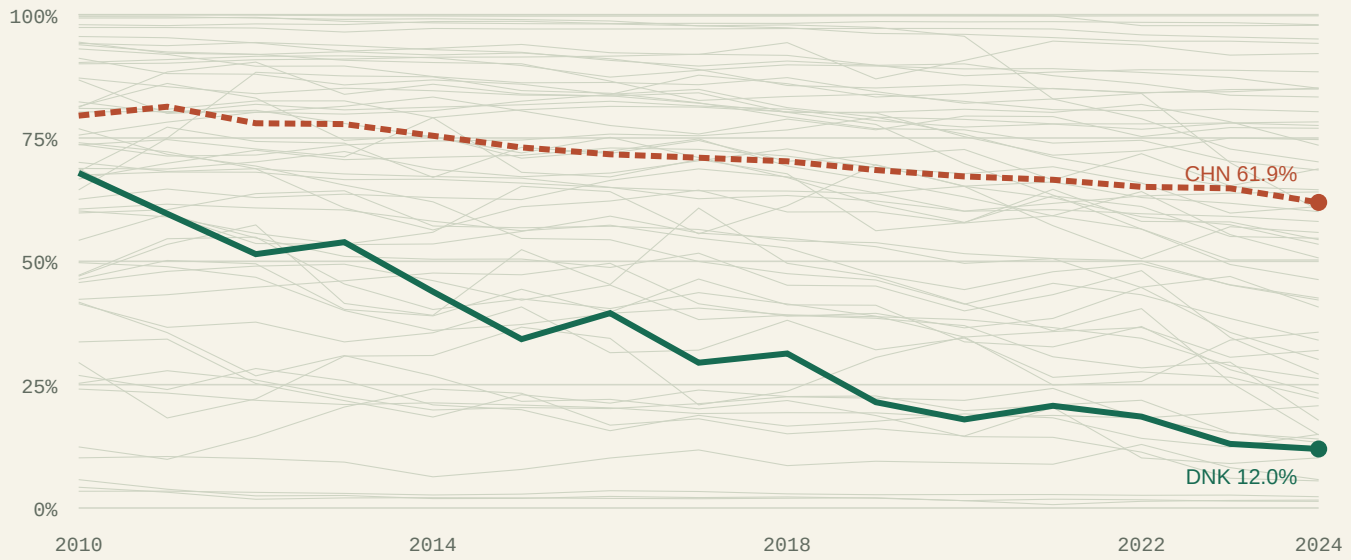
THE ELECTRICITY TRANSITION, EXAMINED / RESEARCH EDITION

Less fossil. *Or just a bigger grid?*

A falling fossil share can coexist with rising fossil generation. Follow 58 electricity systems from 2010 to 2024 to separate the pace of the transition from the scale of the grid.

FOSSIL SHARE OF DOMESTIC GENERATION



Annual observations. Denmark is the solid green line; China is dashed rust. Other eligible grids provide context. All shares use a fixed 0-100% scale. [S1]

-56.0 pp

Denmark: the fastest fossil-share decline in the screened 58-grid cohort.

+2,893 TWh

China: more fossil output even as the fossil share falls by 17.6 percentage points.

Archived open-data edition. The pinned source was committed on 30 May 2025; annual observations stop at 2024. Retrieved 3 September 2026 (UTC). These are historical data, not live telemetry.

