RFNBO-Compliant PPAs in Germany

Availability and Competing Demand

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Executive summary

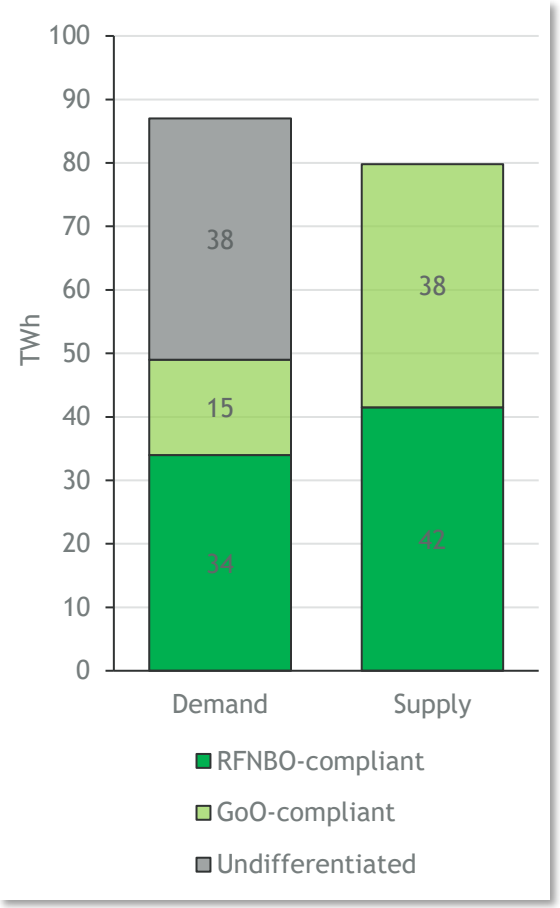
A differentiated regulatory framework drives competition for RFNBO-compliant PPAs in Germany. Consumer-specific regulations are increasingly constraining electricity procurement to RFNBO- and Guarantees of Origin (GoO)-compliant options. While RFNBO criteria for hydrogen production are stringent, renewable energy requirements for data centers and industry can be met through less strict GoO frameworks.

Electricity demand for electrolysis, data centers, and large-scale heat pumps is projected to increase significantly by 2030. The growth in new sources of electricity demand drives up the demand for specialized PPAs. For instance, a ramp-up of electrolysis in Germany could create a demand for RFNBO-specific PPA projects of up to 34 TWh.

New-build plants largely determine the PPA supply. The PPA market potential could increase by approximately 80 TWh across all segments by 2030, whereby RFNBO-compliant PPAs make 42 TWh. New-build offshore wind and large-scale PV drive this PPA potential.

In the medium term, the supply of RFNBO-compliant PPAs appears sufficient to meet specific RFNBO demand. However, the market may tighten if competing sectors, such as industry or data centers, increasingly seek RFNBO-quality electricity for their decarbonization targets or just due to a higher electrification speed. Shortages can also occur on the supply side, if fewer new plants are constructed than anticipated.

EU Electricity Market Design reform, 2-way CfDs, the industrial electricity price, Solar Package and Co-Location can generally support PPA attractiveness for certain technologies. Existing state subsidy systems can create high opportunity costs for operators, potentially limiting the available PPA supply.



In Germany, competing demand for scarce RFNBO-compliant PPAs may emerge in the medium term

On the road to climate neutrality by 2045, electrification and decarbonization are reshaping electricity demand and procurement in Germany.

- **Rising electricity demand**. While electricity consumption in Germany has declined recently, in the medium-term demand growth is expected, mainly driven by electrification in consumption sectors.
- **Large new electricity consumers**. Electrolyzers, data centers, large heat pumps, and industry are likely to account for a significant share of future electricity demand. PPAs may offer a viable option for long-term procurement.
- **Strict procurement requirements for hydrogen.** The EU's delegated act on RFNBO establishes stringent criteria for green electricity in hydrogen production, limiting eligible supply options and increasing the relevance of RFNBO-compliant PPAs.
- **Different electricity qualities across sectors**. Beyond RFNBO regulation, data centers and industry are required or incentivized to procure green electricity under less strict rules, such as Guarantees of Origin (GoO), for which PPAs may also serve as a compliance or signaling instrument.
- **Uncertain PPA supply in Germany**. Existing renewable support schemes create high and secure opportunity costs for generators, potentially limiting incentives to supply electricity through PPAs.

Against this background, how will demand for and supply of RFNBO-compliant PPAs in Germany evolve in the medium term?

RFNBO-compliant[1]

- The renewable power plant must be in the same bidding zone (spatial correlation)
- The renewable power plant must be installed within 36 months before the electrolyzer (Additionality)
- Renewable power generation and electrolyzer production must be balanced within a month (Temporal correlation)

GoO-compliant

- The consumer must prove that the consumed electricity is renewable.
- Guarantees of origin, which have a validity of a year, are sufficient.

Undifferentiated

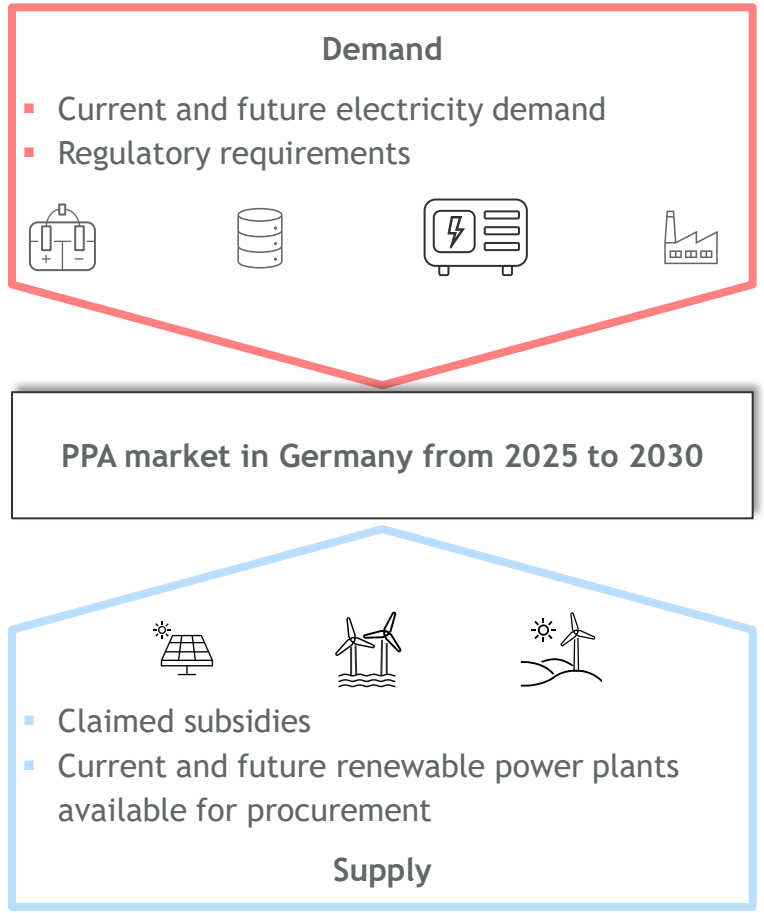
- There is no specific requirement on the procured electricity.

1: There are more nuances in the RFNBO criteria. More information in EWI (2025a).

This project examines competing uses and the supply of RFNBO-compliant PPAs in Germany

The central objective of this project is to identify and assess competing uses of Power purchase agreements (PPAs) among the four main actors: electrolyzers, data centers, large heat pumps, and industry.

