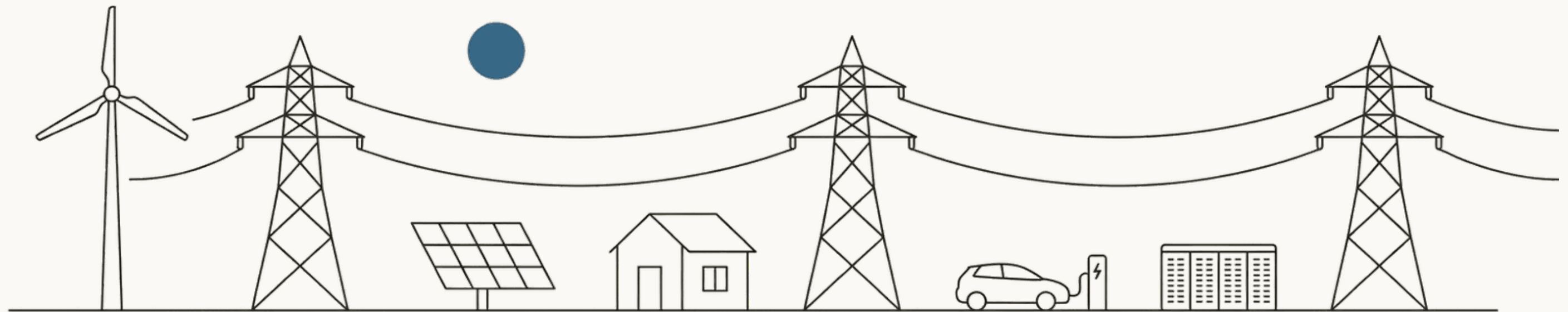


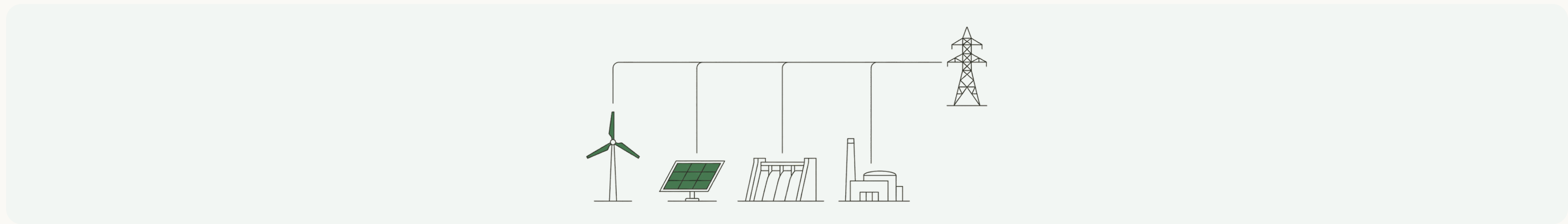
A day on *the grid*

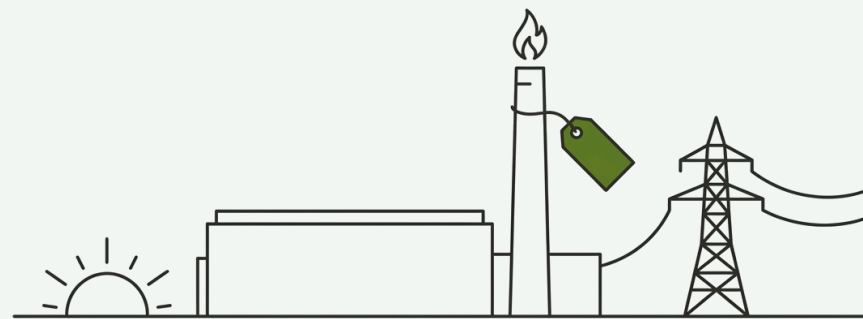
One German day, hour by hour, and the site that explains it. Wattlas turns open electricity-market data into 36 views in eight sections that a stranger can read, with every caveat kept on screen.

