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SPRINGFORUM

LONDON 2025

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AURORA KEYNOTE

BEYOND THE HYPE: NAVIGATING DATA CENTRE GROWTH AND GREEN POWER NEEDS

Exam questions

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How much power will Data Centres need in the coming years?

What drives the decision where to locate Data Centres?

Where can Data Centre providers procure firm, cheap, and green power, and what are the risks associated?

Artificial intelligence is becoming exponentially more data and energy intensive, driving demand for data centre deployment

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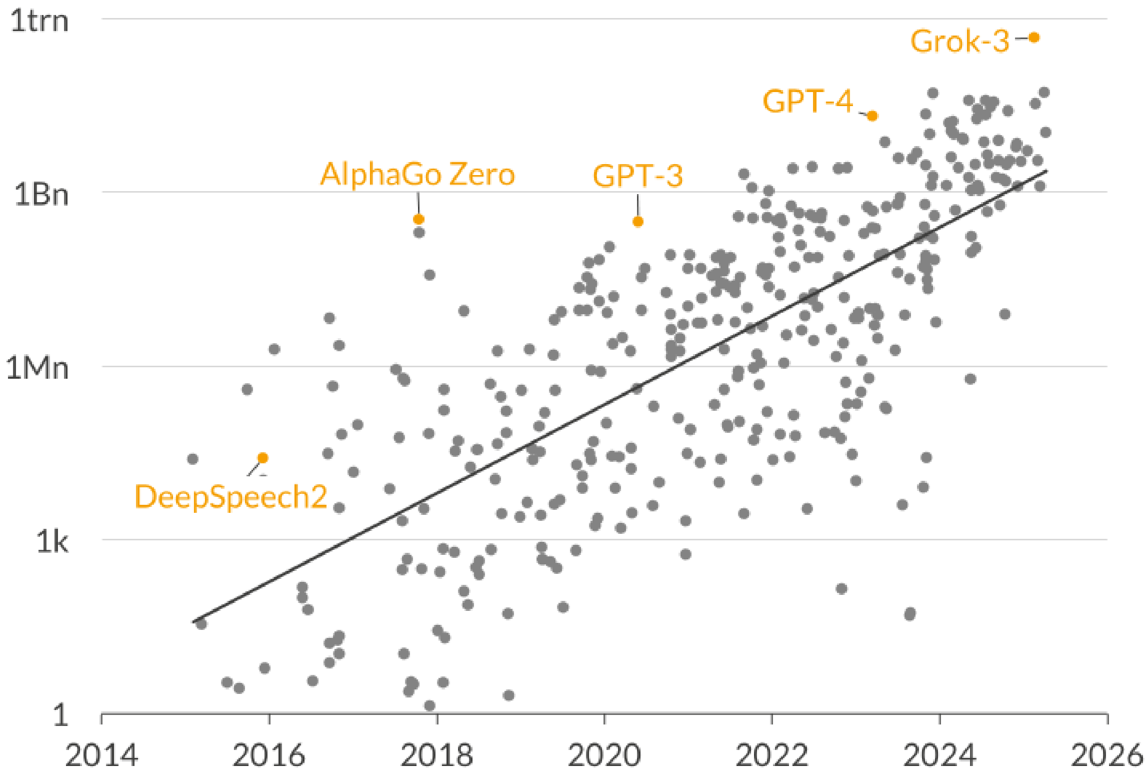
Training compute of notable AI models

PetaFLOPS[1]



Training compute of AI models is doubling every five months or **4.7 times per year**

Power draw required for training frontier models

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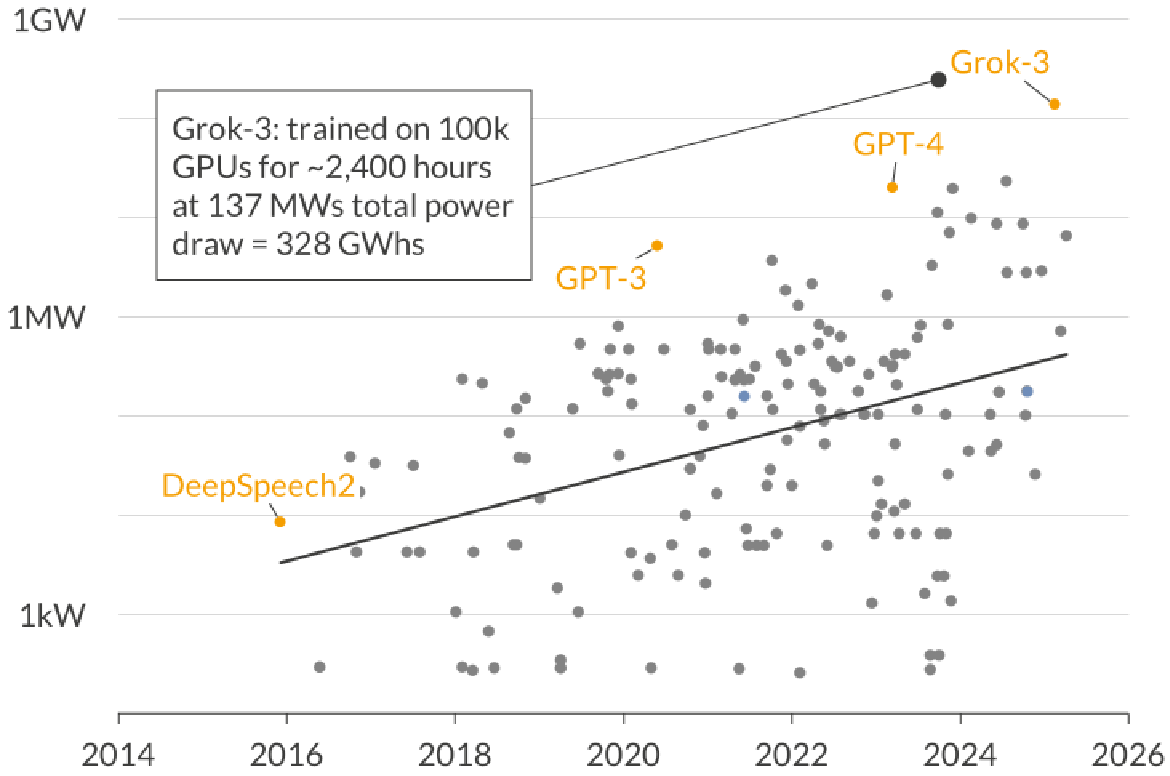

