



INNOBU · THE HANDBOOK IN PICTURES

Digitalising the energy transition, explained

The handbook in twelve pictures

As of 15 October 2026

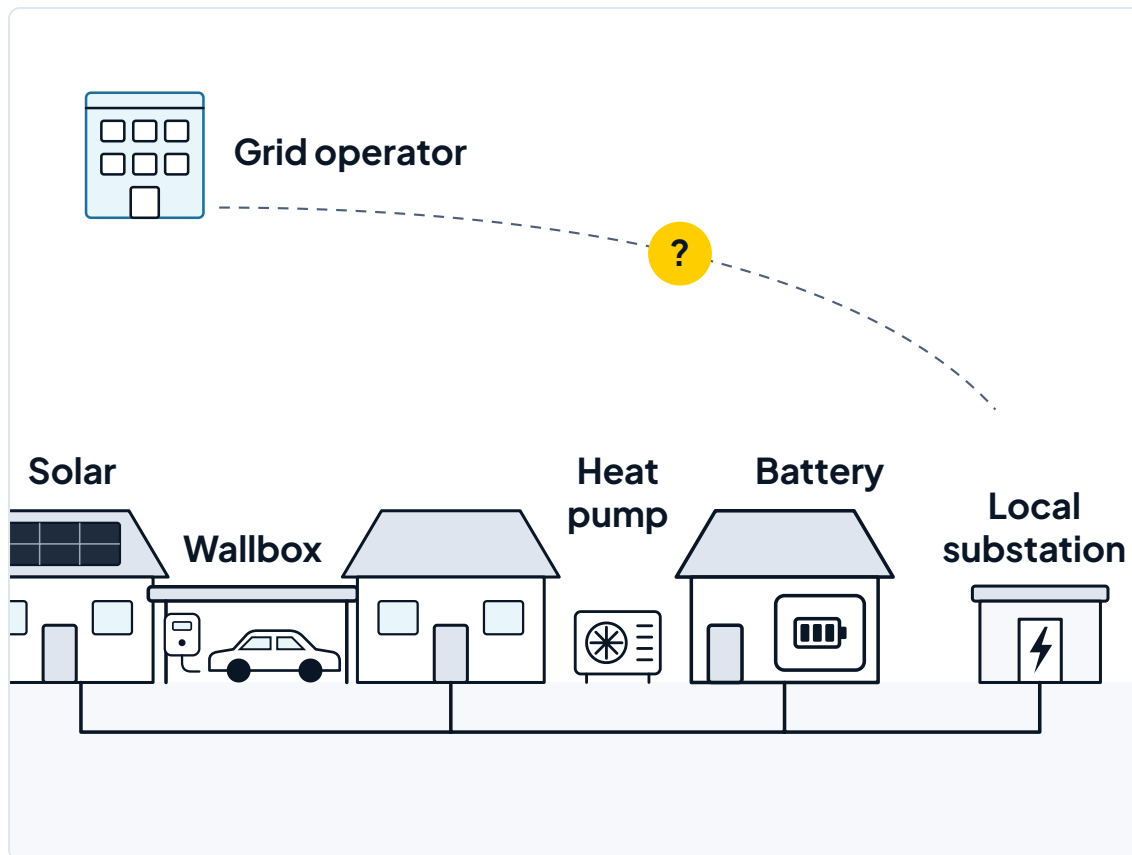
innobu GmbH

Online with current deadlines: www.innobu.com/en/digitalising-the-energy-transition-explained.html

The handbook in twelve sentences

The handbook “Digitalising the Energy Transition” has eight chapters, and nearly every figure in it carries a footnote. This page tells the same story in twelve pictures, for readers who need the big picture rather than every exception. Anything missing here is in the book. Under each picture, a link takes you to the matching chapter. Neither page is legal advice.

- 1 **Heat pumps, wallboxes and solar panels are moving into the low-voltage grid, where grid operators long saw very little.**
- 2 **Since 2023 the dates for the smart meter rollout have been written into the law. Before that, everything hinged on a BSI determination.**
- 3 **A modern digital electricity meter on its own sends nothing. Only with a smart meter gateway does it become an intelligent metering system.**
- 4 **The gateway sits between the meters, the home network and the outside world, and lets through only what's allowed.**
- 5 **No gateway goes into a meter cabinet without two BSI certificates: one for security, one for interoperability.**
- 6 **What a gateway measures, how often and for whom is set by tariff use cases. Only the gateway administrator can switch them on.**
- 7 **Once current measurements show a threat to the grid, the grid operator may turn down a heat pump or wallbox. Never below 4.2 kW.**
- 8 **The grid operator decides, the metering point operator sends the command, and the gateway just passes it on.**
- 9 **Being controllable earns owners lower grid charges. Two of the three modules don't need an intelligent metering system.**
- 10 **On a dynamic tariff the price follows the exchange, which trades quarter hours. It only meets the consumption on the bill.**
- 11 **Grid operators, suppliers and metering point operators exchange almost everything as standardised messages. Web services exist for just two purposes.**
- 12 **26.1 or 5.9 percent: both numbers describe the same rollout on the same day. They just count different things.**



PICTURE 1 OF 12

New devices on the street

Heat pumps, wallboxes and solar panels are moving into the low-voltage grid, where grid operators long saw very little.

The low-voltage grid is the network on your doorstep, from the local substation at the end of the street to each house. Heat pumps, wallboxes and home batteries now hang off it, and solar modules cover many roofs. How heavily a cable was loaded, the grid operator usually didn't know. Hardly anything was measured here. In November 2023 Germany's Federal Network Agency called the observability of the low-voltage grid lamentably inadequate¹.

Strong words from a regulator.