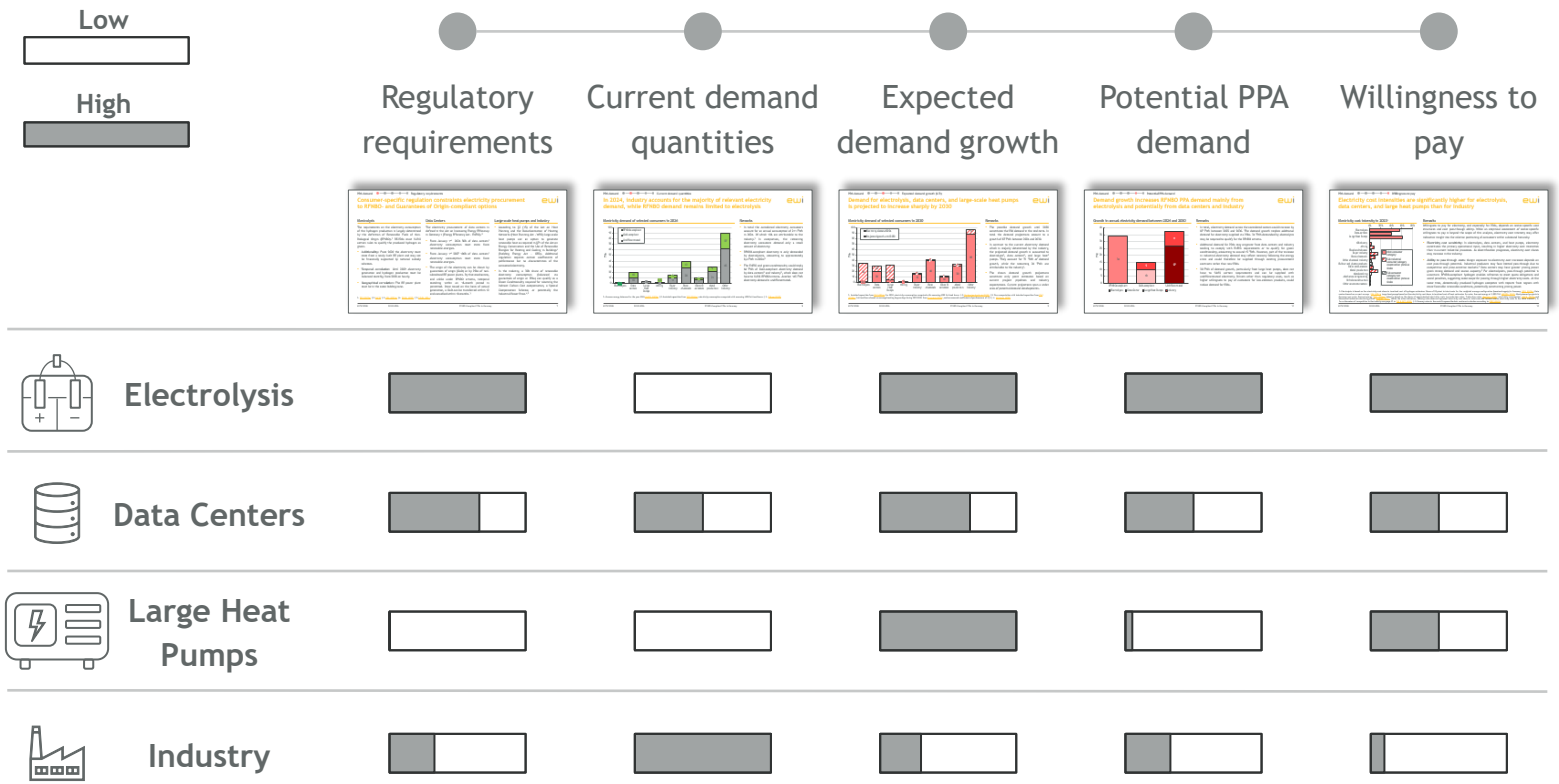
- **Demand side**. To indicate potential demand for green electricity, current and medium-term demand quantities of the four main consumers electrolyzers, data centers, large heat pumps, and industry are evaluated. Using electricity cost intensities and regulatory requirements, the incentives to procure PPAs are described.
- **Supply side**. On the supply side, the renewable technologies wind onshore, wind offshore, and PV are evaluated. Given the current regulatory framework, the analysis distinguishes between newly built, post-subsidized, and operating power plants to indicate potential PPA supply quantities.
- **Green qualities**. The analysis considers regulatory requirements for three types of “green” electricity: RFNBO-compliant, GoO-compliant and undifferentiated. While RFNBO requirements may drive strong PPA demand, GoO obligations are less strict and may be met via alternative procurement options. Undifferentiated electricity demand could also be satisfied without green qualifications.
- **Scope**. The study examines potential PPA demand and supply quantities for the current situation and up to 2030 in Germany. Taking the incentives to procure different qualities of PPAs into consideration, the study formulates synthesis between demand and supply. As actual PPA market data are scarce, the analysis can only provide indicative insights into potential developments on the PPA market.



PPA demand

Electricity consumers under differing regulatory schemes constitute the demand for PPAs in Germany

Overview of demand assessment and key findings



Remarks

Different end-uses may compete for PPAs. We compare regulatory incentives to procure green electricity and evaluate current and potential medium-term electricity and PPA demand.

- **Electrolysis:** RFNBO requirements drive PPA demand, with low current levels but strong growth ahead.
- **Data centers:** Data centers show steady demand growth under comparatively less stringent green electricity requirements.
- **Large Heat Pumps:** High demand growth is expected, while regulatory requirements on procured electricity remain low.
- **Industry:** There are less stringent green electricity requirements. Projected electricity and hence PPA demand is lower.

Consumer-specific regulation constraints electricity procurement to RFNBO- and Guarantees of Origin-compliant options

Electrolysis

The requirements on the electricity consumption of the hydrogen production is largely determined by the definition of Renewable Fuels of Non-Biological Origin (RFNBO).[1] RE-PPAs must fulfill certain rules to qualify the produced hydrogen as *green*.

- **Additionality**: From 2028 the electricity must stem from a newly built RE plant and may not be financially supported by national subsidy schemes.
- **Temporal correlation**: Until 2029 electricity generation and hydrogen production must be balanced monthly, from 2030 on hourly.
- **Geographical correlation**: The RE power plant must be in the same bidding zone.

Data Centers

The electricity procurement of data centers is defined in the Act on Increasing Energy Efficiency in Germany 1 (Energy Efficiency Act - EnEfG).[3]

- From January 1st 2024 50% of data centers' electricity consumption must stem from renewable energies.
- From January 1st 2027 100% of data centers' electricity consumption must stem from renewable energies.
- The origin of the electricity can be shown by guarantees of origin (GoO) or by PPAs of non-subsidized RE power plants. By that mechanism, and unlike under RFNBO criteria, temporal matching within an 18-month period is permitted. Once issued on the basis of actual generation, a GoO can be transferred within 12 and cancelled within 18 months.[3]

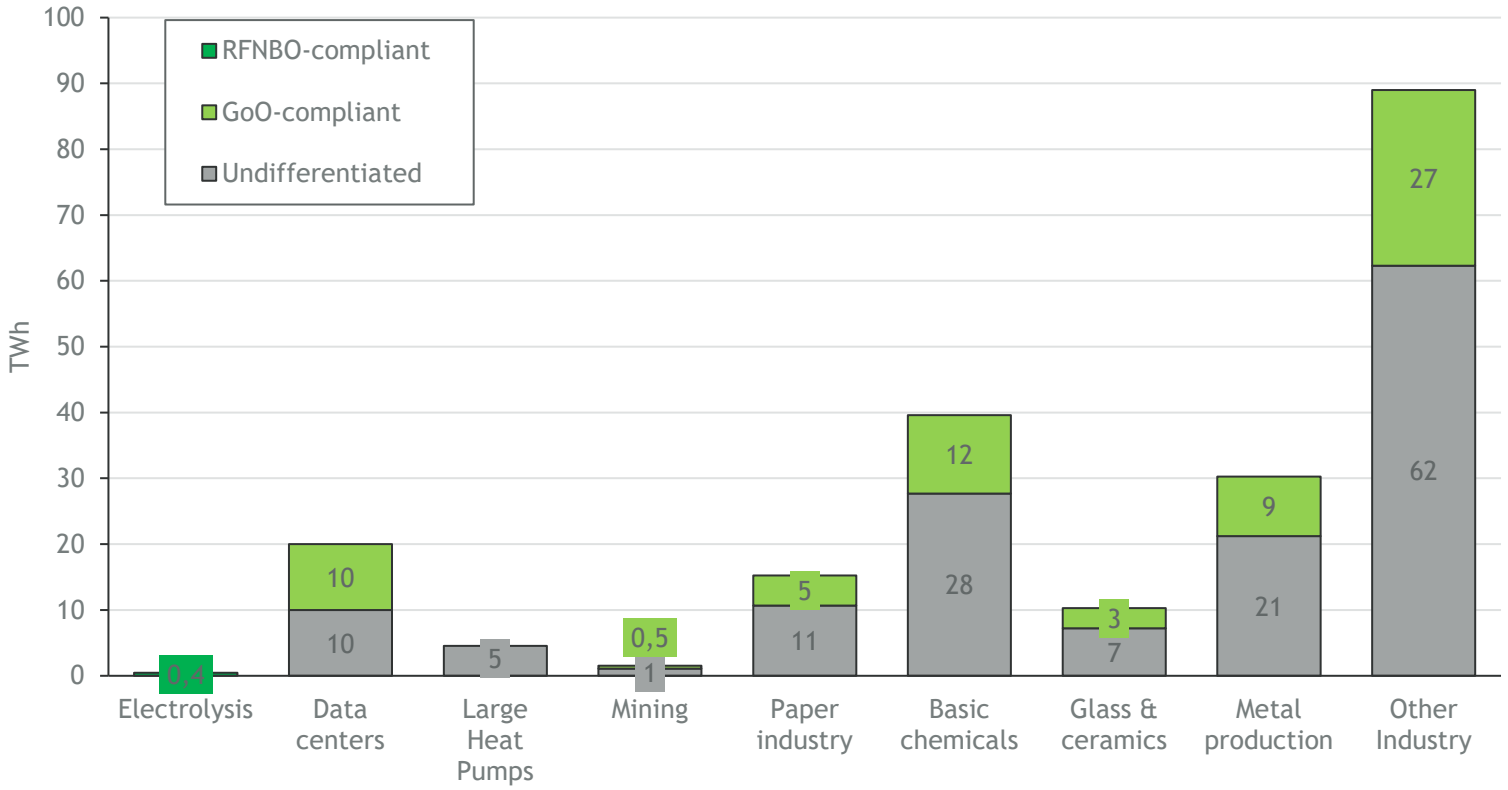
Large scale heat pumps and Industry

- According to §3 (15) of the Act on Heat Planning and the Decarbonization of Heating Networks (Heat Planning Act – WPG) large-scale heat pumps are an option to generate renewable heat as required in §71 of the Act on Energy Conservation and the Use of Renewable Energies for Heating and Cooling in Buildings* (Building Energy Act - GEG). Additional regulation requires certain coefficients of performance but no characteristics of the consumed electricity.
- In the industry, a 30% share of renewable electricity consumption (balanced via guarantees of origin or PPAs) can qualify as a Green Conditionality required for receiving the Indirect Carbon Cost compensation, a Special Compensation Scheme, or potentially the Industrial Power Price.[4,5]

1: EWI (2025a) | 2: EnEfG | 3: UBA (2025a) | 4: DEHSt (2025) | 5: DEHSt (2024)

