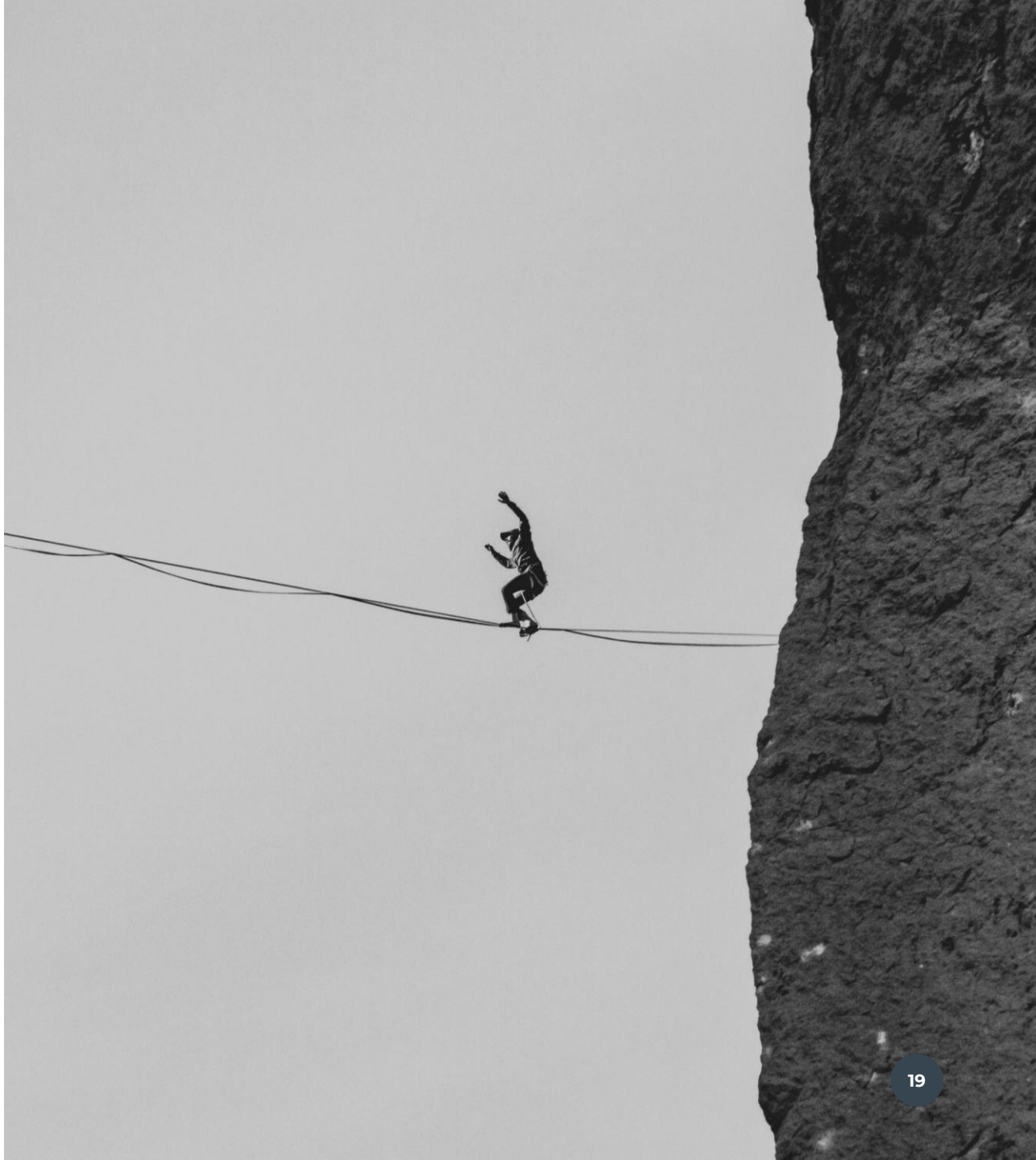
$10bn buys more capacity in every other option, and most of them start producing and cutting emissions years before a reactor would

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Sources: E3 Analytics calculation from **38** IRENA (2026); **40** Lazard (2026); **64 Snowy Hydro (2026); 46 Nant de Drance SA (2022); 14 Cole et al. (2025)**; **26** ACER (2026); **24** Euronews (2023); **19** EDF (2026); **37** IEA (2023, 2026); **3** AIS Wind Energy (2025); **35** Iberdrola (2022, n.d.); **50** ORNL (2026); **63** Siahaan et al. (2023); **71** UK Parliament (2024); **75** WNA (2026)

Taking on new nuclear is a tightwire act

- As fiscal constraints remain high in many countries, cost overruns and delays risk worsening a country's economic performance by fuelling higher electricity prices
- Most utilities cannot carry these construction and interest-rate risks alone[16,17,27,77]
- For **emerging market utilities,** which often face higher interest rates, **the risks are arguably even greater**



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Sources: **27** Eurostat (2018); **16** CRS (n.d.); **17** Cour des comptes (2012, 2025, 2026); **77** World Nuclear News (2017, 2020, 2023, 2024, 2025, 2026)



NEW PROBLEMS

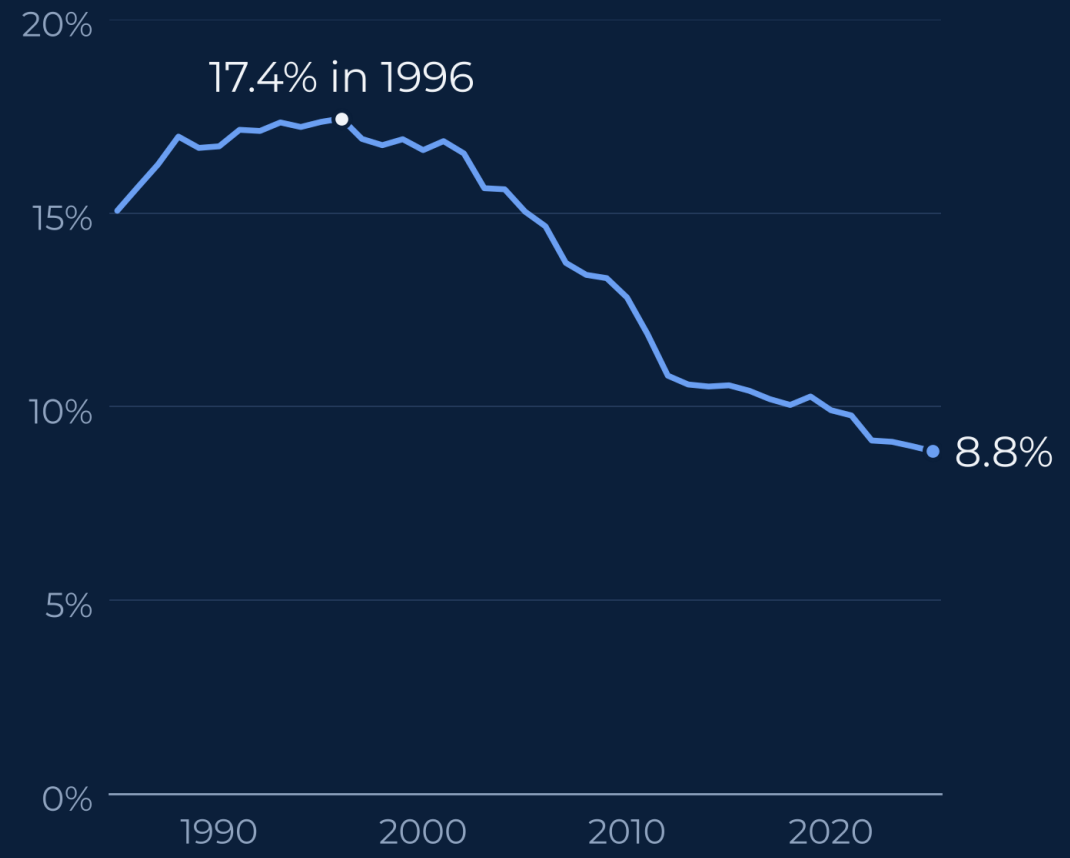
Market forces, reduced capacity factors, and governments that are less able to cover the high costs and risks