In depth in chapter 5: §14a EnWG

www.innobu.com/en/book-14a-grid-oriented-control.html#in-scope

PICTURE 2 OF 12

The law sets the pace

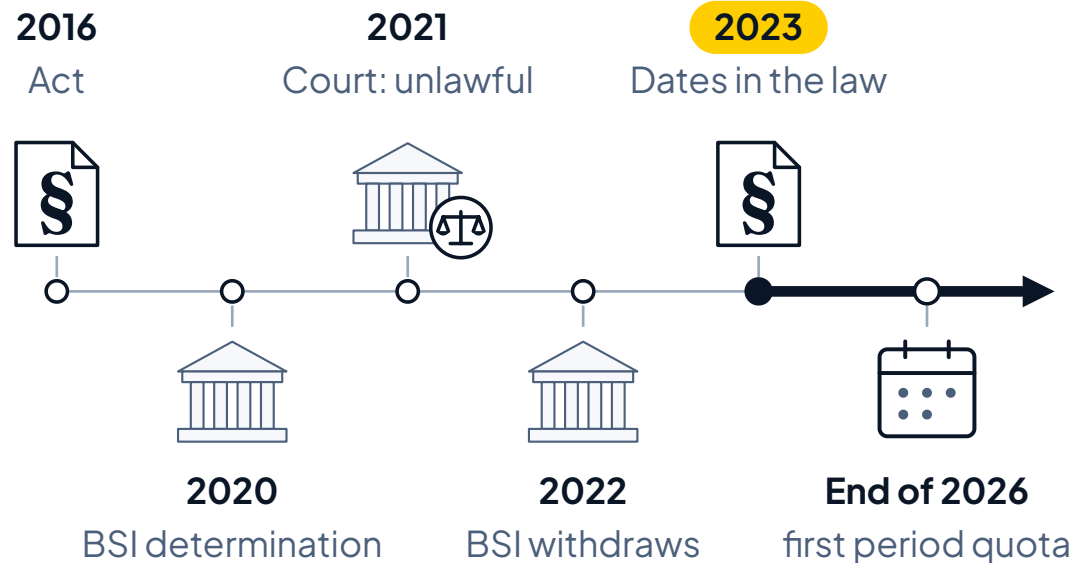
Since 2023 the dates for the smart meter rollout have been written into the law. Before that, everything hinged on a BSI determination.

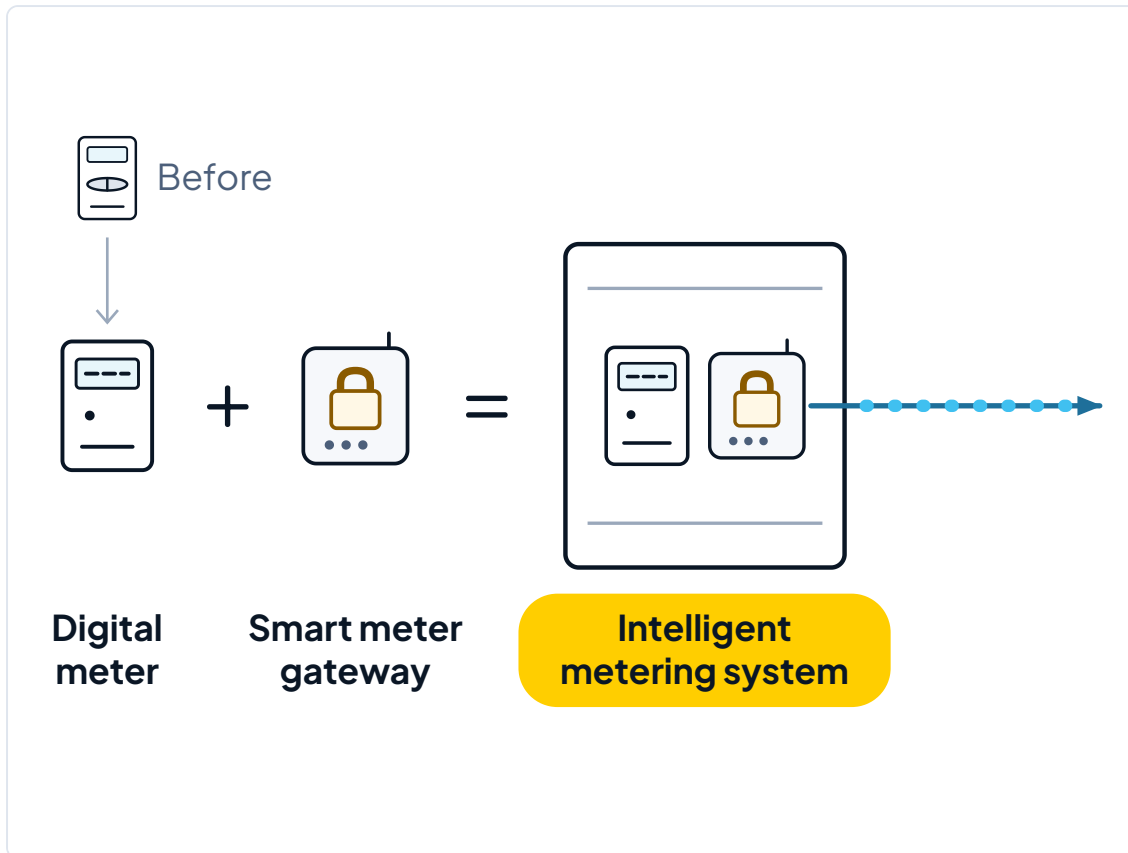
Under the 2016 act², the duty to install only began once the Federal Office for Information Security (BSI) found that three manufacturers offered suitable devices. It did so in February 2020³. A year later the Higher Administrative Court of North Rhine-Westphalia held that finding obviously unlawful in urgent proceedings⁴. That didn't halt installations: the court ruled on one company's lawsuit. In May 2022 the BSI withdrew the finding⁵.

Since 27 May 2023 the dates have been in the act itself^{6,7}. The quotas were rewoded in February 2025⁸. The next deadline is 31 December 2026, when 90 percent of the mandatory cases due since February 2025 must be equipped⁹.