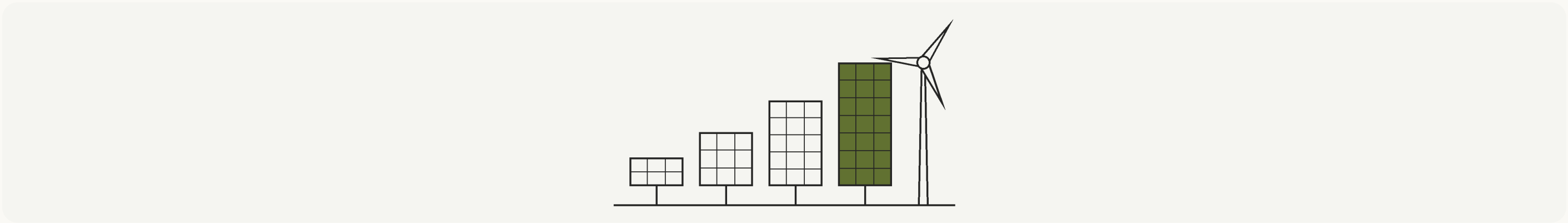


Wattlas · wattlas.net Built and run by Sebastian Knödel Figures as of 23 September 2026; the data refreshes twice a month [Download the PDF](#)









13:00

Solar pushes the price below zero.

By one in the afternoon solar has pushed the average weekday price to its floor, €58/MWh. On the sunniest, windiest days it falls straight through it. In the 12 months to 14 September 2026 the German day-ahead price was below zero for 535 hours.

The site counts those hours by year, month, day and spell length. The per-year count reconciles with the regulator's own (BNetzA): its 2024 figure is matched exactly. The widest day of the year was 1 May 2026: a €672 spread between its cheapest hour (–€499) and its dearest (€173).



Hours below zero per calendar year, DE-LU day-ahead, from a frozen five-year backfill; 2022 is the gas-crisis outlier.

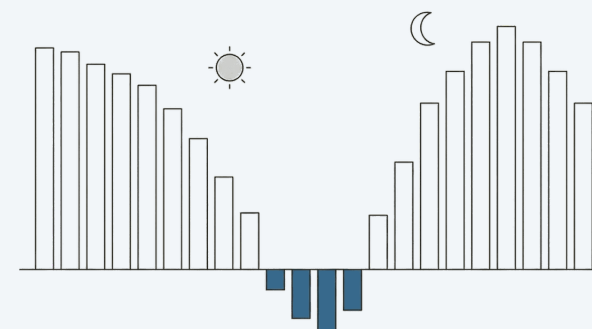
Counted hour by hour in local time, negative prices kept as they are. Since October 2025 the market settles quarter-hourly, so the hourly count **understates** it.

/ negative-prices

/ pulse

/ capture-price

/ spread



The live view, /negative-prices: the year as a calendar, one cell a day; any year loads on demand.



14:00

The north can't ship it south.

Over the last 12 months the north and east generated 81% of Germany's wind and the industrial south-west 2%, with one price stretched between them. When the lines are full the grid pays northern wind to stop.

13.0 TWh

of German wind and solar curtailed in the 24 months to 15 Sep 2026, priced on the page at about €1.0 billion, *an estimate, labelled as one*

Wattlas goes below the bidding-zone line and maps the same congestion problem three ways. Germany keeps one price and curtails. The Nordics split into twelve price zones: over the last 12 months the hydro-rich north (NO4) averaged €30/MWh, the continent-coupled south (DK2) €101. Britain keeps one price and pays constraint costs instead: £7.2 billion since April 2022, per NESO.

/ germany-north-south

/ nordic-bidding-zones

/ uk-regional

/ curtailment

Germany

one price, curtail

~400 Landkreise (counties) from the plant register (MaStR), control-area balance from SMARD.

Nordics

twelve prices

ENTSO-E zone prices; boundaries labelled approximate.

Curtailment is a **managed grid-stability measure**: operators turn generation down to keep the system stable. The single-zone debate is presented as a cited range, and the site never invents a split price.