In 2024, industry accounts for the majority of relevant electricity demand, while RFNBO demand remains limited to electrolysis

Electricity demand of selected consumers in 2024



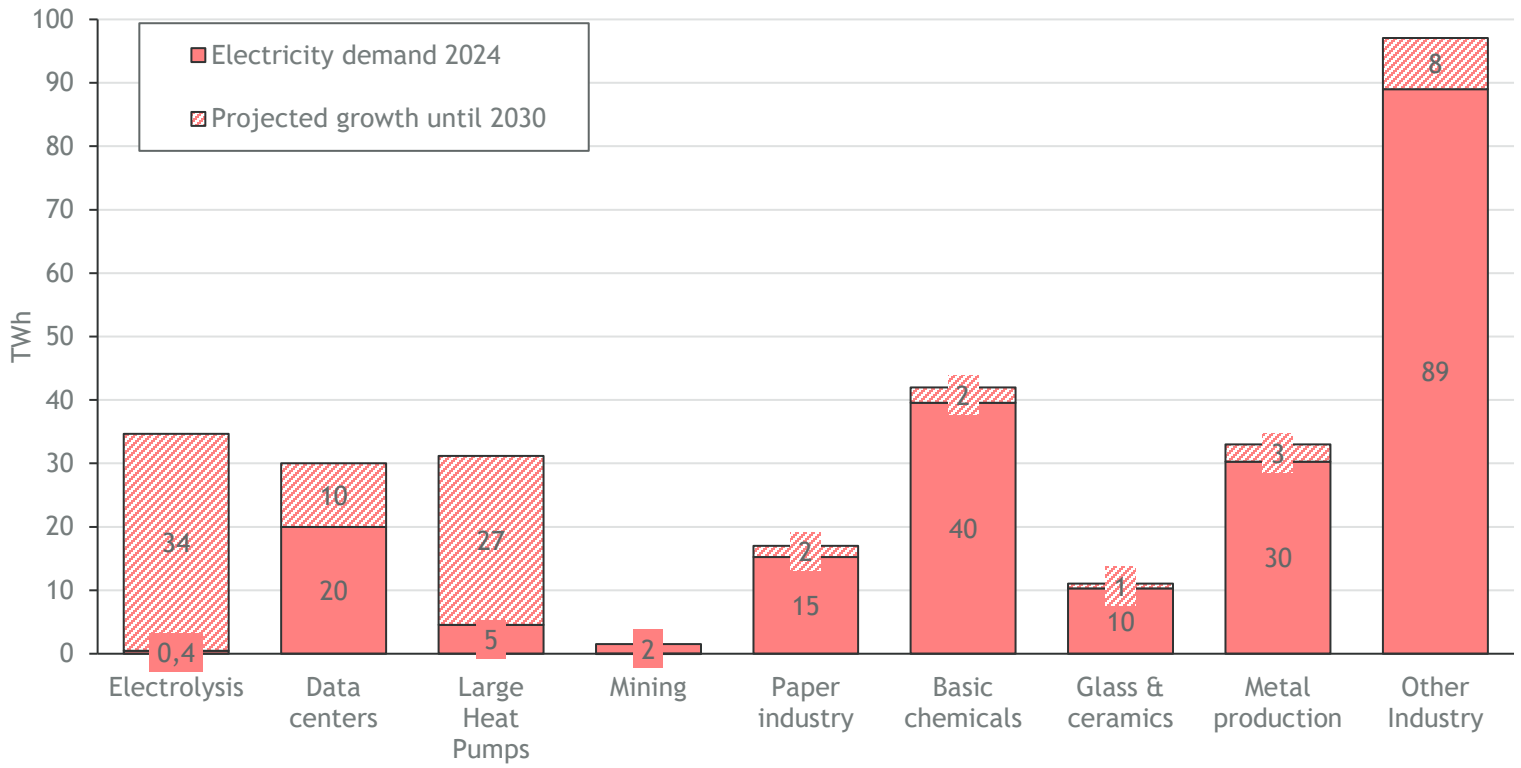
Remarks

- In total the considered electricity consumers account for an annual consumption of 211 TWh in 2024. Of which 186 are attributable to the industry.[1] In comparison, the remaining electricity consumers demand only a small amount of electricity.
- RFNBO-compliant electricity is only demanded by electrolyzers, amounting to approximately 0,4 TWh in 2024.[2]
- The EnEfG and green conditionality could imply 66 TWh of GoO-compliant electricity demand by data centers[3] and industry[1], which does not have to fulfill RFNBO criteria. Another 145 TWh electricity demand is undifferentiated.

1: German energy balances for the year 2024 (AGEB, 2025a) | 2: Installed capacities from EWI (2026a), electricity consumption computed with assuming 4000 full load hours. | 3: Bitkom (2025)

Demand for electrolysis, data centers, and large-scale heat pumps is projected to increase sharply by 2030

Electricity demand of selected consumers in 2030



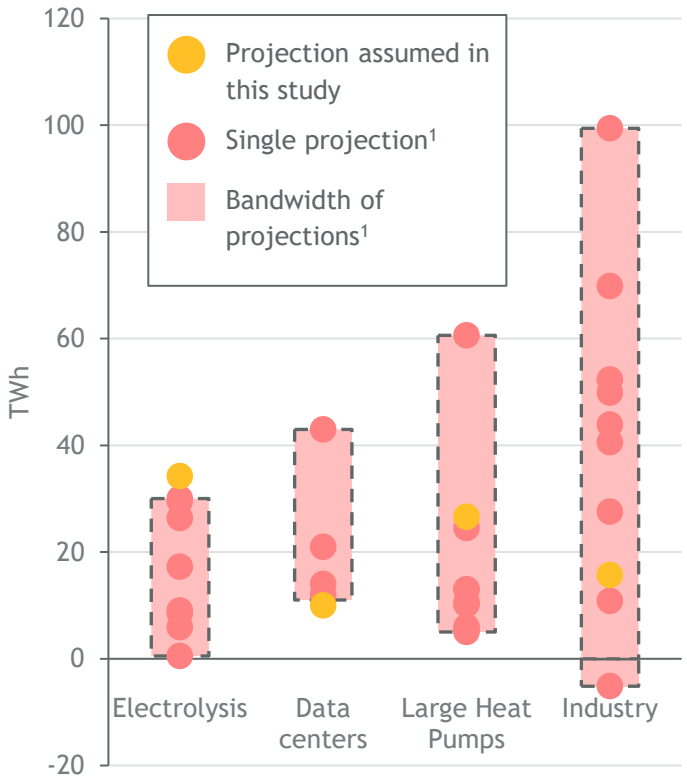
Remarks

- The possible demand growth until 2030 constitutes the PPA demand in the mid-term. In total the demand projections amount to a growth of 87 TWh between 2024 and 2030.
- In contrast to the current electricity demand which is majorly determined by the industry, the projected demand growth is accounted to electrolysis[1], data centers[2], and large heat[3] pumps. They account for 71 TWh of demand growth, while the remaining 26 TWh are attributable to the industry[4].
- The shown demand growth projections constitute only point estimates based on current project pipelines and industry expectations. Current projections span a wider area of potential demand developments.

1: Installed capacities from EWI (2026a) for 2030, electricity consumption computed with assuming 4000 full load hours. | 2: Borderstep Institute (2023) | 3: Own computation with installed capacities from EWI (2026b), full load hours based on average heating degree days during 2015-2024 from Eurostats (2026), and an assumed coefficient of performance of 2,5. | 4: McKinsey (2025)

Even in the medium term, demand outlooks vary broadly across sectors

Electricity demand growth 2024-2030



1: EWI & BET (2025) | 2: McKinsey (2025)

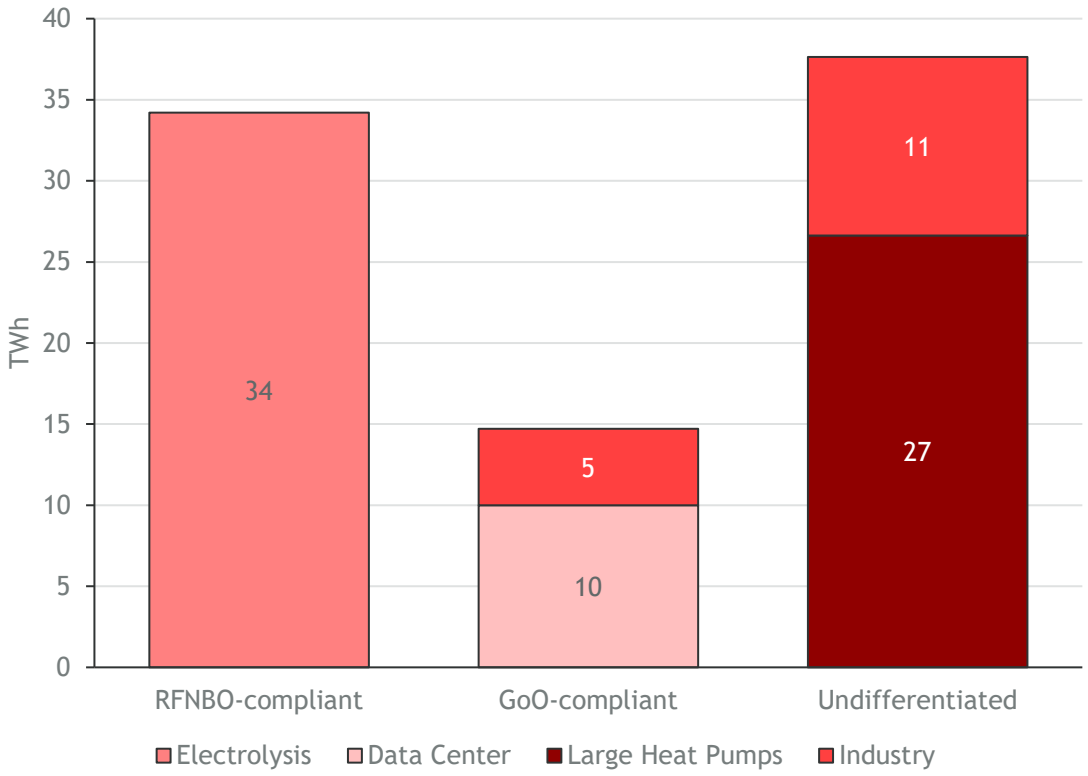
Remarks

The literature suggests considerable uncertainty in medium-term demand trajectories.[1] The growth rates applied here constitute a point estimate for comparison with the supply side.