In depth in chapter 1: Legal framework

www.innobu.com/en/book-legal-framework-msbg.html#dates-instead-of-a-determination





PICTURE 3 OF 12

Two devices, one metering system

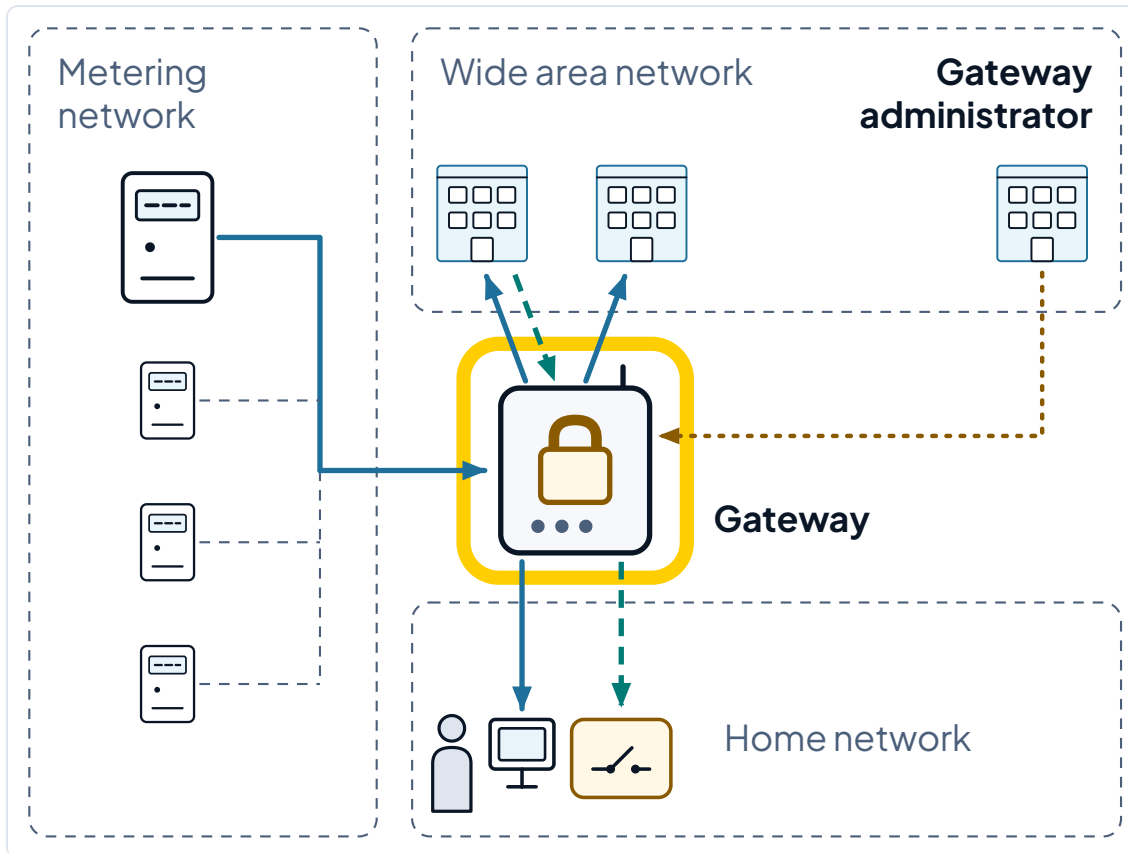
A modern digital electricity meter on its own sends nothing. Only with a smart meter gateway does it become an intelligent metering system.

The old meter with its spinning disc counted kilowatt hours. When the power flowed, it had no idea. Its successor, a modern metering device in legal terms, is digital and records the time too. It still sends nothing anywhere.

That's the gateway's job: a small computer with its own security module. Only meter and gateway together form what the Metering Point Operation Act calls an intelligent metering system¹⁰. Far from the norm: in mid-2026, 5.9 percent of metering locations had one¹¹.