Wattlas

A day on the grid · hour by hour



06 / 13

19:00

The evening peak, when batteries sell.

At seven the sun is gone and demand isn't. The average weekday price peaks at €163/MWh; the residual load (demand minus wind and solar) peaks at 40 GW. A battery earns from the gap between a day's cheapest and dearest hour.

€137/MWh

the average daily top–bottom spread (TB1), DE-LU, 12 months to 14 Sep 2026

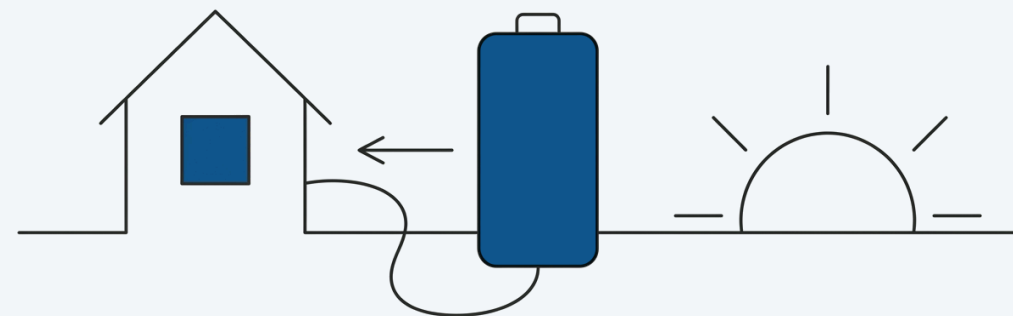
Wattlas runs a modelled 1 MW / 2 MWh battery through the real price profile and states what perfect foresight would earn: about €95 000 per MW a year. Germany's large-scale fleet grew from 0.6 GW at the end of 2021 to 2.6 GW at the end of 2025 in the German plant register (MaStR), with 11.6 GW more registered as planned: a registration, with no promise it will be built.

The arbitrage figure is **an upper bound**: it assumes perfect foresight, no round-trip losses and no price impact. Real batteries earn less. The spread itself is a conservative lower bound since the quarter-hourly switch.

/ spread

/ storage

/ residual-load



The live view, /spread: negative-price days flagged, the upper-bound caveat under the chart.

Wattlas

A day on the grid · hour by hour



07 / 13

19:00 · €163/MWh, weekday average
weekday price by hour, DE-LU, 12 months to 14 Sep 2026

A November night with no wind.

For 52 hours in November 2025, wind and solar together covered 9% of German demand, against a normal 50%. A Dunkelflaute. Coal, gas, biomass, hydro and imports carried the load, and the price climbed.

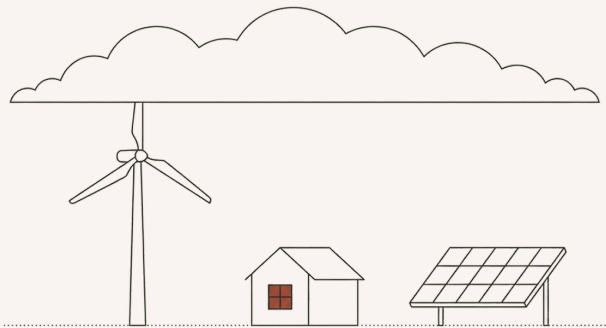
The site finds the worst such spell in the last year automatically, plots it hour by hour, and keeps the record across a frozen five-year history: 14 sustained spells since 2021, the longest 97 hours in December 2022. Even on an ordinary day the wind is hard to call: over the last year the grid operators' day-ahead forecast missed onshore wind by 10% of its output. Germany's answer to the long gaps is a law passed in July 2026, the StromVKG, which auctions 11 GW of firm capacity for 2031.