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Nuclear's share of global power keeps falling

- From 2006 to 2025, 106 reactors closed and 104 started up
- The result is that while nuclear power's total output has remained largely flat, its share has continued to shrink as global electricity demand has continued to grow
- In addition, nuclear is suffering from market forces: it is being increasingly **out-competed by cheaper and faster alternatives**

Figure 8. Nuclear share of global electricity generation, 1985–2025



Sources: **53** Our World in Data (2026); **76** WNISR (2026); **21** Ember (2026)

The rise of competitive electricity markets has made it harder for new nuclear to gain a foothold

- In contrast to the pre-2000 period, where generation could be added to the grid by utilities operating under cost-plus regulation, many electricity markets are now at least partially liberalised
- The result is that **nuclear has to be shielded from market forces**; such protection comes at a cost to ratepayers

Figure 9. Power market structure, 2024



- **Liberalised or partially liberalised**
  incl. wholesale competition and single-buyer markets
- Vertically integrated utility

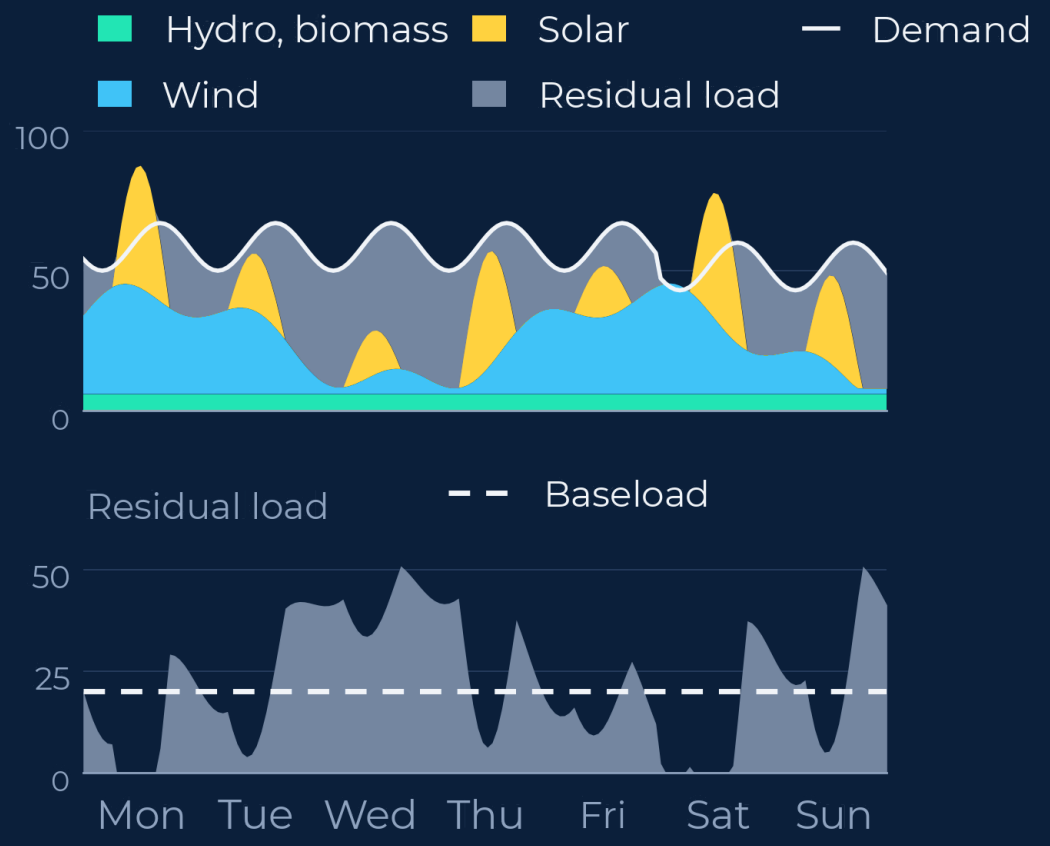
Sources: **4** Akcura (2024)

In modern power systems, the lowest-cost resources get dispatched first

- As wind and solar grow, the residual demand gets spikier; the result is that power plants increasingly need to ramp
- And though many reactors can technically ramp, most are *commercially* unable to do so[40]

This is because new reactors have large debt burdens to repay, which means they typically can't afford to reduce their output

Figure 10. A week of power supply with a high share of wind and solar, GW, illustrative

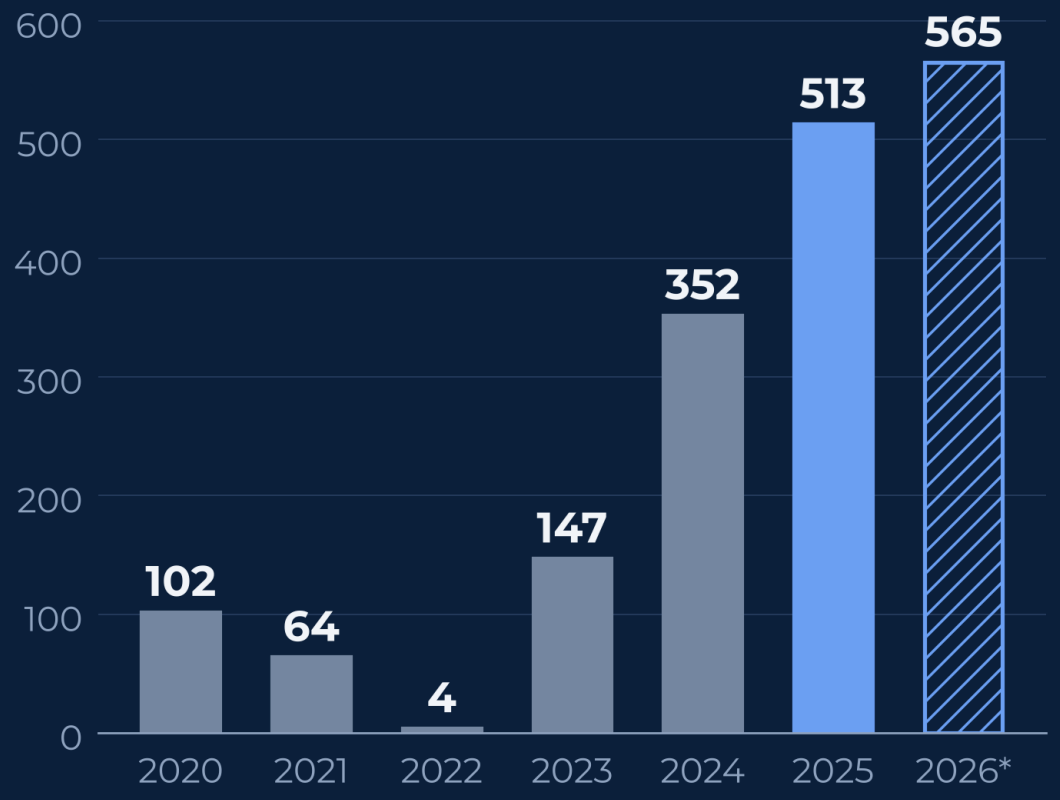


Sources: illustrative, after **18** E3 Analytics (2025); **40** Lazard (2025, 2026)