[S1] OWID electricity snapshot, 30 May 2025

[S2] Source definitions

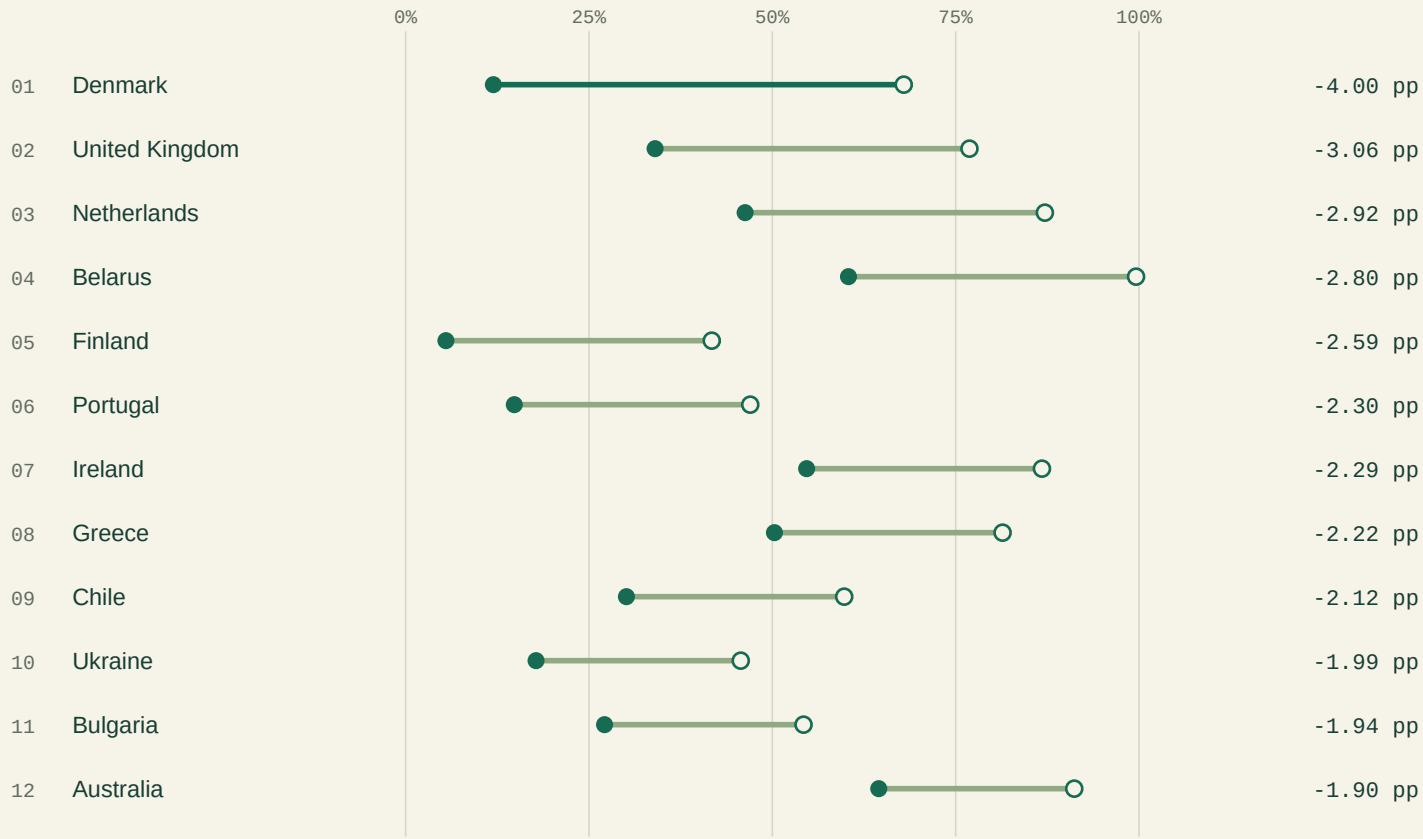
Source table: data/evidence/rankings.csv; raw-row traces: evidence.html#pace and #growth.

01 + 05 / THE PACE AND THE SCALE

The leader depends *on the yardstick.*

Denmark leads in percentage-point decline per year. The United States leads in absolute fossil decline. These are different questions, and the same country need not win both. [S1]

TWELVE FASTEST FOSSIL-SHARE DECLINES



Open dot: 2010. Filled dot: 2024. Same 0-100% scale for every grid. Ranking divides by 14 elapsed years, not 15 observations. [S1, S2]

The US counterexample

Fossil output falls 334.54 TWh, the largest absolute decline. Its share-speed rank is 26. Coal falls 1,195 TWh while gas rises 877 TWh; both remain in the fossil category. [S1]

The screen matters: 58 country and territory grids with at least 20 TWh of generation in 2010 and complete annual core data. Small or incomplete grids are excluded. This is a descriptive ranking, not a policy scorecard.

[S1] OWID electricity snapshot, 30 May 2025

[S2] Source definitions

Full 58-grid table: rankings.csv. Screen audit: coverage.csv. Traces: evidence.html#pace and #scale.

