
The US Green Strategy, 2010–2026

Reduced technology costs, rising electricity demand, and the decisions that connect them.

Four administrations · a supercomputing centre · one rebuilt house

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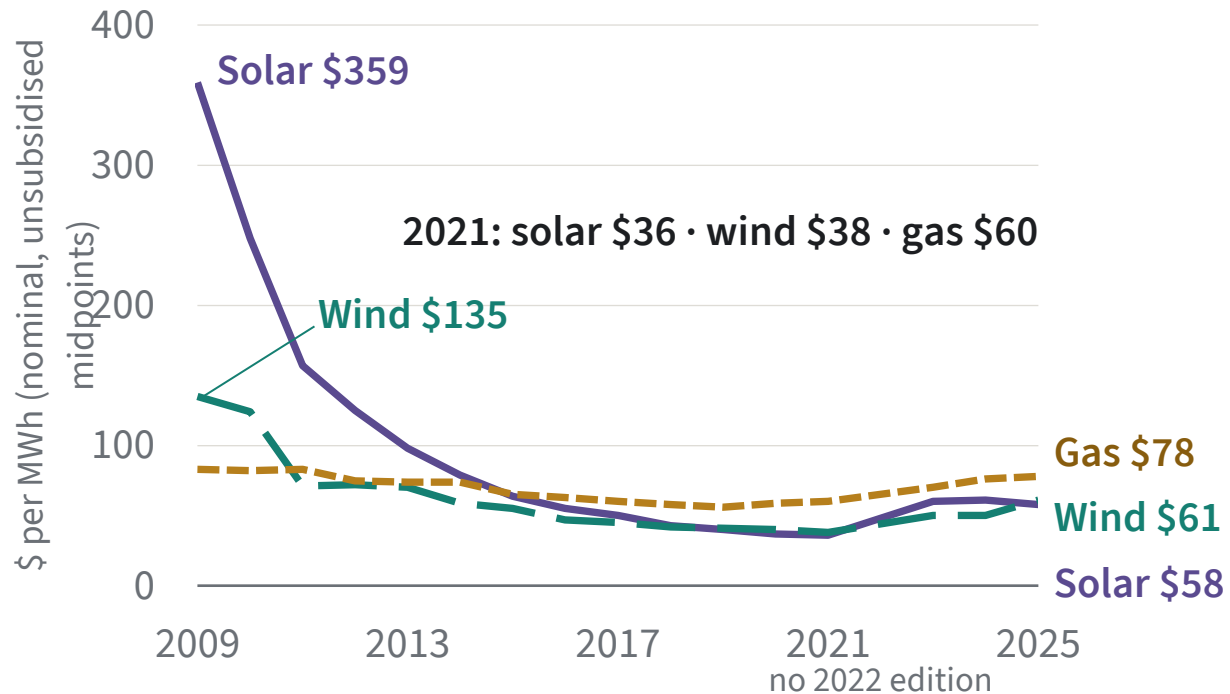
Federal policy changed repeatedly; state policies created different paths

Mechanism	Obama 2009–2016	Trump I 2017–2020	Biden 2021–2024	Trump II 2025–
Standards	Clean Power Plan	Plan repealed; Paris exit	Paris rejoined; vehicle rules reissued	Vehicle rules rescinded; Paris exit again
Incentives	Recovery Act; tax credits extended	Credits phasing down	Inflation Reduction Act	EV credit ended; wind and solar deadlines tightened; storage and nuclear kept
What endured	State renewable mandates	Coal kept falling	State and utility procurement	Wind, solar, storage kept growing

Federalism lets states move ahead of Washington — and lets opponents block national action.

Karapin 2020, J. Environment & Development; Yi & Feiock 2014, Policy Studies Journal. EV credit: vehicles acquired after 30 Sept 2025 (CRS IF12600). Vehicle GHG standards: EPA final rule rescinding the 2009 endangerment finding, Federal Register 18 Feb 2026, effective 20 Apr 2026. Credit deadlines: One Big Beautiful Bill Act, 4 Jul 2025; IRS Notice 2025-42.
Thomas Hauser · hauserlab.eu

Wind and solar remain far cheaper than in 2009, despite recent cost increases



2009–2021:

- Solar –90%
- Onshore wind –72%

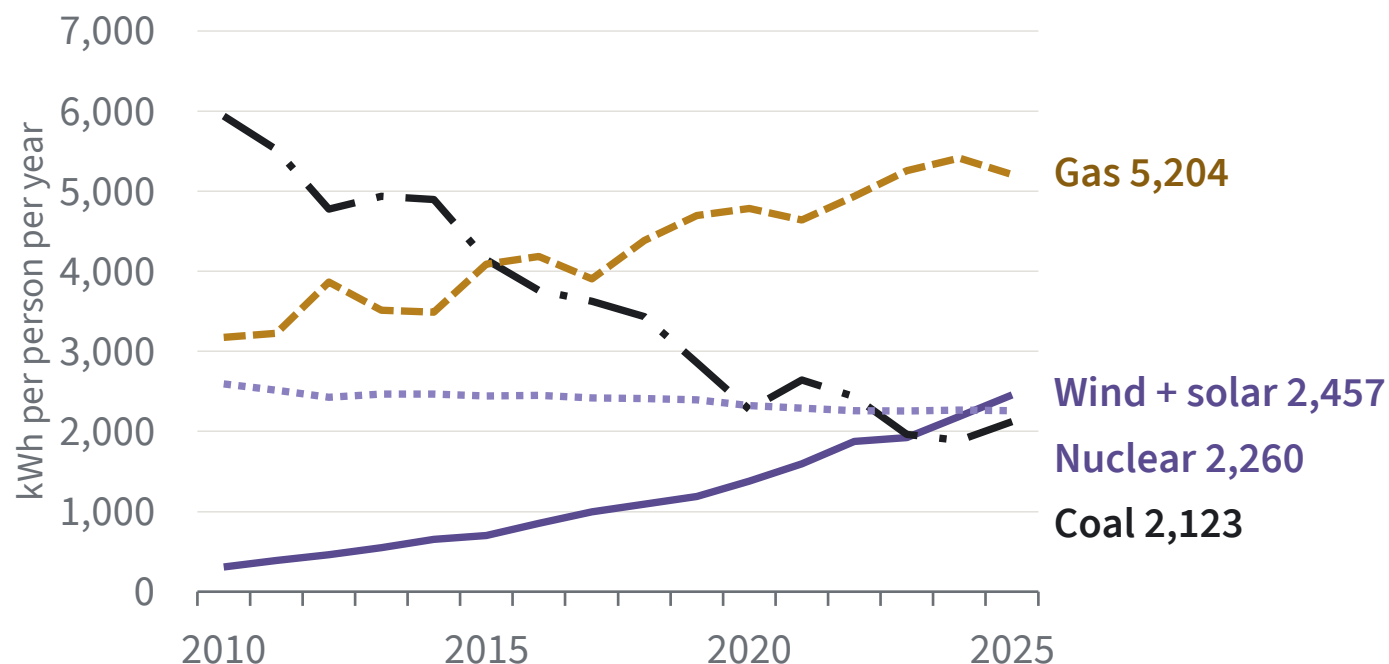
Benchmark costs rose after 2021:

- Solar \$36 → \$58
- Wind \$38 → \$61
- Gas \$60 → \$78

Higher financing and equipment costs contributed to the rise after 2021.
These are new-generation costs; system costs also depend on networks and balancing.

Lazard, Levelized Cost of Energy+ June 2025 (v18), unsubsidised midpoints, nominal \$/MWh; gas at \$3.45/MMBtu; coal omitted (no new-build data since 2020).

Coal generation per person fell 64% since 2010; wind and solar passed it in 2024



2010–2025, kWh per person:

- Coal 5,939 → 2,123
- Wind + solar 308 → 2,457
- Gas rose by about half of coal's decline

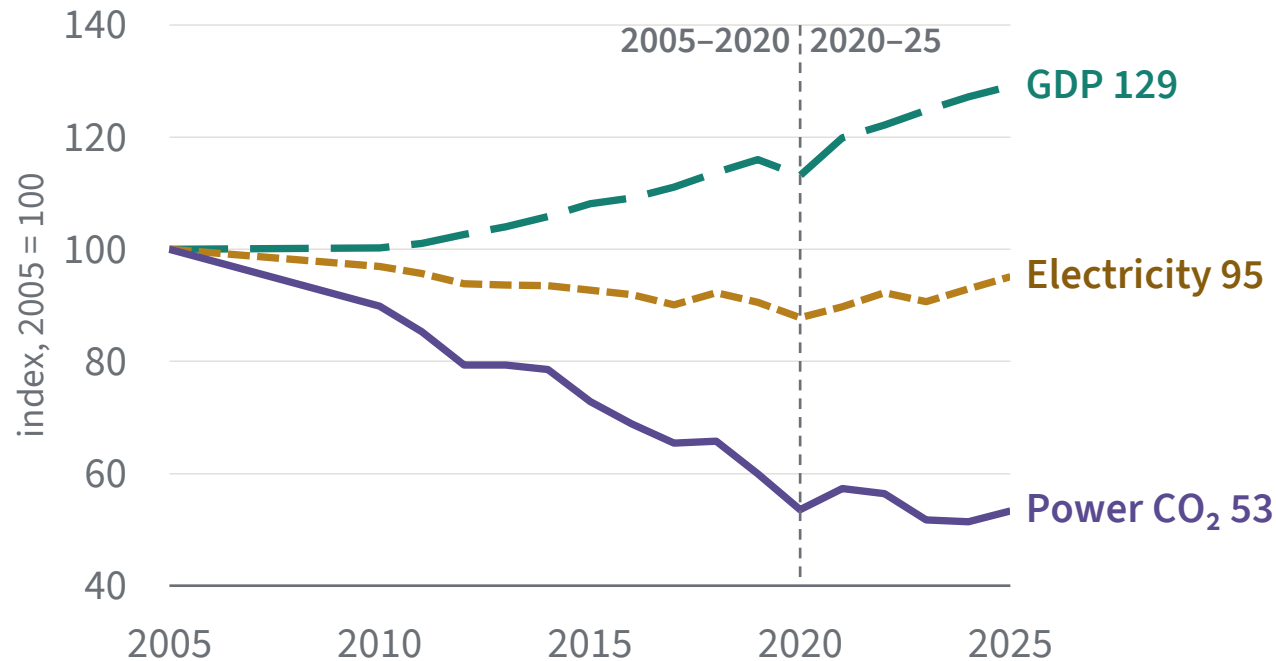
2025, provisional:

- Coal generation rose
- 2.6 of an expected 8.0 GW retired

Coal's 2025 rise is consistent with rising load and slower retirements; the cause is not yet established.

US EIA via Ember / Our World in Data, generation per person; 2025 provisional. Retirements: EIA Today in Energy, 2026. Hydro, oil and other sources omitted.

Until 2020, electricity use and power emissions per person fell while income rose



2005–2020, per person:

- Real GDP +13%
- Electricity –12%
- Power-sector CO₂ –46%: 8.2 → 4.4 t

Consistent with:

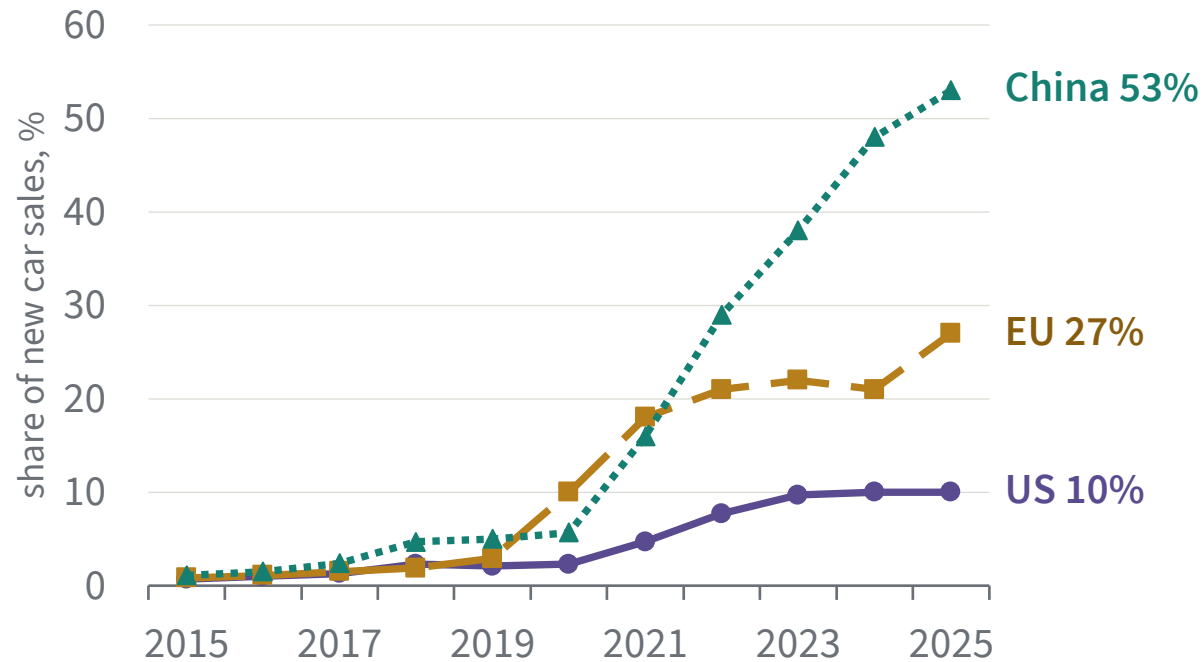
- Efficiency and structural change
- Shale gas, renewables replacing coal

Electricity only — not total energy use.

Electricity use per person fell 12% and power-sector CO₂ per person fell 46%, to 4.4 tonnes, while income rose.

BEA real GDP per person (chained 2017 \$) via FRED; Ember/EIA electricity demand per person; EIA Monthly Energy Review Table 11.6, electric power sector CO₂ ÷ World Bank population. 2005 = 100.