Negative prices make reactors hold back

- France had **513 hours** of negative prices in 2025, up from 147 in 2023; 2026 surpassed that total on **23 August**[9]
- Producing during periods of negative prices costs money, either to the utility or to the government
- A total of **33 TWh** was reportedly held back in France in 2025
- The result is that the remaining hours must earn more in order for the plants to remain commercially viable[15]

Figure 11. Hours of negative day-ahead prices in France, per year



*Until 4 November 2026

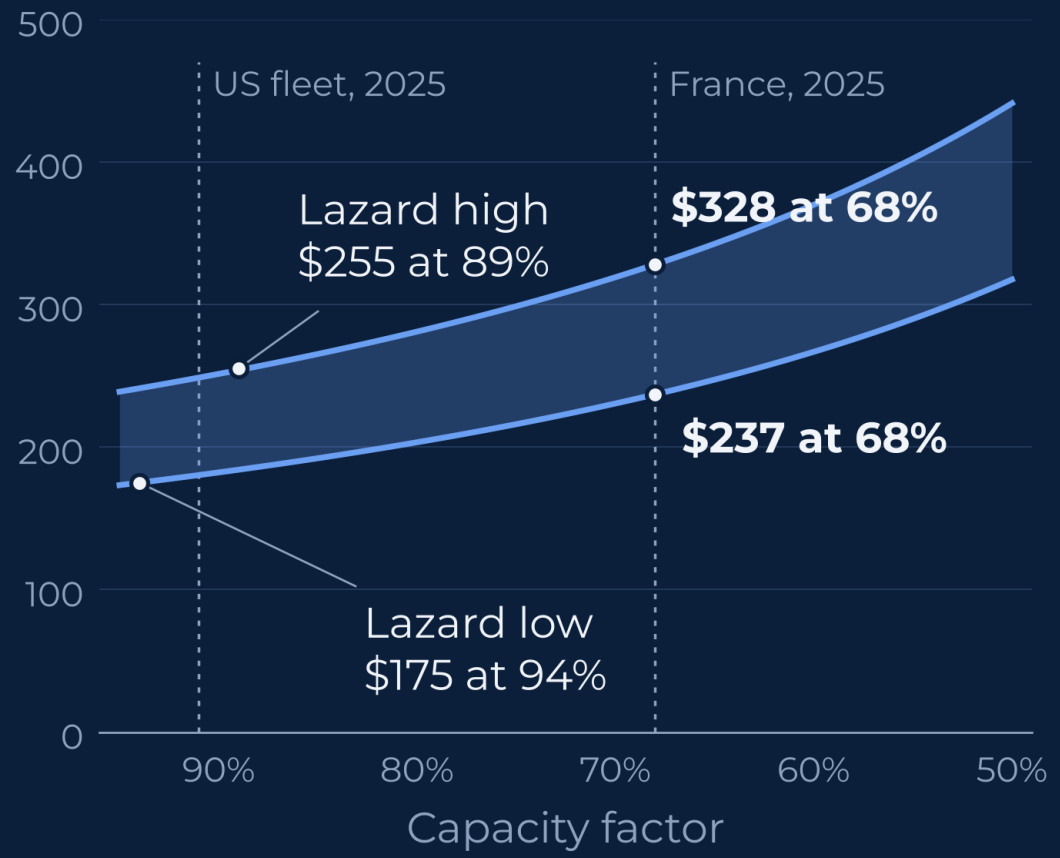
Sources: **9** Bundesnetzagentur | SMARD.de (2026); **61** RTE (2023, 2026); **15** CRE (2026); **19** EDF (2022, 2023, 2025, 2026)

Fewer operating hours raises the price nuclear needs to break even

- Lazard's cost range for nuclear plants assumes reactors run 89–94% of the year
- 90% is not guaranteed: France's fleet averaged 68% in 2025[61]

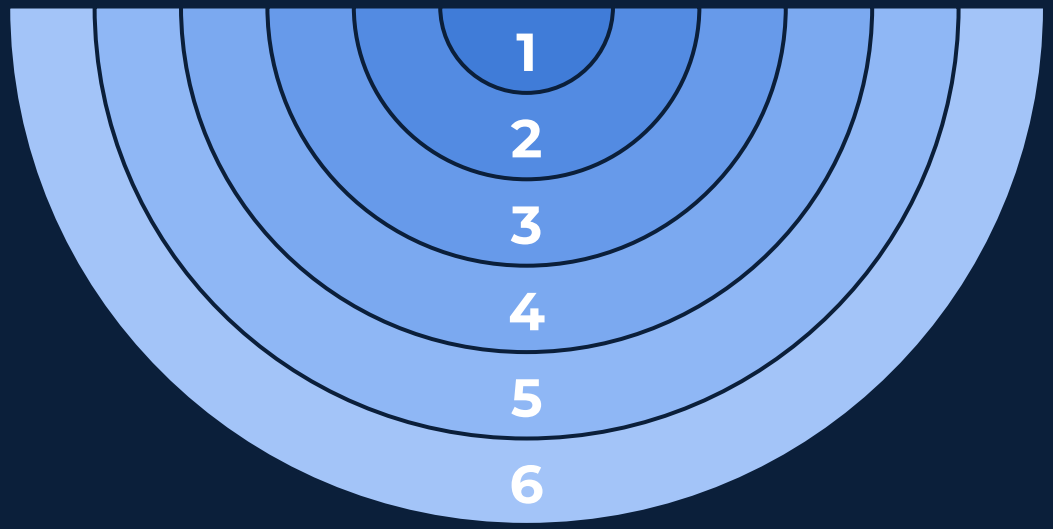
Ramping, curtailment, or outages caused by unplanned maintenance, or by a lack of cooling water, all push up the break-even price

Figure 12. Break-even cost of a new reactor by capacity factor, US, $/MWh



Sources: E3 Analytics calculation from **40** Lazard (2025, 2026); **61** RTE (2023, 2026); 23 EIA (2026)

Nuclear projects benefit from multiple layers of subsidies in order to be investable

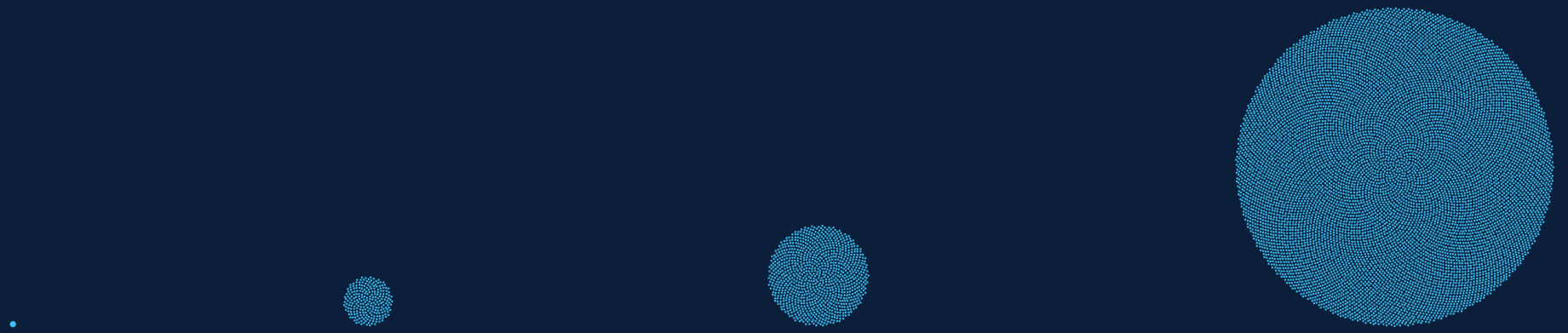


1. **Plant's originally promised generation cost:** $175–255/MWh (Lazard)[40]
2. **Overruns are usually covered by the public, as taxpayers or ratepayers: past projects** overran by 120% on average[28]
3. **Subsidised financing:** state loans, loan guarantees and guaranteed power prices (EPR2, Vogtle, Hinkley Point C)[1,19,33,68]
4. **Decommissioning support:** UK fund topped up by taxpayers: $14bn and rising[34]
5. **Waste management:** each country needs its own waste storage, at a cost of tens of billions more (often only partially covered by utility reserve funds)[68]
6. **Accidents:** no nuclear plant gets built without capping its total liability for catastrophes; Fukushima's clean-up and compensation are officially estimated at $156bn[47,70]