02 + 03 / WHAT ACTUALLY BALANCES THE CHANGE

The fossil balance has *three moving parts.*

More clean generation can reduce fossil output, but demand and trade also change. The identity below accounts for the observed difference; it does not identify independent causal effects. [S1, M1]

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Fossil change = demand change - clean change - net imports change
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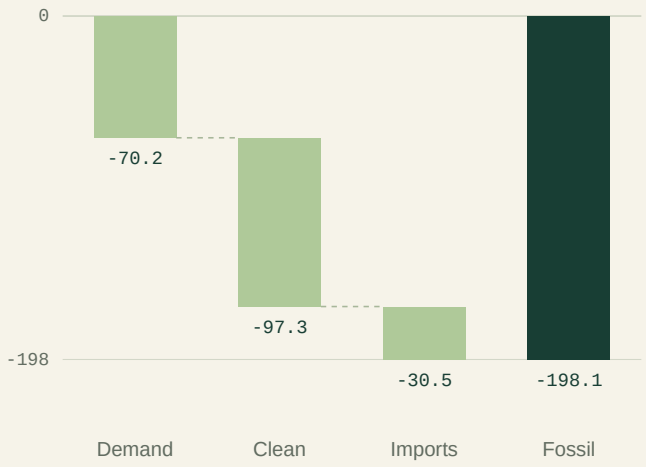
United Kingdom

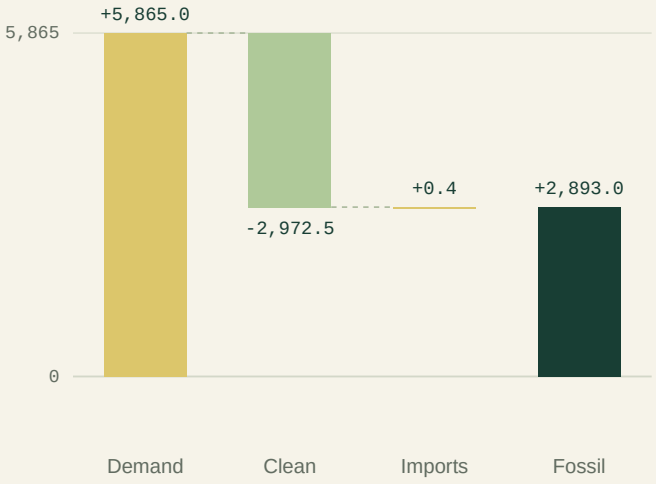
-198.05 TWh fossil change



UK: lower demand, more clean output and more net imports all align with falling domestic fossil generation. Imported electricity is not necessarily fossil-free. [S1]

China

+2,892.96 TWh fossil change



China: clean output grows by 2,972.48 TWh, but demand grows by 5,865.02 TWh. Fossil output fills much of the remaining balance. India has the same directional pattern. [S1]

Separate TWh scales in the two waterfalls keep both grids legible. Compare the printed values, not bar heights. Positive contributions raise fossil generation; negative contributions reduce it.

