Technology Collaboration Programme
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International Energy Agency
Photovoltaic Power Systems Programme

Task 1 Analysis & Outreach

PVPS

# National Survey Report of PV Power Applications in Sweden

2024

Swedish Energy Agency

BECQUEREL SWEDEN

# What is IEA PVPS TCP?

The International Energy Agency (IEA), founded in 1974, is an autonomous body within the framework of the Organization for Economic Cooperation and Development (OECD). The Technology Collaboration Programme (TCP) was created with a belief that the future of energy security and sustainability starts with global collaboration. The programme is made up of 6.000 experts across government, academia, and industry dedicated to advancing common research and the application of specific energy technologies.

The IEA Photovoltaic Power Systems Programme (IEA PVPS) is one of the TCP's within the IEA and was established in 1993. The mission of the programme is to "enhance the international collaborative efforts which facilitate the role of photovoltaic solar energy as a cornerstone in the transition to sustainable energy systems." In order to achieve this, the Programme's participants have undertaken a variety of joint research projects in PV power systems applications. The overall programme is headed by an Executive Committee, comprised of one delegate from each country or organisation member, which designates distinct 'Tasks,' that may be research projects or activity areas.

The 28 IEA PVPS participating countries are Australia, Austria, Belgium, Canada, China, Denmark, Finland, France, Germany, India, Israel, Italy, Japan, Korea, Lithuania, Malaysia, Morocco, the Netherlands, Norway, Portugal, South Africa, Spain, Sweden, Switzerland, Thailand, Turkiye, the United Kingdom and the United States of America. The European Commission, Solar Power Europe and the Solar Energy Research Institute of Singapore are also members.

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# What is IEA PVPS Task 1?

The objective of Task 1 of the IEA Photovoltaic Power Systems Programme is to promote and facilitate the exchange and dissemination of information on the technical, economic, environmental and social aspects of PV power systems. Task 1 activities support the broader PVPS objectives: to contribute to cost reduction of PV power applications, to increase awareness of the potential and value of PV power systems, to foster the removal of both technical and non-technical barriers and to enhance technology co-operation. An important deliverable of Task 1 is the annual "Trends in photovoltaic applications" report. In parallel, National Survey Reports are produced annually by each Task 1 participant. This document is the country National Survey Report for the year 2024. Information from this document will be used as input to the annual Trends in photovoltaic applications report.


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**SUGGESTED CITATION**

Lindahl J., Öhgren G. (2025) *National Survey Report of PV Power Applications in Sweden 2024*. IEA PVPS Task 1. https://ieapvps.org/national_survey/nsr-sweden-2024/

**COVER PICTURE**

PV park with vertical bifacial modules in northeastern Sweden. Photo: Sunna Group

INTERNATIONAL ENERGY AGENCY

PHOTOVOLTAIC POWER SYSTEMS PROGRAMME

# National Survey Report of PV Power Applications in Sweden 2024

## IEA PVPS
## Task 1
## Strategic PV Analysis & Outreach

October - 2025

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# 1 INSTALLATION DATA

The PV power systems market is defined as the market of all nationally installed (terrestrial) PV applications with a PV capacity of 40 W or more. A PV system consists of modules, inverters, batteries and all installation and control components for modules, inverters and batteries. Other applications such as small mobile devices are not considered in this report.

For the purposes of this report, PV installations are included in the 2024 statistics if the PV modules were installed and connected to the grid between 1 January and 31 December 2024, although commissioning may have taken place at a later date.

## 1.1 Applications for Photovoltaics

The installation of grid-connected PV systems in Sweden can be said to have taken off in 2006, with approximately 300 kW installed that year. Before that, only a few grid-connected systems were installed annually, and the Swedish PV market primarily consisted of a small but stable off-grid sector, serving mainly holiday cottages, marine applications, and caravans. This domestic off-grid market has remained relatively stable over the years.

However, since 2007, the annual installation of grid-connected capacity has surpassed that of off-grid capacity. The grid-connected market is predominantly comprised of distributed roof-mounted systems installed by homeowners, companies, municipalities, farmers, and other entities. Right from the beginning, the Swedish distributed market has been driven by the self-consumption business model due to the absence of feed-in tariffs. To support this business model, capital subsidies and a feed-in premium scheme, which adds value to excess electricity, have been vital. However, as of 2023, subsidies are almost exclusively allocated to the distributed PV market segment, predominantly benefitting private installations.

On the other hand, the centralized PV sector is comparatively small on a global scale. However, there has been a notable increase in interest and activity in recent years within the centralised PV park market segment. Although the capacity additions from PV parks remain limited, this trend is anticipated to continue, resulting in a growth in both the quantity and size of centralized PV parks in the coming years.

## 1.2 Annual installed PV capacity

According to official statistics, 41 395 new PV systems were connected to the electricity grid in 2024 in Sweden, adding a total installed capacity of 847.5 MW. This represents a 47% decrease compared to the record-setting 1 586.0 MW installed in 2023. Nevertheless, 2024 still marks the second-highest year for installed capacity to date, exceeding 2022 by 6% (796.7 MW).

The residential market saw a sharp decline during the year. A total of 36 517 new systems under 20 kW were installed in 2024 — 62% fewer than in 2023 — contributing 389.3 MW of annual capacity in 2024 as compared to 1 053.6 MW in 2023.

The mid-sized segment, comprising systems between 20 kW and 1,000 kW, also experienced a downturn in 2024. A total of 329.0 MW was installed — 21% less than the year before — but still 51% more than in 2022. The average system size in this category reached a new record at 67.9 kW.

By contrast, large-scale systems over 1 MW continued to grow. An additional 129.2 MW was installed in 2024, an 11% increase from 2023 (116.5 MW).

For Figure 1 and Table 1, the following definitions apply:

Centralized: any PV installation which only injects electricity and is not associated with a consumer (no self-consumption).

Decentralized: any PV installation which is embedded into a customer's premises (self-consumption).

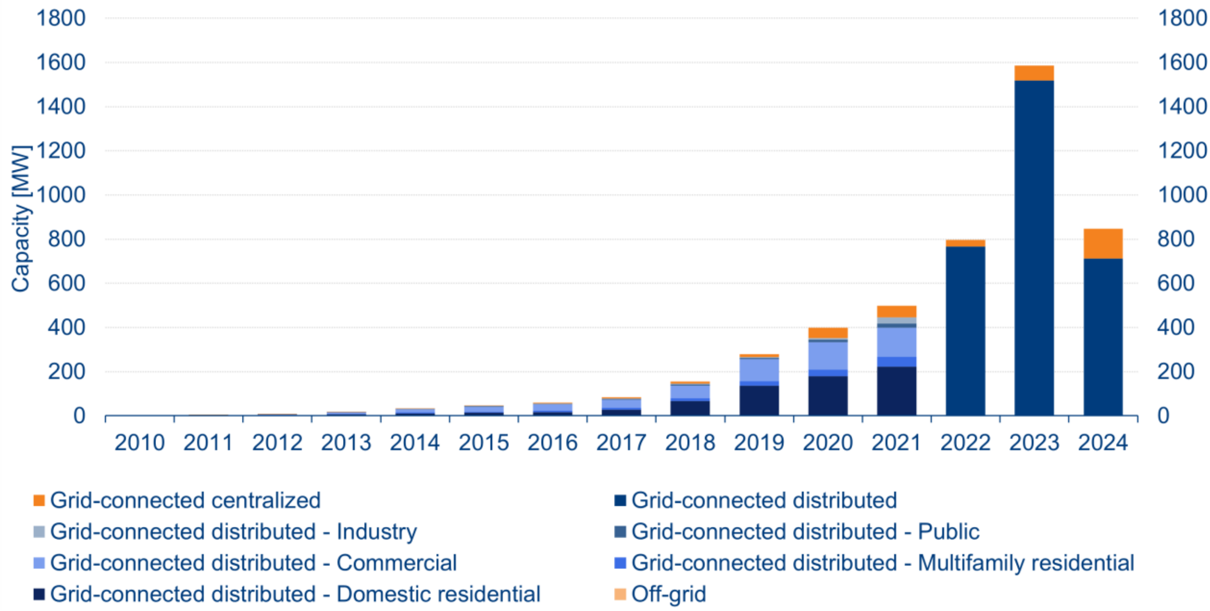


**Figure 1. Annual installed PV capacity in Sweden.**

**Table 1: Annual PV power installed during calendar year 2024-**

| | | Installed PV capacity in 2024 [MW] | AC or DC |
|---|---|---|---|
| | Decentralized | 711.3 | AC |
| | Centralized | 136.2 | AC |
| | Off-grid | 1.2 (±0.1 MW) | DC |
| | **Total** | **848.7** | **AC** |

There are currently no official statistics on battery energy storage systems (BESS) in Sweden. However, the Swedish Solar Energy Association has produced estimates based on data from the Swedish transmission system operator (TSO), Svenska Kraftnät, the Swedish Tax Agency, and grid operators. According to these estimates, between 650 and 800 MW of battery capacity was installed in 2024 — several times more than in any previous year [1]. The total battery capacity connected to the Swedish grid is now likely well above 1 GW.

Please note that the figures above refer to systems' grid-connected (AC) capacity and should not be confused with the total DC capacity of the installed solar panels.

As noted in the previous section, Sweden has a small but steady off-grid PV market. Between 2017 and 2019, sales averaged around 2 MW per year for off-grid applications. In 2020, the market declined slightly to 1.6 MW, before rebounding to 1.9 MW in 2021. The collection of off-grid capacity data through sales statistics was not included in the 2022 and 2023 National Survey Reports. However, for this report an effort was made to gather such data. While some companies involved in the sale and installation of off-grid systems provided input, fewer companies were willing to share data compared to previous years. Based on the available information, combined with assumptions and upscaling from the 2020 and 2021 statistics, the author estimates that approximately 1.1–1.3 MW of PV was sold in 2024 for various off-grid applications. These include both stationary off-grid systems and mobile PV solutions, such as installations on caravans and boats.

Worth noting is that, with the discontinuation of the capital subsidy program (See previous Swedish National Survey Reports) and the gradual phasing-out of the electricity certificate system (See Section 3.2.1), replicating the past market segmentation — which was based on the databases of these two subsidy programmes — of the Swedish installed capacity is no longer viable. Consequently, market segmentation of the Swedish PV market is nowadays more difficult and from 2022 and onwards, the segmentation is less granular and estimated by the author of the report based on assumptions. This shift is clearly reflected in the data portraying the yearly installed capacity, as shown in Figure 1.

**Table 2: Data collection process.**

| | |
|---|---|
| If data are reported in AC, please mention a conversion coefficient to estimate DC installations. | The reported data is in AC and the data is not reconstructed to DC in this report. Studies have shown that the Swedish PV parks commissioned in 2019 and 2020 that use a configuration with regular modules, and a fixed south tilt have an DC/AC ratio of average 1.2 [2]. For the residential segment, the background data of a cost break-down study of Swedish BAPV systems on single-family houses installed in 2020 [3] show an average DC/AC ratio of 1.04. A similar cost break-down study done for this report on the C&I segment revealed average DC/AC ratios of 1.12. |
| Is the collection process done by an official body or a private company/Association? | Public body, the Swedish Energy Agency (grid connected data)<br><br>Company, Becquerel Sweden (off-grid data before 2022 and in 2024) |
| Link to official statistics | Swedish Energy Agency – Statistics |
| The different data sources used for this report are all described and discussed in Appendix A – Data sources and their limitations | |

## 1.3 Total photovoltaic power installed

The total grid-connected capacity at the end of 2024 was 4 808.4 MW according to the Swedish grid operators. Out of this capacity, about 368.1 MW is estimated to be centralised PV and 4 440.3 MW to be distributed. In addition, a total of approximately 26 MW of off-grid PV applications is estimated to have been sold in Sweden between 1992 and 2024, of which 22.3 MW is assumed to still be in operation.

By adding the off-grid and the grid-connected PV capacities together, a total of 4 830.7 MW of PV capacity is estimated to up and running in Sweden by the end of 2024, illustrated in Figure 2 and summarised in Table 3. The total installed PV capacity grew by 21% in 2024, continuing the overall upward trend, though at a slower pace than during the previous five years, where the total market grew by 66% in 2023, 49% (2022), 45% (2021), 57% (2020), 66% (2019), and 59% (2018).

Just as for Figure 1, the discontinuation of the capital subsidy and the gradual phasing-out of the electricity certificate system program (See previous Swedish National Survey Reports) do not allow for the same market segmentation for 2022–2024 as for previous years in Figure 2.