In depth in chapter 2: SMGW architecture

www.innobu.com/en/book-smart-meter-gateway-architecture.html#stufen



PICTURE 4 OF 12

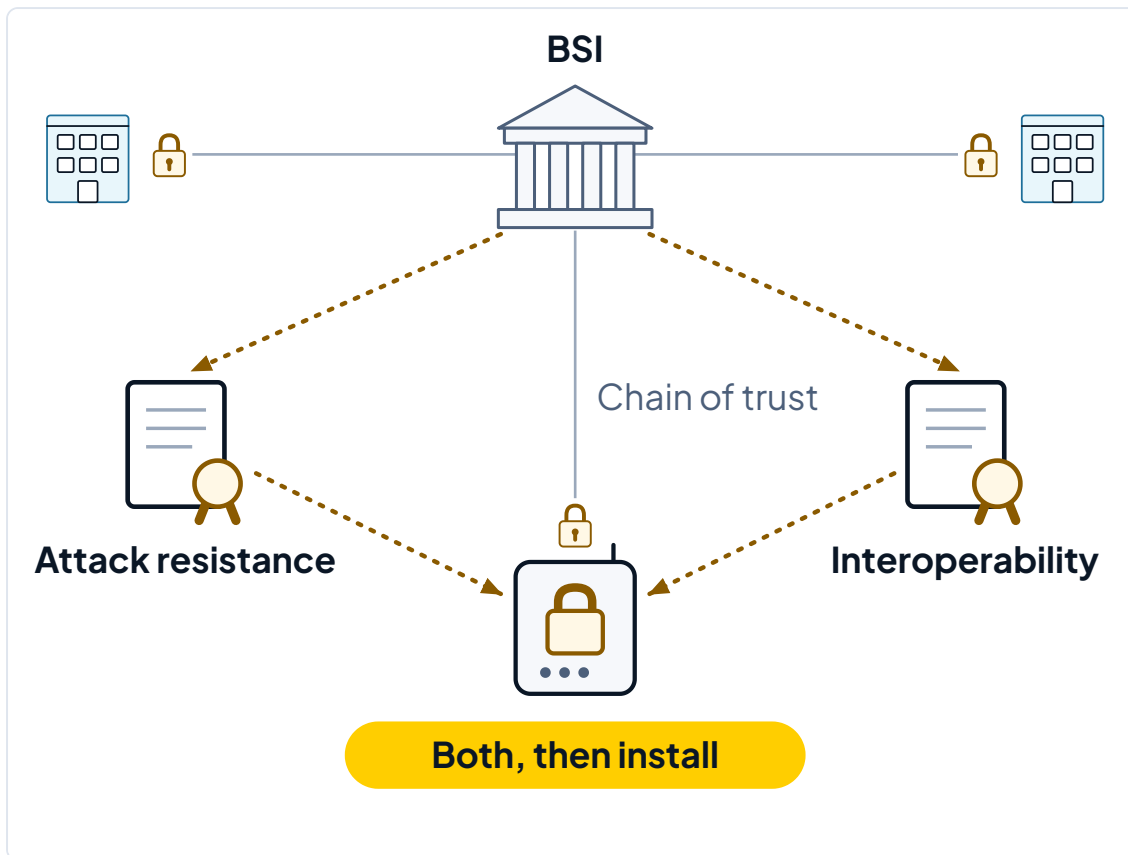
Three networks, one firewall

The gateway sits between the meters, the home network and the outside world, and lets through only what's allowed.

Think of a gatekeeper with three doors. Through the first come the meter readings: electricity and, under the BSI's guideline, gas, water and heat too. Behind the second lies the home network with the customer display, the service technician and controllable devices like the heat pump. The third leads out to the companies allowed to receive data.

Only the gateway administrator may configure it. Yet the BSI states plainly that the administrator has no insight into the readings¹². Where does the comparison limp? A gatekeeper makes their own calls; the gateway follows rules others load into it.

In depth in chapter 2: SMGW architecture
www.innobu.com/en/book-smart-meter-gateway-architecture.html#drei-netze



PICTURE 5 OF 12

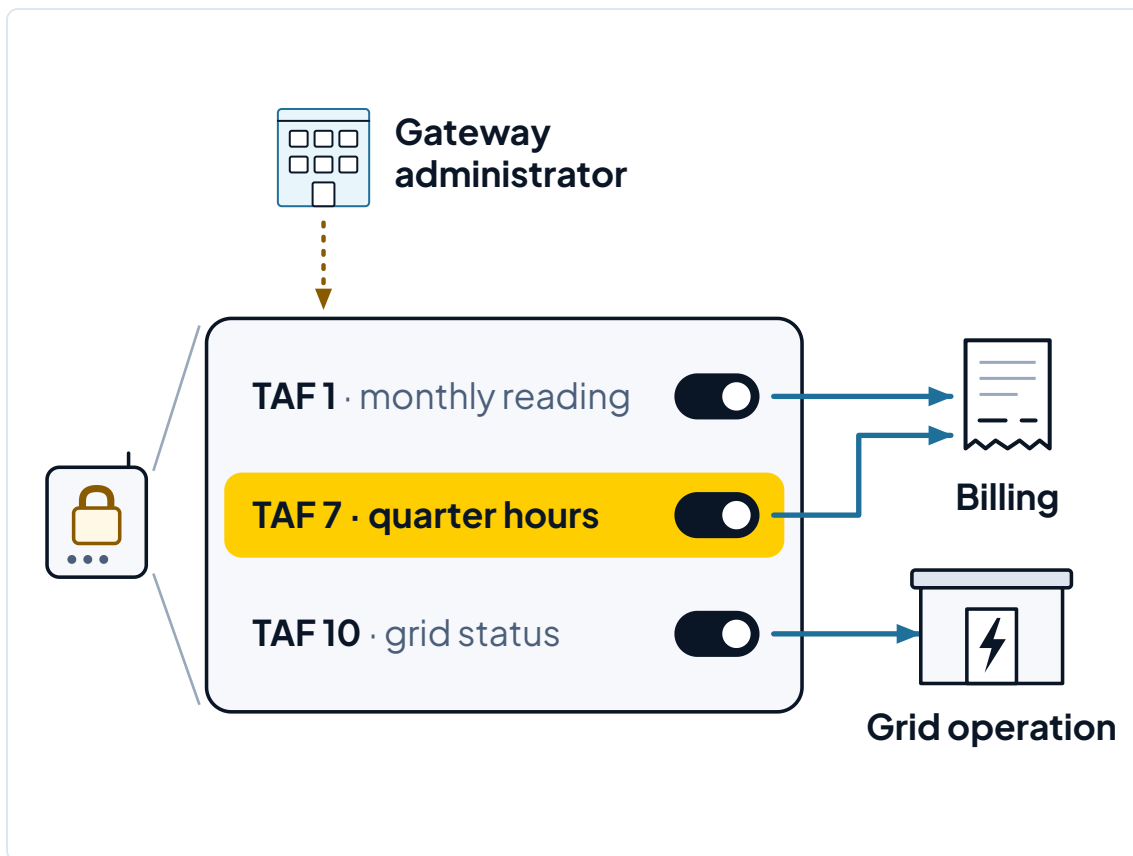
Checked twice

No gateway goes into a meter cabinet without two BSI certificates: one for security, one for interoperability.

The first certifies under an international standard, the Common Criteria, that the device withstands attacks, above all from outside. A single one of those could hit a great many devices. The second confirms that the gateway meets the BSI's technical guideline and works with the other companies' systems. The law requires both¹³. Every new function goes through this testing again before an update brings it into the field.

Then there's a chain of trust: everyone involved identifies with certificates whose root the BSI itself holds¹⁴.