CHECK THE SIGNS

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UK:    -70.20 - 97.32 - 30.53 = -198.05 TWh
China: 5865.02 - 2972.48 - (-0.42) = 2892.96 TWh
```

[S1] OWID electricity snapshot, 30 May 2025
[S2] Source definitions
[M1] Ember methodology

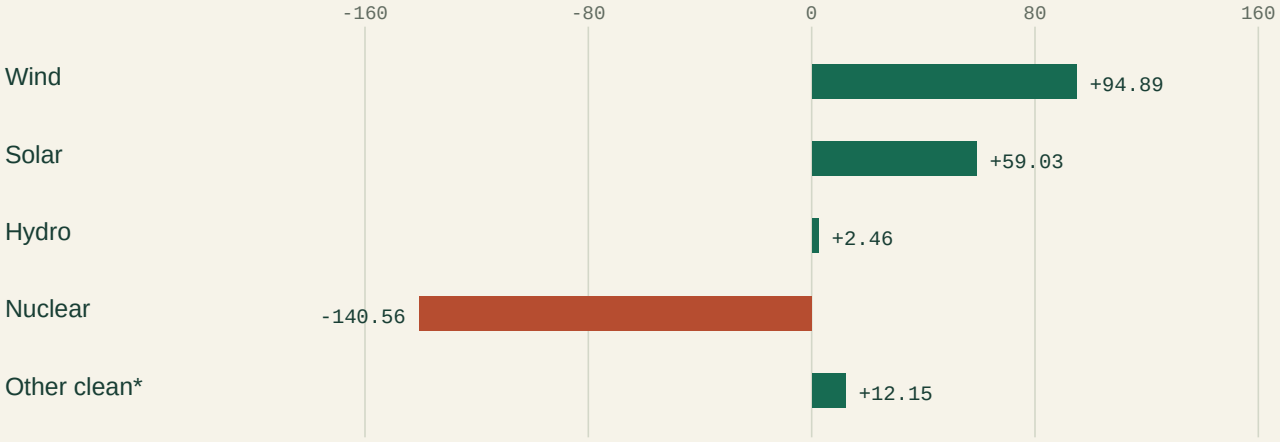
Endpoint balances: rankings.csv. Independent raw arithmetic: verification.json. Traces: #demand and #growth.

04 + 06 / THE STARTING MIX MATTERS

New clean supply can *replace old clean supply.*

Germany adds 153.92 TWh of wind and solar between 2010 and 2024. Nuclear output falls 140.56 TWh. The net gain across all clean sources is 27.97 TWh. This is an observed balance, not a nuclear-policy counterfactual. [S1]

GERMANY / CLEAN-GENERATION CHANGE, 2010-2024 / TWh



* Calculated residual including bioenergy and other renewables. France starts with a much larger nuclear share; comparing the two countries does not hold demand, trade or other conditions constant.

Starting clean leaves less room to fall.

Norway

Norway: fossil share falls from 4.2% to 1.6%. A modest 2.6-point decline reflects a grid that was already overwhelmingly low-carbon in 2010. [S1]

Brazil

Brazil: fossil share falls from 12.4% to 10.2%, but fossil output grows 11.90 TWh. More clean electricity can coexist with more fossil electricity. [S1]

Fossil Nuclear Hydro Wind Solar Other clean

[S1] OWID electricity snapshot, 30 May 2025 [S2] Source definitions

Generation components and endpoint shares: electricity.csv. Calculation traces: #replacement and #starting.

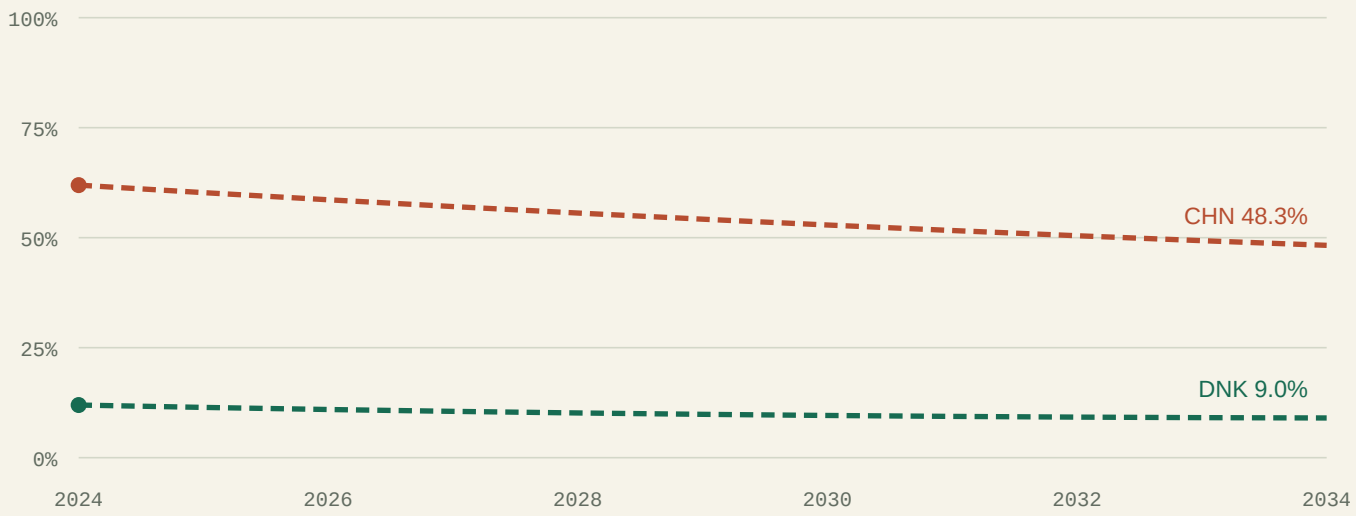
A THOUGHT EXPERIMENT / NOT A FORECAST

Two assumptions. *One balance.*

ILLUSTRATIVE - NOT A FORECAST

Start from observed 2024 values. Demand grows 2% each year. New clean output adds 2.5% of baseline generation each year as a constant TWh increment. Net imports stay fixed. Fossil generation fills the remaining balance.

FOSSIL SHARE / TEN-YEAR ILLUSTRATIVE PATHS



Filled starting dots are observed. Every subsequent point is a model calculation. Both lines use the same 0-100% axis. This experiment makes no statement about the probability of either path.

Denmark

2034 illustrative fossil output: **4.0 TWh**.
Clean output: 40.1 TWh.
Demand: 47.8 TWh.
Surplus: 0.0 TWh.

China

2034 illustrative fossil output: **5,923.6 TWh**.
Clean output: 6,351.8 TWh.
Demand: 12,261.5 TWh.
Surplus: 0.0 TWh.

Fossil output cannot fall below zero. Surplus would require curtailment or additional exports. The model omits retirements, prices, storage, weather, transmission, hourly reliability and emissions. It is arithmetic, not a power-system simulation.