Sources: **40** Lazard (2025, 2026); **28** Flyvbjerg & Gardner (2023); **1** AFP (2026); **19** EDF (2022, 2023, 2025, 2026); **33** HM Government (2025, n.d.); **68** US DOE (2008, 2019, 2020, 2023, 2026); **34** Committee of Public Accounts (2022); **47** Nuclear Emergency Response Headquarters (2023); **70** US NRC (2026, n.d.)

And the subsidies don’t stop once the reactor stops: spent fuel must be safely buried for 100,000 years

Figure 13. A reactor’s lifetime against how long its spent fuel must be managed, one dot = 100 years



A reactor runs
up to 60 years

Plutonium-239
halves in 24,000 years

Back to the radioactivity
of its ore: 100,000 years

Standard for Yucca Mountain (US)
a proposed repository: 1 million years

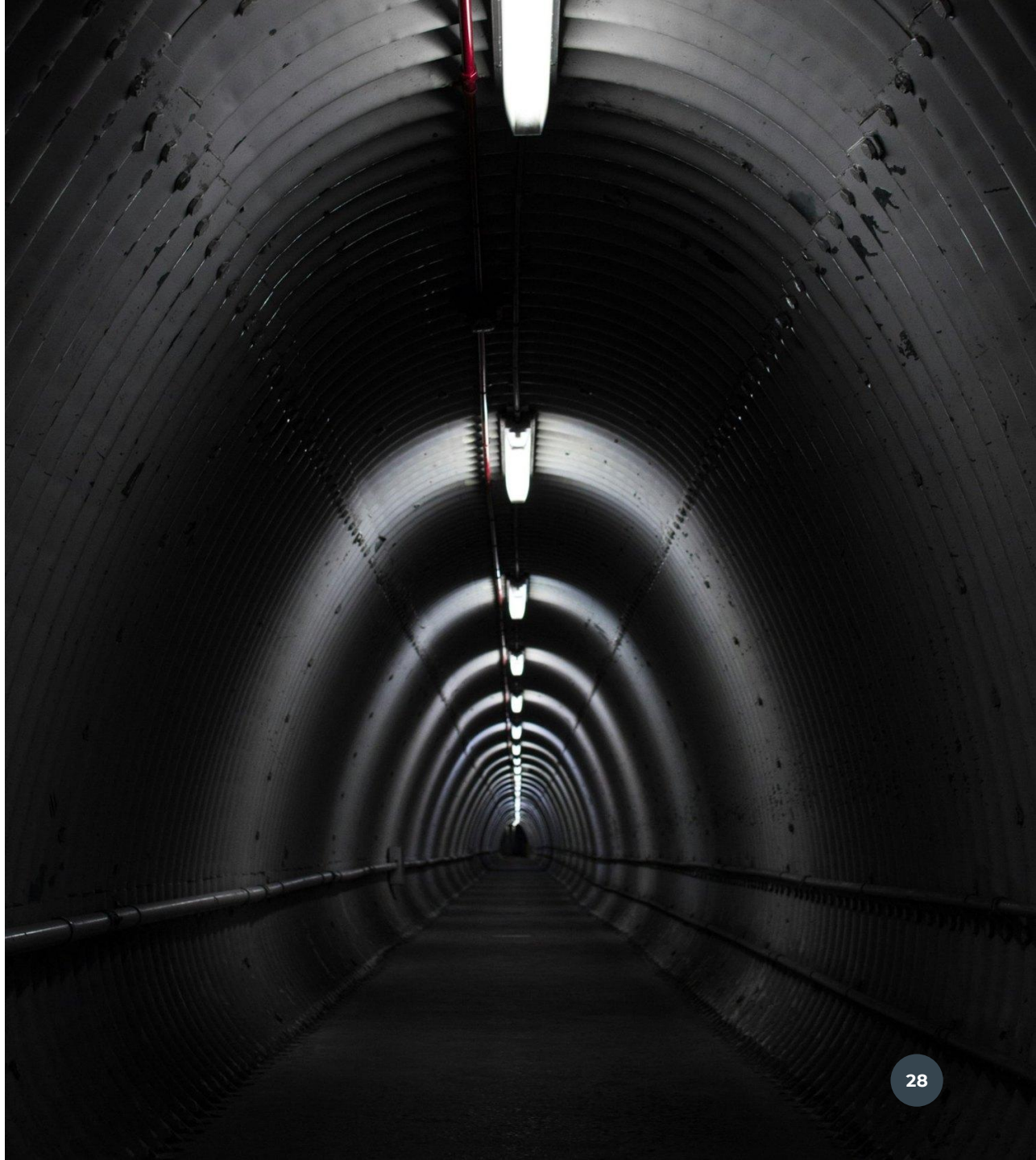
Nuclear plants generate electricity for 40–60 years; the waste management legacy extends over 4,000 generations. Ensuring the safety of waste sites over these time horizons adds another long-term cost

Sources: **36** IAEA (2026); **66** SKB (n.d.); **54** Posiva (n.d.); **69** US EPA (2008)

Few industries lean on the state as much as nuclear does

- Every layer of subsidy is covered by the public[1,34,55,68,70]
- In addition, both plant decommissioning and long-term waste disposal sites are exposed to their own cost overrun risks

> **Nuclear only gets built where its costs and risks are heavily socialised. We all carry the costs, both present and future**



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Sources: **1** AFP (2026); **34** Committee of Public Accounts (2022); **55** Post and Courier (2018); **68** US DOE (2008, 2019, 2020, 2023, 2026); **70** US NRC (2026, n.d.); **77** World Nuclear News (2026)