- The figure shows implicit growth of annual demand from 2024 to 2030 derived from the explorative scenarios in EWI & BET (2025). Unlike normative scenarios, which assume compliance with climate targets, explorative scenarios reflect current trends and conditions without necessarily achieving these targets. Given the use of current project pipelines for electrolysis and large heat pumps, relying on medium-term trends is more consistent than using long-term target-oriented scenarios. For all considered sectors, the literature projects on average rising electricity demand through 2030. Potential demand trajectories vary strongly, reflecting current regulatory and economic uncertainty.
- The electrolyzer demand projected in this study is higher than in the explorative scenarios of EWI & BET (2025), possibly because it incorporates announced projects accounting for uncertain demand growth of 28,7 TWh.
- The projections in the industry sector spread from a decline up to a demand growth of nearly 100 TWh. The differences can be attributed to various assumptions regarding the structure of the industry, the depth of value added, and economic developments.[1] Demand developments can vary across different industrial branches. The assumed industry demand in this study lies to the lower end of the projected demand[2] because McKinsey (2025) represents a conservative trend projection and part of the electrolysis demand is attributed to the industry.

Demand growth increases RFNBO PPA demand mainly from electrolysis and potentially from data centers and industry

Growth in annual electricity demand between 2024 and 2030

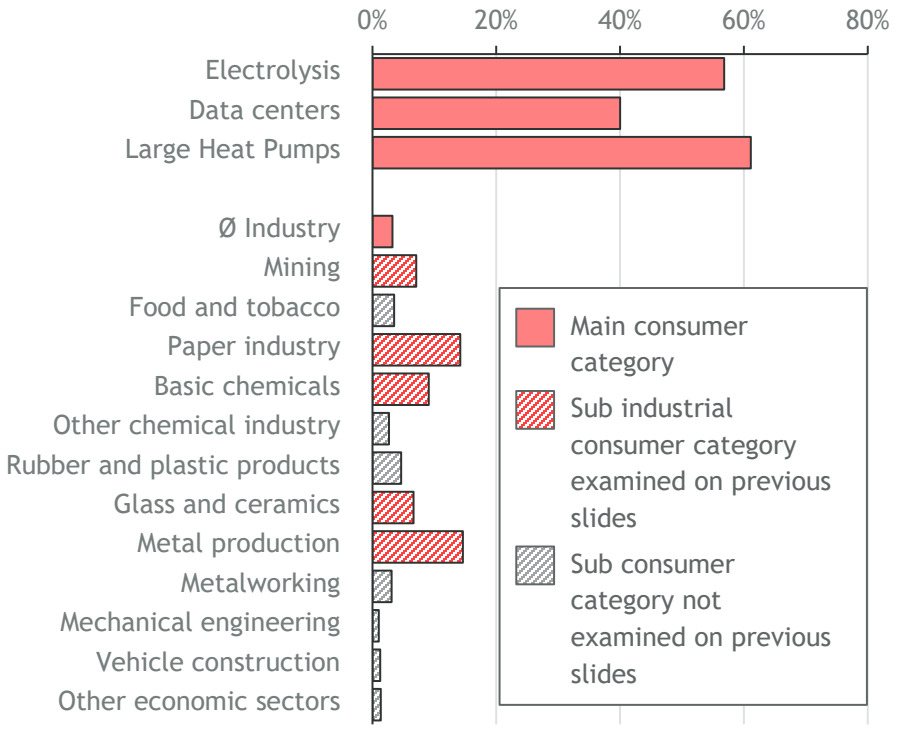


Remarks

- In total, electricity demand across the considered sectors could increase by 87 TWh between 2025 and 2030. The demand growth implies additional demand for electricity supplied via PPAs. 34 TWh demanded by electrolysis may be required to qualify for the RFNBO criteria.
- Additional demand for PPAs may originate from data centers and industry seeking to comply with EnEfG requirements or to qualify for green conditionality, amounting to around 15 TWh. However, part of the increase in industrial electricity demand may reflect recovery following the energy crisis and could therefore be supplied through existing procurement contracts rather than new PPAs.
- 38 TWh of demand growth, particularly from large heat pumps, does not have to fulfill certain requirements and can be supplied with undifferentiated electricity. Drivers other than regulatory ones, such as higher willingness to pay of customers for low-emission products, could induce demand for PPAs.

Electricity cost intensities are significantly higher for electrolysis, data centers, and large heat pumps than for industry

Electricity cost intensity in 2023[1]



Remarks

Willingness to pay for electricity, and especially for PPAs, depends on sector-specific cost structures and cost pass-through ability. While an empirical assessment of sector-specific willingness to pay is beyond the scope of this analysis, electricity cost intensity may offer indicative insight into the relative positioning of consumers within a demand hierarchy.

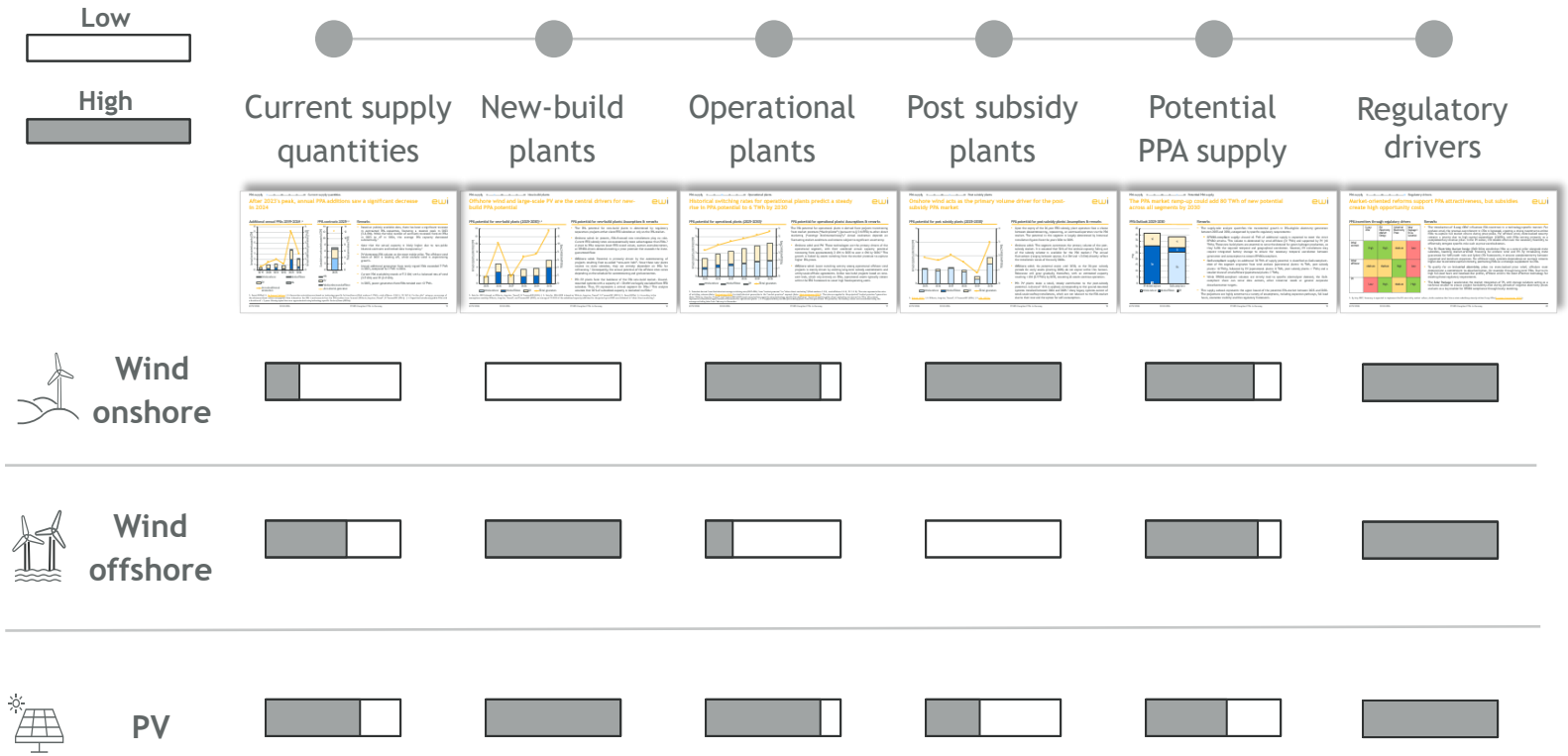
- **Electricity cost sensitivity:** In electrolysis, data centers, and heat pumps, electricity constitutes the primary operational input, resulting in higher electricity cost intensities than in current industrial processes. As electrification progresses, electricity cost shares may increase in the industry.
- **Ability to pass through costs**: Margin exposure to electricity cost increases depends on cost pass-through potential. Industrial producers may face limited pass-through due to competitive and price-sensitive markets.[2] Data centers may have greater pricing power given strong demand and scarce capacity.[3] For electrolyzers, pass-through potential is uncertain: RFNBO-compliant hydrogen enables refineries to meet quota obligations and avoid penalties, suggesting some scope for passing through higher electricity costs. At the same time, domestically produced hydrogen competes with imports from regions with more favorable renewable conditions, potentially constraining pricing power.