Power required to train each new AI model is **doubling annually**

1) 1 PetaFLOP = 10^{15} FLOPS

Sources: Epoch.AI, Data on Notable AI models

Data centre demand will continue to surge globally, but forecasts diverge heavily due to uncertainties in both directions

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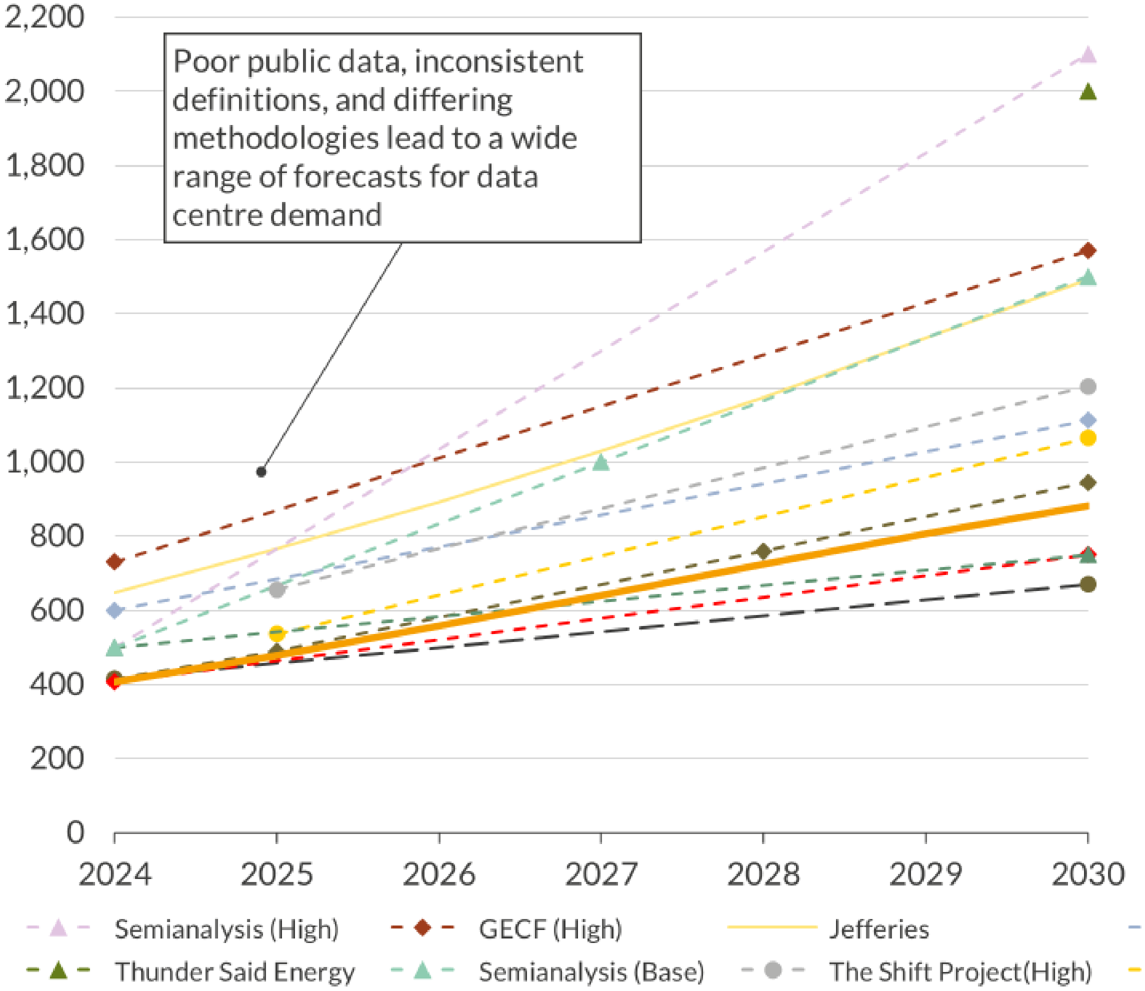
Global Data Centre Demand according to different studies
TWh



To reach the upper end of forecasted demand, the following factors could contribute…

- Faster AI adoption and digital integration in the workplace, driving increased demand
- Greater AI workloads, especially for training, enabling greater location flexibility
- Slower efficiency gains increasing overall energy demand as Data Centre capacity continues to expand