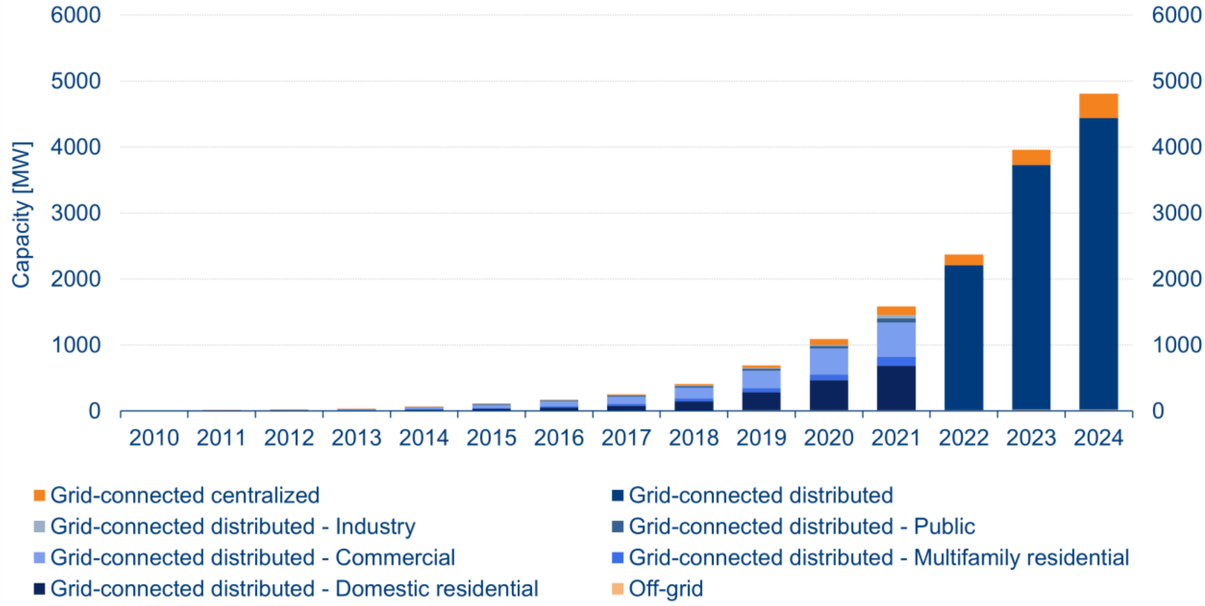


**Figure 2. Total installed PV capacity in Sweden.**

**Table 3: The cumulative installed PV power in 3 sub-markets.**

| Year | Off-grid [MW] | Grid-connected distributed [MW] | Grid-connected centralised [MW] | Total [MW] |
|---|---|---|---|---|
| 1992 | 0.80 | 0.01 | 0.00 | 0.81 |
| 1993 | 1.03 | 0.02 | 0.00 | 1.05 |
| 1994 | 1.31 | 0.02 | 0.00 | 1.33 |
| 1995 | 1.59 | 0.03 | 0.00 | 1.62 |
| 1996 | 1.82 | 0.03 | 0.00 | 1.85 |
| 1997 | 2.03 | 0.09 | 0.00 | 2.12 |
| 1998 | 2.26 | 0.11 | 0.00 | 2.37 |
| 1999 | 2.46 | 0.12 | 0.00 | 2.58 |
| 2000 | 2.68 | 0.12 | 0.00 | 2.80 |
| 2001 | 2.88 | 0.15 | 0.00 | 3.03 |
| 2002 | 3.14 | 0.16 | 0.00 | 3.30 |
| 2003 | 3.39 | 0.19 | 0.00 | 3.58 |
| 2004 | 3.67 | 0.19 | 0.00 | 3.86 |
| 2005 | 3.98 | 0.25 | 0.00 | 4.23 |
| 2006 | 4.30 | 0.56 | 0.00 | 4.86 |
| 2007 | 4.57 | 1.68 | 0.00 | 6.25 |
| 2008 | 4.83 | 3.08 | 0.00 | 7.91 |
| 2009 | 4.97 | 3.54 | 0.06 | 8.57 |
| 2010 | 5.34 | 5.12 | 0.25 | 10.71 |
| 2011 | 5.78 | 8.47 | 0.28 | 14.53 |
| 2012 | 6.38 | 14.92 | 0.89 | 22.19 |
| 2013 | 7.31 | 32.14 | 1.37 | 40.82 |
| 2014 | 8.20 | 63.81 | 2.95 | 74.95 |
| 2015 | 9.16 | 109.19 | 4.30 | 122.64 |
| 2016 | 10.43 | 165.17 | 7.12 | 182.73 |
| 2017 | 12.27 | 244.19 | 11.64 | 268.10 |
| 2018 | 14.09 | 390.15 | 20.90 | 425.14 |
| 2019 | 15.82 | 655.86 | 35.07 | 706.75 |
| 2020 | 17.20 | 1 007.82 | 81.58 | 1 106.60 |
| 2021 | 18.89 | 1 453.33 | 133.84 | 1 606.06 |
| 2022 | 20.13 | 2 211.44 | 163.44 | 2 395.01 |
| 2023 | 21.39 | 3 728.94 | 231.94 | 3 982.27 |
| 2024 | 22.30 | 4 440.28 | 368.14 | 4 830.72 |

In total, there were 293 019 grid-connected PV systems in Sweden by the end of 2024 according to the surveys sent out by Statistics Sweden, SCB, (Statistiska Centralbyrån) on behalf of the Swedish Energy Agency (Energimyndigheten) to all Swedish DSOs. The number of off-grid systems is unknown. A majority of the grid-connected PV systems, 264 779, are small systems below 20 kW. 28 110 are in between 20 kW – 1000 kW and 130 systems are above 1 MW according to the official statistics (summarised in Table 4).

However, the official statistics count everything behind one single connection point to the grid as one system. Several of the centralised PV parks built in Sweden have multiple connection points to the low-voltage distribution grid. These PV parks are divided into several systems in the statistics, and often in sizes below 1 MW. Thus, the actual number of PV systems above 1 MW in Sweden is larger than 130, if each PV park is considered as a single system.

**Table 4: Other PV market information.**

<table>
<tr><th colspan="2"></th><th colspan="2">2024</th></tr>
<tr><td rowspan="5">Number of PV systems in operation in Sweden</td><td rowspan="4">Grid-connected PV</td><td>Under 20 kW</td><td>264 779</td></tr>
<tr><td>20 kW – 1000 kW</td><td>28 110</td></tr>
<tr><td>Above 1000 kW</td><td>130</td></tr>
<tr><td>Total</td><td>293 019</td></tr>
<tr><td colspan="2">Off-grid PV</td><td>Unknown</td></tr>
<tr><td colspan="2">Decommissioned PV systems during the year [MW]</td><td colspan="2">285 kW of off-grid system is estimated to have been decommissioned</td></tr>
<tr><td colspan="2">Repowered PV systems during the year [MW]</td><td colspan="2">Unknown</td></tr>
</table>

With regards to the number of installed PV systems in Sweden, statistics are available for grid-connected system for the years 2016 to 2024. The number of systems at the end of each year, and the corresponding average system size are presented in Table 5.

At the end of 2024, the average PV system size in Sweden was approximately 16.4 kW, illustrating that the market continues to be dominated by small, distributed installations. This trend underscores the strong presence of residential and small commercial systems in Sweden's PV expansion.

**Table 5: Number and average sizes of grid-connected PV systems in Sweden at the end of each year.**

| Year | Number of systems | Average size per system for the total number of systems at the end of each year [kW] | Average size per system for the annual market [kW] |
|---|---|---|---|
| 2016 | 10 006 | 13.99 | - |
| 2017 | 15 273 | 15.12 | 17.25 |
| 2018 | 25 486 | 16.13 | 17.64 |
| 2019 | 43 343 | 15.94 | 15.67 |
| 2020 | 65 797 | 16.56 | 17.75 |
| 2021 | 92 360 | 17.09 | 18.40 |
| 2022 | 147 690 | 16.08 | 14.40 |
| 2023 | 251 624 | 15.74 | 15.26 |
| 2024 | 293 019 | 16.41 | 20.47 |

Looking at the average PV system sizes of annual installations, several clear trends can be observed in recent years. In 2022 and 2023, the average system size in Sweden decreased notably. This decline coincided with the energy crisis triggered by Russia's invasion of Ukraine, which caused sharply rising electricity prices across Europe. The resulting surge in interest in self-consumption led to rapid growth in the residential and small commercial PV segments, as such systems can be planned and installed much faster than large-scale projects.

At the same time, several developers of centralized PV parks reported delays in construction and grid connection during these years, which further contributed to the temporary decline in average system size. The data and feedback from market actors suggest that 2022–2023 were exceptionally strong years for residential PV deployment, rather than weak years for centralized PV.

However, in 2024, interest from private individuals in installing new PV systems appears to have declined significantly. This development is likely due to market saturation, lower electricity prices compared to the peaks in 2022, and the phase-out of several subsidy schemes targeting the residential market.

Looking ahead, the average system size is expected to increase in the coming years, driven by the commissioning of postponed large-scale projects and a gradual normalization of the residential market. Together, these dynamics suggest that the Swedish PV market is moving toward a more balanced phase, where both distributed and centralized segments contribute more evenly to future capacity growth.

## 1.4 The geographical distribution of PV in Sweden

The data from the grid operators' statistics about the installed PV power in Sweden has a geographical resolution down to the municipality level. The expansion of PV takes place at different speeds in Sweden's municipalities. When it comes to the total most installed PV capacity, Gothenburg, followed by Uppsala and Malmö were at the top at the end of 2024 with 164.5, 92.3, and 87.8 MW, respectively.

The top 3 municipalities in terms of watts of PV capacity installed per capita are Borgholm, Gullspång, and Sölvesborg, with 1 884 W/capita (total 20.1 MW), 1 858 W/capita (total 9.4 MW), and 1 776 W/capita (total 31.0 MW), respectively. Figure 3 shows the installed capacity per capita in the 21 Swedish counties and 290 municipalities respectively.

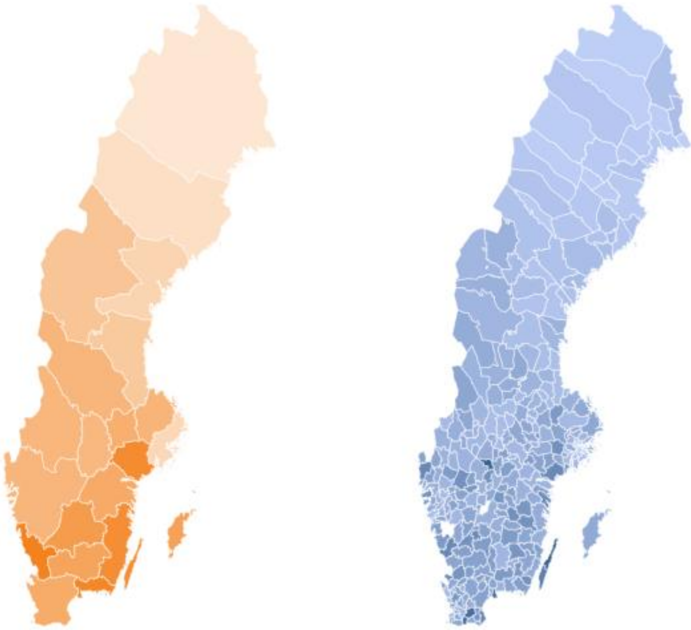

**Figure 3. Installed PV capacity per capita per county respective municipality in 2024.**

The Swedish electricity market was divided into four north–south bidding areas on November 1, 2011, by decision of the Swedish TSO, Svenska Kraftnät. The reason is that northern Sweden has an excess of electricity generation since that is where a lot of the wind power and most of the hydropower is situated, while the demand is larger than the generation in southern Sweden. This has resulted in transmission bottlenecks, and the borders between the bidding areas have been drawn where there are congestions in the national grid. From this perspective, it is positive that most of the PV capacity is being installed in southern Sweden and mainly in the more densely populated municipalities.

## 1.5 PV in the broader Swedish power system

In recent years, significant changes in the Swedish power system include the expansion of wind power, the shutdown of two nuclear reactors (Ringhals 2 in December 2019 and Ringhals 1 in December 2020), and the closure of the last coal power plant in 2020.

In 2024, Sweden's electricity consumption, excluding losses, was recorded the second lowest, after 2023, since the start of the Swedish Energy Agency’s and SCB’s time series in 1990. Additionally, the total electricity generation increased resulting in a surplus for the year. Sweden imported 5.6 TWh, including transit losses, and exported approximately 38.9 TWh, also including transit losses. This signifies a decreased import by about 23% and an increase in exports by approximately 9% compared to 2023. Consequently, Sweden maintained a net electricity export of 33.3 TWh. Norway stands as the primary source of power imports for Sweden, while the primary export markets are Denmark, Finland and Norway. Throughout the year, total electricity generation was approximately 169.6 TWh, while electricity consumption amounted to 136.6 TWh. This reflects an increased production by around 4% and an increase in consumption by about 1% compared to 2023.

In Figure 4, the Swedish electricity generation in 2024 is presented. The electricity generation data used in Figure 4 and Figure 5, along with Table 6, were retrieved from the Swedish TSO, Svenska Kraftnät [4], but with complementary data from Swedenergy [5] with regards to the fuels used in the Swedish CHP power plants and solar power self-consumption estimated by this report.