14 times

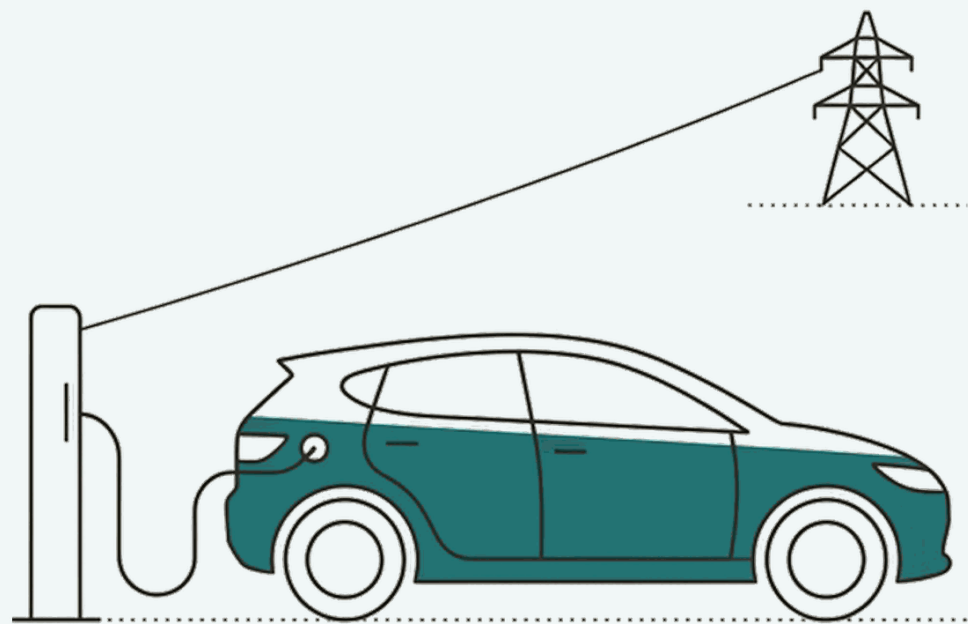
from 2021 to 2025, wind and solar covered less than 10% of German demand for a day or longer · the longest lasted 97 hours

The page shows what covers such spells (**firm capacity, storage or interconnection**) and argues neither for nor against renewables. The law is enacted; its cost is the European Commission's **expected range**, and the levy an estimate until its own law sets it.

- / dunkelflaute
- / forecast-error
- / capacity-adequacy



The live view, /dunkelflaute: the spell of 7–10 November 2025, hour by hour; the threshold is adjustable and stated.



The live view, /ev-charging-network: every one of the register's points placed in its district.



The bill lands.

A German household paid about 39 ct/kWh in 2024. The energy itself was 17 ct of that; network charges 11 ct; taxes and levies 11 ct. The wholesale price this deck has followed all day is a minority of the bill.

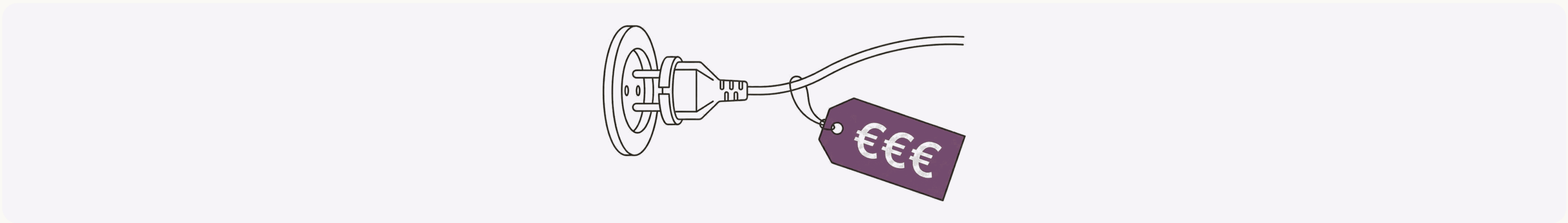


Eurostat, annual, Germany, 2024.

What can a household do about it? Shift load into the cheap hours. An EV charging in the cheapest four hours of each day would have saved about €210 over the last 12 months against a flat tariff; a home battery about €260.