03

PART 3

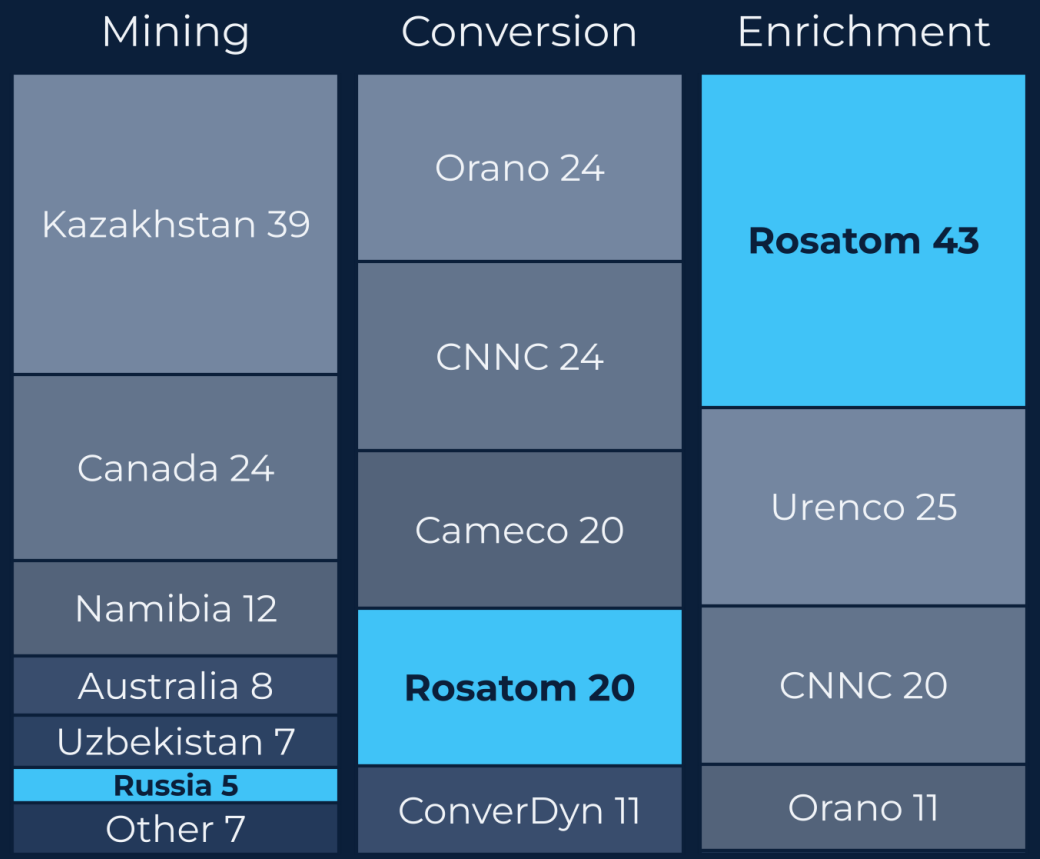
Nuclear fuel supply is not as secure as many think

Nuclear fuel depends on a handful of countries

- Five countries mined **89%** of the world's uranium in 2024; Kazakhstan alone **39%**
- Conversion is just as concentrated: five firms hold all capacity, Russia and China hold **44%**
- Russia and China together hold **63%** of the world's enrichment capacity

> **Nuclear power creates an important strategic vulnerability by increasing countries' dependence on a small number of fuel suppliers**

Figure 14. Share of world supply by supplier, %



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Sources: **75** WNA (2020, 2025, 2026); **77** World Nuclear News (2017, 2020, 2023, 2024, 2025, 2026)

Building your own fuel chain is slow and costly

- Enriched uranium is a common input, but fuel assemblies are built for one reactor design: until 2023, VVER-440 reactors could only load Russian-made fuel
- Many advanced SMR designs need one special type of fuel: HALEU, currently made at commercial scale only in Russia

Figure 15. What it takes to add fuel supply outside Russia

15–20 years
to develop a new uranium mine

$1.9bn, 5 years
to expand France's main enrichment plant by 30%

About $5bn
for one new US enrichment plant in the early 2030s

2029
first new commercial HALEU supply expected outside Russia, in the US (earliest estimate)

Sources: **77** World Nuclear News (2017, 2020, 2023, 2024, 2025, 2026); **75** WNA (2020, 2025, 2026); **36** International Atomic Energy Agency (1997, n.d.); **68** US DOE (2008, 2019, 2020, 2023, 2026); **5** American Nuclear Society (2026); **52** Orano (2023, 2026)

Large reactors become single points of failure

- Failure at one plant or substation can cause gigawatts to drop out in seconds
- Ukraine has experienced this vulnerability since 2022: its reactors cut output after strikes on the grid, and its largest plant is currently occupied[36]

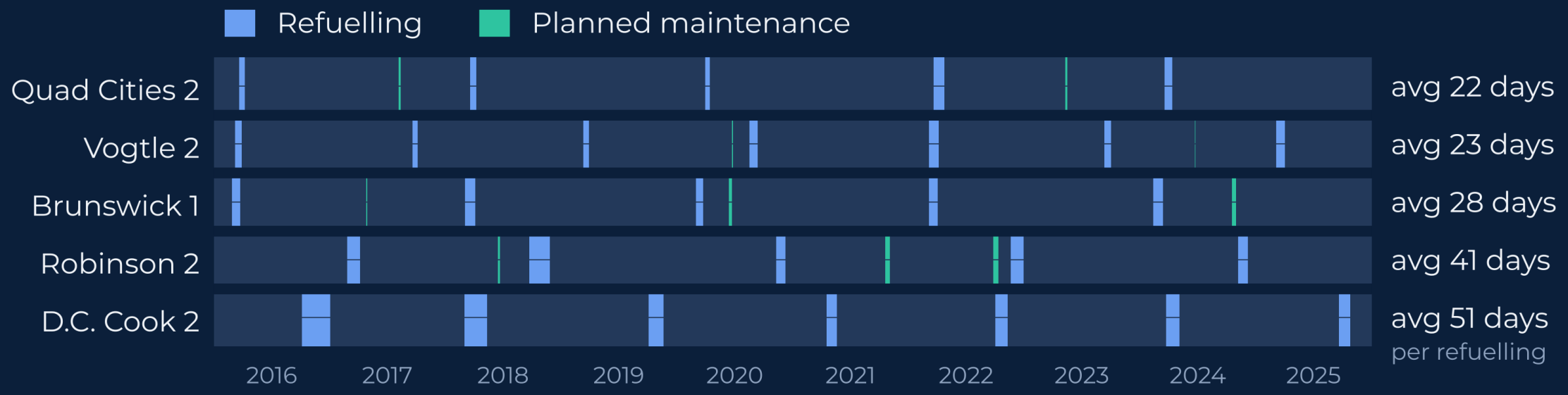
> **A system that leans on a few large units is vulnerable to sabotage, cyber risks, as well as more recent threats such as drone attacks**



Source: **36** International Atomic Energy Agency (2024, 2025)