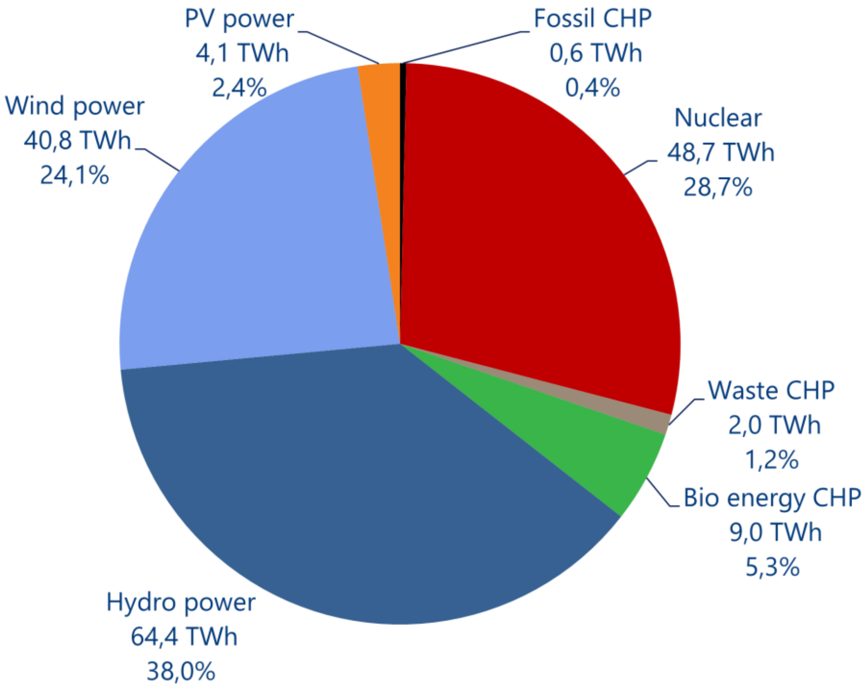


**Figure 4. Total electricity generation in Sweden in 2024.**

**Table 6: PV power and the broader national energy market**

| | Data | Year |
|---|---|---|
| Total power generation capacities [GW] | 51 595 | 2024 |
| Total renewable power generation capacities (including hydropower) [GW] | 38 090 | 2024 |
| Total electricity demand [TWh] | 136.6 | 2024 |
| New power generation capacities installed [GW] | 1 385 | 2024 |
| New renewable power generation capacities (including hydropower) [GW] | 1 449 | 2024 |
| Estimated total PV electricity generation (including self-consumed PV electricity) in [GWh] | 4 087 | 2024 |
| Total PV electricity generation as a % of total electricity consumption | 2.4 | 2024 |
| Average yield of PV installations (in kWh/kWp) | 850 | 2024 |

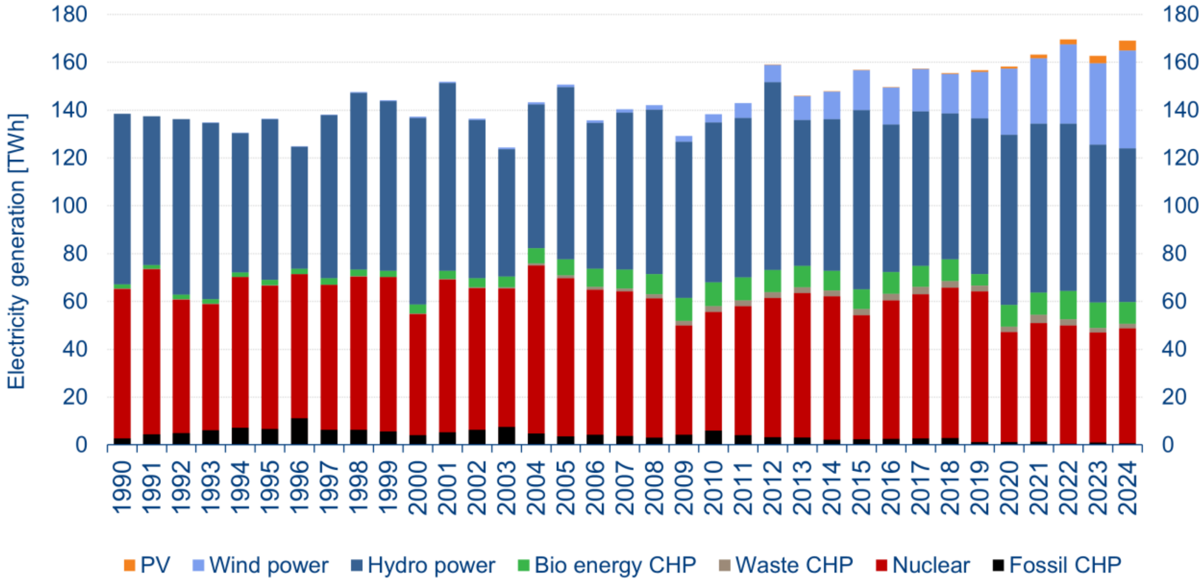


**Figure 5. Total annual electricity generation in Sweden between 1990 to 2024.**

As can be seen in Figure 5, Sweden's electricity has historically been generated primarily from low-carbon sources. Combined with comparatively low electricity prices (see Section 2.8) and modest solar irradiance levels, this explains why Sweden's PV deployment began later than in many other European countries and why solar power still represents a relatively small share of the national energy mix.

## 1.6 Key enablers of PV development

Table 7 summarizes the installed capacity and total volumes of key decentralized energy technologies in Sweden, including BESS, residential heat pumps, and electric vehicles. While no official statistics currently exist for BESS, estimates from the Swedish Solar Energy Association suggest an annual addition of 650–800 MW and a total installed capacity exceeding 1 GW. Data for heat pumps and electric vehicles are based on national industry associations and show strong growth across all segments, reflecting Sweden's advancement in electrification and decentralization of the energy system.

**Table 7: Information on key enablers.**

| | Description | Annual Volume | Total Volume | Source |
|---|---|---|---|---|
| Decentralized BESS | | 650-800 MW | > 1GW | There are currently no official statistics on BESS in Sweden. However, the Swedish Solar Energy Association has produced estimates [1]. |
| Residential Heat Pumps [#] | | 150 493 | 1 848 609 | https://skvp.se/nyheter-o-statistik/statistik/varmepumpforsaljningen |
| Battery Electric Vehicles [#] | | 66 162 | 356 359 | https://powercircle.org/elbilsstatistik/ |
| Plug In Hybrid Vehicles [#] | | 31 821 | 303 130 | |
| Electric buses and trucks [#] | Including light trucks | 7 429 | 28 516 | |
| Other [#] | EV-motorcycles | 284 | 3 006 | |

### 1.6.1 The public opinion about PV

Public sentiment towards PV technology in Sweden is overwhelmingly positive. A recent bi-annual survey [6] conducted by the SOM Institute, in which respondents were randomly selected and asked about their preferred energy investments over the next 5–10 years, found that 66% of participants supported increased investments in PV technology. This places PV at the top as the most favored electricity generation technology and the least disliked among the surveyed population.

The high acceptance of PV is closely linked to the fact that Sweden's PV market is primarily composed of distributed, self-consumption installations. While some PV park developments have faced local opposition, it has not significantly slowed deployment. Such opposition typically arises from two main concerns: (1) "Not In My Back Yard" (NIMBY) resistance from residents wishing to preserve the rural landscape, and (2) national considerations about protecting agricultural land to maintain food production autonomy.

Local authorities and grid operators were initially unprepared for the surge of interest from farmers seeking to lease land for PV parks, leading to lengthy permitting processes, particularly for agricultural land. Nevertheless, many PV parks have been successfully sited on less valuable land, including industrial areas near highways, former landfills, and grassy plots near airports. These projects generally encounter minimal opposition and are often welcomed by local communities, who view the repurposing of such land for renewable energy as a positive contribution [7].

Another common practice in Sweden is to name PV parks after the companies purchasing electricity through PPAs. This highlights the close link between the PV parks and corporate sustainability initiatives, as well as the positive PR value of such projects — further illustrating the high social acceptance of solar PV in Sweden.

# 2 COMPETITIVENESS OF PV ELECTRICITY

## 2.1 Module prices

Module prices in Sweden are closely tied to the global module market. Between 2008 and 2013, PV module prices in Sweden dropped significantly. This was partly due to the growing domestic market, which enabled retailers to import larger quantities, and partly due to the global price decline driven by advances in mass production and technology development. These advances also reduced the material and energy required per kWp of PV capacity. However, between 2013 and 2016, the decline in prices was more gradual. This stability in module prices was primarily attributed to the introduction of import duties on Chinese PV modules and cells by the European Commission in 2013 [8]. These measures included the establishment of a minimum import price (MIP), which meant that silicon modules could not be imported into the European Union at a price lower than 0.56 €/Wp, approximately equivalent to 5.2 SEK/Wp.

Following the removal of these duties, many Swedish retailers reduced module prices for Swedish installation companies by 20–30%. As a result, the average typical module price for end consumers decreased by 14 % in 2018, followed by a 4 % decline in 2019 and a further 7 % drop in 2020 (see Table 8).

Starting 2021, the price survey indicated a notable increase in prices, marking the first such increase since data collection began. These price hikes were observed across various sources, primarily attributed to supply chain constraints, as reported in the IEA PVPS Task 1 Global Trends report [9]. Throughout 2022, global prices for polysilicon, wafers, and cells remained consistently high or continued to rise for most of the year. There was a dip in the final weeks of the year, influenced by factors such as production expansions and the global and Chinese New Year.

The trend of declining prices continued throughout the entirety of 2023, particularly in the second half of the year. After several years of tension in material and transport costs, module prices plummeted. This phenomenon was not unique to Sweden but rather a trend that contributed significantly globally to the competitiveness of PV systems, even though electricity prices decreased after the historical peaks in 2022. As in earlier developments, the Swedish PV market pricing remained closely linked to global trends. This steep cost decrease is attributed to several factors, primarily an oversupply in the manufacturing industry since the increases in the global module manufacturing capacity, predominantly in China, have not been matched by as large of an increase in deployments [10].

**Table 8. The historical development of typical module prices. The prices are reported by Swedish installers and retailers. The prices are the prices to the end costumer, not the import price for the retailers and without VAT.**

| Year | Lowest price of a standard module crystalline silicon [SEK/$W_p$] | Highest price of a standard module crystalline silicon [SEK/Wp] | Typical price of a standard module crystalline silicon [SEK/$W_p$] |
|---|---|---|---|
| 2004 | - | - | 70 |
| 2005 | - | - | 70 |
| 2006 | - | - | 65 |
| 2007 | - | - | 63 |
| 2008 | - | - | 61 |
| 2009 | - | - | 50 |
| 2010 | 20 | 68 | 27 |
| 2011 | 12 | 50 | 19 |
| 2012 | 9.5 | 40 | 14 |
| 2013 | 6.0 | 16 | 8.9 |
| 2014 | 6.0 | 12 | 8.2 |
| 2015 | 5.1 | 10 | 7.6 |
| 2016 | 4.5 | 9.3 | 7.1 |
| 2017 | 4.0 | 6.6 | 5.3 |
| 2018 | 3.2 | 6.6 | 4.5 |
| 2019 | 2.9 | 5.4 | 4.3 |
| 2020 | 2.5 | 6.6 | 4.0 |
| 2021 | 3.5 | 7.0 | 4.6 |
| 2022 | 2.6 | 7.8 | 5.6 |
| 2023 | 1.7 | 5.6 | 3.1 |
| 2024 | 1.2 | 5.5 | 2.5 |

## 2.2 System prices

Average typical prices for turnkey PV systems (excluding VAT) — reported by Swedish installation companies — in 2024 are presented in Table 9. Just like PV modules, Swedish PV system prices have dropped substantially since 2010, particularly before 2013, as illustrated in Figure 6 and Table 10. This decline is mainly explained by two factors. First, prices for both PV modules and balance-of-system (BoS) components have fallen globally. Second, the expansion of the Swedish market has provided installation companies with a more stable demand and the opportunity to optimize their processes, thereby reducing labour and overhead costs. As a result, companies have grown and become increasingly efficient in marketing and installation.

**Table 9: Turnkey PV system prices of different typical PV systems.**

| Category/Size | Typical applications and brief details | Current average prices [SEK/W] |
|---|---|---|
| Off-grid<br>2 kW | A stand-alone PV system is a system that is installed to generate electricity to a device or a household that is not connected to the public grid. The price is for a small off-grid system on a cottage for seasonal use (summer) that is not connected to main grid. | 25.0 |
| Residential BAPV<br>5-10 kW | Grid-connected, roof-mounted, distributed PV systems installed to produce electricity to grid-connected households. Typically roof-mounted systems on villas and single-family homes. | 14.7 |
| Residential BIPV<br>5-10 kW | Grid-connected, building integrated, distributed PV systems installed to produce electricity to grid-connected households. Typically, on villas and single-family homes. | Unknown |
| Small commercial BAPV<br>10-100 kW | Grid-connected, roof-mounted, distributed PV systems installed to produce electricity to grid-connected commercial buildings, such as public buildings, multi-family houses, agriculture barns, grocery stores etc. | 12.0 |
| Small commercial BIPV<br>10-100 kW | Grid-connected, building integrated, distributed PV systems installed to produce electricity to grid-connected commercial buildings, such as public buildings, multi-family houses, agriculture barns, grocery stores etc. | Unknown |
| Large commercial BAPV<br>100-250 kW | Grid-connected, roof-mounted, distributed PV systems installed to produce electricity to grid-connected large commercial buildings, such as public buildings, multi-family houses, agriculture barns, grocery stores etc. | 9.4 |
| Large commercial BIPV<br>100-250 kW | Grid-connected, building integrated, distributed PV systems installed to produce electricity to grid-connected commercial buildings, such as public buildings, multi-family houses, agriculture barns, grocery stores etc. | Unknown |
| Industrial BAPV<br>>250 kW | Grid-connected, roof-mounted, distributed PV systems installed to produce electricity to grid-connected industrial buildings, warehouses, etc. | 7.8 |
| Small centralized PV<br>1-20 MW | Grid-connected, ground-mounted, centralized PV systems that work as central power station. The electricity generated in this type of facility is not tied to a specific customer and the purpose is to produce electricity for sale. | 7.0 |
| Large centralized PV<br>>20 MW | Grid-connected, ground-mounted, centralized PV systems that work as central power station. The electricity generated in this type of facility is not tied to a specific customer and the purpose is to produce electricity for sale. | Unknown |

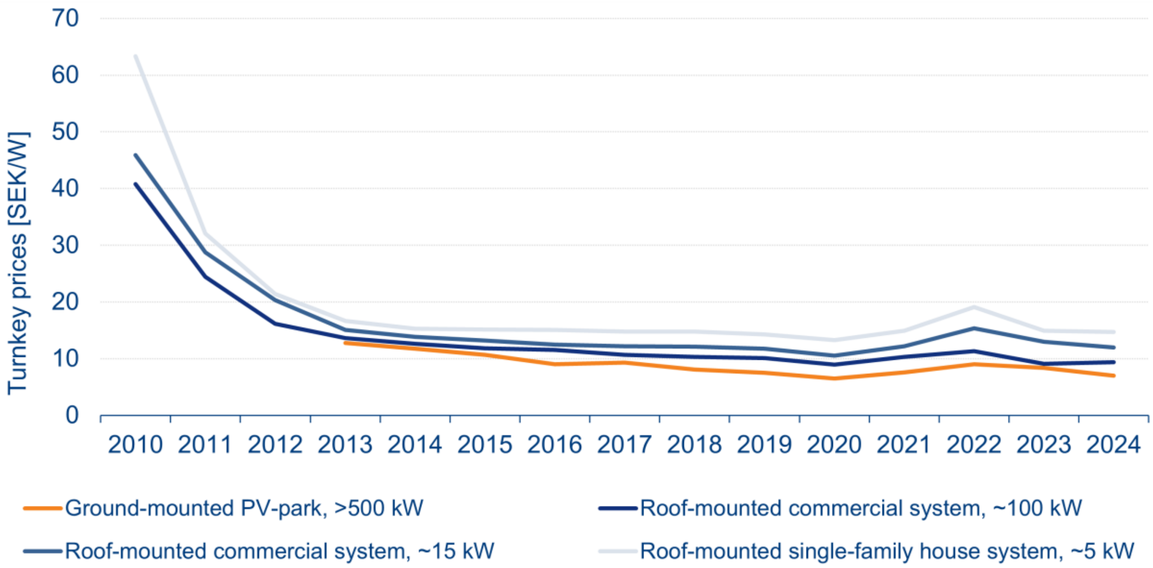


**Figure 6. Historic development of the average typical prices for turnkey PV systems (excluding VAT), reported by Swedish installation companies.**

Since 2013, prices have continued to decrease, though at a slower pace, except for 2021 and 2022. The temporary increase in those years can be linked to disruptions caused by the COVID-19 pandemic and subsequent supply chain constraints.