1: Electrolysis is based on the electricity cost share in levelized cost of hydrogen estimates. Share of RE plant in total costs for the weighted average configuration (baseload supply) in Germany (EWI, 2025b); Data centers based on current surveys KKA (2024); Large heat pumps based on the electricity cost share in levelized cost of heat estimates for water thermal energy at 2.800 FLH (AGORA, 2023). Most planned projects in Germany use water thermal energy (EWI, 2026b); Industry based on the share of approximated electricity costs in production value. Production value (Destatis, 2026), electricity consumption (AGEB, 2025b) and discounted industrial electricity prices (BNetzA, 2024). Unlike the other indicators, industry ratio does not represent electricity cost share in total costs but instead relates electricity costs to the value created. | 2: For a discussion of competition in the industry see page 37 in EWI & BET (2025) | 3: Vacancy rates in the main European Markets continue to decline according to CBRE (2025).

PPA supply

Offshore wind and PV drive new-build growth, while onshore wind dominates post-subsidy potential

Overview of supply assessment and key findings



Remarks

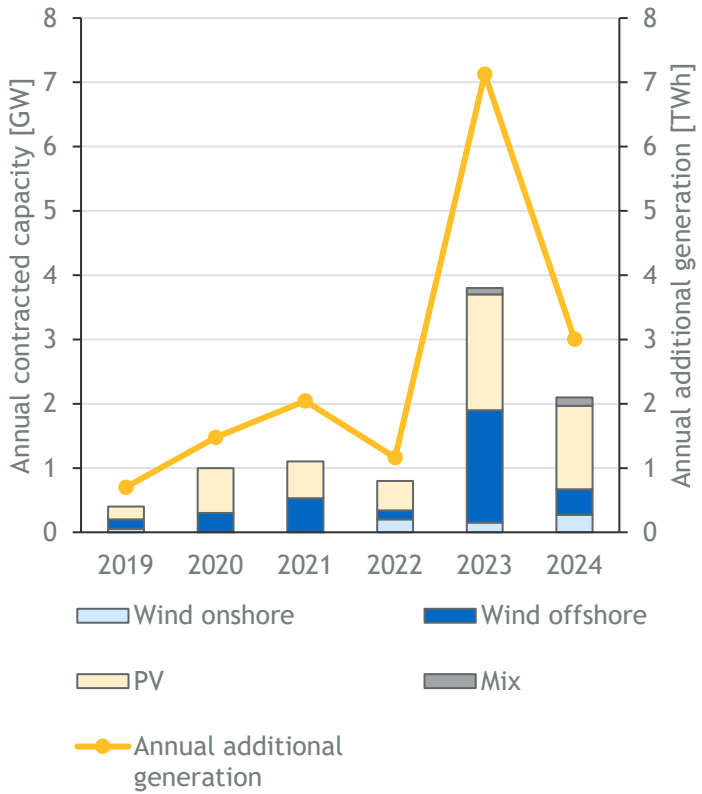
Onshore wind: Relevance is almost exclusively limited to operational and post-subsidy assets, as fixed feed-in tariffs are currently more attractive than PPA terms, effectively blocking the new-build market. Thus, this segment is not RFNBO-compliant.

Offshore wind: New-build plants rely on PPAs due to “zero-cent bids”, while operational plants remain mostly tied to existing EEG subsidies. Offshore wind provides the largest RFNBO-compliant volume.

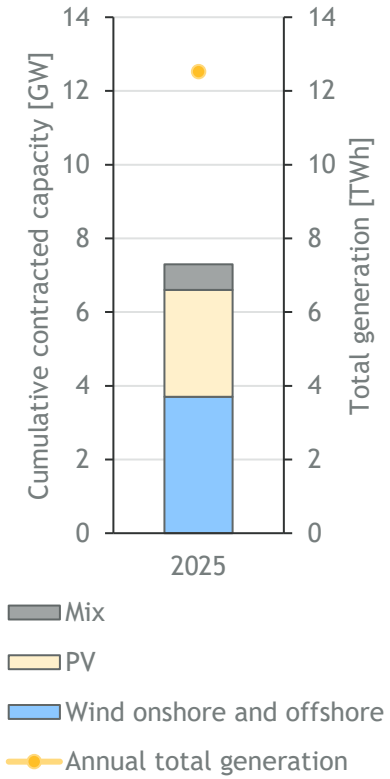
PV: PV plays a key role across all segments, especially in new-builds, as large-scale ground-mounted systems (> 20 MW) are legally excluded from EEG subsidies. New-build potential is RFNBO-compliant, provided that integrated storage ensures the required temporal correlation of generation.

After 2023's peak, annual PPA additions saw a significant decrease in 2024

Additional annual PPAs 2019-2024[1,3]



PPA contracts 2025[2,3]



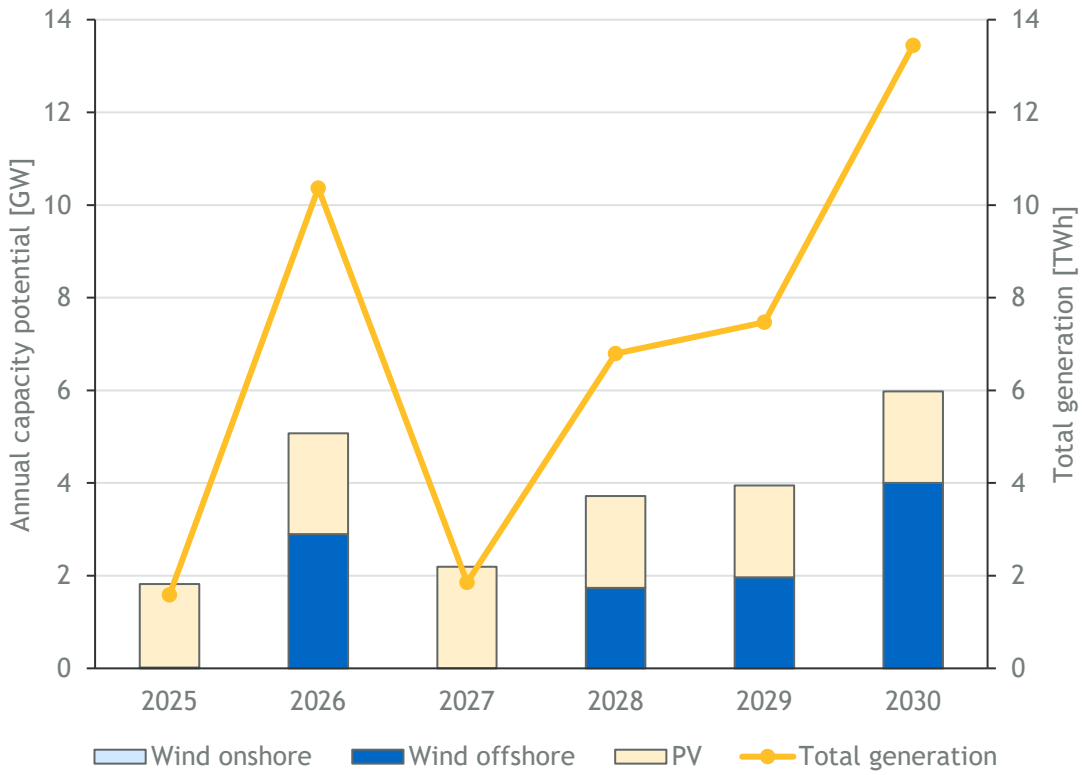
Remarks

- Based on publicly available data, there has been a significant increase in contracted PPA capacities, featuring a massive peak in 2023 (3.8 GW). While the total number of contracts increases from 44 PPAs in 2023 to 47 in 2024, the average PPA capacity decreased substantially.[1]
- Note that the actual capacity is likely higher due to non-public bilateral contracts and limited data transparency.[4]
- PV dominates PPA volume as the most stable pillar. The offshore wind boom of 2023 is leveling off, while onshore wind is experiencing growth.
- Annual additional generation from newly signed PPAs exceeded 7 TWh in 2023, compared to 3 TWh in 2024.
- Current PPA availability stands at 7.3 GW, with a balanced mix of wind (3.7 GW) and PV (2.9 GW).
- In 2025, power generation from PPAs totaled over 12 TWh.

1: Dena (2025a)| 2: Re-Source Platform | 3: Generation calculations are based on technology-specific full-load hours (Wind onshore: 1.796 h, wind offshore: 2.942 h, PV: 847 h). For the „Mix“ category, an average of the aforementioned values was applied. Data is based on the 2024 trend scenario from the EEG medium-term forecast (50Hertz, Amprion, TenneT, & TransnetBW (2024)). | 4: Capacities include only public PPAs with a duration of > 5 years. Missing capacities were approximated using technology-specific factors (Dena (2025a)).