…but might be counterbalanced by factors leading to lower demand

- Continued advances in hardware efficiency, along with software and systems optimisation, can reduce overall demand
- Local regulations and grid delays could hinder short-term deployment
- AI monetisation uncertainty and a slow shift from traditional pricing could hinder progress
- Supply chain pressure and competing demand for materials (e.g. copper, aluminum) could slow construction and strain energy supplies
- Tariff hikes under the Trump administration raise hardware costs (e.g., chips) and increase investment uncertainty

Sources: Aurora Energy Research, IEA, Goldman Sachs, Jefferies, Deloitte, IEA-4E, Semianalyis, Greenberg Traurig, Data Center Frontier

After securing a fast data connection, Data Centres locate where they can get fast grid access and firm, cheap, green power

deep dive

Driver / Region	Proximity to demand centres	Fast grid access A	Firm power supply SAIDI[1]/ major events	Costs Baseload price & surcharges[2]	Greenness B 2025 carbon intensity (gCO_2/ kWh)	Data Centre power demand 2024 and 2030, TWh
Great Britain		Long queues				+92%
Germany		Long queues				+73%
Spain		Moderate queues				+339%
Ireland		Moratorium in Dublin				+65%
North Virginia		Long queues				+80%
North Texas		Moderate queues				+99%

1) System Average Interruption Duration Index over the period 2014-2020, 2) European tariffs for non-households consumers between 20,000 MWh and 69,999 MWh for EU countries and Average Price of Electricity for Industrial Users for US regions

Sources: Aurora Energy Research, World Bank, Eurostat, EIA, Data Center Map

Fast grid access: Europe and the US are primary locations for Data Centres, but grid constraints push operators in secondary locations

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North Texas (US): North Texas is a fast-growing US data centre hub, with typical queues of 2–5 years, but proposed large-load regulations are raising concerns

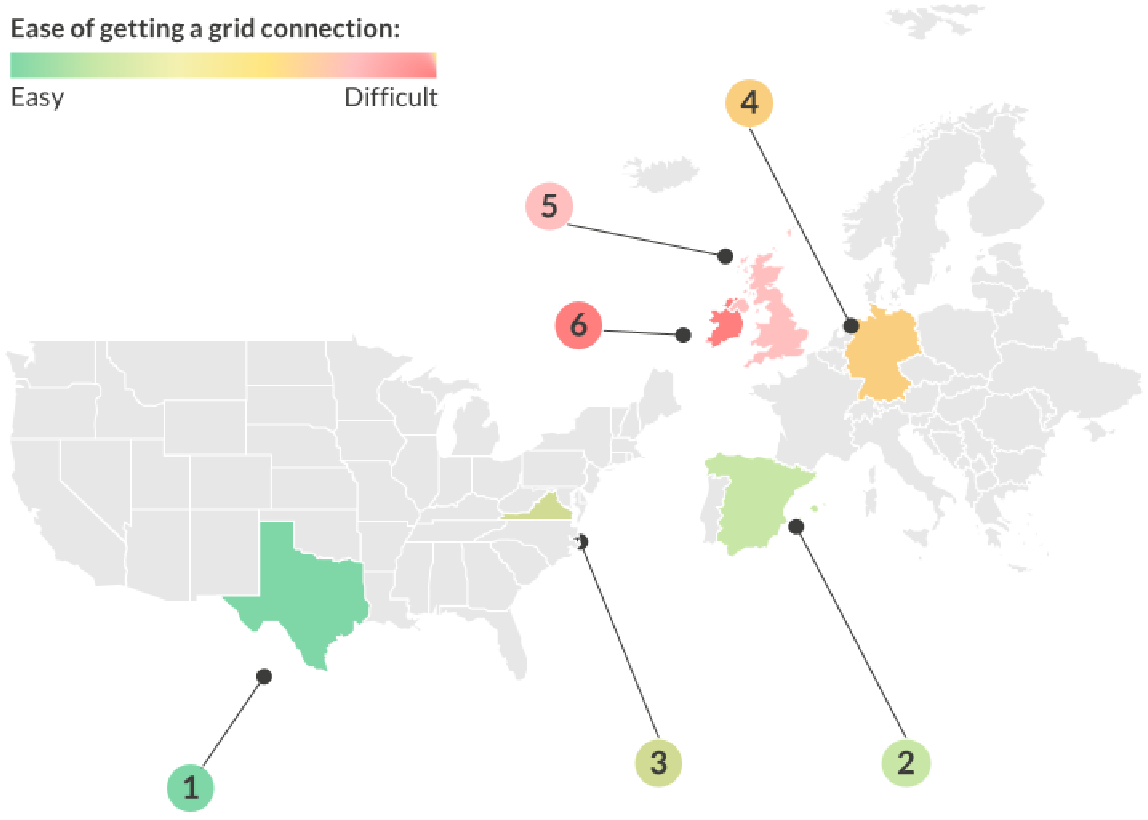
Spain: Grid queues range 3–5 years. While major cities face grid saturation issues, Aragon leads with over 3 GW queued—though just 410 MW will be allocated under a new process by late 2025

North Virginia (US): Northern Virginia leads in data centre capacity but faces grid delays up to 7 years—over twice the US average