US plug-in sales share stayed near 10% as Europe and China grew



Plug-in share of new car sales, 2025:

- US 10% — near 10% since 2023
- EU 27%
- China 53%

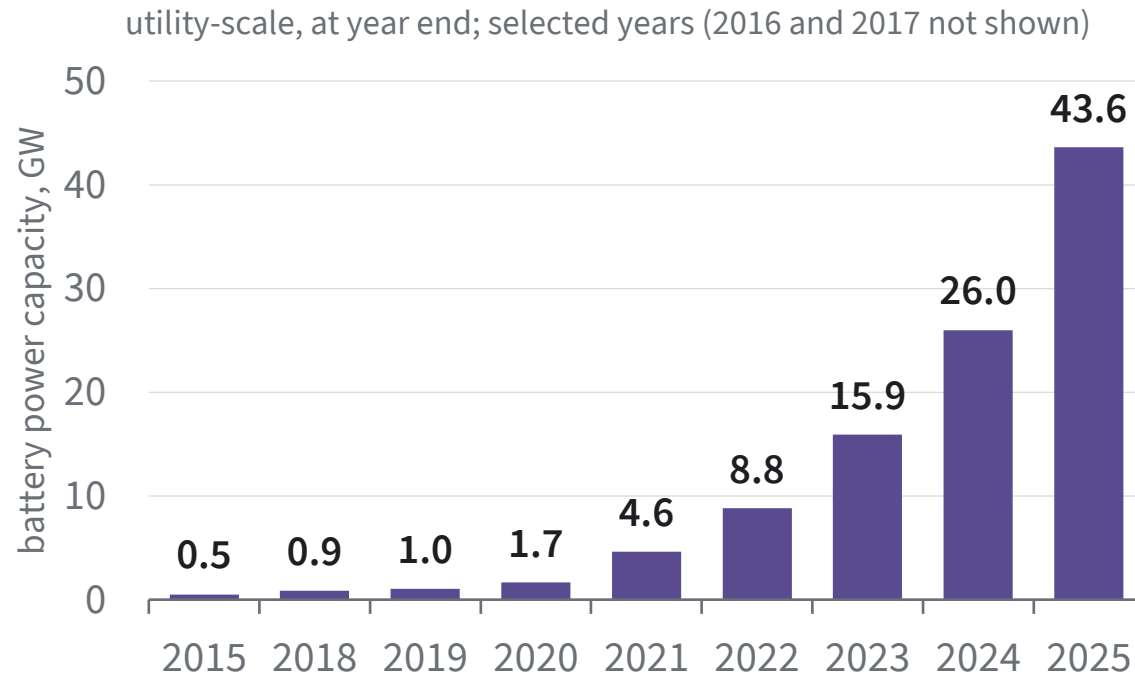
Battery-electric sales volume, not share:

- -36%, Q4 2024 → Q4 2025
- Federal \$7,500 credit ended 30 September 2025; purchases were pulled forward into Q3

The US plateau began in 2023; the end of federal support explains the late-2025 drop, not the whole plateau.

IEA Global EV Outlook 2026 (plug-in = battery-electric + plug-in hybrid, % of new car sales; EU as defined by the IEA). Cox Automotive / Kelley Blue Book (battery-electric volume) via CSIS.

US grid batteries reached 43.6 GW; California and Texas lead



End-2025 and after:

- 43.6 GW is about 0.13 kW per person (utility-scale)
- Nearly 52 GW by June 2026
- Operators plan 54 GW more by 2028 — planned, not delivered

Two routes to rapid build-out:

- California: state climate targets and procurement mandates
- Texas: no climate target; state-mandated wind transmission (CREZ) and an energy-only market

Texas and California enabled rapid deployment through different policies and market arrangements.

EIA, Preliminary Monthly Electric Generator Inventory via Today in Energy, 7 Aug 2026: utility-scale battery power capacity at year end; 2026–28 additions as reported by operators. Per person: 43.6 GW ÷ 340 million (Census 2025).