Offshore wind and large-scale PV are the central drivers for new-build PPA potential

PPA potential for new-build plants (2025-2030)[1,2]



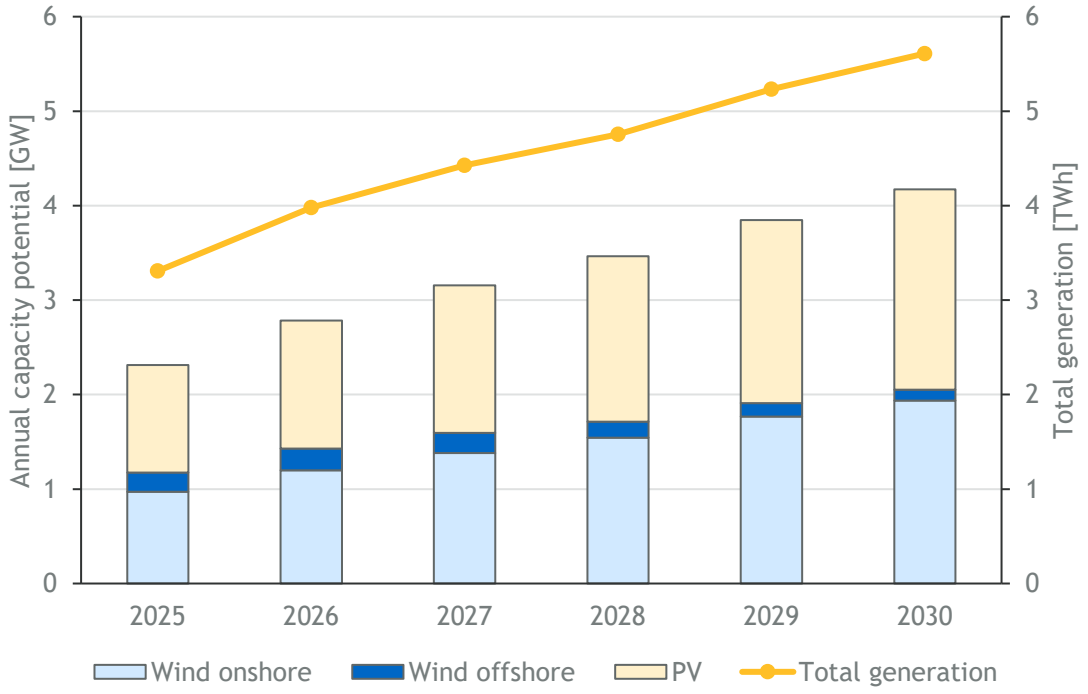
PPA potential for new-build plants: Assumptions & remarks

- The PPA potential for new-build plants is determined by regulatory separation: projects either claim EEG subsidies or rely on the PPA market.
- **Onshore wind:** At present, PPA-financed new installations play no role. Current EEG subsidy rates are economically more advantageous than PPAs.[3] A pivot to PPAs requires lower EEG award values, auction oversubscription, or RFNBO-driven demand creating a price premium that exceeds the state-guaranteed floor.
- **Offshore wind:** Potential is primarily driven by the commissioning of projects resulting from so-called “zero-cent bids”. Since these new plants receive no state subsidies, they are entirely dependent on PPAs for refinancing.[3] Consequently, the annual potential of the offshore sites varies depending on the schedule for commissioning and grid connection.
- **PV:** PV plants form the backbone of the PPA new-build market. Ground-mounted systems with a capacity of > 20 MW are legally excluded from EEG subsidies. Thus, PV represents a critical segment for PPAs.[3] This analysis assumes that 20 % of subsidized capacity is marketed via PPAs.[4]

1: Data for 2025 is based on 50Hertz, Amprion, TenneT, & TransnetBW (2024). | 2: Data for 2026-2030 is based on 50Hertz, Amprion, TenneT, & TransnetBW (2025) | 3: Dena (2025a) | 4: According to the assumptions made by 50Hertz, Amprion, TenneT, and TransnetBW (2025), an average of 15-20 % of the subsidized capacity additions for the period up to 2030 are attributed to “other direct marketing”.

Historical switching rates for operational plants predict a steady rise in PPA potential to 6 TWh by 2030

PPA potential for operational plants (2025-2030)[1]



PPA potential for operational plants: Assumptions & remarks

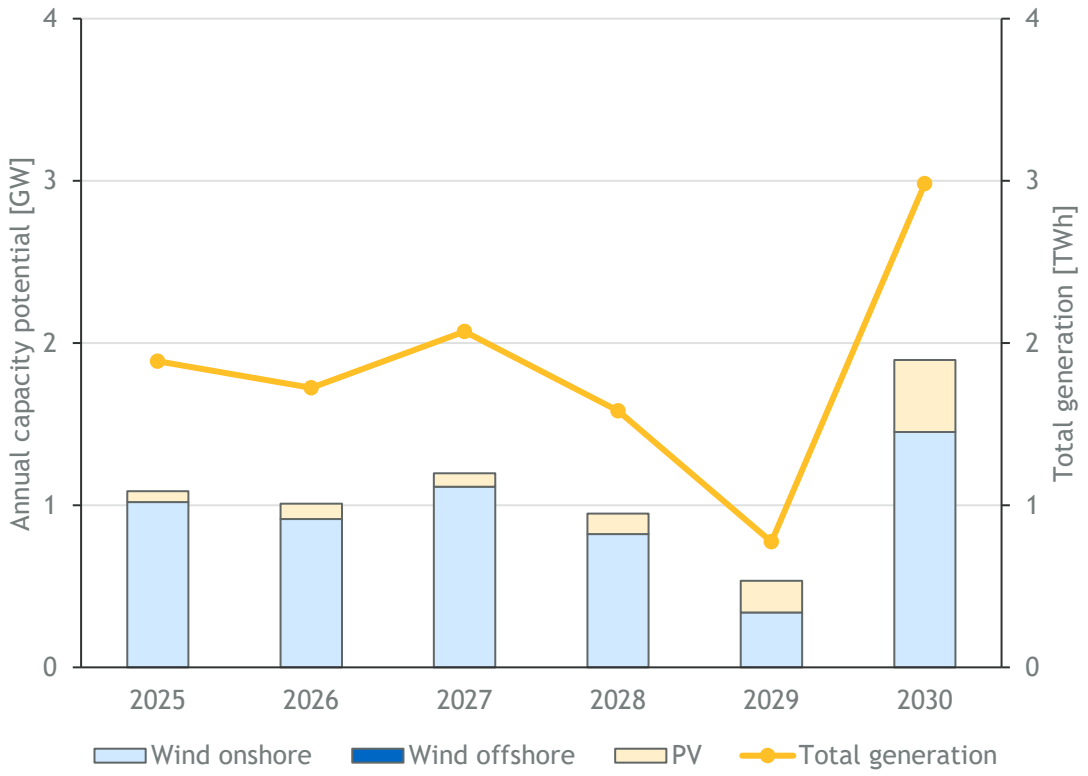
The PPA potential for operational plants is derived from projects transitioning from market premium ("Marktprämie") (pursuant to § 21b EEG) to other direct marketing ("sonstige Direktvemarktung").[1] Actual realization depends on fluctuating market conditions and remains subject to significant uncertainty.

- **Onshore wind and PV:** These technologies are the primary drivers of the operational segment, with their combined annual capacity potential increasing from approximately 2 GW in 2025 to over 4 GW by 2030.[2] This growth is fueled by assets switching from the market premium to capture higher PPA prices.
- **Offshore wind:** Lower switching activity among operational offshore wind projects is mainly driven by existing long-term subsidy commitments and utility-scale offtake agreements. Unlike new-build projects based on zero-cent bids, which rely entirely on PPAs, operational assets typically remain within the EEG framework to cover high fixed operating costs.

1: Potential derived from the historical average switching rate (2021–2024) from "market premium" to "other direct marketing" (Wind onshore: 1.9 %, wind offshore: 3.2 %, PV: 3.2 %). This rate represents the ratio of switching volumes (data: Öko-Institut (2025)) to total historical generation in the "market premium" segment (data: Netztransparenz (2025)). The rates are applied to the projected "market premium" generation (data: 50Hertz, Amprion, TenneT, and TransnetBW (2025)) and converted into capacity using technology-specific full-load hours. As not all assets in other direct marketing are secured via PPAs, this volume represents a theoretical upper bound of the market for operational plants. | 2: To approximately exclude post subsidy plants from the operational PPA potential, the January values were normalized using the average switching data from February to December.