In depth in chapter 3: BSI and certification
www.innibu.com/en/book-bsi-tr-03109-certification.html#doppelte-zertifizierung



PICTURE 6 OF 12

Functions to switch on

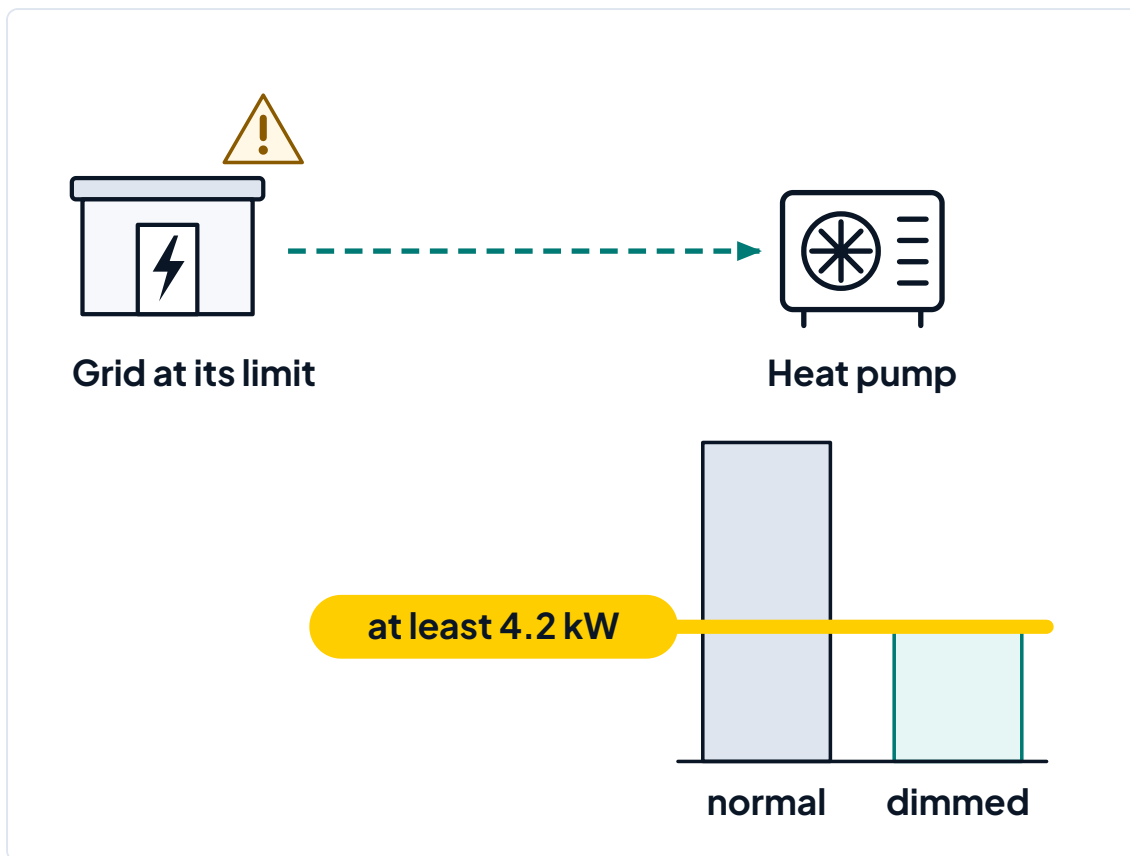
What a gateway measures, how often and for whom is set by tariff use cases. Only the gateway administrator can switch them on.

Tariff use case, or TAF after the German term, is a clunky name for a gateway function. TAF 1 sends single meter readings, monthly under the latest guideline of December 2024¹⁵. TAF 7 records the reading every quarter hour and delivers the values daily. Quarter-hour balancing, where companies settle their energy volumes, depends on it, and so, as a rule, does the dynamic tariff. It's the workhorse. TAF 10 reports voltage and current at the connection to the grid operator, by default as quarter-hour values once a day. Minute values cost extra and cover a quarter of connections at most¹⁶.

Plenty of slide decks still list TAF 1 to 14. That's the state of play before 2021¹⁷.

In depth in chapter 4: Tariff use cases

www.innobu.com/en/book-tariff-use-cases-taf.html#what-a-tariff-use-case-is



PICTURE 7 OF 12

Dimming, not switching off

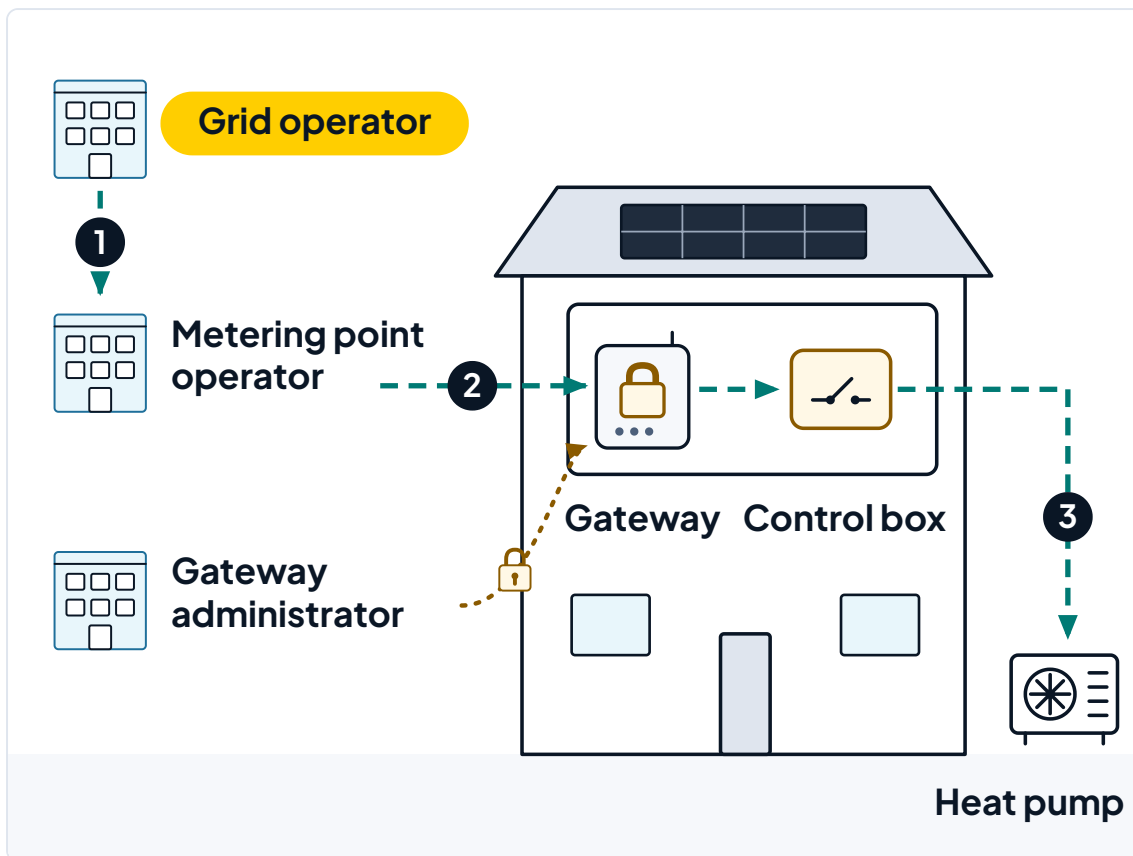
Once current measurements show a threat to the grid, the grid operator may turn down a heat pump or wallbox. Never below 4.2 kW.