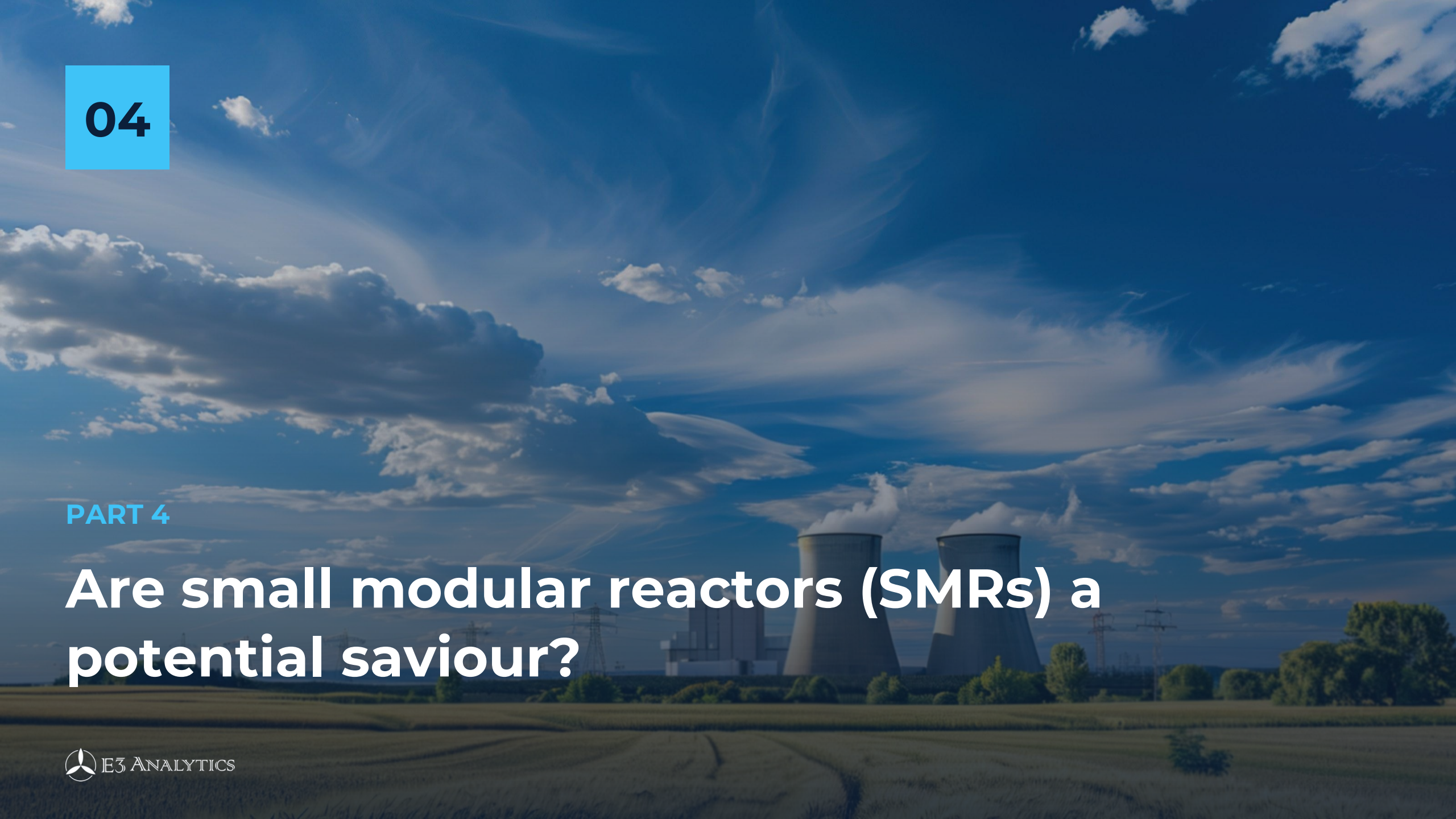
Nuclear has its own “Dunkelflauten” but they are longer, lasting 36 days on average (based on the US nuclear fleet)

Figure 16. Days offline for refuelling and planned maintenance, best-to-worst reactor, 2016–2025



Dunkelflauten for wind and solar typically last 3–5 days, though some can last up to 7 days. Since they are seasonal in nature (mainly from November to January in northern Europe) they are similarly plannable.

Source: **70** US NRC (2026)



04

PART 4

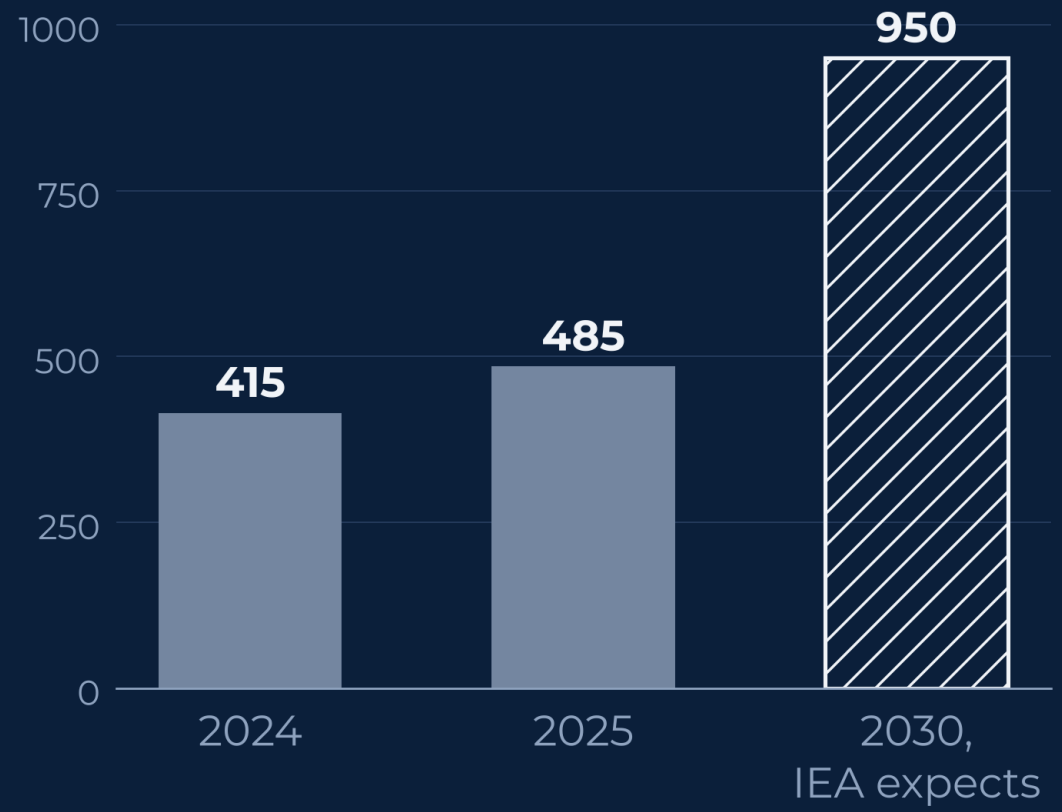
Are small modular reactors (SMRs) a potential saviour?

Much of the excitement in the nuclear industry today centres on SMRs

- SMRs are also proposed for industry and remote grids, but much of the hype currently surrounds data centres
- Tech firms have signed **45 GW** of SMR deals, though none has yet reached financial close
- Only **two** SMRs operate today (in Russia and China)

A closer look reveals that the case for SMRs is not as strong as backers assume

Figure 17. Projected data-centre electricity use, worldwide, TWh



Sources: **37** IEA (2024, 2025, 2026); **62** Shehabi et al. (2024); **39** Kairos Power (2024); **78** X-energy (2024); **56** POWER (2026); **77** World Nuclear News (2017, 2020, 2023, 2024, 2025, 2026); **48** NEI Magazine (2017, 2026)