Sensitivity check: with the same 58 grids and a 2024 endpoint, Denmark leads from 2010; Belarus leads from 2015 or 2020. A start date is an analytical choice, not a confidence interval. [S1]

[S1] OWID electricity snapshot, 30 May 2025

[S2] Source definitions

Scenario formula: model.mjs; observed baseline: electricity.csv. Alternate baselines: baseline-sensitivity.csv.

THE EVIDENCE / METHODS, LIMITS AND A REPRODUCIBLE SNAPSHOT

Read the fine print.

A selected-country table anchors the charts. All TWh changes are 2024 minus 2010. The companion CSVs contain all 58 grids and every annual observation. [S1]

Grid	2010 %	2024 %	Fossil delta	Clean delta	Demand delta	Imports delta
Denmark	67.9	12.0	-22.08	18.78	1.64	4.94
United Kingdom	76.9	34.0	-198.05	97.32	-70.20	30.53
Netherlands	87.2	46.3	-46.33	50.53	-2.96	-7.16
Belarus	99.6	60.4	-7.40	17.81	8.33	-2.08
Finland	41.7	5.5	-29.07	32.03	-4.35	-7.31
Portugal	47.0	14.8	-18.27	11.10	0.69	7.86
Ireland	86.8	54.7	-7.50	10.28	6.89	4.11
Greece	81.4	50.3	-17.30	17.92	-5.25	-5.87
Chile	59.8	30.1	-9.16	38.17	28.05	-0.96
Australia	91.2	64.5	-48.24	77.17	28.93	0.00
Germany	60.6	42.6	-175.31	27.97	-106.94	40.40
United States	70.1	58.1	-334.54	607.86	261.15	-12.17
China	79.5	61.9	2,892.96	2,972.48	5,865.02	-0.42
India	82.3	77.5	823.64	296.43	1,111.45	-8.62
France	10.2	5.8	-25.07	20.44	-64.94	-60.31
Brazil	12.4	10.2	11.90	217.56	209.92	-19.54
Norway	4.2	1.6	-2.67	35.65	6.91	-26.07
Japan	64.5	68.5	-45.17	-88.57	-133.74	0.00

Shares divide fossil by domestic generation. Demand equals generation plus net imports; negative imports indicate net exports. Electricity is not total energy. Generation (TWh) is not installed capacity (GW).

Sampling and missing values

Screen: ISO-3 country/territory code, 2010 generation at least 20 TWh, complete core data in every 2010-2024 year. 58 of 220 candidate grids qualify. Detailed source blanks stay missing; 339 remain in the 870-row panel. Reported zero remains zero.

What was independently checked

12 country endpoint calculations, the full ranking and both annual identities for all 870 rows were recomputed from original raw values using Decimal arithmetic. 14,790 cleaned source cells were compared with the original CSV.

[S1] OWID Energy data: pinned commit f419e8f

[S2] Pinned OWID codebook and source attribution

[M1] Ember methodology, current reference

Data combine Ember (2025) and Energy Institute (2024), with Ember priority where both overlap. OWID and Ember: CC BY; third-party terms retained. See source-manifest.json for URLs, hashes and license notes.

The current methodology reference may differ from the 2025 vintage. Source estimates, revisions and bioenergy caveats are inherited; this export supplies no row-level uncertainty intervals. Accounting contributions do not prove causation.