Since 2024 new rules under §14a of the Energy Industry Act have applied¹. They cover almost every new heat pump, air conditioner, non-public wallbox and battery over 4.2 kW in the low-voltage grid¹⁸. Throttling comes only after a threat has been detected; experts call this curative. Nothing gets switched off: directly controlled devices keep 4.2 kW, heat pumps and air conditioners over 11 kW more. Operators who can't yet measure in real time may throttle based on planning data for now. The limits: 24 months per grid area, the end of 2028 at the latest, two hours a day¹⁸.

And the owner? The grid operator may not refuse or delay the device's connection for lack of capacity. Plus money, see picture 9.

In depth in chapter 5: §14a EnWG

www.innobu.com/en/book-14a-grid-oriented-control.html#curative



PICTURE 8 OF 12

How a control command travels

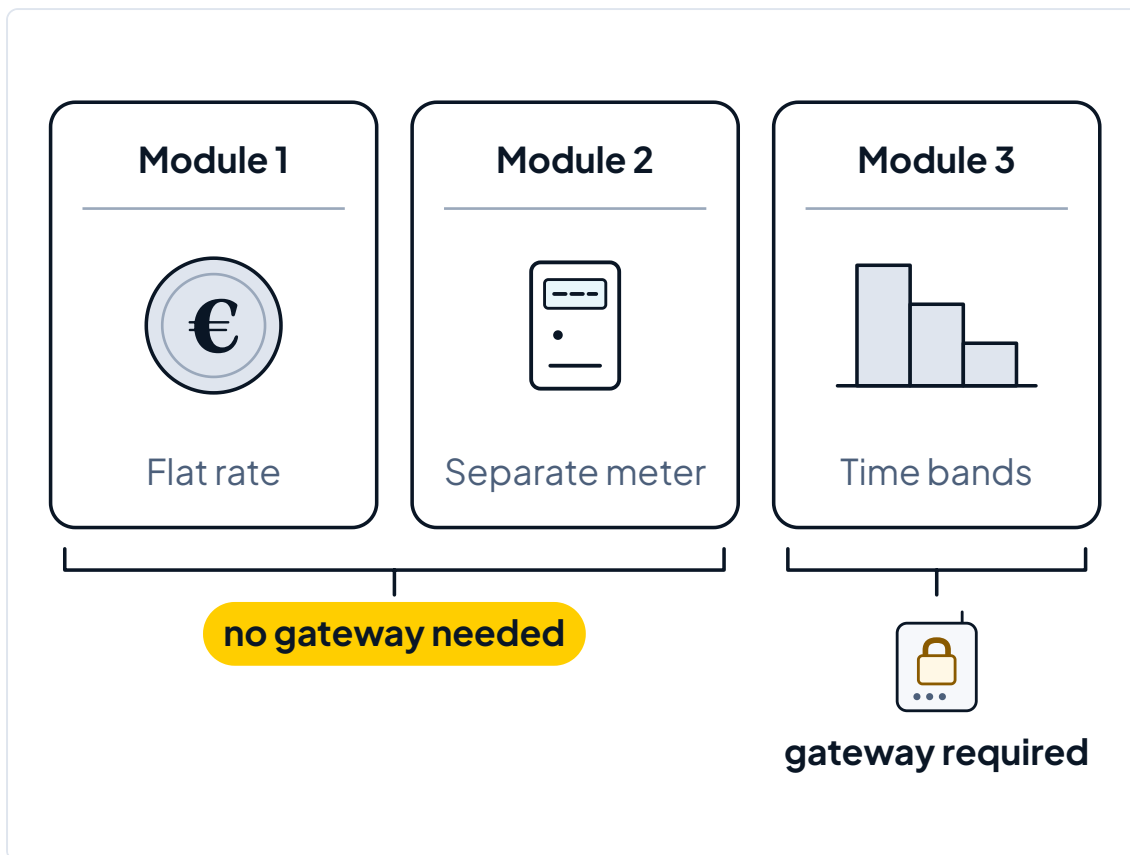
The grid operator decides, the metering point operator sends the command, and the gateway just passes it on.

Once the grid operator detects a threat, the regulator's rule gives it five minutes at most to instruct the metering point operator¹⁸. That operator sends the command through a secured channel in the gateway to the control box in the house. The box hands it to the heat pump, or to an energy management system serving several devices.

The gateway administrator sets up the channel but doesn't send commands. Often several of these roles sit in one company. And with no box at all? The BSI has described control from the gateway itself. By mid-October 2026 it listed no certificate under the new rules for this¹⁹. Even so, manufacturers say gateways with a built-in control module are already in the field²⁰.

In depth in chapter 5: §14a EnWG

www.innoby.com/en/book-14a-grid-oriented-control.html#control-chain



PICTURE 9 OF 12

What device owners get in return

Being controllable earns owners lower grid charges. Two of the three modules don't need an intelligent metering system.

Module 1 is a flat-rate cut of 80 euros gross a year. On top comes a stability bonus that depends on the local grid operator's energy rate²¹. Choose nothing and you get this one. Module 2 cuts the energy rate to 40 percent and drops the standing charge, but needs a separate meter²¹. Module 3 adds three price bands across the day, only on top of Module 1 and only with an intelligent metering system.

By mid-October 2026 the Federal Network Agency had threatened four distribution system operators with penalty payments, mainly over Module 3²².