National transmission sharply reduces modelled system cost and storage needs

Study 1 · Brown & Botterud 2021

100%-renewable US grid in 2040: national AC and DC lines versus state-by-state planning

\$135 → \$73

per MWh system cost, –46%

23 h → 5.3 h

storage, in hours of average demand: three-quarters less

Study 2 · Senga et al. 2025

2035 grid with a 30% inter-regional transfer requirement

–39% outages

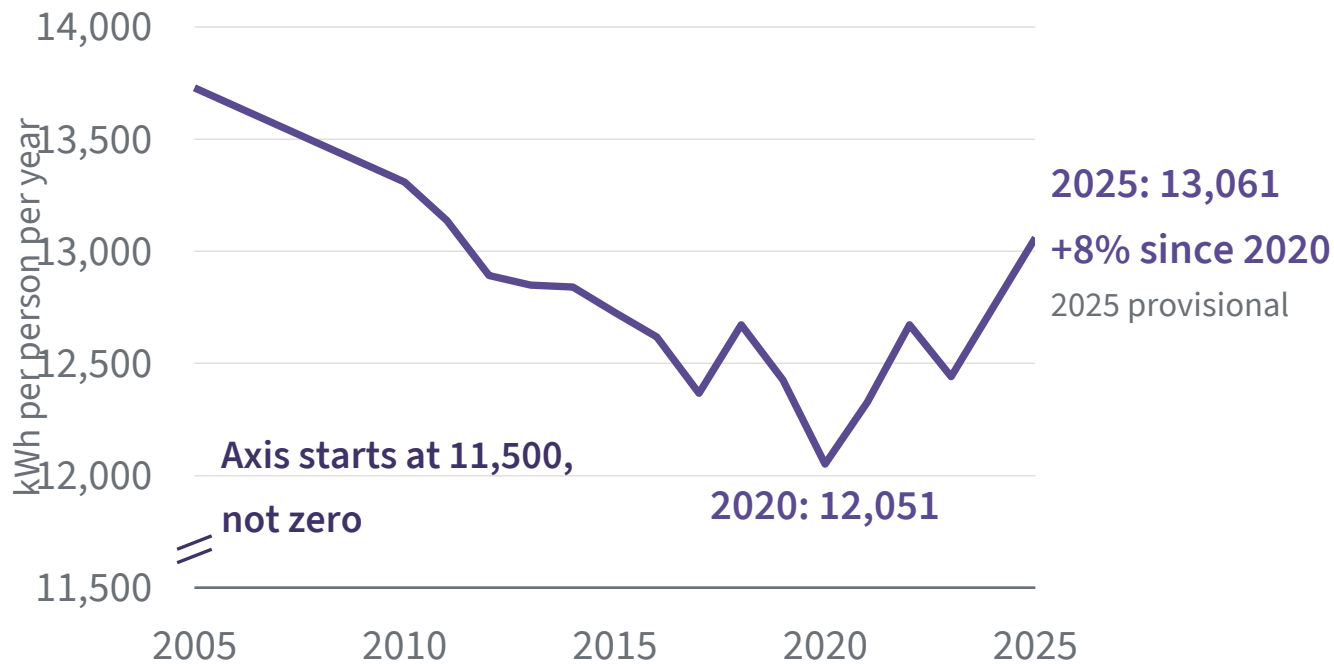
average across regions, simulated extreme weather

Uneven: the north-east and Florida gain little; California can worsen.

Coordinated transmission planning can reduce the cost of reliable clean supply.
Both are optimisation models: hourly, perfect hindsight; system cost excludes distribution.

Brown & Botterud 2021, Joule 5:115. Senga, Botterud, Parsons, Story & Knittel 2025, Nature Energy; policy brief Feb 2026. System cost = generation + storage + transmission, not distribution.

Electricity demand per person is rising again — near the 2011 level



Per person since the 2020 trough:

- Electricity +8% (+5% since 2019)
- Real GDP +14%
- Power-sector CO₂ -1%

Not one cause:

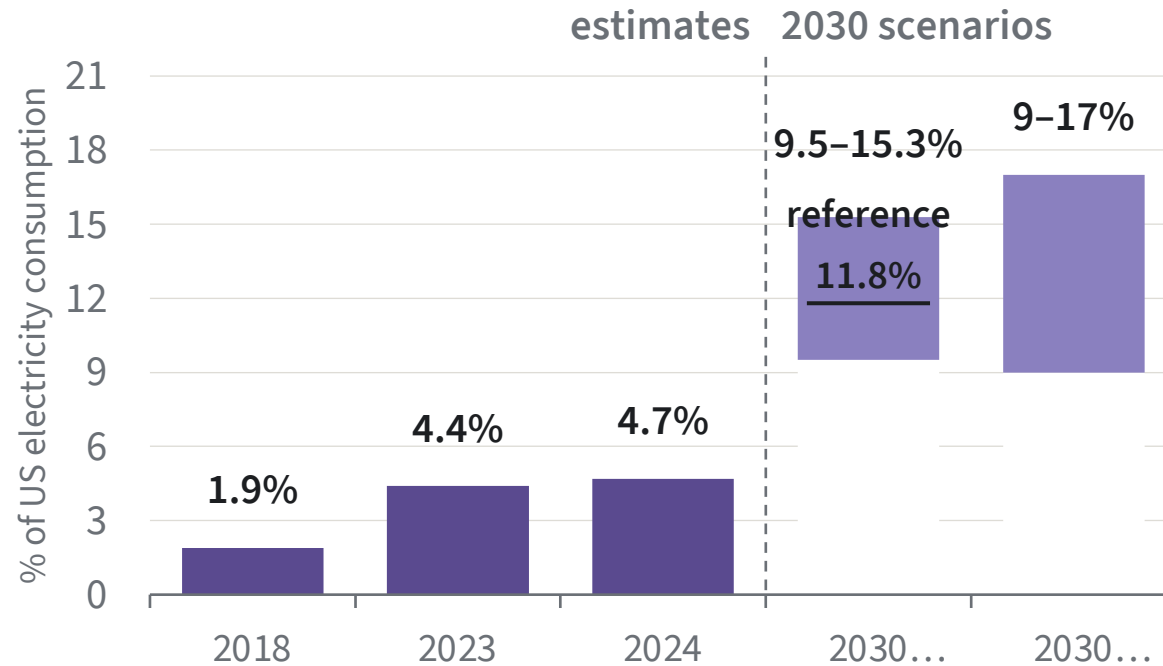
- Data centres, factories, electrification, weather
- IEA projection: data centres about half of US demand growth to 2030