Those savings are a **perfect-foresight upper bound**; real charging and batteries save less. Eurostat's figures are per kWh for *Germany*; the wholesale price is per MWh for the *DE-LU zone*.

- / electricity-bill-breakdown
- / flexibility
- / industrial-power-prices



The live view, /electricity-bill-breakdown: how the wedge has shifted since 2019.

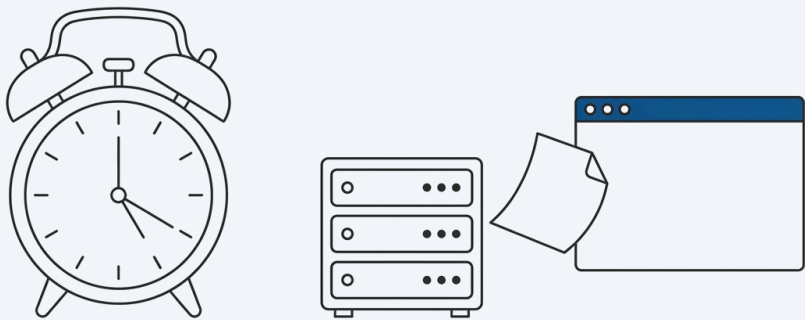
The site's own day begins before dawn.

Twice a month a scheduled job fetches more than a dozen open feeds, computes every metric in Python and writes 64 small JSON files. Firebase Hosting publishes whatever changed.

The browser gets static pages: no framework, no database, no map tiles, so an API outage cannot take the site down. The only code running on a server is the assistant.

A view can be up to two weeks old between runs, and every page says when its data was updated.

- / how-it-works
- / data-sources



Open data ENTSO-E, SMARD, MaStR, NESO, Eurostat and more	pipeline/ Python and pandas, one module per source
data/*.json 64 pre-computed files, committed	site/ 59 static pages, vanilla JS, D3 maps
Firebase Hosting, plus the assistant's functions	

Ask the page a question.

Every view has a small assistant under its chart. Ask it about the numbers in front of you and it answers from that page's own data, and nothing else.

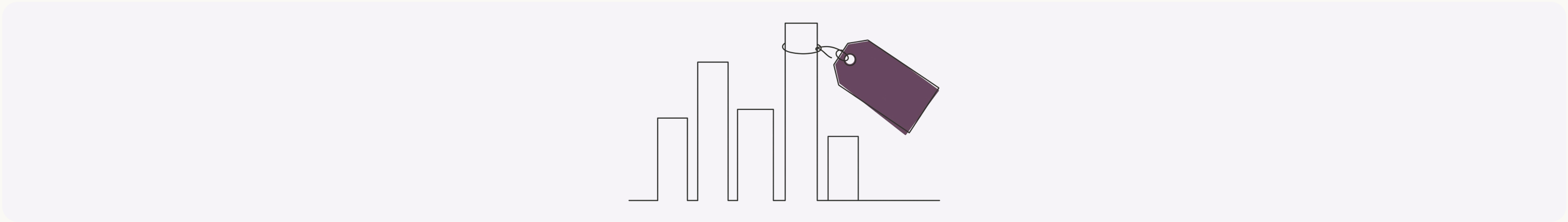
The server fetches the page's data itself, so a question cannot slip in other numbers, and when an answer leaves out the view's caveat, the caveat is added. Each page's three suggested questions are answered ahead of time and served as plain files.

44 pages

carry the assistant · 3 questions free per visitor every 30 days, 20 a day after signing in

Answers are labelled **AI-generated and unverified** on screen. Questions are logged on the server with no account attached, and the browser keeps no record of them.

- / spread
- / how-it-works



The live view, /spread: the question box and its three suggested questions.

00:00 tomorrow

Have data people need to understand?

I build the whole path from raw data to a page a newcomer can read: the pipeline, the interface and the caveats that travel with every number. Wattlas is the working example, built and run by one person.

If your organisation has numbers that deserve a clear page, write to me.

Open wattlas.net

contact@sekond.de

This deck as a PDF

Sebastian Knödel · data engineering and product design · sekond.de