Onshore wind acts as the primary volume driver for the post-subsidy PPA market

PPA potential for post subsidy plants (2025-2030)[1]



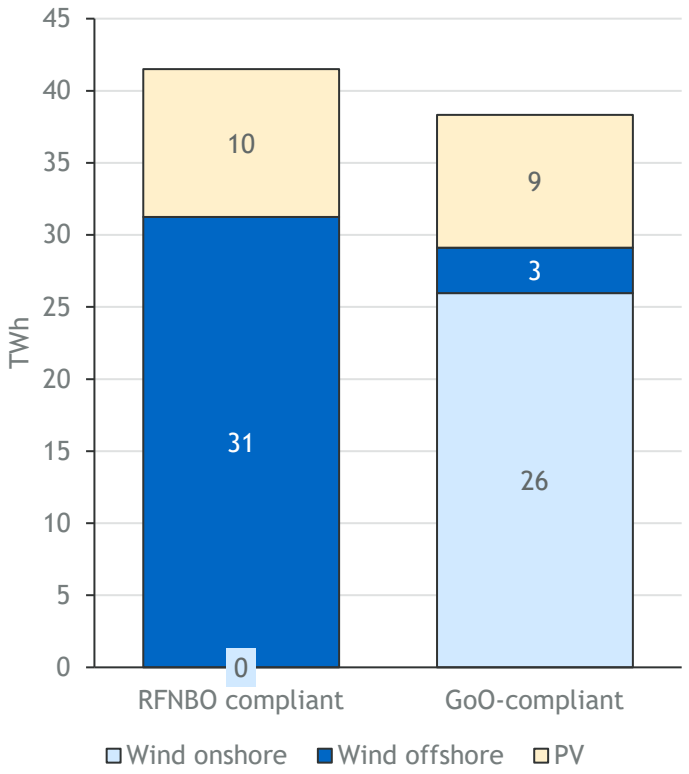
1: BNetzA (2021) | 2: 50Hertz, Amprion, TenneT, & TransnetBW (2024) | 3: UBA (2025b)

PPA potential for post subsidy plants: Assumptions & remarks

- Upon the expiry of the 20-year EEG subsidy, plant operators face a choice between decommissioning, repowering, or continued operation via the PPA market. The potential in this segment is largely determined by historical installation figures from the years 2004 to 2009.
- **Onshore wind:** This segment constitutes the primary volume of the post-subsidy market. It is assumed that 50 % of the onshore capacity falling out of the subsidy scheme is available for the PPA market.[2] The annual fluctuations (ranging between approx. 0.4 GW and 1.5 GW) directly reflect the installation waves of the early 2000s.
- **Offshore wind:** No potential exists until 2030, as the 20-year subsidy periods for early assets (starting 2009) do not expire within this horizon. Relevance will grow gradually thereafter, with an estimated capacity reaching 1 GW (2.9 TWh) by 2035, assuming all assets continue operation.
- **PV:** PV plants make a small, steady contribution to the post-subsidy potential. A share of 10 % is applied, corresponding to the ground-mounted systems installed between 2004 and 2009.[3] Many legacy systems consist of small-scale rooftop installations, which are not relevant to the PPA market due to their size and the option for self-consumption.

The PPA market ramp-up could add 80 TWh of new potential across all segments by 2030

PPA Outlook 2025-2030



Remarks

- The supply-side analysis quantifies the incremental growth in PPA-eligible electricity generation between 2025 and 2030, categorized by specific regulatory requirements:
  - **RFNBO-compliant supply:** Around 42 TWh of additional supply is expected to meet the strict RFNBO criteria. This volume is dominated by wind offshore (31 TWh) and supported by PV (10 TWh). These new build plants are essential to serve the demand for green hydrogen production, as they fulfill the required temporal and geographical correlation. However, PV installations may require integrated battery storage to ensure the necessary temporal correlation between generation and consumption to remain RFNBO-compliant.
  - **GoO-compliant supply:** An additional 38 TWh of supply potential is classified as GoO-compliant. Most of this segment originates from wind onshore (operational plants: 16 TWh, post subsidy plants: 10 TWh), followed by PV (operational plants: 8 TWh, post subsidy plants: 1 TWh) and a smaller share of wind offshore (operational plants: 3 TWh).
  - While RFNBO-compliant volumes are strictly tied to specific electrolyzer demand, the GoO-compliant share can serve data centers, other industrial needs or general corporate decarbonization targets.
- This supply outlook represents the upper bound of the potential PPA market between 2025 and 2030. The projections are highly sensitive to a variety of assumptions, including expansion pathways, full load hours, economic viability and the regulatory framework.

Market-oriented reforms support PPA attractiveness, but subsidies create high opportunity costs

PPA incentives through regulatory drivers

	2-way CfDs	EU Electricity Market Design	Industrial Electricity Price	Solar Package I & Co-Location
Wind onshore	High	High	Medium	Low
Wind offshore	Medium	Medium	High	Low
PV	Low	High	Medium	High

Remarks

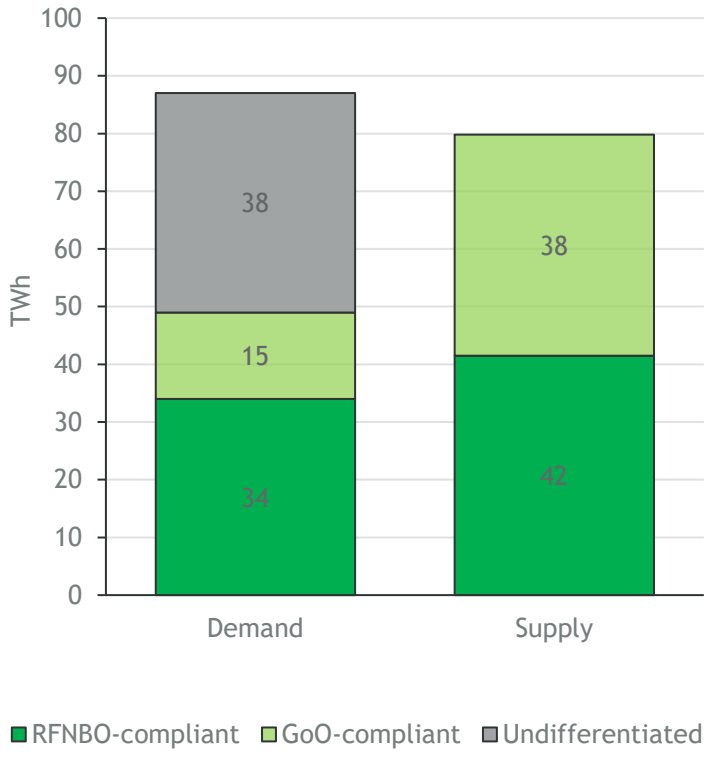
- The introduction of **2-way CfDs**[1] influences PPA incentives in a technology-specific manner: For onshore wind, the revenue cap inherent in CfDs is bypassed, creating a strong incentive to utilize PPAs to capture full market returns during price peaks. For offshore wind, state-backed security remains a priority due to high capital expenditure (CAPEX), with PPAs serving primarily as a complementary revenue pillar. In the PV sector, CfD models often lack the necessary flexibility to effectively mitigate specific risks such as price cannibalization.
- The **EU Electricity Market Design** (EMD 2024) establishes PPAs as a central pillar alongside state subsidies, boosting market-oriented financing for onshore wind and PV. By introducing state guarantees for SME credit risks and hybrid CfD frameworks, it ensures complementarity between supported and merchant expansion. For offshore wind, systemic dependence on auctions remains higher due to extreme capital intensity, positioning PPAs as a strategic supplement to CfDs.
- To qualify for an **industrial electricity price** via state-backed price relief, offtakers must demonstrate a commitment to decarbonization, for example through long-term PPAs. Due to its high full-load hours and baseload-like profile, offshore wind is the most effective technology for meeting these regulatory requirements.
- The **Solar Package I** accelerates the market integration of PV, with storage solutions acting as a technical enabler to ensure project bankability even during periods of negative electricity prices and acts as a key enabler for RFNBO compliance through hourly matching.

1: By July 2027, Germany is expected to implement the EU electricity market reform, which mandates that future state subsidies primarily utilize 2-way CfDs (European Commission (2025)).

Synthesis

In the medium term, the supply of RFNBO-compliant PPAs could be sufficient to meet RFNBO-compliant demand

Demand and Supply until 2030



Remarks

- **Baseline RFNBO demand**: In the synthesis, the potential supply of RFNBO-compliant PPAs appears sufficient to meet RFNBO-compliant demand implied by growth projections up to 2030. While the 2030 outlook is balanced, the market might face structural supply gaps due to non-linear offshore build-out and grid delays. This is exacerbated by the RFNBO "additionality" rule, which stipulates that electricity for new hydrogen projects must stem from a newly built RE plant.
- **Additional green electricity demand**: If demand for renewable electricity that is not required to be RFNBO-compliant also procures RFNBO-compliant PPAs, available supply would no longer be sufficient. Given uncertainties in both demand and supply projections, the resulting market could become tight.
- **Undifferentiated electricity demand**: The total demand potential could rise to 87 TWh when including undifferentiated electricity demand. This exceeds the total projected supply of 80 TWh (42 TWh RFNBO + 38 TWh GoO). Consequently, meeting this demand with RFNBO-compliant PPAs is impossible. Even if the entire GoO-compliant supply were allocated to this segment, a market-wide gap of 7 TWh would remain if all other demand categories were also to be served.
- There is no clear indication whether the examined demand will manifest as demand for RFNBO-compliant PPAs or for other supply options. The hierarchy among the different demand sectors is beside the regulatory quantities determined by their pass-through and substitution options. The quantities displayed here do not represent the general willingness to pay for PPAs.

Outlook: Further research for overcoming financial, regional and opportunity cost barriers

- **Evaluation of subsidy competition.** The attractiveness of PPAs is not static. It depends on the opportunity costs relative to evolving state support schemes. As long as the strike price of 2-way CfDs or EEG auctions remains high, sellers will prioritize de-risked state revenue over PPAs.
- **Outlook 2035.** While the share of renewable energy sources in gross electricity consumption is projected to exceed 80%, grid connection bottlenecks mean the 30 GW offshore target will likely be delayed from 2030 to 2032[1], pushing significant PPA volumes into the next decade[2]. The 2030–2035 period marks a turning point as massive early-wave capacities exit their 20-year EEG subsidies. These assets will unlock high volumes of cost-competitive green power, accelerating the shift toward PPAs. Post-2030, surging industrial demand will maintain high pressure on RFNBO-compliant PPAs. To ensure regulatory compliance and reliability, high-availability offshore wind and co-located storage will become the essential pillars of the domestic energy supply.
- **Pricing the counterparty risk.** A major barrier is the credit risk, which requires a risk premium unlike state-backed EEG payments. The mismatch between generation structures and consumption profiles remains unaddressed. Final pricing must incorporate balancing costs to account for the intermittent nature of supply relative to industrial load.
- **Addressing the regional supply-demand imbalance.** A geographical mismatch persists between PPA supply and demand. While offshore wind is the primary volume driver, it is concentrated in the North, far from high-load industrial hubs like North Rhine-Westphalia (NRW). To mitigate this, two parallel strategies are required: Accelerated grid expansion to transport northern offshore volumes to southern and western industrial clusters; and improving the framework for local PV and onshore wind near industrial sites to reduce dependency on long-distance transmission.
- **Aversion to electricity market risk exposure**: Willingness to pay for PPAs may be driven by aversion to short-term electricity market risks. The core value creation of the considered sectors lies outside energy trading, which may limit their willingness to manage procurement risks internally. The actual risk appetite could vary by actor.