The ongoing maturation of the Swedish PV market, together with rising competition and low module prices, has since contributed to renewed downward pressure on system prices. As supply chain conditions normalized and hardware availability improved, system prices dropped significantly in 2023 and continued to decline in 2024. According to sales statistics from the 2023 and 2024 surveys, prices have now returned to pre-disruption levels. In numerical terms, the survey results show that small residential systems continued to experience relatively low prices in 2024, with a modest decrease from 14.9 SEK/W in 2023 to 14.7 SEK/W, marking a 1.3 % decline. Small commercial systems decreased more noticeably, from 13.0 SEK/W to 12.1 SEK/W (7 % decrease). Large commercial systems experienced a slight increase, from 9.1 SEK/W to 9.4 SEK/W, while ground-mounted centralized parks decreased from 8.4 SEK/W to 7.1 SEK/W, corresponding to a 16 % decrease.

Overall, these figures indicate that the Swedish PV market returned to price levels similar to those seen in 2021 for residential systems, while centralized and commercial systems continued to show variability depending on project size and type. The substantial drop in ground-mounted park prices in 2024 reflects improved module availability, lower balance-of-system costs, and the easing of supply chain constraints that had increased prices in 2021–2023.

It should be noted, however, that these reported prices are not adjusted for Sweden's high inflation in 2022–2023, as shown in Figure 8. When adjusting for inflation and purchasing power, the relative cost of PV systems in Sweden is hence at its lowest level to date.

The methodology for collecting price statistics is described in Section 8.1.5. Compared to earlier years of sales data collection, installation and sales companies have found it increasingly challenging to provide generalized annual price trends for 2021–2024. This is due to greater volatility in hardware prices in recent years, as well as increased diversification in customer offerings, including a wider range of system sizes, technologies, and options.

In addition, it should be noted that the market segment sizes used in the survey may no longer fully reflect the current Swedish PV market. Today, residential systems are typically larger than 5 kW [11], commercial systems often exceed 15 kW and approach 100 kW, and ground-mounted parks frequently surpass 500 kW. While the prices are reported normalized in SEK/W, the impact of system scale on PV economics remains significant [11]. For the sake of consistency and comparability across years, however, the original size ranges have been maintained in the PV system price survey.

Therefore, the average values presented in this report should be interpreted as indicative trends rather than precise, statistically validated figures.

**Table 10: National trends in system prices for different applications.**

| Year | **Residential BAPV**<br>Grid-connected, roof-mounted, distributed PV system<br>5-10 kW<br>*(historical data for Sweden ~5 kW)*<br>**[SEK/W$_p$]** | **Small commercial BAPV**<br>Grid-connected, roof-mounted, distributed PV systems<br>10-100 kW<br>*(historical data for Sweden ~15 kW)*<br>**[SEK/W$_p$]** | **Large commercial BAPV**<br>Grid-connected, roof-mounted, distributed PV systems<br>100-250 kW<br>*(historical data for Sweden ~100 kW)*<br>**[SEK/W$_p$]** | **Centralized PV**<br>Grid-connected, ground-mounted, centralized PV systems<br>10-50 MW<br>*(historical data for Sweden >0.5 MW)*<br>**[SEK/W$_p$]** |
|---|---|---|---|---|
| 2008 | | 96.00 | 67.00 | |
| 2009 | | 76.00 | 47.00 | |
| 2010 | 63.33 | 45.89 | 40.79 | |
| 2011 | 32.07 | 28.77 | 24.44 | |
| 2012 | 21.43 | 20.29 | 16.13 | |
| 2013 | 16.68 | 15.09 | 13.62 | 12.73 |
| 2014 | 15.28 | 13.81 | 12.63 | 11.77 |
| 2015 | 15.13 | 13.20 | 11.82 | 10.69 |
| 2016 | 15.07 | 12.48 | 11.56 | 9.03 |
| 2017 | 14.81 | 12.22 | 10.70 | 9.30 |
| 2018 | 14.76 | 12.09 | 10.31 | 8.18 |
| 2019 | 14.40 | 11.74 | 10.28 | 7.50 |
| 2020 | 13.27 | 10.50 | 8.92 | 6.50 |
| 2021 | 14.91 | 12.21 | 10.34 | 7.60 |
| 2022 | 19.12 | 15.34 | 11.32 | 9.01 |
| 2023 | 14.88 | 13.04 | 9.11 | 8.38 |
| 2024 | 14.70 | 12.07 | 9.40 | 7.05 |

## 2.3 Cost breakdown of PV installations

In addition to the PV system prices derived from sales statistics, cost breakdown studies have been periodically conducted within the framework of Sweden's participation in the IEA PVPS program. A study on grid-connected, roof-mounted residential PV systems was carried out in 2020 [2]; however, as this survey is now five years old, it is no longer considered representative of the current cost structure. Readers interested in this analysis are referred to the Swedish National Survey Reports (NSRs) from 2020–2023.

For 2024, an in-depth techno-economic study of commercial and industrial (C&I) PV systems in Sweden was conducted as a diploma thesis [12]. The study analysed the cost structure of systems installed during the year, based on surveys distributed to relevant installation companies. Responses were received from nine stakeholders providing detailed economic data for 27 C&I PV systems. In addition to cost breakdowns, the study includes levelized cost of energy (LCOE) calculations, analyses of azimuth and tilt angles, and typical DC/AC ratios. Readers seeking further details on these analyses are referred to the diploma thesis [12].

The average cost structure for the 27 C&I PV systems in SEK/kW is presented in Figure 7 and Table 11 below. It should be noted that system sizes ranged from just under 50 kW to over 500 kW, and economies of scale partly explain the wide variation observed between the lowest and highest prices across some cost categories in Table 11. The profit margin for each system was not collected in the survey, as respondents considered this information commercially sensitive and are hence not included in Figure 7. Consequently, a profit margin of 15% was assumed by the author of this report to enable the derivation of final average prices to the end customer in Table 11.

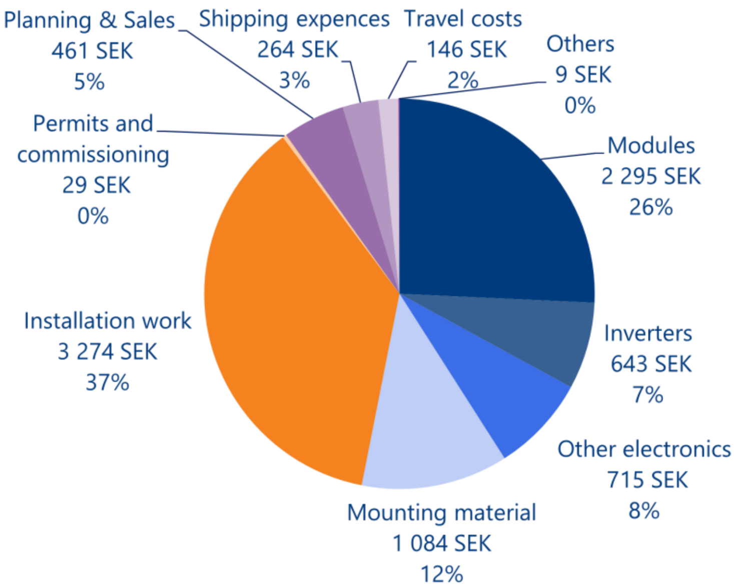


**Figure 7. The average cost structure of C&I PV systems in 2024 in SEK/kW.**

**Table 11: Cost breakdown for grid-connected roof-mounted, distributed C&I systems of 50–500 kW in 2024.**

| Cost category | Average [SEK/kW] | Low [SEK/kW] | High [SEK/kW] |
|---|---|---|---|
| **Hardware** | | | |
| Modules | 2 295 | 1 424 | 3 186 |
| Inverter(s) + power optimizers | 643 | 353 | 904 |
| Mounting material | 1 084 | 723 | 2 062 |
| Other electronics (cables, etc.) | 715 | 236 | 1 253 |
| **Subtotal Hardware** | **4 737** | | |
| **Soft costs** | | | |
| Planning & Sales | 461 | 146 | 1 363 |
| Installation work | 3 274 | 1 580 | 6 387 |
| Shipping and travel expenses to customer | 410 | 86 | 1 096 |
| Permits and commissioning | 29 | 0 | 68 |
| Other | 9 | 0 | 68 |
| **Subtotal Soft costs** | **4 182** | | |
| Project margin | 15% | Unknown | Unknown |
| **Total (excluding VAT)** | **10 257** | | |

## 2.4 Financial Parameters and specific financing programs

Like many other European economies, Sweden experienced a period of economic instability in 2022 and 2023, characterized by elevated energy prices and high inflation. In response, the Swedish Central Bank (Riksbanken) raised the policy rate (styrräntan) from 0.0 percent in beginning 2022 to 4.0 percent, as illustrated in Figure 8.The rate hikes aimed to return inflation towards the 2 percent target within a reasonable timeframe. Following this period of monetary tightening, the Swedish Central Bank maintained a high policy rate throughout most of 2024 before initiating a gradual reduction towards the end of the year — a trend that has continued into 2025. These policy rate adjustments directly influenced market interest rates, resulting in a relatively high cost of capital in Sweden during 2024.

In Figure 8 and Table 10 the average nominal mortgage rates for households, for loans with an initial fixed period of up to 3 months (variable), for residential installations in 2024 has been used.

In addition to mortgage loans, several commercial banks have introduced specialised "solar loans" aimed at individual homeowners with single-family houses. As far as the authors are aware, the first loan explicitly designed for PV installations in Sweden was launched by Sparbanken Syd in 2019 [13]. Since then, others have followed, and in addition to Sparbanken Syd examples of large Swedish banks include Swedbank, SEB, Nordea and Länsförsäkringar which at mid-2025 offered rates of 5.64%, 3.97%, 4.95%, 4.14% and 4.40%, respectively.

For commercial installations in Sweden, a realistic nominal loan rate has been reported to be the STIBOR rate plus 450 basis points (bps).

However, it's important to note that since policy rates have been changing substantially in the period 2022–2024, readers should consider the loan rates in Table 12 as estimates and note that they have not been stable throughout 2024.

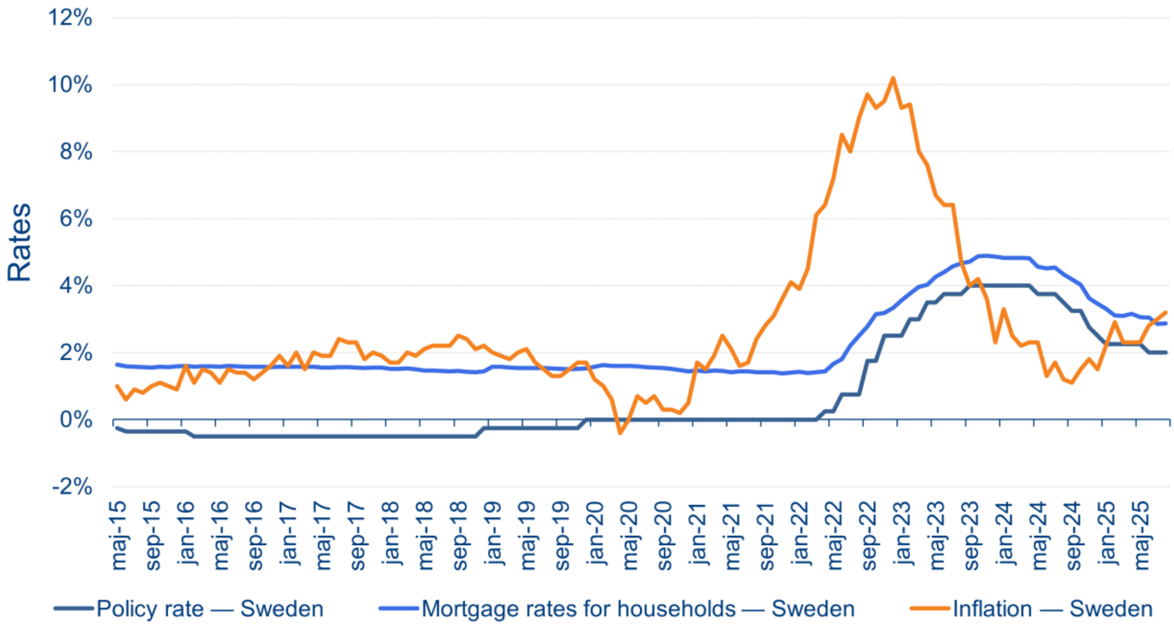


**Figure 8. The historic policy rate, mortgage ratees for households and inflation levels in Sweden.**

**Table 12: PV financing information in 2024.**

| Different market segments | Loan rate [%] |
|---|---|
| Average rate of loans – residential systems [14] | 4.4 % |
| Average rate of loans – commercial systems [15] | 7.0 % |
| Average cost of capital – industrial and ground-mounted systems [15] | 7.0 % |

## 2.5 Specific investments programs

As early as 2009, Sweden's first PV cooperative, Solel i Sala & Heby ekonomisk förening, was formed, entering a FiT agreement with the local utility and ultimately building six systems totaling 599 kWp. Other notable early cooperatives include Solel i Bergslagen (four systems, 166 kWp) and Zolcell 1:1 (two systems, 27 kWp).