Germany: Grid queues exceed 7 years for new data centres. Frankfurt remains the leading hub—with nearly 2× more sites than any other region—but grid access is a growing bottleneck

Great Britain: With grid queues of 7–10 years and delays at Iver B stalling West London, new data centres are starting to disperse more widely across the UK

Ireland: The Irish government has kept the Dublin connection pause in place until 2028



Sources: Aurora Energy Research, IEA, Irish Commission for Regulation of Utilities (CRU), Colliers, El Periódico de la Energía, Heraldo, The Journal

Data Centres can procure power through the grid and/or 'behind-the-meter', each strategy having its own advantages

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Data Centre power procurement

Grid-based power supply

Direct grid supply

- **Grid supply**: Power from distribution or transmission grid via retail tariff
- **Most common sourcing method for DCs today**

▲ Relatively secure supply, but additionality depends on overbuild of grid access

▼ Carbon footprint in line with grid carbon intensity

Offtakers can buy green certificates to improve green credentials, but hard to demonstrate additionality or 24/7 green power matching

Power purchase agreements (PPAs)

- DCs can enter **PPAs with low carbon power generators.**
- PPAs can be sleeved or virtual, depending on whether a supplier intermediary is involved.

▲ Potential to source high share of green power

▼ Imperfect matching the higher the share of green power required

PPAs directly with utilities or aggregators to access tailored generation profiles.

Hybrid solution

- Typically combines a number of different power generation technology types
- Different technologies can include green gas and storage technologies

▲ Possibility to connect to the grid and run in island mode, backup during grid failures that increases resilience

▲ Can be combined with PPAs

Behind the meter

- **Direct supply**: Generation assets (e.g. gas, biofuel, SMR, batteries.) connected straight to the DC (via direct wire PPA), bypassing the grid
- **Onsite generation**: Most DCs have behind-the-meter backup systems

▲ Avoid retail markups

▲ Saves on network charges

▼ Would reduce supply security and make aim of 99.9999% uptime expensive

Co-location with onsite renewables

Source(s): Aurora Energy Research

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Source(s): Aurora Energy Research

Aurora has developed a bespoke tool optimising a DC's procured power mix, given load factors, PPA prices, and requirement for 24/7 green power matching

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INPUTS

Technology and archetype specific

Half-hourly load factors
Allows sensitivities on weather year robustness and locational load factors

PPA prices

Onsite BESS configuration
Allows sensitivities on battery capacity and duration

24/7 matching requirement
Allows sensitivity on % of green power matching achieved

Half-hourly demand profile
Allows sensitivities on flexibility of DC demand

OPTIMISER

- Half-hourly supply-demand matching
- Iterative modelling
- Dynamic dispatch of BESS capacity
- Independent grid import decisions
- Satisfaction of all green power constraints

Linear optimisation model used to match half hourly supply to demand

OUTPUTS

Capacity mix

Battery dispatch decisions

Grid import costs and carbon intensity

Total power procurement costs in €/MWh

Export of excess power

Source(s): Aurora Energy Research

Green and cheap power: requiring 95% time-matched green power increases PPA costs by 21% compared to grid procurement, but cuts emissions by 90%