In depth in chapter 5: §14a EnWG
www.innobu.com/en/book-14a-grid-oriented-control.html#modules

PICTURE 10 OF 12

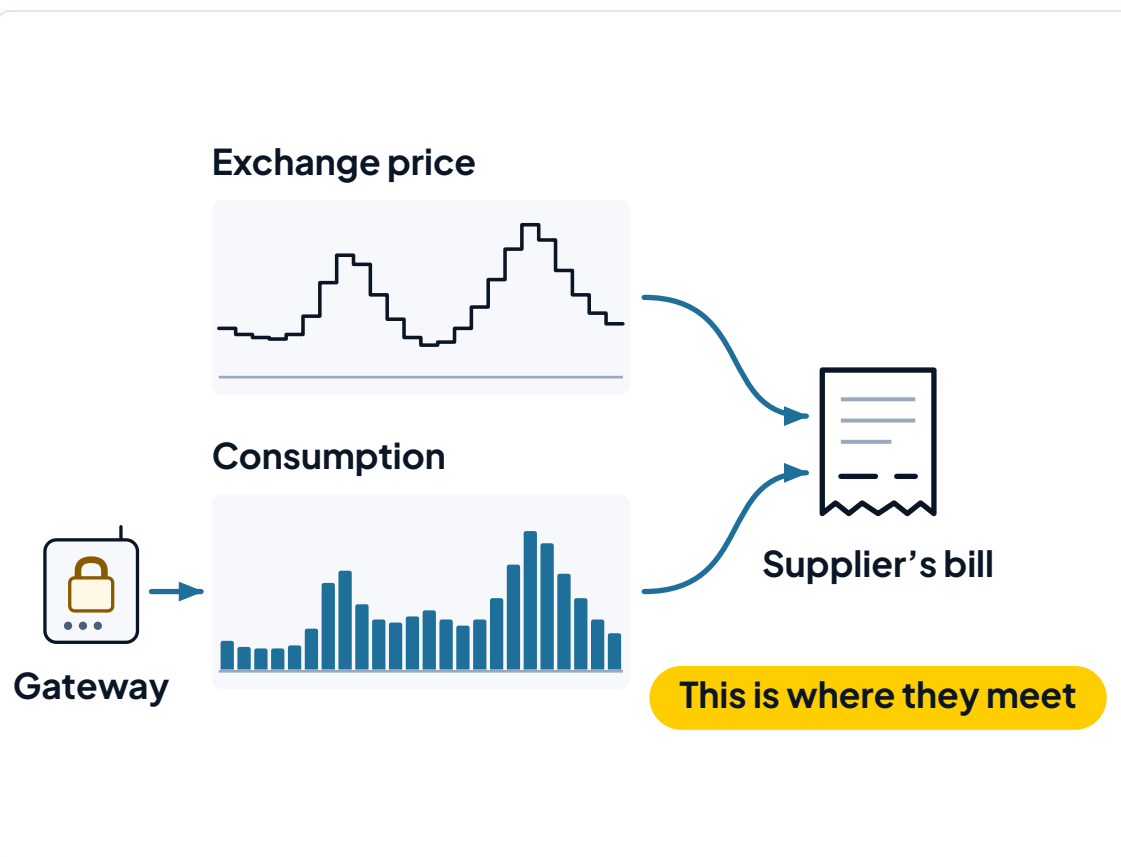
A price that follows the exchange

On a dynamic tariff the price follows the exchange, which trades quarter hours. It only meets the consumption on the bill.

Since January 2025 every German electricity supplier has had to offer a dynamic tariff, though only to customers with an intelligent metering system²³. The price follows the exchange, whose day-ahead auction has traded quarter hours since October 2025²⁴. That's normally 96 prices a day. Whether a tariff that still passes on hourly prices meets the law, no authority has explicitly said.

The bill needs as many consumption values. The gateway usually records them via TAF 7, the metering point operator forwards them daily, and both series meet only in the supplier's billing. That's 35,040 values per supply point a year, where one annual reading used to do. A leap for any billing system that thinks in years.

In depth in chapter 6: Tariffs and grid charges
www.innobu.com/en/book-dynamic-tariffs-grid-charges.html#messung



PICTURE 11 OF 12

How companies talk to each other

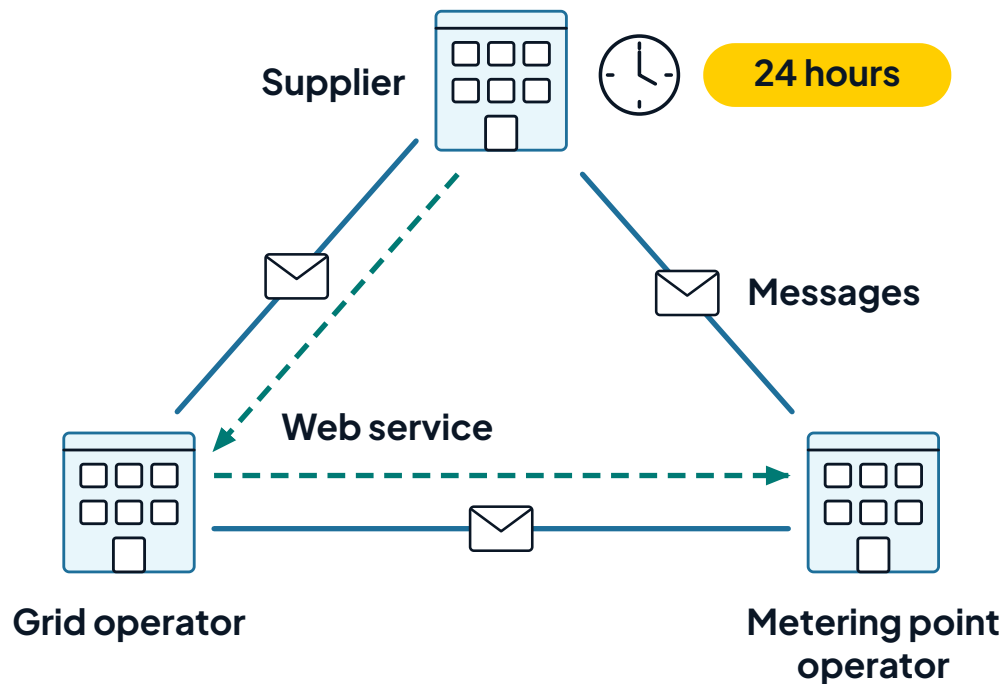
Grid operators, suppliers and metering point operators exchange almost everything as standardised messages. Web services exist for just two purposes.