The cooperative model has since evolved and been adopted by utilities for larger projects. Private individuals or companies purchase shares corresponding to electricity generation or compensation, which the cooperative applies to electricity bills or pays out monetarily. Examples include the 1 MWp solar tracking park outside Västerås (Mälarenergi and KP), the 600 kWp rooftop system at Nöbble Gård and subsequent 750 kWp staged PV park near Kalmar Airport (Kalmar Energi), and Öresundskraft's 530 kWp landfill PV park near Helsingborg. Karlskrona Solpark (Affärsverken) and Östersunds Solpark (Jämtkraft) further illustrate this model, with crowd-funded stages completed between 2019 and 2020. Tranås Energi and C4 Energi operate PV cooperatives with 1.2 MWp and 4 MWp parks outside Tranås and Kristianstad, respectively. Additional examples highlight Sweden's expanding energy community landscape: HSB Södermanland is developing a 20 MW solar park near Strängnäs, allowing members to purchase shares for fixed, below-market electricity; the village of Simris has achieved 100% renewable energy through PV, wind, and storage; and Stockholm's Hammarby Sjöstad energy community, launched in 2023, includes multiple housing cooperatives and aims to serve over 20,000 residents.

Virtual sharing is a relatively new concept in Sweden, as the country has lagged in implementing EU directives on energy communities and regulatory frameworks. However, an example is Austerland Ekonomisk förening on Eastern Gotland, which operates a 1.7 MW solar PV park as of early April 2025, practicing virtual energy sharing among its members.

**Table 13. Summary of existing investment schemes in Sweden.**

| Investment Schemes | Introduced in Sweden |
|---|---|
| Third party ownership (no investment) | Yes |
| Renting | Yes |
| Leasing | Yes |
| Financing through utilities | Yes |
| Investment in PV plants against free electricity | Yes |
| Crowd funding (investment in PV plants) | Yes |
| Community solar | Yes |
| International organisation financing | No |

## 2.6 Merchant PV / PPA / CPPA

Sweden's PV market is primarily distributed and largely driven by the self-consumption business model. However, this model is only permitted for systems smaller than 500 kW and for on-site consumption (see Section 3.3). Since the termination of the Capital Subsidy Program (see earlier National Survey Reports or [16]) and the suspension of new systems under the renewable electricity certificate program in 2021 (see Section 3.2.3), roof-mounted systems above 500 kWp and larger PV parks have been developed without subsidies. While alternative arrangements exist, power purchase agreements (PPAs) have become the dominant business model for these larger installations.

In Sweden, PPAs are most commonly structured as "as-produced" contracts, where the off-taker purchases electricity as it is generated, often designed financially as contracts for difference (CFDs). Although more dynamic and innovative pricing mechanisms are emerging, fixed-price contracts remain the most common, typically spanning ten years. Guarantees of origin (see Section 3.2.4) are usually included, providing a key incentive for entering a PPA by ensuring the availability and price of renewable electricity over the contract period. Companies value these guarantees for sustainability reporting and to demonstrate active participation in the green transition.

As noted in Section 1.6.1, electricity off-takers are usually commercial actors who actively communicate their engagement in the project.

## 2.7 Additional Country information

Sweden is a country in northern Europe. With a land area of 407 272 km² [17]. Sweden is the fifth largest country in Europe. With a population of 10 587 710 people at the end of 2024, the population density of Sweden is quite low with about 25.8 inhabitants per km², but with a much higher density in the southern part of the country [18]. About 88% of the population lives in urban areas [19].

The typical end-consumer electricity prices for 2024 are presented in Table 14, while the development of household electricity prices in Sweden, with comparisons to other Nordic countries, is illustrated in Figure 9.

**Table 14: Country information 2024.**

| | |
|---|---|
| Retail electricity prices for a household [SEK/W] | 1.9–3.1 SEK/kWh (including grid charges and taxes) |
| Retail electricity prices for a commercial company [SEK/W] | 1.1–2.6 SEK/ kWh (including grid charges and taxes) |
| Retail electricity prices for an industrial company [SEK/W] | 0.8–2.2 SEK/kWh (including grid charges and taxes) |
| Liberalization of the electricity sector | Sweden currently has one of the most liberalised and top ranked electricity systems in the world, due to its (1) high operational reliability — the delivery security was 99.988 % in 2023 [20], (2) high electrification level — 100 % of the total population have access to electricity, and (3) low greenhouse gas emissions — fossil-fuel-based domestic electricity generation in 2024 amounted to ~0.6 TWh, or 0.4% of Sweden's total electricity generation of 169.6 TWh (see Section 1.5). |

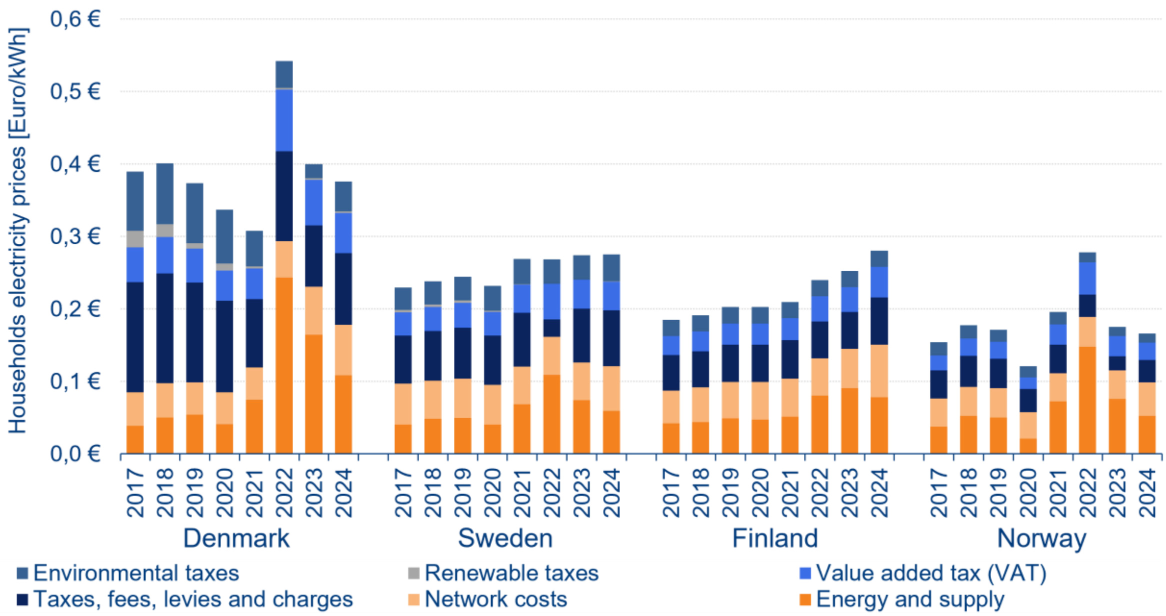


**Figure 9. Electricity price components for households in the Nordic countries between 2017–2024 with annual consumption from 5000 kWh to 14 999 kWh [54].**

## 2.8 Electricity spot prices

Since the introduction of electricity bidding areas on November 1, 2011, the average spot price difference between northern and southern Sweden has been increasing. Since 2011, four nuclear reactors have been shut down, including Ringhals 2 (852 MW net capacity, closed in 2019) and Ringhals 1 (881 MW net capacity, closed in 2020). These closures have contributed both to a higher supply deficit in southern Sweden and to constraints on transmission capacity within the country.

In recent years, increased interconnection capacity between southern Sweden and neighboring countries — for example, the 700 MW NordBalt cable to Lithuania (2015) and the

600 MW SwePol Link HVDC cable to Poland (2000) — has enhanced the ability to export electricity from southern Sweden to continental Europe. This has, in turn, made southern Swedish electricity prices more sensitive to developments in European markets. Consequently, the spot price difference between northern and southern Sweden has tended to increase, reflecting the growing influence of continental electricity prices on the southern regions.

Extreme weather events such as the Dunkelflaute in Germany — prolonged periods of low wind and solar generation during high demand — have further amplified price volatility across Europe, indirectly affecting Swedish electricity markets. Models such as Flowbase have been introduced to better forecast and manage short-term imbalances caused by such events, highlighting the increasing importance of cross-border flows and storage in stabilizing prices.

With the decline in spot prices in 2023, electricity prices continued to decrease in 2024, with the average annual price across all areas falling by 23–38%. However, these prices remain higher than in previous years, except for 2022 and 2023. Similarly, the occurrence of negative prices has become more frequent, increasing from 4–5% of the hours in 2023 to 7–9% of the hours in the Swedish price areas in 2024. The lowest recorded hourly spot price during the year was -0.69 SEK/kWh in all regions except Luleå (SE1), where the lowest price was -0.57 SEK/kWh.

In 2024, electricity prices in Sweden exhibited larger-than-usual fluctuations, with high prices at the beginning and end of the year and lower prices in between. Average day-ahead spot prices across the four Swedish bidding areas — Luleå (SE1), Sundsvall (SE2), Stockholm (SE3), and Malmö (SE4) — ranged from 0.28 to 0.57 SEK/kWh. Prices were identical across all areas for nearly 50% of the hours in the year, slightly lower than the corresponding number of 61% in 2023, indicating that uniform pricing across Sweden has become less common. On average, electricity prices in the south were 0.16 SEK/kWh higher than in central Sweden and 0.29 SEK/kWh higher than in the north.

The highest recorded day-ahead spot electricity price in 2024 was 8.16 SEK/kWh in SE4, significantly higher than the highest price in 2023, recorded at 3.76 SEK/kWh in both southern and central Sweden. This increase occurred despite the lower annual average price in 2024 compared to 2023.

# 3 POLICY FRAMEWORK

This chapter describes the support policies aiming directly or indirectly to drive the development of PV. Direct support policies have a direct influence on PV development by incentivizing or simplifying or defining adequate policies. Indirect support policies change the regulatory environment in a way that can push PV development. Table 15 and Figure 10 summarizes the policy development in Sweden over the years.

**Table 15: Summary of PV support measures**

| Category | Residential | | | Commercial + Industrial | | | Centralized | | |
|---|---|---|---|---|---|---|---|---|---|
| **Measures 2024** | **Legacy** | **On-going** | **New** | **Legacy** | **On-going** | **New** | **Legacy** | **On-going** | **New** |
| Feed-in tariffs | - | - | - | - | - | - | - | - | - |
| Feed-in premium | Yes | Yes | - | (Yes)[1] | (Yes)[1] | - | - | - | - |
| Capital subsidies | Yes | Yes | - | Yes | - | - | Yes | - | - |
| Green certificates | Yes | - | - | Yes | - | - | Yes | - | - |
| Renewable portfolio standards | - | - | - | - | - | - | - | - | - |
| Income tax credits | Yes[2] | Yes[2] | - | (Yes)[2] | (Yes)[2] | - | - | - | - |
| Self-consumption | Yes | Yes | - | Yes | Yes | - | - | - | - |
| Net-metering | Yes[3] | - | - | - | - | - | - | - | - |
| Net-billing | Yes[3] | - | - | - | - | - | - | - | - |
| Collective self-consumption | Yes | Yes | - | Yes | Yes | - | Yes | Yes | - |
| Sustainable building requirements | Yes | Yes | - | Yes | Yes | - | - | - | - |
| BIPV incentives | - | - | - | - | - | - | - | - | - |
| Merchant PV facilitating | - | - | - | - | - | - | Yes | Yes | - |
| Guarantees of origin | Yes | - | - | Yes | Yes | - | Yes | Yes | - |

[1] Only small commercial system <69 kW can benefit from the Swedish feed-in-premium system.
[2] The Swedish feed-in premium is compensated as income tax credits. It is the same system, as the above.
[3] Historically, some local DSOs offered residentials customers net-metering or net-billing schemes

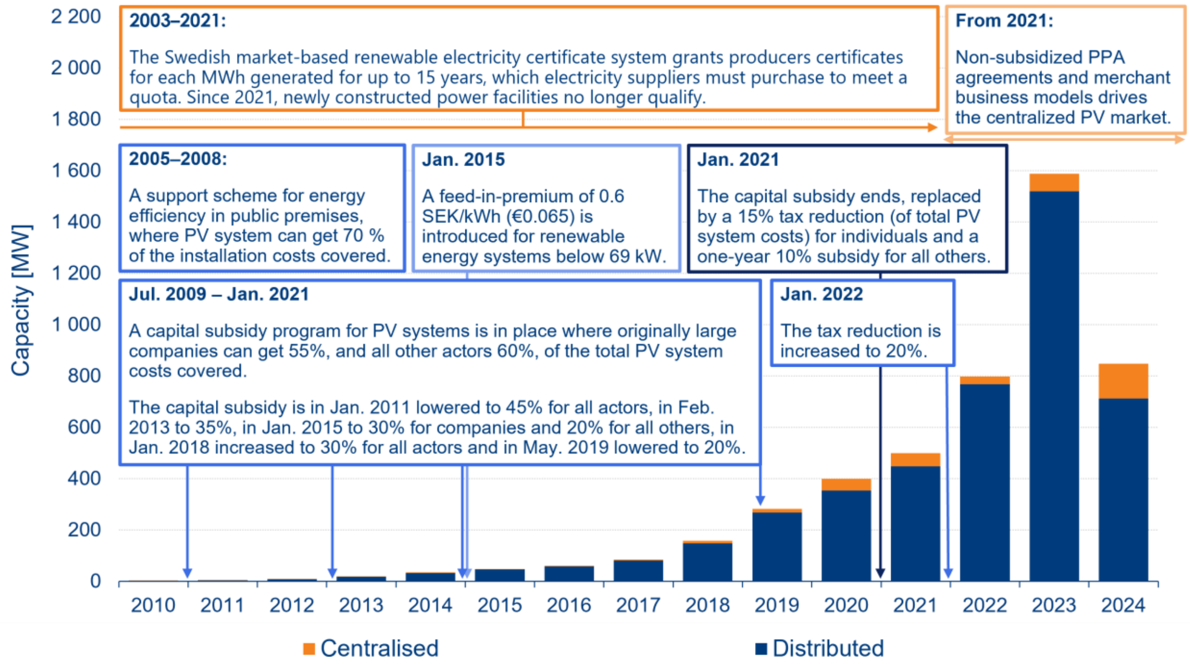


**Figure 10. Annual installed PV capacity in Sweden from 2010 to 2024, segmented into distributed PV systems and centralized PV parks, along with summary on key policy changes and market drivers influencing the deployment trends.**

## 3.1 National targets for PV

Sweden does not have an official target for PV installations.