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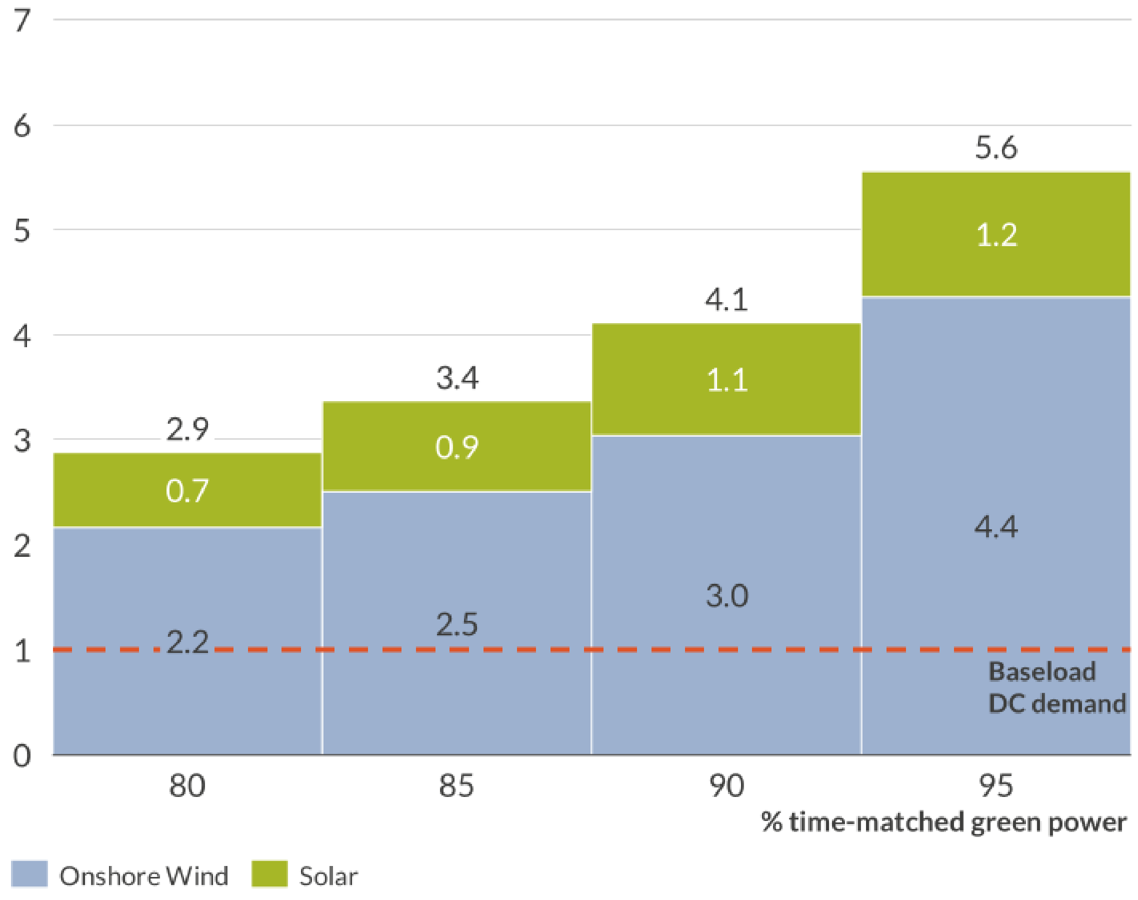
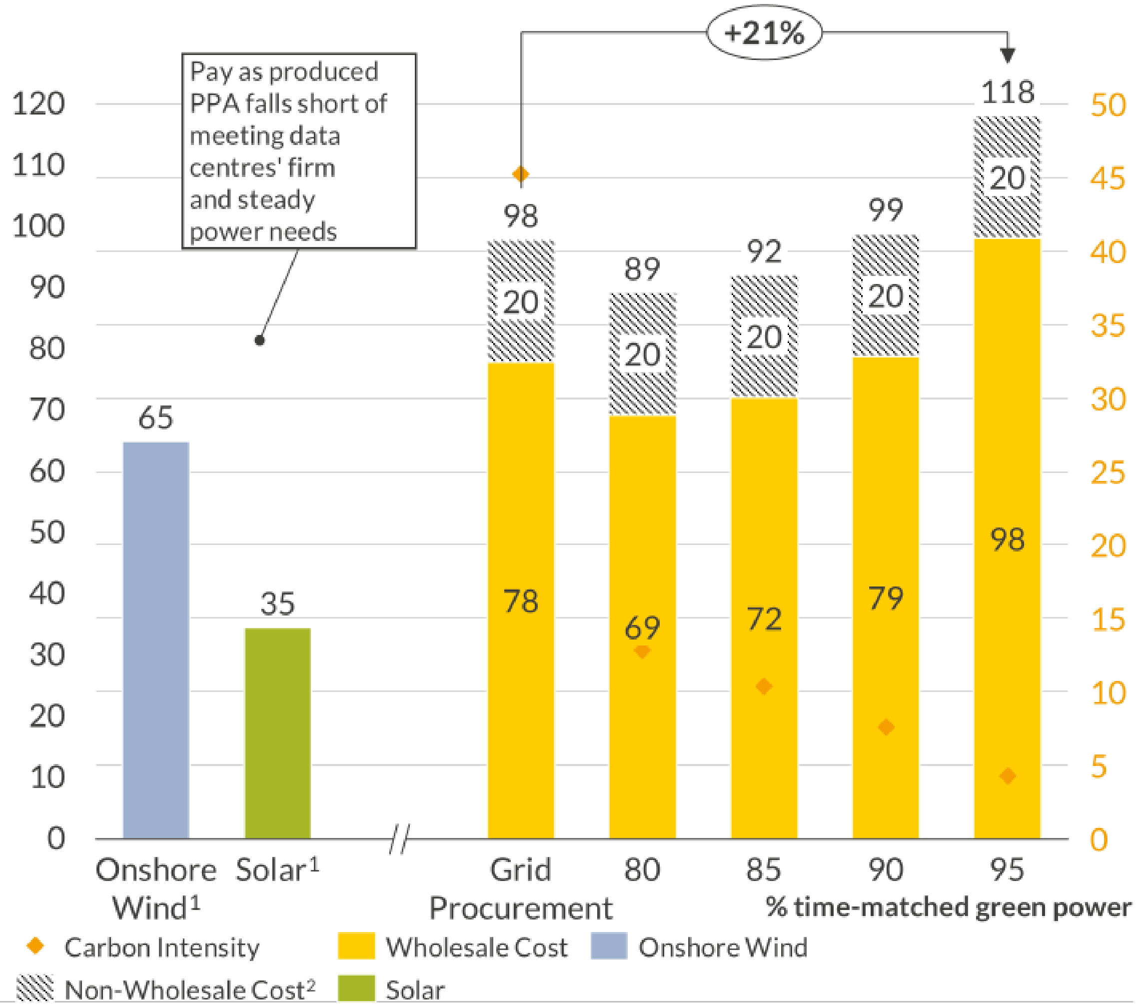
Capacity procured to meet 1 MW of baseload demand