1: EWI & BET (2025) | 2: Further delays may occur due to postponed or unsuccessful tenders. For instance, the cancellation of 2026 auctions and their rescheduling to 2027 following the failed August 2025 round highlights ongoing risks in the project pipeline that could further defer capacity realization.

Institute of Energy Economics at the University of Cologne

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Literature

50Hertz, Amprion, TenneT, & TransnetBW (2024)	50Hertz, Amprion, TenneT, & TransnetBW. (2024) EEG-Mittelfristprognose zur deutschlandweiten Stromerzeugung aus EEG-geförderten Kraftwerken für die Kalenderjahre 2025 bis 2029
50Hertz, Amprion, TenneT, & TransnetBW (2025)	50Hertz, Amprion, TenneT, & TransnetBW. (2025) EEG-Mittelfristprognose zur deutschlandweiten Stromerzeugung aus EEG-geförderten Kraftwerken für die Kalenderjahre 2026 bis 2030
AGEB (2025a)	AGEB (2025a): Schätzbilanz 2024, URL: https://ag-energiebilanzen.de/daten-und-fakten/bilanzen-ab-1990/?_jahresbereich-bilanz=aktuelle-schaetzbilanz-2m, last accessed on: 19.02.2026
AGEB (2025b)	AGEB (2025b): Bilanz 2023, URL: https://ag-energiebilanzen.de/daten-und-fakten/bilanzen-ab-1990/?_jahresbereich-bilanz=2021-2030, last accessed on 19.02.2026
AGORA (2023)	AGORA (2023): Roll-out von Großwärmepumpen in Deutschland, URL: https://www.agora-energiewende.de/publikationen/roll-out-von-grosswaermepumpen-in-deutschland, last accessed on: 19.02.2026
Bitkom (2025)	Bitkom (2025): Rechenzentren in Deutschland – Aktuelle Marktentwicklungen (Update 2025), URL: https://www.bitkom.org/sites/main/files/2025-11/bitkom-studie-rechenzentren-in-deutschland-2025.pdf#page=8.16, last accessed on: 19.02.2026
BMWK (2025)	BMWK (2025) Monitoring der Direktvermarktung: Jahresbericht 2024 und Ausblick 2025
BNetzA (2021)	BNetzA (2021): EEG in Zahlen 2019, URL: https://www.bundesnetzagentur.de/DE/Fachthemen/ElektrizitaetundGas/ErneuerbareEnergien/EE-Statistik/start.html, last accessed on: 28.01.2026
BNetzA (2024)	BNetzA (2024): Monitoringbericht 2023, URL: https://www.bundesnetzagentur.de/DE/Fachthemen/ElektrizitaetundGas/Monitoringberichte/start.html, last accessed on: 19.02.2026
Borderstep Institute (2023)	Borderstep Institute (2023): Facts & Figures: Stromverbrauch von Rechenzentren in Deutschland nimmt weiter zu. URL: https://www.borderstep.de/wp-content/uploads/2023/12/Borderstep_FactsFigures_Rechenzentren-2022.pdf, last accessed on: 19.02.2026
CBRE (2025)	CBRE (2025): January 2025 Forecast – Significant new supply to be added in 2025, URL: https://www.cbre.com/insights/books/european-real-estate-market-outlook-mid-year-review-2025/data-centres, last accessed on: 19.02.2026
Dena (2025a)	Dena (2025a) (Hrsg.) PPA-Marktanalyse Deutschland 2024
Dena (2025b)	Dena (2025b) (Hrsg.) Wie können PPAs in der kommenden Legislatur gestärkt werden?
DEHSt (2024)	DEHSt (2024): Informationsveranstaltung zu ökologischen Gegenleistungen in der Strompreiskompensation sowie Carbon-Leakage-Kompensation. URL: https://www.dehst.de/SharedDocs/downloads/DE/praesentationen/oegl-2024-04-24-themenblock-1.pdf?__blob=publicationFile&v=2, last accessed on: 19.02.2026
DEHSt (2025)	DEHSt (2025): BEHG Carbon Leakage – Ökologische Gegenleistungen der Unternehmen, URL: https://www.dehst.de/SharedDocs/downloads/DE/nehs/clk-hinweispapier-oekologische-gegenleistungen.pdf?__blob=publicationFile&v=7, last accessed on: 19.02.2026
Destatis (2026)	Destatis (2026): Beschäftigte, Umsatz, Produktionswert und Wertschöpfung der Unternehmen im Verarbeitenden Gewerbe: Deutschland, Jahre, Wirtschaftszweige. URL: https://www-genesis.destatis.de/datenbank/online/statistic/42251/table/42251-0001/search/s/QnJ1dHRvd2VydHNjaCVDMyVCNnBmdW5n, last accessed on: 19.02.2026

Literature

European Commission (2025): European Commission (2025): Electricity market design. URL: https://energy.ec.europa.eu/topics/markets-and-consumers/electricity-market-design_en, last accessed on: 03.02.2026

Eurostats (2026): Eurostats (2026): Cooling and heating degree days by country – annual data, URL: https://ec.europa.eu/eurostat/databrowser/view/nrg_chdd_a/default/table, last accessed on: 19.02.2026

EWI & BET (2025): EWI & BET (2025): Energiewende. Effizient. Machen. – Monitoringbericht zum Start der 21. Legislaturperiode, im Auftrag des Bundesministerium für Wirtschaft und Energie. URL: https://www.ewi.uni-koeln.de/de/publikationen/energiewende-effizient-machen-monitoringbericht/, last accessed on: 13.02.2026

EWI (2025a): EWI (2025a): Green hydrogen production under RFNBO criteria – Analyzing the system and business case perspective. URL: https://www.ewi.uni-koeln.de/cms/wp-content/uploads/2025/10/20251028_EWI_GreenHydrogenProduktionUnderRFNBOCriteria.pdf, last accessed on: 19.02.2026

EWI (2025b): EWI (2025b): EWI Global PtX Cost Tool, URL: https://www.ewi.uni-koeln.de/de/tools/ewi-global-ptx-cost-tool/, last accessed on: 19.02.2026

EWI (2026a): EWI (2026a): Entwicklungen im Elektrolyse-Hochlauf in Deutschland, URL: https://www.ewi.uni-koeln.de/de/publikationen/entwicklungen-im-elektrolyse-hochlauf-in-deutschland/, last accessed on: 19.02.2026

EWI (2026b): EWI (2026b): Großwärmepumpen: Markthochlauf und Kosten in Deutschland, URL: https://www.ewi.uni-koeln.de/de/publikationen/grosswaermepumpen-markthochlauf-und-kosten-in-deutschland/, last accessed on: 19.02.2026

KKA (2024): KKA (2024): Energiekosten in Rechenzentren eindämmen, URL: https://www.kka-online.info/artikel/energiekosten-in-rechenzentren-eindaemmen-4151555.html#:~:text=Energiekosten%20sind%20der%20gr%C3%B6%C3%9Fte%20Posten,in%20Rechenzentren%20Energie%20zu%20sparen, last accessed on: 19.02.2026

McKinsey (2025): McKinsey (2025): Zukunftspfad Stromnachfrage, URL: https://www.mckinsey.de/~/media/mckinsey/locations/europe%20and%20middle%20east/deutschland/news/presse/2025/2025-01-20%20zukunftspfad%20stromnachfrage/mckinsey_zukunftspfad%20stromnachfrage_januar%202025.pdf, last accessed on: 19.02.2026

Netztransparenz (2025): Netztransparenz (2025): EEG-Jahresabrechnungen. URL: https://www.netztransparenz.de/de-de/Erneuerbare-Energien-und-Umlagen/EEG/EEG-Abrechnungen/EEG-Jahresabrechnungen, last accessed on: 03.02.2026

Re-Source Platform: Re-Source Platform: PPA Deal Tracker. URL: https://resource-platform.eu/buyers-toolkit2/ppa-deal-tracker/, last accessed on: 28.01.2026

UBA (2025a): UBA (2025a): Die Geltungsdauer eines Herkunftsnachweises. URL: https://www.umweltbundesamt.de/system/files/medien/372/dokumente/geltungsdauer_eines_herkunftsnachweises.pdf, last accessed on: 19.02.2026

UBA (2025b): UBA (2025b): Erneuerbare Energien in Zahlen. URL: https://www.umweltbundesamt.de/themen/klima-energie/erneuerbare-energien/erneuerbare-energien-in-zahlen#emissionsbilanz, last accessed on: 28.01.2026

Öko-Institut (2025): Öko-Institut (2025): Dashboard zum Monitoring der Direktvermarktung, URL: https://ee-direktvermarktung.oeko-institute.eu/direktvermarktung, last accessed on: 27.01.2026