## 3.2 Direct support policies for PV installations

### 3.2.1 Tax reduction for green technology

*3.2.1.1 Introduction and legal background*

The tax reduction program for green technology gained legal effect January 1st 2021 and replaced three existing support systems, namely the direct capital subsidy for PV installations (2009:689) [21] for private persons, the subsidy for storage of self-produced electricity (2016:899) [22] and the subsidy for private installations of charging points for electric vehicles (2017:1318) [23]. It is often referred to as the *green deduction*.

*3.2.1.2 Administration and mechanism*

The support system is managed and administered by the installers or vendors and ultimately by the Swedish Tax Agency (Skatteverket). It is designed much like the ROT tax deduction (see Section 3.8.3). This means that instead of the system owner applying for the economic support and handling the process — as was the case with the capital subsidy program it replaced — the tax deduction reduces the price for the house owner already on the invoice, and the installers or vendors will report the deducted amounts to the tax authorities.

*3.2.1.3 Deduction levels and eligibility*

This system provides a percentual tax deduction for the hardware and installation costs of the three energy efficiency measures for private house owners. PV installations are offered a 20% deduction, while batteries and charging points for electric vehicles get a 50 % tax deduction.

This deduction can be made by private individuals and can be used once per year and person. There is a maximum annual accepted amount of 50 000 SEK. In the case of all three measures being installed at once, which has both cost and installation benefits, there is a possibility that the maximum amount will be reached. Since PV have the lowest deduction level, the regular ROT-tax deduction might be applied to the PV installation while the charging point and the battery installation is included in the green deduction.

To facilitate the administration for both companies and the Swedish Tax Agency, a level of 97% of the total investment cost has been approved as deductible costs for the green deduction [24]. The support can logically only be given if the system owners have paid enough tax to deduct.

*3.2.1.4 Market uptake and trends*

Table 16 confirms the strong growth of Sweden's domestic grid-connected PV segment, consistent with the trends shown in Table 3. In 2023, installations of small-scale systems (≤20 kW), mainly in the residential sector, increased markedly. Data from the tax deduction program also indicate a marked increase rise in residential battery installations that year. Since eligibility for the tax deduction requires that the battery is connected to a PV system or other renewable electricity source, these systems can confidently be categorized as residential solar batteries. The growing uptake of BESS contributed to the expansion of the residential PV market, as the combination of tax incentives, volatile electricity prices, and aggregator-based grid services made batteries a rational complement to PV systems.

In the first two years of the green tax deduction, most funds went to EV chargers. However, in 2024, deductions for chargers fell by 5% in number and 12% in value. For PV systems, the number of homeowners using the deduction decreased by 61% in 2024 after having increased by 106% the year before, and the total deductible funds dropped by 75% following a 155% rise in 2023. In contrast, the use of the deduction for BESS continued to grow — up 30% in users and 40% in funds between 2023 and 2024 — following earlier surges of 199% (2022–2023) and 559% (2021–2022), though from a low base.

**Table 16. Statistics about the tax reduction for green technology [25].**

| | Number of buyers of PV systems that received the green deduction | | | | Total amount deducted inside the green deduction system [SEK, thousands] | | | | Average amount of tax deduction per buyer of green technology [SEK, thousands] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Solar PV | EV Chargers | BESS | Total | Solar PV | EV Chargers | BESS | Total | Solar PV | EV Chargers | BESS | Total |
| **2021** | 22 171 | 53 958 | 2 163 | 72 304[1] | 473 251 | 577 791 | 65 890 | 1 116 933 | 21.3 | 10.7 | 30.5 | 15.4 |
| **2022** | 59 090 | 94 857 | 14 244 | 143 350[1] | 1 297 491 | 1 013 881 | 453 074 | 2 764 445 | 22.0 | 10.7 | 31.8 | 19.3 |
| **2023** | 121 934 | 81 394 | 42 598 | 197 960[1] | 3 305 822 | 820 815 | 1 439 293 | 5 565 930 | 27.1 | 10.1 | 33.8 | 28.1 |
| **2024** | 48 115 | 77 304 | 55 385 | 144 526[1] | 812 663 | 718 321 | 2 008 588 | 3 539 571 | 16.9 | 9.3 | 36.3 | 24.5 |

[1] Since the same buyer can use the green deduction for several green technologies, the total number of buyers is lower than the sum of the buyers having used the green deduction for each green technology.

PV installations have historically accounted for the largest share of deducted funds, reflecting both their higher investment cost and wider adoption, but on annual basis BESS surpassed PV in 2024. For BESS, the tax deduction data is likely capturing most residential installations nationwide. Although the scheme tracks cost rather than technical details like capacity, the continued increase in battery deductions despite fewer new PV systems suggests that BESS is increasingly being added to existing installations rather than installed concurrently.

*3.2.1.5 Financial impact and total PV investment estimates*

Considering that the green deduction accounted for 14.6% (97% of 15%) of the total investment for a residential PV system in 2021 and 19.4% (97% of 20%) in 2022, 2023 and 2024, one can estimate that approximately 3.24 billion SEK was invested in the private residential PV sector in 2021, 6.69 billion SEK in 2022, and 17.05 billion SEK in 2023 and 4.19 billion SEK in 2024. It is however important to note that there are simplifications to this estimate. Firstly, for the deduction to apply, the PV system owner must have paid sufficient taxes to cover the full deduction. Therefore, the actual deducted amount may be less than the full 14.6% respective 19.4% of the total investment these years. While most private individuals are likely eligible for the full deduction, there could be exceptions. Secondly, since there is a maximum deduction limit of 50 000 SEK within the program, it's possible that the ROT-deduction (see Section 3.8.3) is used instead of the green deduction when installing multiple green technologies, especially since PV has a lower deductible share than EV chargers and BESS. Lastly, there might be special cases where the total cost of the PV installation alone exceeds the total deductible amount.

*3.2.1.6 Advance Payment Rules for the Green Tax Deduction*

The Green Tax Deduction has generally been well received by both PV installers and customers in Sweden since it replaced the former direct capital subsidy. However, the Swedish Solar Energy Association has identified a practical issue: the deduction is only validated after the final invoice is paid, and it is tied to the calendar year. In practice, installers often request advance payments of 10–80% as a security measure, while the final invoice typically covers only the last stage of work.

This structure causes no problem when all payments occur within the same year, but complications arise when advance payments are made in one year and the installation is completed in the next. In such cases, only the portion paid in the final year qualifies for the deduction.

To address this, the Ministry of Finance issued a memorandum for public consultation in early 2024 proposing an amendment to include advance payments in the eligible total. The amendment was finalized in November 2024 and will take effect on January 1, 2025, allowing payments made the year before completion to qualify for the deduction [26]. This change is expected to simplify administration and better reflect industry payment practices.

*3.2.1.7 Clarification of green tax deduction rules for solar batteries*

In late 2023, a new issue arose that could affect the Swedish residential market for PV systems and solar batteries. The concern related to whether a battery remains eligible for the Green Tax Deduction if it is used for purposes beyond increasing self-sufficiency in self-produced renewable electricity. Alternative uses such as spot-price arbitrage (charging from the grid during off-peak hours and discharging at peak hours), peak shaving, and participation in grid and frequency support markets raised uncertainty among installers and consumers.

The matter gained attention following a discussion in late 2023 and a clarification from the Swedish Tax Agency in early 2024, which initially stated that eligible batteries must be connected to a grid-tied renewable generation system and used primarily for storing self-produced electricity for later household consumption.

After further public and regulatory debate, the Swedish Tax Agency issued an updated clarification later in 2024. The revised interpretation allows tax deductions for batteries used partly for ancillary services or electricity price arbitrage, as long as they are also used — fully or partially — to store self-generated electricity. This adjustment provides greater flexibility and better reflects emerging use cases for residential energy storage.

*3.2.1.8 Planned Adjustment to PV Tax Reduction*

Looking ahead, the Swedish government plans to reduce the tax deduction for PV installations from 20% to 15%, effective July 1, 2025. This adjustment reflects the rapid growth of installations, which has reduced the need for subsidies, and aims to promote a market-driven expansion guided by electricity price signals, supporting Sweden's long-term energy security and policy goals [27].

### 3.2.2 Tax credit for micro-producers of renewable electricity

On 1 January 2015, an amendment to Sweden's Income Tax Act introduced a tax credit (income tax reduction) for micro-production of renewable electricity [28]. The credit is **0.60 SEK per kWh** for surplus renewable electricity fed into the grid at the same connection point (with fuse ≤ 100 A). The right to receive it applies to both private individuals and legal entities.

To qualify for the tax credit, the PV system owner must satisfy the following conditions:

- The excess electricity must be fed into the same connection point as where electricity is consumed.
- The connection point must have a fuse of up to 100 amperes.
- The producer must notify the grid owner that the connection point produces renewable electricity.

The tax credit amount is determined by the number of kWh fed into the grid at that connection point during a calendar year. However, there are limitations:

- The credit cannot exceed the number of kWh purchased from the grid at the same connection point in the same year.
- The credit is capped at a maximum of 30,000 kWh per year, or equivalently up to SEK 18,000 (0.60 × 30,000).

The grid owner is responsible for measuring net flows (electricity fed and consumed) at the connection point and supplying this data to the Swedish Tax Agency (Skatteverket). The tax credit is then incorporated into the income tax return filed in the following year.

This tax credit of 0.60 SEK/kWh acts similarly to a small **feed-in premium** for surplus electricity, supplementing other revenue streams such as retailer remuneration (see Section 6.2), grid benefit compensation (see Section 3.10.2.2), and earnings from renewable certificates (see Section 3.2.3) or guarantees of origin (see Section 3.2.1.8). However, unlike many feed-in tariffs or premiums, there is no guarantee on how many years this tax credit will remain active; it is dependent on policy decisions.

Consequently, in autumn 2024, the Swedish government proposed abolishing the tax credit for micro-producers effective 1 January 2026 [27], with the same justification as the reduction of the Tax reduction for green technology from 20% to 15% as presented in Section 3.2.1.

The proposal will have a negative effect on the Swedish residential PV market but will probably be positive for the deployment of residential BES, as the value of the excess electricity from a PV system will decrease significantly.

According to the Swedish Tax Agency, a total of 261 698 micro-producers of renewable electricity collectively received 951 709 951 SEK for the excess electricity they supplied to the grid in 2024 [29]. This calculation is based on the 1 625 696 kWh of excess electricity reported by grid operators to the Swedish Tax Agency. On average, micro-producers with a capacity of less than 100 amperes contributed with 6 045 kWh of electricity to the grid in 2024, as summarized in Table 17. The reader should note a slight variation in the figures compared to last year's report, which applies retroactively to all years. This is because the Swedish Tax Agency makes retroactive adjustments when new data is available.

**Table 17. Statistics about tax credit for micro-producers of renewable electricity [29].**

| Year | Number of micro-producers | Paid funds each year [SEK] | The basis (excess electricity) of the tax reduction [kWh] | Average electricity fed into the grid per micro-producer [kWh/micro-producer] |
|---|---|---|---|---|
| 2015 | 5 051 | 10 766 633 | 18 427 927 | 3 567 |
| 2016 | 7 722 | 18 643 902 | 31 724 664 | 4 043 |
| 2017 | 11 745 | 29 299 902 | 49 535 391 | 4 148 |
| 2018 | 20 415 | 57 543 195 | 97 536 068 | 4 697 |
| 2019 | 36 182 | 103 079 151 | 174 739 419 | 4 750 |
| 2020 | 55 528 | 182 409 099 | 308 231 132 | 5 475 |
| 2021 | 78 600 | 246 598 541 | 417 875 239 | 5 223 |
| 2022 | 126 405 | 415 690 357 | 707 083 017 | 5 433 |
| 2023 | 218 819 | 731 802 510 | 1 254 449 149 | 5 532 |
| 2024 | 261 698 | 951 709 951 | 1 625 695 708 | 6 045 |
| **Total** | **-** | **2 747 543 241** | **4 685 297 714** | **-** |

These figures cover all small-scale renewable energy, not just PV. Historically, systems under 69 kW — the 100-ampere limit for the tax reduction — have been analysed to estimate the PV share in the green electricity certificate system (see Section 3.2.3). While this provides only a rough estimate due to variations in generation and self-consumption, PV has consistently dominated small-scale renewable systems, and it can be assumed that PV stand for ~98% of the numbers in Table 17.