MW



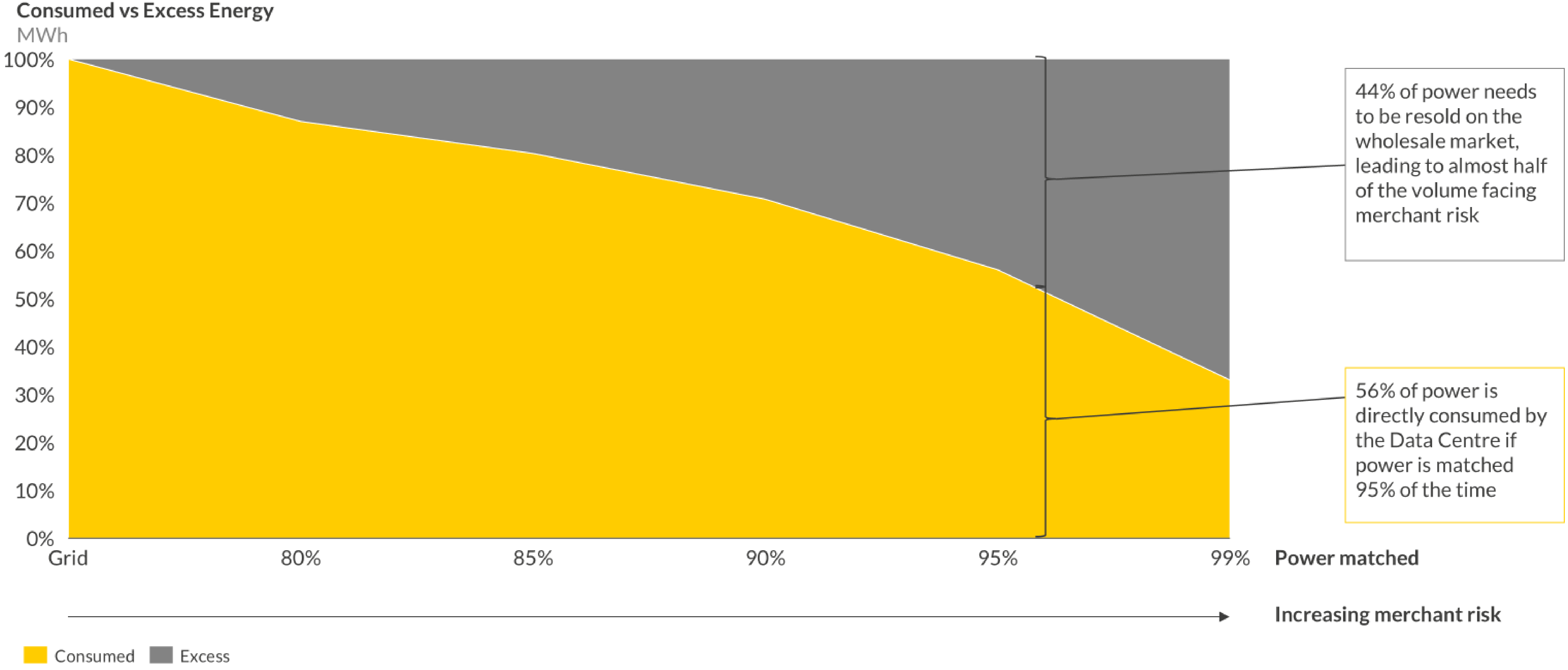
Power costs and carbon intensity

Costs: €/MWh, Carbon Intensity: gCO_2/kWh



1) Pay-as-Produced (PaP) PPA fundamental prices starting in 2027 with a 10-year duration; 2) Non-wholesale costs including taxes, levies and fees

…but poses significant risk due to 44% of excess power, which must be managed and marketed



Spain offers the lowest cost in Europe for 95% green power matching, but US outcompetes Europe on the cost of grid power

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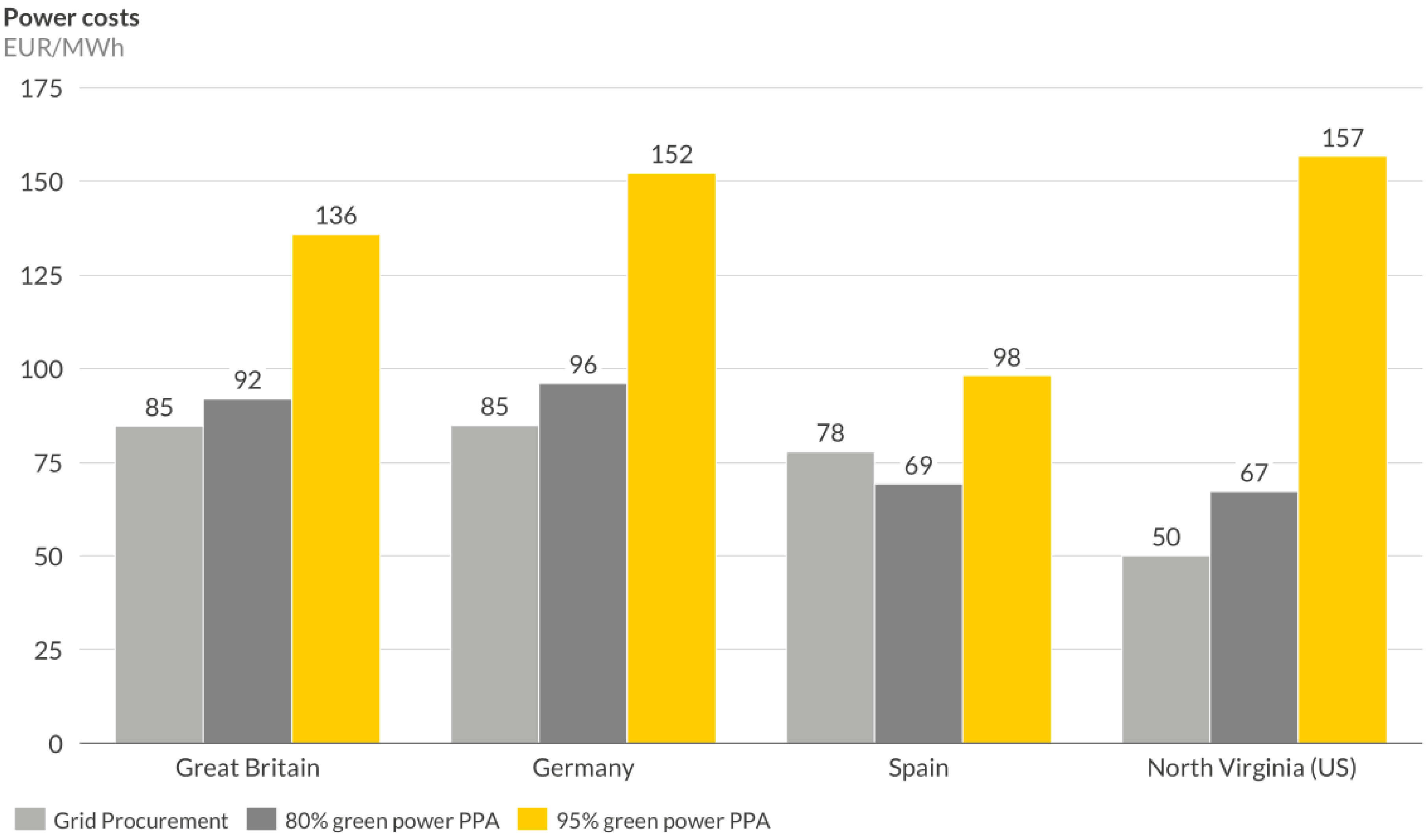