Electrification raises electricity use while cutting fuel use.

Electricity use per person is rising, but more slowly than income.

Ember/EIA, electricity demand per person (2025 provisional). Real GDP per person: BEA via FRED. Power-sector CO₂: EIA MER Table 11.6 ÷ population. IEA, Energy and AI, 2025 (projection).

Data centres used an estimated 4.7% of US electricity in 2024; 2030 scenarios 9–17%



All data centres, not AI alone — estimates, not meter readings:

- Built bottom-up: server shipments, utilisation, cooling
- 2018 and 2023 from the 2024 report; 2024 from the 2025 update

2030 scenarios, share of US electricity:

- Berkeley Lab 9.5–15.3%, reference 11.8%
- EPRI 9–17% — a different forecast of total demand

The range is wide enough that grid plans need to work under more than one demand outcome.

Lawrence Berkeley National Laboratory, US Data Center Energy Usage Report 2024 and 2025 Update (2030: 521–843 TWh, reference 649). EPRI, Powering Intelligence, Feb 2026 (2030: 380–790 TWh).

At NWSC, low cooling overhead was only part of energy efficiency



NCAR-Wyoming Supercomputing Center (NWSC), Cheyenne

Operated by CISL, the NCAR lab I directed:

- Opened 2012; free cooling
- PUE about 1.1
- Derecho: 85% utilised, 2025

PUE, power usage effectiveness: total facility electricity divided by IT-equipment electricity

PUE 1.1: 91% IT equipment (incl. idle servers)

9% overhead: cooling, power conversion

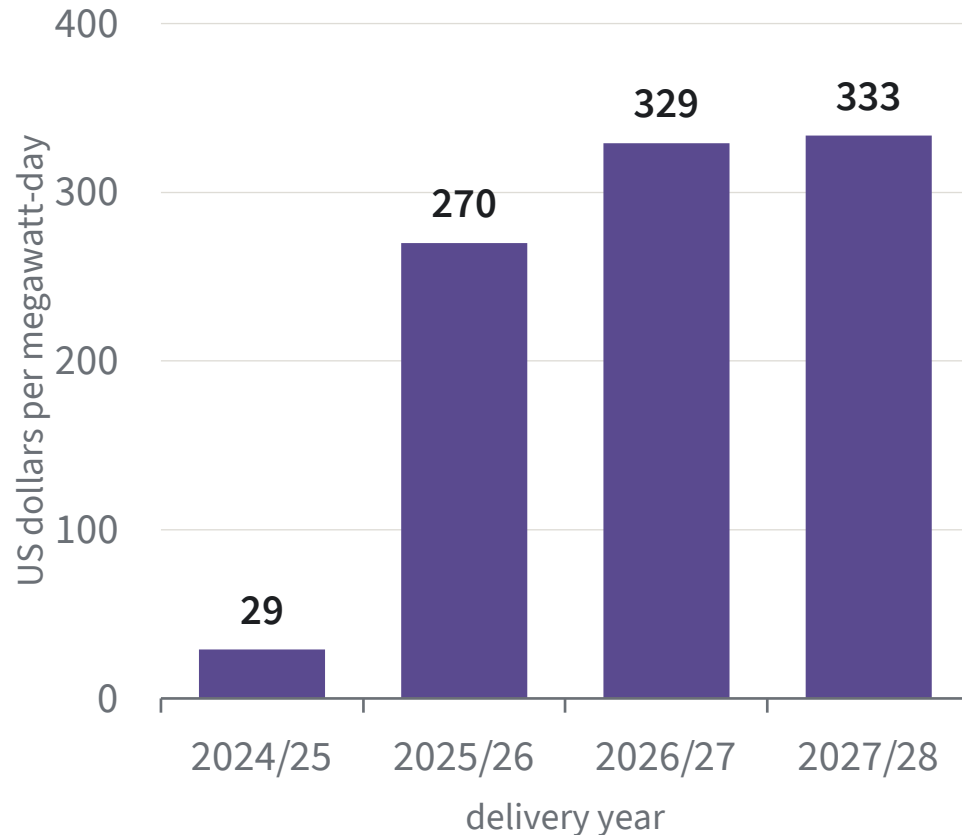
What PUE does not measure:

- Useful work: what the electricity delivered
- Idle equipment: half-used GPUs (graphics processors, the chips that run AI) still draw power
- Water, and the carbon intensity of supply

Low overhead does not cap demand.

NWSC PUE 1.08: NCAR Annual Report FY2017. PUE 1.13 and Derecho utilisation (scheduler-based, 2025 to date): CISL HPC, Storage & NWSC Facility Report to NSF, November 2025; GPU partition read from its monthly chart. Photographs: NWSC.

PJM's auction shows how new data-centre demand can raise capacity costs



PJM, grid and market operator for 13 states, 67 million people:

- Its capacity auction pays generators to be available at peak
- Price \$29 → \$333 per MW-day in three years; the last two at the cap

\$6.5 bn

Estimated reduction in auction cost without 17 GW of data-centre load

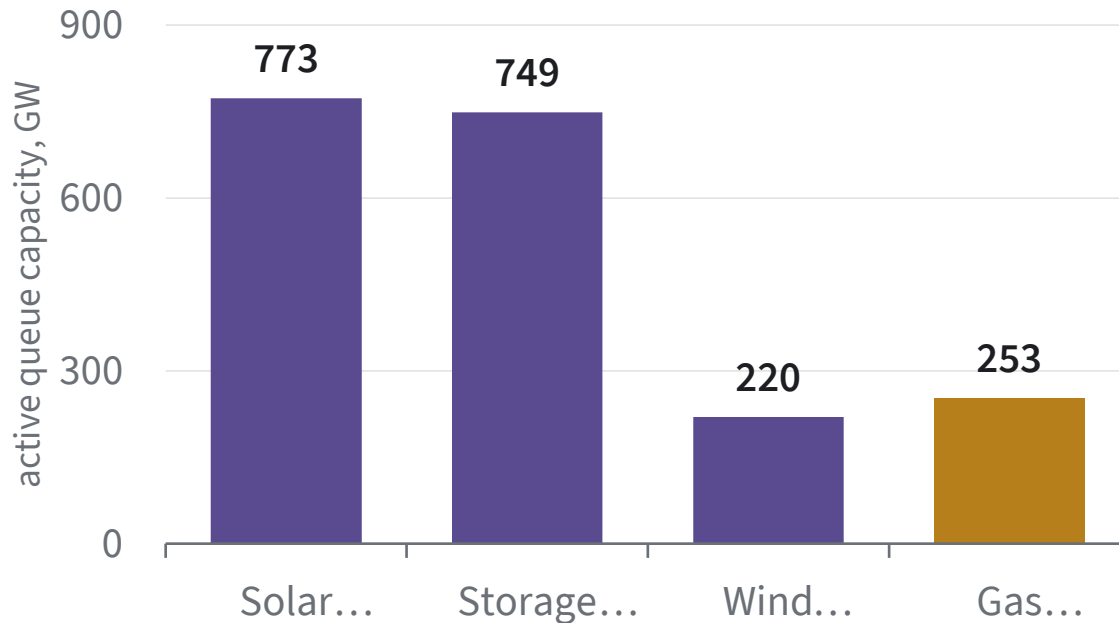
December 2025 auction, delivery year 2027/28: 39.6% of its \$16.4 billion

A counterfactual (a model of the same auction without the data-centre load), not a customer-bill amount:

- What reaches bills depends on state regulation and customer class

PJM base residual auction reports (RTO clearing price; 2027/28 auction held 17 Dec 2025, total \$16.4bn). Monitoring Analytics, Analysis of the 2027/2028 BRA, Jan 2026 — counterfactual without 17,071 MW of data-centre load.

Gas requests grew while solar, wind and storage queues shrank in 2025



Generation and storage waiting to connect, end 2025:

- About 2,061 GW — down 10% on the year
- Still overwhelmingly solar, storage and wind

Change in active queue capacity during 2025:

- Gas +86%
- Solar, storage and wind each down 16–19%

A queue of generators, not of new electricity users.

Only 13% of the capacity requested in 2000–2020 was operating by end-2025; most requests are withdrawn.