### 3.2.3 The renewable electricity certificate system

The renewable electricity certificate system operates on the principle that producers of renewable electricity receive government-issued certificates for each MWh of renewable electricity they generate. Meanwhile, certain players on the electricity market have a quota obligation, meaning they must purchase certificates corresponding to a set share of the electricity they sell or consume. These certificates provide extra income to producers alongside their electricity sales revenue. Ultimately, the cost of these certificates is passed on to electricity consumers, affecting their electricity prices.

Eligible energy sources for certificates include wind, small hydropower, some biofuels, solar PV, geothermal energy, wave, and peat in power generation. Each electricity generation facility can earn certificates for up to 15 years, with a cutoff in 2035.

The quota-bound stakeholders are:

1. Electricity suppliers
2. Electricity consumers using more than 60 MWh annually from a plant with over 50 $kW_p$ capacity
3. Electricity consumers using imported or Nordic power exchange-purchased electricity
4. Producers commercially annually supplying more than 60 MWh of electricity to a grid without grid concession (nätkoncession), if it's used by consumers on the same grid
5. Electricity-intensive industries registered by the Swedish Energy Agency.

The system began in Sweden in 2003 to boost renewable electricity use. Initially, the goal was to increase annual renewable energy generation by 17 TWh by 2016 compared to 2002 levels. In 2012, Sweden and Norway established a joint certificate market with a target of increasing renewable electricity generation by 26.4 TWh between 2012 and 2020. This common market allows the trading of both Swedish and Norwegian certificates to meet quotas. In March 2015, Sweden and Norway increased their combined goal to 28.4 TWh by 2020, funded primarily by Swedish consumers [30]. Additionally, in 2017, the system was extended until 2030 with an additional 18 TWh of renewable electricity, gradually increasing by 2 TWh each year from 2022 to 2030 [31]. Due to rapid wind power expansion, this goal was reached in March 2021 [32].

To prevent certificate prices from plummeting and adversely affecting early investors, the Swedish government made changes in November 2020. It was decided that power generation constructed after 2021 would no longer be eligible for certificates, and the system's termination was advanced to 2035 from the previous 2045 end date [33]. This transition means that some PV systems in Sweden still benefit from the certificate system, but it is gradually being phased out.

In 2024, the average price was 6.41 SEK/MWh, which is lower than the average certificate price of 9.07 SEK/MWh in 2023 [34]. Before this, two sharp price drops occurred: in 2021, the average price fell to 18.9 SEK/MWh — down from 69.6 SEK/MWh the previous year and from as high as 120.7 SEK/MWh in 2019 [35]. The quota obligation was increased to 27.3% in 2024, reversing the downward trend of recent years that had brought it to 25.1% in 2023. This followed a brief uptick to 26.2% in 2022, which interrupted the earlier declines from 30.5% in 2019 to 26.3% in 2020, 25.5% in 2021, and 25.1% in 2023 [36].

Until 2005, there were no PV systems included in the electricity certificate system [37][34]. However, as indicated in Table 18, the number of approved PV installations has grown steadily until 2020, with a majority of the number of approved plants in the certificate system now being PV systems. Nevertheless, these PV systems account for only a small fraction of the total installed power and generated certificates.

After the amendment stipulating that no power generation constructed after 2021 would qualify for certificates, the Swedish Parliament introduced an annual administrative fee of 200 SEK for owners of certificate trading accounts, effective from July 1st, 2021, [38]. This change rendered participation in the renewable electricity certificate system unprofitable for owners of smaller PV systems, including many villa owners. To avoid the account fee, PV system owners had to close their electricity certificate accounts before May 31st, 2021, resulting in the revocation of the approval of their systems for electricity certificates. This explains the significant drop in systems approved for electricity certificates at the end of 2021, along with the reduced number of certificates issued to PV systems, as seen in Table 18. It's evident in Table 18 that only larger PV systems continue to benefit from the electricity certificate system, as the average system size more than doubled when 67% of the PV systems withdrew their participation in the program between 2020 and 2021.

**Table 18. Statistics about PV in the electricity certificate system [39][34][37].**

| | Number of approved PV systems in the certificate system at the end of each year | Total approved solar power in the certificate system at the end of each year | Average size of PV systems in the certificate system at the end of each year | Number of issued certificates from solar cells per year. Each certificate corresponds to 1 MWh. | Number of produced certificates eligible in kWh per installed power and year |
|---|---|---|---|---|---|
| 2006 | 3 | 103 kW | 34.3 kW | 20 MWh | 194 kWh/kW |
| 2007 | 6 | 184 kW | 30.6 kW | 19 MWh | 103 kWh/kW |
| 2008 | 16 | 508 kW | 31.7 kW | 129 MWh | 254 kWh/kW |
| 2009 | 27 | 1 059 kW | 39.2 kW | 212 MWh | 200 kWh/kW |
| 2010 | 62 | 3 227 kW | 52.1 kW | 278 MWh | 86 kWh/kW |
| 2011 | 138 | 4 196 kW | 30.4 kW | 556 MWh | 133 kWh/kW |
| 2012 | 395 | 8 104 kW | 20.5 kW | 1 029 MWh | 127 kWh/kW |
| 2013 | 972 | 18 419 kW | 19.0 kW | 3 705 MWh | 201 kWh/kW |
| 2014 | 1 866 | 36 437 kW | 19.5 kW | 10 771 MWh | 296 kWh/kW |
| 2015 | 3 270 | 63 934 kW | 19.6 kW | 24 544 MWh | 384 kWh/kW |
| 2016 | 5 107 | 104 070 kW | 20.4 kW | 45 535 MWh | 438 kWh/kW |
| 2017 | 7 428 | 159 050 kW | 21.4 kW | 74 148 MWh | 466 kWh/kW |
| 2018 | 11 282 | 250 912 kW | 22.2 kW | 120 919 MWh | 482 kWh/kW |
| 2019 | 16 683 | 380 227 kW | 22.8 kW | 181 908 MWh | 478 kWh/kW |
| 2020 | 19 903 | 492 759 kW | 24.8 kW | 290 152 MWh | 589 kWh/kW |
| 2021 | 6 615 | 333 954 kW | 50.5 kW | 255 206 MWh | 764 kWh/kW |
| 2022 | 6 279 | 338 442 kW | 53.9 kW | 248 072 MWh | 733 kWh/kW |
| 2023 | 5 301 | 321 682 kW | 60.6 kW | 224 318 MWh | 697 kWh/kW |
| 2024 | 4 913 | 308 844 kW | 63.3 kW | 180 103 MWh | 579 kWh/kW |

180 103 certificates were issued to PV in 2024 [34]. This is only about 0.4% of the theoretical electricity generation of 4 800 MW × 900 kWh/kW ≈ 4 320 GWh from all grid-connected PV systems in Sweden. The reader should note that the calculation above is very simplified, especially since the whole cumulative grid-connected PV power at the end of 2024 was not up and running throughout the whole year. In 2024, 308.8 MW of PV power was still in the certificate system [37], making it 6 % of the total installed PV grid-connected capacity.

In summary, the current form of the renewable electricity certificate system has primarily benefited larger PV systems and parks constructed before the close of 2021. Neither currently nor historically has it offered substantial support to smaller PV systems in Sweden.

### 3.2.4 Guarantees of origin

Guarantees of Origin (GOs) were introduced in Sweden on 1 December 2010 as electronic certificates that verify the source of electricity generation. For each megawatt-hour (MWh) of electricity produced, electricity producers can apply to receive a GO issued by the Swedish Energy Agency, which serves as the national issuing body under the Act (2010:601) and Regulation (2010:853) on Guarantees of Origin. Applying for GOs remains a voluntary process.

GOs can be traded on the voluntary market, typically between electricity producers, brokers, and utilities seeking to document the origin of the electricity they sell. When a supplier uses GOs to demonstrate that a certain quantity of electricity sold to customers originates from a specific source, the corresponding GOs are annulled (makulerade). This annulment ensures that the amount of certified electricity sold matches the amount produced from that energy source, preventing double counting.

A utility company wishing to sell electricity from, for example, solar PV can do so in two ways: by annulling GOs issued for its own PV generation, or by purchasing GOs from an independent PV producer and annulling them when selling the electricity to its customers.

On 1 June 2017, amendments to the Swedish GO Act (2010:601) and Regulation (2010:853) empowered the Swedish Energy Agency to issue GOs that can be transferred across EU and EEA member states [40]. This alignment with the EECS (European Energy Certificate System) standard facilitated cross-border trading of renewable electricity certificates and integrated Sweden into the AIB (Association of Issuing Bodies) network.

According to Svensk Kraftmäkling (SKM), the largest brokerage firm in the Nordic electricity certificate market, prices for solar GOs started 2023 at historically high levels — around €8.6/MWh — following the record-high prices of 2022. These peaks were primarily driven by the extremely weak hydrological balance in the Nordic region and the European gas crisis. Prices normalized during the spring of 2023, declining steadily to around €1.25/MWh by the end of the year. Consequently, the former premium that solar GOs held over the benchmark Nordic hydro GOs, became negligible in 2024 and were sold at around €1/MWh. The volume of traded solar GOs remains relatively small, largely because buyers of electricity from large new utility-scale PV plants often require the associated GOs to be included within their power purchase agreements (PPAs) (see Table 19 for historical statistics on issuance, transfers, annulments, and trade of solar GOs in Sweden).

Since 1 October 2021, GOs may only be issued for electricity fed into a grid covered by a grid concession (nätkoncession). Previously, GOs could also be issued for electricity delivered within grids that lacked such concession — for example, internal local grids or off-grid systems. This regulatory change ensures consistency between the physical electricity system and the traceability of renewable energy generation.

**Table 19. Statistics about solar guarantees of origin [41][39].**

| Year | Solar GOs issued in Sweden | Solar GOs transferred within Sweden | Solar GOs imported to Sweden | Solar GOs exported from Sweden | Solar GOs nullified in Sweden | Solar GOs that expired in Sweden |
|---|---|---|---|---|---|---|
| 2011 | 194 | 96 | - | - | 0 | 0 |
| 2012 | 378 | 173 | - | - | 104 | 90 |
| 2013 | 2 337 | 1 373 | - | - | 324 | 294 |
| 2014 | 7 846 | 4 563 | - | - | 1 510 | 972 |
| 2015 | 18 953 | 11 301 | - | - | 5 314 | 2 830 |
| 2016 | 36 702 | 22 183 | - | - | 11 966 | 9 454 |
| 2017 | 58 806 | 65 936 | 1 481 437 | 69 279 | 96 442 | 16 146 |
| 2018 | 111 143 | 1 306 626 | 568 832 | 1 467 852 | 317 189 | 29 499 |
| 2019 | 166 670 | 894 568 | 1 527 014 | 526 292 | 976 716 | 51 935 |
| 2020 | 272 646 | 943 181 | 1 383 593 | 373 746 | 927 148 | 68 924 |
| 2021 | 316 475 | 518 255 | 969 157 | 201 969 | 952 894 | 111 143 |
| 2022 | 383 928 | 967 315 | 2 376 906 | 120 393 | 2 881 142 | 115 057 |
| 2023 | 404 099 | 567 518 | 1 256 963 | 137 908 | 972 134 | 232 123 |
| 2024 | 393 582 | 606 977 | 2 371 200 | 846 020 | 1 673 911 | 128 179 |

### 3.2.5 BIPV development measures

In 2024, Sweden did not have any specific measures in place for BIPV.

### 3.2.6 Merchant PV development measures

Virtual PPAs have become increasingly common in the Swedish market, enabling developers to secure stable revenue streams for centralized PV projects. These agreements provide a hedge against fluctuating spot prices and rely on Guarantees of Origin (GOs) (see Section 3.2.1.8 to track and verify the bilateral trade of PV electricity between the producer and the off taker.

## 3.3 Self-consumption measures

Self-consumption of PV electricity is allowed in Sweden, and it is the primary business model that is driving the market. Numerous utilities provide a range of agreements for surplus electricity generated by micro-producers.

Since the spring of 2014, an ongoing discourse has unfolded regarding the applicable tax regulations for micro-producers. Consequently, there have been several amendments to various tax laws during this period. This section outlines some specific tax regulations that have an impact on self-consumption and micro-producers in Sweden.

**Table 20: Summary of self-consumption regulations for private PV systems in 2024.**

| | | | |
|---|---|---|---|
| PV self-consumption | 1 | Right to self-consume | Yes |
| | 2 | Revenues from self-consumed PV | Savings on the electricity bill |
| | 3 | Charges to finance Transmission, Distribution grids & Renewable Levies | None |
| Excess PV electricity | 4 | Revenues from excess PV electricity injected into the grid | Various offers from utilities + 0.6 SEK/kWh + Feed in compensation from the grid owner |
| | 5 | Maximum timeframe for compensation of fluxes | One year |
| | 6 | Geographical compensation (virtual self-consumption or metering) | On-site only |
| Other characteristics | 7 | Regulatory scheme duration | Subject to annual revision |
| | 8 | Third party ownership accepted | Yes |
| | 9 | Grid codes and/or additional taxes/fees impacting the revenues of the prosumer | Grid codes requirements |
| | 10 | Regulations on enablers of self-consumption (storage, DSM…) | Tax reduction for green technology |
| | 11 | PV system size limitations | 1.Below 100 A and maximum 30 MWh/year for the tax credit.<br>2.Below 500 kWp for no energy tax on self-consumed electricity. |
| | 12 | Electricity system limitations | None |
| | 13 | Additional features | Feed-in compensation from the DSO |

### 3.3.1 General taxes on electricity

In Sweden, taxes and fees are levied on both the production and consumption of electricity. These include property taxes, fuel taxes, emissions taxes, and energy taxes.