- **Spain** shows limited cost differences between grid and green options, driven mostly by low-cost solar generation that supports high renewable shares without significant premiums
- **Germany** and the **US** see sharp cost increases when moving from 80% to 95% green power, due to costlier capacity mixes. Higher efficiency and prices may improve resale value but also elevate cost exposure and risk.
- Diversified portfolios across sites and technologies help smooth spreads, as illustrated by the **Great Britain** example

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Co-location with onsite renewables

Source(s): Aurora Energy Research

Adding a 4h BESS onsite reduces excess energy procurement by 11%pp, and total costs by 20%, whilst improving resilience

Consumed vs Excess Energy
MWh

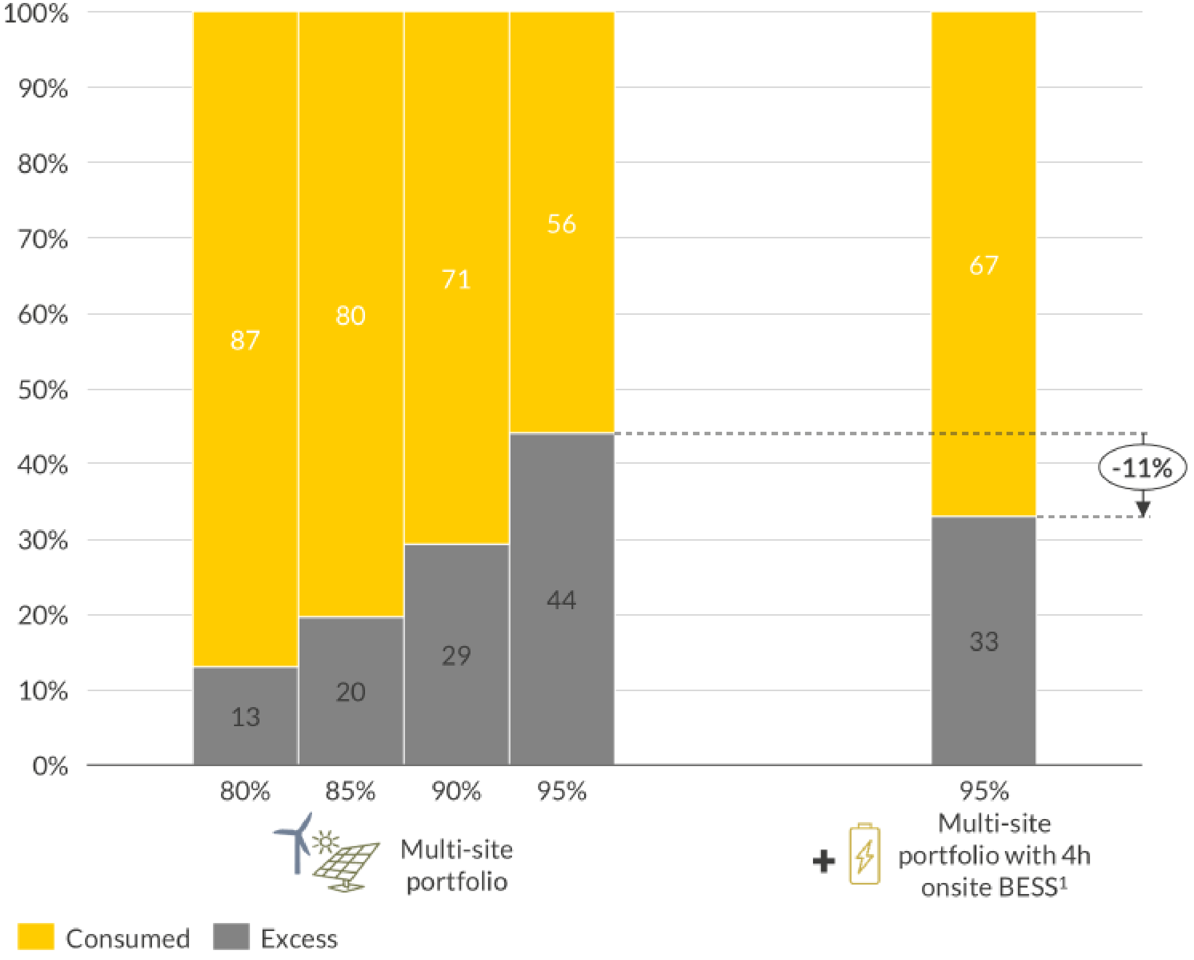
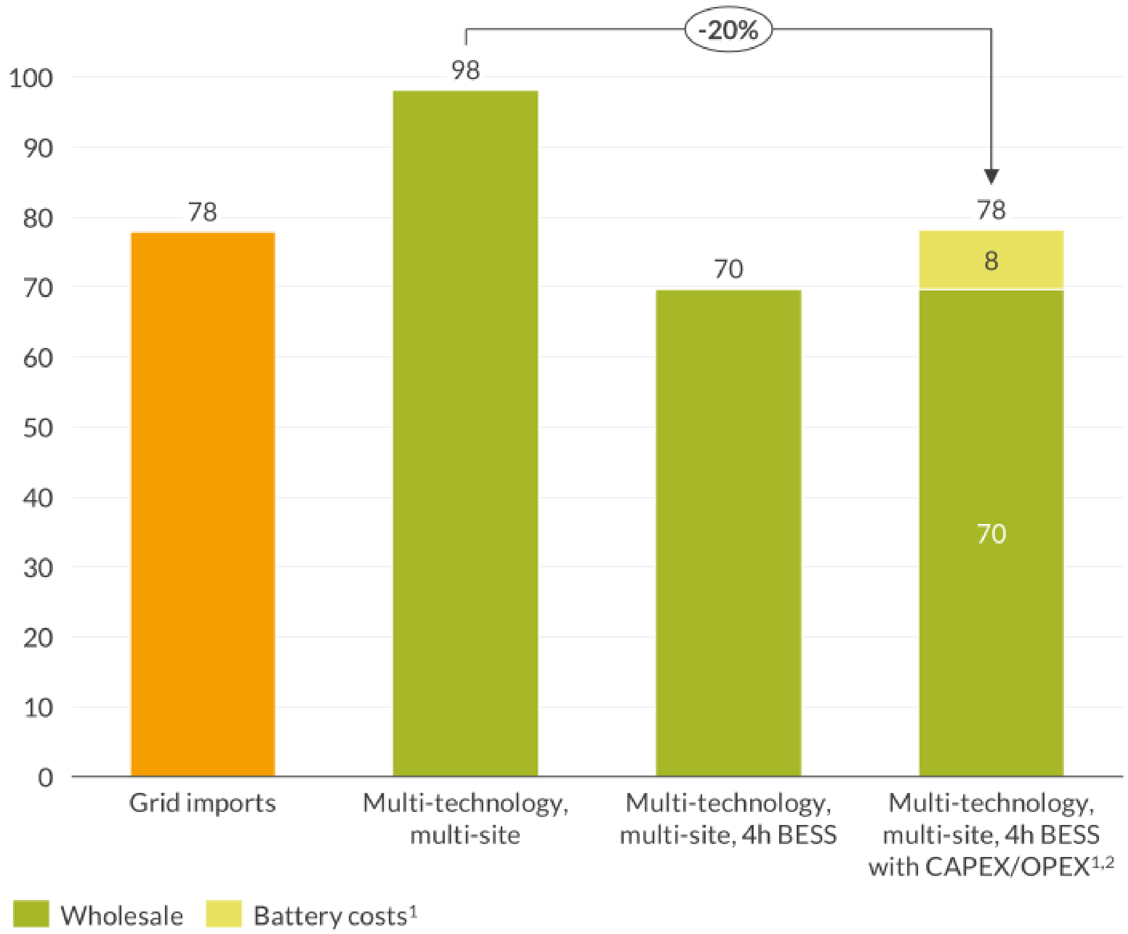


Illustration of wholesale costs across different PPA + BESS configurations for 95% time-matched green power
EUR/MWh/MW$_{datacentre}$



1) 0.5 MW BESS relative to 1MW datacentre in Aurora's base case

Key takeaways

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Estimates for Data Centre demand growth vary widely from +65% to +320% by 2030. Aurora projects a more conservative increase of +120%, reflecting bearish factors such as grid constraints, supply chain pressure, increasing costs due to tariffs, and uncertainty of the monetarisation of AI business models.

Data Centres locate close to low latency cable connections, demand centres and where they can get cheap, green, firm power supply. However, as the grid becomes a major bottleneck for Data Centre buildout, availability of grid connections will be the most important driver.

Spain is the cheapest option in Europe for green power supply while also having better grid access than other European primary markets. At the same time, the Spanish grid is less reliable than other European locations and the recent blackouts increase uncertainty.

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