Lawrence Berkeley National Laboratory, Queued Up: 2026 Edition — 8,244 active requests at end-2025, ≈2,061 GW; active capacity by type and year-on-year change; completion rate by capacity, 2000–2020 requests.

Data-centre demand is prompting both private gas generation and utility expansion

Turbine order books run to 2031; coal retirements are being delayed. Three routes:

Route	Project	Gas generation	Status (date of source)
Private, on site	xAI Colossus, Memphis	35 mobile turbines	Operating; air permits contested (Apr 2026)
Private, on site, permitted	OpenAI Stargate (Crusoe), Abilene, Texas	360 MW permitted; >1 GW of turbines ordered	Under construction, 2025–26
Regulated utility build	Meta Hyperion, Louisiana (Entergy)	2.26 GW of utility gas plants approved	Approved Aug 2025; 5.2 GW more proposed (Mar 2026)

Different routes raise different questions about emissions, oversight and who funds the infrastructure. Requirements: Texas SB 6 (2025), Ohio tariff (2025), FERC orders (Dec 2025, Jun 2026).

New York Times (Aug 2026, Feb 2026); Earthjustice; Entergy / Louisiana PSC; E&E News; GE Vernova Q2 2026. Statuses as reported at source date. Rules: Texas SB 6; PUCO; FERC. Full references in the notes.

After the Marshall Fire, we had to decide how to rebuild



Why households matter:

- Households account for 37% of US retail electricity sales (2024)
- Per person, about 4,400 kWh a year: 3× the EU, 4× China

30 December 2021, Boulder County, Colorado:

- A winter grass fire, regional gusts above 160 km/h (100 mph)
- Roughly 1,100 homes destroyed in an afternoon
- Mine was one of them

What did a thousand households build when they rebuilt — with codes, incentives and resources that differed from house to house?

Households: EIA Electric Power Annual 2024, Table 2.2 (37.3% of retail sales); per person, household electricity only: US 2024 (EIA), EU 2023 (Eurostat, 1,545 kWh), China 2024 (NEA via CET). Fire: Boulder County (about 1,100 residential structures destroyed); NWS Boulder, 30 Dec 2021. Photograph: the author.

Our rebuilt house kept power through most of two wind-shutoff periods



≈59 hours

reported outage, two wind shutoffs

2¼ hours

without house power, once

Two shutoffs, different evidence: April 2024 from the household record; December 2025 from five-minute inverter logs.

All-electric: 7.68 kW solar · 10 kWh battery · load-shedding panel · ground-source heat pump

Metered	generated	used (incl. car charging, hot tub)
2024	12.5 MWh	14.9 MWh
2025	≈12.7 MWh, adjusted	13.3 MWh

Modelled: HERS -5
Home Energy Rating System: 100
= a 2006-code home, 0 = net-zero; -5 = modelled to generate slightly more than it uses

Generation 84–96% of use; net grid import 3.8 and 2.4 MWh.

Insulation, airtightness, load control and a small battery covered nearly all of two major shutoffs.

HERS certificate, RESNET rater, June 2023 (vehicle charging outside the rating). Sol-Ark inverter: monthly totals 2024–25, with an anomalous Sept 2025 counter reading replaced by an estimate; five-minute logs 17–19 Dec 2025. April 2024 shutoff from the household record, no logger data.

Generous incentives helped many households rebuild more efficiently

about **70%**

of completed rebuilds
received or qualified for
incentives

65% received, 5% qualified
but not yet applied; 583
households, October 2025

at least **21%**

documented all-electric

A lower bound: the
incentive paperwork runs
to the end of 2026

One transaction — our sale:

- The appraisal assigned no explicit value to the energy systems
- Three bidders exceeded it; the winner paid about 20% over asking price
- One sale cannot isolate why

What generalises:

- Load reduction, appropriate equipment and accessible advice
- Not a full rebuild — most households, and renters, cannot choose one

Incentives reached most rebuilders; in our sale the appraisal assigned the energy systems no explicit value.

Urban Institute, Rebuilding Better after the Marshall Fire, Dec 2025 (Boulder County, Louisville and Superior permit data; Xcel registrations; as of Oct 2025). Valuation: personal transaction; Fannie Mae Selling Guide; Appraisal Institute green addendum.

Rising demand makes the next decisions harder. Three of them:

01 **Connect clean supply sooner**

Transmission and interconnection turn cheap generation into delivered electricity.

02 **Standardise what large new loads must provide**

Before they connect: supply, flexibility, and who pays for the infrastructure.

03 **Make efficient homes reachable**

Financing, advice and valuation practices that let more households benefit.

Efficiency matters most when we measure the service it delivers, and plan the rest of the system around it.

Questions?

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Prepared with Claude (Anthropic) — research synthesis, drafting, deck build. Every source checked; the claims are mine.