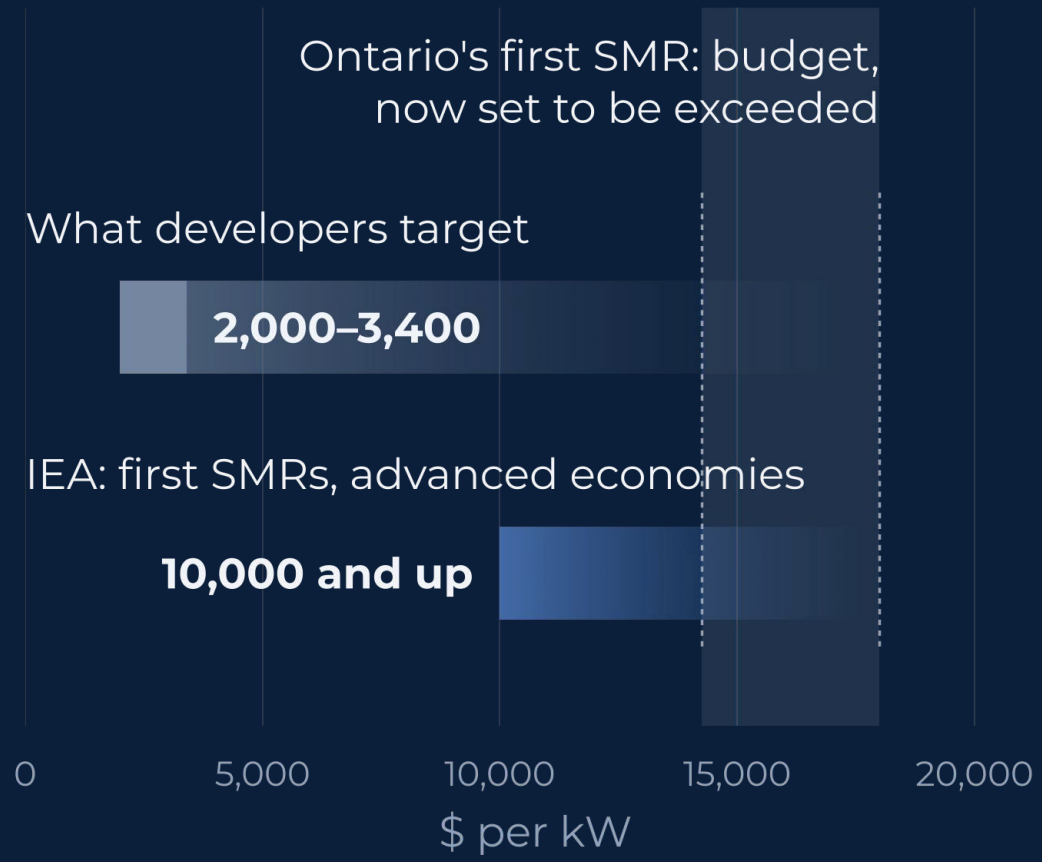
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SMRs promise to be cheaper, faster to build and safer

- IEA: the first SMRs are expected to cost **about twice** as much per kW as large reactors[37]
- Savings must come from many identical units largely assembled off-site in factories

Historically, smaller reactors have cost more per kilowatt (and per kWh), not less

Figure 18. Cost of a new SMR, $/kW



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Sources: **37** IEA (2024, 2025, 2026); **51** NEA (2011); **77** World Nuclear News (2017, 2020, 2023, 2024, 2025, 2026)

SMRs are less modular than they look

- Only the reactor is expected to be factory-built: civil works, buildings and grid connection still need to be designed and built on site
- SMRs are still large plants (Ontario's first is 300 MW) and local public acceptance is not guaranteed

> **Modular design is unlikely to simplify local permitting and approval, or fully dispel public safety concerns**



E3 Analytics

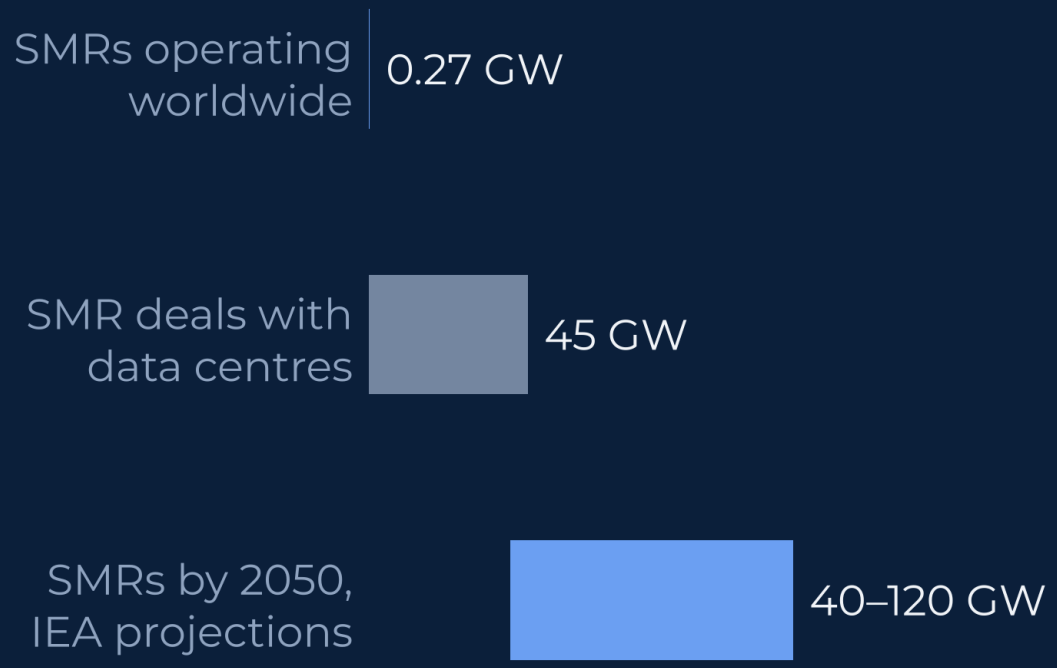
Sources: **48** NEI Magazine (2017, 2026); **10** CNSC (2025); **70** US NRC (2026, n.d.)

Costs fall with the number of units built

- Since nuclear has few units, it is unlikely ever to match the cost declines seen in technologies like solar, wind, and batteries
- There are currently 127 SMR designs in the works, 7 of them operating or under construction; roughly 10–25 committed units in the West

> **The SMR order book is likely to remain too small, and split across too many designs, to meaningfully bend the cost curve down**

Figure 19. SMRs operating, in data-centre deals and projected for 2050, GW



Sources: **51** NEA (2020, 2025); **37** IEA (2024, 2025, 2026); **48** NEI Magazine (2017, 2026); **17** Cour des comptes (2012, 2025, 2026); **74** Wilson et al. (2020)

Like larger reactors, SMRs also need protection, including against hybrid warfare

- Ukraine has shown that drones can reach and damage nuclear sites[36]

> **An SMR is smaller, but a successful strike could still cause a release of radioactive material. What is released, and how dangerous it is, depends on the specific fuel the reactor uses**

Figure 20. What new reactor sites have to withstand

2009

the US required new reactor designs to assess a large aircraft impact, after 9/11

Feb 2025

a drone pierced Chernobyl's reactor shelter, which has since lost its confinement function

Nov 2025

an attack on a substation critical for nuclear safety forced two Ukrainian nuclear plants to cut output for over ten days

Sources: **36** International Atomic Energy Agency (2025); **70** US NRC (2009)



Lenders, insurers and regulators are likely to require protection against hybrid warfare techniques

- This adds another layer of cost to a technology that is already under economic pressure

Sources: **70** US NRC (2024)