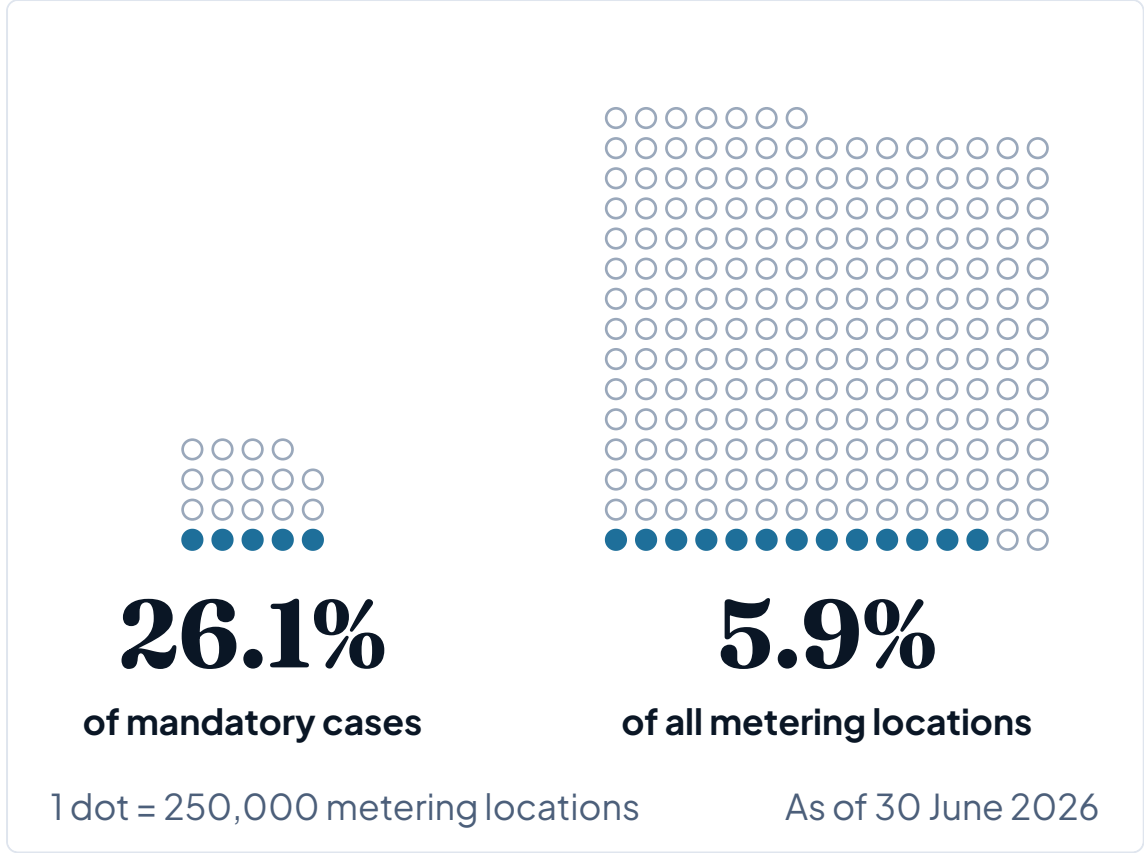
A customer switches supplier. For them it's a form. For the companies it's a chain of standardised EDIFACT messages over a secured transport channel called AS4. Since January 2026 the switch has had to work technically within 24 hours²⁵.

Web services query one system directly from another. They exist for two tasks only. With one, a supplier looks up the ID of a market location, the point it supplies. With the other, grid operators and suppliers place control commands with the metering point operator. In July 2026 a consultation proposed expanding them²⁶. On 1 October the Federal Network Agency dropped the idea: the UTILS message stays, and web services stay at two uses for now²⁷. The real bottleneck is elsewhere anyway: master data that's wrong.

In depth in chapter 7: Market communication

www.innobu.com/en/book-market-communication-mako.html#mako-2026-messages-transport-web-services





PICTURE 12 OF 12

Two numbers, two denominators

26.1 or 5.9 percent: both numbers describe the same rollout on the same day. They just count different things.

On 30 June 2026, 26.1 percent of mandatory cases had an intelligent metering system¹¹. This quota counts customers using 6,000 to 100,000 kWh a year plus controllable devices under §14a, about 4.8 million. Across all 54.1 million reported metering locations it was 5.9 percent that day. The real figure is probably higher, the agency says, because competitive metering operators report voluntarily. By how much, it doesn't say.

Quote only one and you paint a skewed picture. The first quota, 20 percent of mandatory cases by the end of 2025, applied to each company separately. Since March 2026 the Federal Network Agency has opened supervisory proceedings against 434 companies for missing it; 150 have since been closed²⁸.

In depth in chapter 8: Rollout practice
www.innobu.com/en/book-smart-meter-rollout-practice.html#pflicht-gesamt

The whole journey

Twelve pictures take apart what belongs together in the grid. The [interactive model](#) follows a quarter-hour reading from the basement to the bill, step by step. A control command travels almost the same route back, over a different channel. Click a node to see what happens there, which chapter covers it and which deadline comes next.

What nobody knows yet

Some things can't be simplified because nobody collects them. Do the installed gateways actually deliver quarter-hour values, do they operate a control box? Nobody publishes a figure. For dynamic tariffs the Federal Network Agency counts providers, 412 in 2024²⁹, but publishes no customer count. And the time from installation to the first quarter-hour bill? Nobody measures it so far.

The book collects such gaps under [Open questions and negative findings](#), along with the points where sources contradict each other.

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