05

PART 5

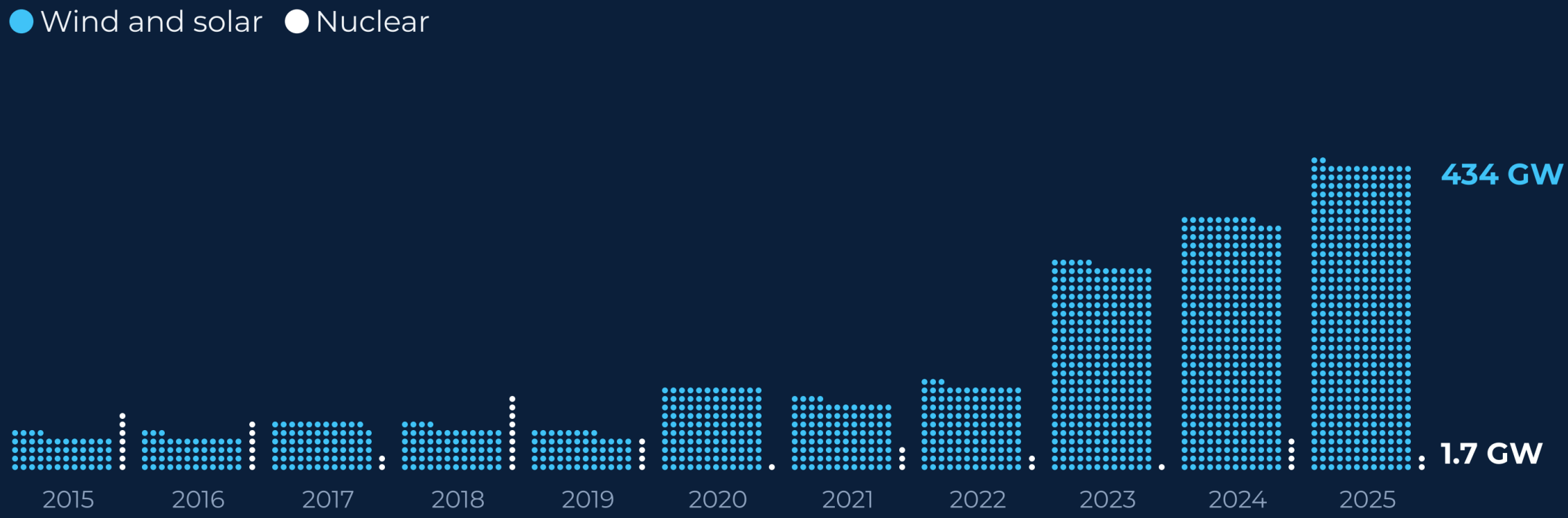
What about China?



E3 Analytics

China has built wind and solar at ~100 times the rate of nuclear over the last five years

Figure 21. China: capacity added each year, nuclear vs wind and solar, 2015–2025, each dot = 1 GW

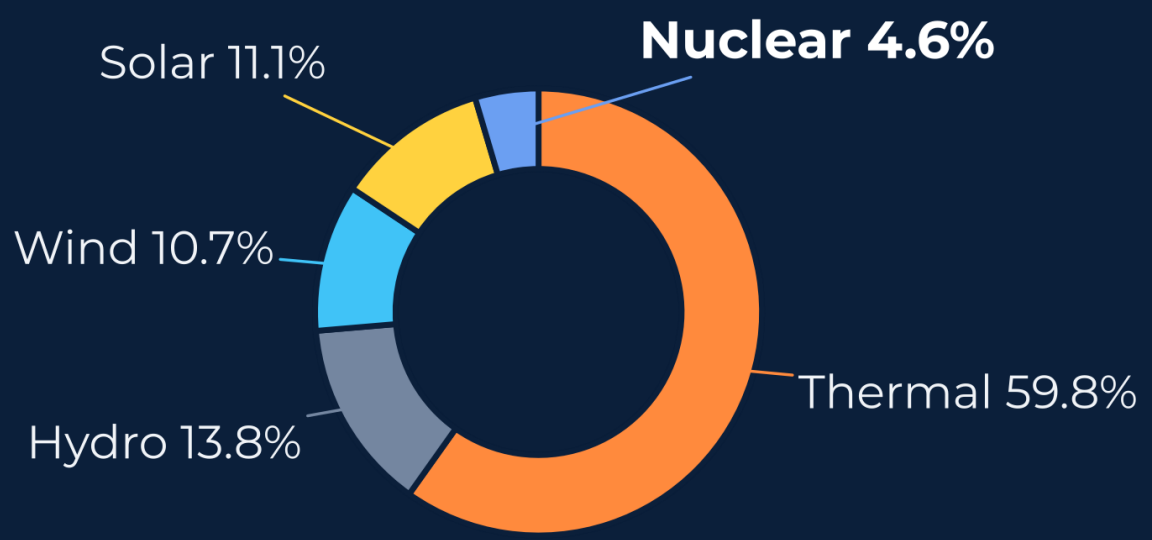


Sources: **45** NEA China (2022, 2023); **44** NBS (2021–2026); **12** CEC (2011–2020); **13** CNEA (2023)

Despite a sustained push and hundreds of billions spent, China still gets less than 5% of its electricity from nuclear

- In 2025, China's nuclear reactors generated 485 TWh of electricity
- This represents 4.6% of China's total electricity production, less than half the output from wind or solar on their own[44]

Figure 22. China: electricity generation by source, 2025, share of total



Sources: **44** NBS (2026); **12** CEC (2025)

Replicating China's nuclear power supply chain, build times, and installed costs, is not realistic

> **Proponents who argue that doing so would be achievable, in the West or in any other developing country markets with little existing labor and supply chain capacity, have a daunting reference class to contend with**



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Sources: **36** International Atomic Energy Agency (2025); **70** US NRC (2009)

06



PART 6

So far, the renaissance lives largely in the headlines

Despite the surge of interest, little nuclear capacity is being built

- Approximately 80 reactors are reported to be under construction worldwide
- SMRs are a small part of this: they represent **under 2 GW** of the **90 GW** under construction worldwide



E3 Analytics

Source: **75** WNA (2020, 2025, 2026)

The case for new nuclear hinges on several conditionals. It can compete and grow if:

01

Each new reactor costs less

Fifty years of Western builds show costs rising with each new reactor design

02

Interest rates go back down

A decade+ of construction debt at today's interest rates is likely to push up costs for most new projects

03

Plants are shielded from competition

The presence of competitive power markets makes it harder, and costlier, to guarantee high capacity factors for new reactors

04

SMRs reach factory volume

There are currently over 100 SMR designs, all competing for the same small pipeline of projects

05

The state continues to carry most of the risks

The bulk of costs related to waste, accidents and liability continue to be socialised

Nuclear power faces an uphill battle

01

The nuclear industry is big on promises, but weak on delivery

Those who argue that this time is different have to confront the reality of nuclear power's reference class

02

Despite decades of engineering effort, nuclear remains an expensive way to generate electricity

Wherever it is built, it relies on multiple layers of government subsidies

03

Fuel supply is a major strategic vulnerability in a less stable world

Relying on others for nuclear fuel creates dependencies that are difficult to reverse

04

Ensuring public safety in a world with hundreds of large reactors and SMRs as cyber and drone warfare evolve, is a tall order

Fortunately, alternatives to nuclear power abound

- Alternatives are not limited to wind, solar, and battery storage: other low-carbon thermal power generation options like **deep geothermal** are now commercially viable
- Without exception, these alternatives are lower cost, faster to deploy, they carry fewer catastrophic risks, and they entail fewer long-term liabilities.
- Ultimately, a diverse and decentralized energy system represents **a safer bet** in an increasingly fractious and unpredictable world.



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Source: **75** WNA (2020, 2025, 2026)


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All money in US dollars at 2025 annual average rates (Federal Reserve, G.5A): 1.1306 $/€, 1.3192 $/£, 0.6450 $/A$, 149.57 ¥/$, 7.1875 CNY/$ and 0.8305 CHF/$. One rate for every figure keeps the ratio between a first and a latest estimate as in the source. Price bases are those of the source.

Pages	Original figure	Shown
13	Sizewell C: £20bn (2020) → £38bn (2024 prices)	$26bn → $50bn
14	Olkiluoto 3: €11bn / 1.6 GW = €6,900/kW	$7,800/kW
14	Flamanville 3: €13.2bn (2015 €) to €23.7bn (2023 €) / 1.6 GW	$9,300–16,700/kW
14	Hinkley Point C: £35bn (2015 prices) to £49bn / 3.26 GW	$14,200–19,800/kW
26	£10.7bn (UK Nuclear Liabilities Fund top-ups, 2020–22)	$14bn
26	¥23.4tn (Fukushima, official estimate 2023)	$156bn
31	Georges Besse 2 extension: €1.7bn (2023)	$1.9bn

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