For electricity consumption, the primary taxes are the energy tax on electricity and the value-added tax (VAT). As of 2024, the energy tax on electricity for residential customers is 0.535 SEK/kWh (excluding VAT), which represents a 9.2% increase from the previous rate of 0.490 SEK/kWh in 2023.

Additionally, a 25% VAT is applied to the energy tax, resulting in an effective energy tax rate of approximately 0.669 SEK/kWh for residential consumers.

However, some municipalities in northern Sweden have a lower energy tax rate. For consumers living in these municipalities with reduced electricity tax, a deduction of 0.096 SEK/kWh is applied

The energy tax rate for manufacturing and agriculture industries is set at the minimum rate stipulated by the EU Energy Tax Directive, which is 0.50 EUR per MWh (equivalent to approximately 0.535 SEK/kWh).

Sweden also imposes a carbon tax on fossil fuels. As of 2024, the carbon tax rate is 1.45 SEK per kilogram of $CO_2$ emitted.

### 3.3.2 Energy tax on self-consumption

In Sweden, all electricity consumed is generally subject to the energy tax under the Energy Tax Act (1994:1776). However, there are exemptions for self-consuming electricity from small-scale production facilities. For solar PV, the exemption threshold is 500 kW, which refers to the combined rated capacity of the panels. According to the Swedish Tax Agency (Skatteverket), the inverter capacity or differences between actual conditions and standard test conditions should not be considered when calculating the total installed peak capacity of a PV system.

The energy tax is levied on the consumer of electricity, meaning that no energy tax is payable on electricity sold to the grid. For self-consumed electricity from PV systems to be exempt from tax, three conditions must be met:

1. The electricity must be produced in a PV system with a total installed capacity of less than 500 kW.
2. The producer must control total PV capacity below 500 kW.
3. The electricity must not be fed into a grid subject to concession obligations.

A PV system is considered a single unit if installed on a connected building, even if panels are located on different roof surfaces and connected to separate meters.

Those who control a PV system exceeding 500 kW are considered electricity producers and are liable for energy tax on all electricity used, including self-consumption. This also applies to owners of multiple smaller systems whose combined capacity exceeds 500 kW. For those not classified as producers, the grid owner collects and reports the energy tax to Skatteverket.

For PV systems under 500 kW, owners are entitled to a full tax exemption for self-consumed electricity, effectively paying 0 SEK/kWh. The Swedish Solar Association continues to advocate for the removal of energy tax on self-consumed electricity, noting that its elimination could significantly increase solar production in the country.

With regards to the rules described above, Sweden stands out in the EU with the most restrictive energy taxation on self-consumption of PV electricity [42].

### 3.3.3 Collective self-consumption, community solar and similar measures

In Sweden, collective self-consumption from a photovoltaic (PV) system within an apartment building is permitted, provided that all apartments share the same electricity subscription. This arrangement is common among housing companies and housing societies. Typically, the entire apartment building holds a single electricity contract with the utility, and electricity costs are either included in the rent or measured and billed internally by the housing company or society.

To modernize legislation concerning electricity grids, an exception to the IKN Ordinance came into effect on January 1, 2022, [43]. This exception allows property owners to establish low-voltage microgrids for sharing and storing renewable electricity. Under this provision, internal low-voltage grids can operate as a supplement to the public grid within a limited area, provided they are confined to the property owner's premises or adjacent properties. However, the practical implementation of these criteria can be subject to different interpretations, and clarity may be sought through binding legal responses from the Energy Markets Inspectorate (Ei).

As of January 14, 2025, the Swedish government introduced updates to the IKN Ordinance, enabling the installation of large-scale PV systems in combination with various energy storage systems without requiring a grid concession [44]. These new regulations allow energy production facilities to connect to energy storage units within a confined area — even if they do not share a common connection point — and extend to storage systems beyond just batteries. This adjustment increases flexibility for large-scale PV and energy system installations.

Currently, there is no well-defined implementation of energy communities in Sweden, nor a clear definition that fosters widespread adoption in society. According to the definitions in the European directives (Directive 2018/2001 on the promotion of the use of energy from renewable sources and Directive 2019/944 on common rules for the internal market for electricity), there are few to no energy communities in Sweden. In 2024, the Government tasked the Swedish Energy Agency with investigating the conditions for energy communities and the potential need for enabling measures

## 3.4 Tenders, auctions & similar schemes

There were no national or regional tenders or auctions in 2024 in Sweden.

## 3.5 Other utility-scale measures including floating or agricultural PV

As of 2024, Sweden does not offer specific national or regional subsidies for utility-scale photovoltaic (PV) systems. The primary support mechanisms previously available to this sector have either expired or are no longer applicable. These included:

1. **Direct Capital Subsidy**: This program provided up to 1.2 million SEK per system, expired in mid-2020. It was primarily designed for smaller installations and had limited applicability to large-scale PV parks.
2. **Green Electricity Certificate System** (see Section 3.2.3): This market-based support scheme for renewable electricity production was terminated for new facilities at the end of 2021. Existing facilities approved before this deadline remain eligible for certificates until 2035, but no new projects can benefit from this scheme.
3. **Guarantees of Origin System** (see Section 3.2.4): While still operational, this system certifies the renewable origin of electricity but does not provide direct financial support financed by the government for new utility-scale PV installations.

Consequently, since 2022, the utility-scale PV sector in Sweden has been developing under unsubsidized market conditions. Despite the absence of direct subsidies, the sector has shown resilience and growth. In 2024, approximately 136.2 MW of centralized ground-mounted PV capacity was added, indicating a 99% increase compared to 2023 (see Section 1.2). This growth suggests that utility-scale PV projects can still be competitive and viable in the Swedish market, even without direct financial support.

### 3.5.1 Property taxes

Power generation facilities in Sweden are subject to the real estate tax applicable to industrial properties. Although PV parks are very few, they are not explicitly classified under the “power production unit” category in Fastighetstaxeringslagen. In practice, the Swedish Tax Agency (Skatteverket) has treated large PV parks as “other buildings,” taxing them at the industrial property rate. Currently, the property tax rate for industrial properties and most electricity generation facilities is 0.5% of the assessed property value.

Recent policy proposals (2025) aim to harmonize taxation by raising the property tax rate for wind turbines (which presently may benefit from lower rates under certain conditions) to 0.5% across the board for electricity production units. However, as of now, there is no confirmed change establishing PV parks explicitly as “power production units” in legislation; their classification remains under “other buildings” for property tax purposes.

## 3.6 Social Policies

There was no social policy measures directed to PV in Sweden in 2024.

## 3.7 Retroactive measures applied to PV

Sweden has not applied any retroactive measures to historical PV subsidies so far. The proposed change to reduce the green technology tax reduction for PV from 20% to 15% has been announced (see Section 3.2.1) but is not retroactive and will only affect new or future installations under specified conditions. However, the cancellation of the tax credit for micro-producers of renewable electricity (the Swedish feed-in premium) as of 2026 (see Section 3.2.1.8) will also affect existing PV systems and reduce their profitability. Nevertheless, since this scheme never had a formally defined end date, it is debatable whether its cancellation can be considered a retroactive measure.

## 3.8 Indirect policy issues

### 3.8.1 Rural electrification measures

There were no dedicated rural electrification programs or legislation in Sweden in 2024. While some initiatives support grid expansion or capacity improvements, they are not specifically designed or presented as rural electrification measures.

### 3.8.2 Support for electricity storage and demand response measures

In Sweden, the framework for electricity storage and demand-side flexibility is still developing, with a growing emphasis on integrating flexibility into the national power system.

Under the Electricity Act (Ellagen), DSOs are prohibited from imposing technical or administrative requirements that unnecessarily hinder demand flexibility, as long as system reliability is not compromised. This aligns with the Swedish government’s broader aim to make it easier for consumers and third parties to contribute to balancing and optimizing the electricity system.

To enable this, the role of “aggregator” — a service provider that pools and trades flexibility from multiple consumers — was formally introduced into Swedish legislation in 2023. Complementing this, the government has tasked the Swedish TSO, Svenska kraftnät, with developing a compensation model that ensures electricity suppliers are reimbursed when flexibility is activated through aggregation services. The model, presented in September 2024, is designed to make flexibility a more attractive and fair business case for all actors involved.

At the European level, new EU network codes for demand response are being prepared by ACER and the European Commission. Once adopted, these will harmonize rules across member states, making it easier for flexibility and storage operators to participate in electricity markets throughout the EU.

The Swedish TSO, Svenska Kraftnät, and the Energy Markets Inspectorate (Ei) have also identified several milestones for enabling a more flexible energy system by 2030, including the introduction of 15-minute market intervals, new tariff structures, and better information and compensation tools for flexibility.

In terms of financial support, private individuals can receive a 50% tax deduction for the hardware and installation costs of BESS through the tax reduction for green technology scheme which has previously been described in Section 3.2.1.

Meanwhile, the government is preparing capacity mechanisms to secure electricity supply during peak demand periods. This mechanism could, in the future, provide new revenue opportunities for energy storage systems and flexible demand that can serve as capacity resources.

Despite these advances, several challenges remain. The compensation framework is not yet fully implemented, and much of the potential value from flexibility still fails to reach end-users due to limited business models, technical requirements, and weak price signals. Investment support for larger-scale BESS also remains limited, meaning that most progress so far relies on market innovation rather than direct subsidies.

### 3.8.3 ROT tax deduction

The ROT program is an incentive program for private individuals who buy services from the construction industry in Sweden. The program is in the form of tax credits. ROT is a collective term for measures to renovate and upgrade existing buildings, mainly residential properties. Reparations, maintenance, conversions and extensions are counted as ROT work and are therefore tax deductible, provided that such work is carried out in close connection to a residence that the client owns and in which he or she lives (or if it is a second home, like a vacation house).

The ROT-tax deduction in 2024 was 30 % of the labour cost and of maximum 50 000 SEK per person and year at the start of 2024 but was increased to 75 000 SEK as of the 1st of July 2024. The requirements are that the house is older than five years, and that the owner has not used the green tax deduction for the same service. Installation and replacement of solar panels are entitled to ROT, while mentation of solar panels is not.

According to the Swedish Tax Agency, labour costs are estimated at 30 % of the total cost, including VAT. The total deduction for the whole PV systems was therefore 9 % in 2024. If it can be proved that the labour costs constitute a higher proportion than 30 %, the total deduction then consequently becomes higher [45].

### 3.8.4 Support for encouraging social acceptance of PV systems

Sweden promotes social acceptance of photovoltaic (PV) systems through a combination of national, regional, and private initiatives. At the national level, the Swedish Energy Agency provides free, impartial energy advisory services to households and businesses, offering guidance on PV installations and energy efficiency. The Agency also encourages the formation of energy communities through economic associations, allowing groups of residents or businesses to collectively invest in and benefit from PV projects, fostering local engagement and shared ownership.

Regionally, many municipalities have adopted the "eco-municipality" model, integrating ecological and social justice values into governance and supporting renewable energy projects, including PV systems. Some municipalities have also developed local energy plans that incorporate strategies for increasing PV adoption, often involving community consultations tailored to local conditions.

Private and civil society initiatives further support social acceptance. Community solar projects enable residents to invest in shared PV installations while receiving educational guidance to build trust and awareness. Additionally, industry groups and NGOs run public awareness campaigns highlighting the benefits of PV systems and addressing common misconceptions. Together, these efforts create a supportive environment for PV adoption in Sweden, emphasizing education, transparency, and community involvement.

### 3.8.5 Exemption for building permits for solar energy systems

As of the first of August 2018, PV and solar thermal system installations on buildings are exempted from building permits in general. Some installations still require building permits, and that is when one of following situations applies [46]:

- When the PV or solar thermal system does not follow the shape of the current building.
- When the PV or solar thermal system is installed within a residential area that is classified as valuable from either a historical, cultural, environmental, or artistic point of view.
- When the PV or solar thermal system is installed within a residential area where the municipality in the detailed development plan defined that building permits are required for solar systems.
- When the PV or solar thermal system is installed within an area that is of national interest to the military. Maps over these areas are located can be found here.

In these cases, a regular building permit must be submitted to the municipality.

## 3.9 Financing and cost of support measures

In the first version of the direct capital subsidy program 142 531 152 SEK were disbursed and in the second version a total of 3 545 404 848 SEK has been disbursed from 2009 to the end of 2021. These two subsidy systems were financed by the Swedish state budget, and the money was distributed by the 21 county administrations.

Secondly, the direct capital subsidy for renewable energy production in the agriculture industry program granted a total support of 33 542 362 SEK to PV systems during 2015–2021. This system was financed by the European Agricultural Fund for Agricultural Development (EJFLU), meaning the funding comes from the European Union.

Furthermore, PV systems have benefited from the renewable electricity certificate system and had at the end of 2024 received a total of 1 661 624 certificates over the years (see Section 3.2.3). By taking the monthly average prices for the certificates and multiplying these prices with the number of certificates that have been issued to PV in each month the total support to PV by the end of 2024 becomes 73 620 616 SEK. The renewable electricity certificate system is financed by electricity consumers, except for electricity-intensive industries that have certificate costs only for the electricity that is not used in the manufacturing process.

In addition, based on the estimation that 98% of the systems in tax credit for micro-producers of renewable electricity subsidy programme are PV systems, a total of 2 692 592 376 SEK (see Table 17 section 3.2.1.8) has been paid to small scale PV system owners through this scheme between 2015–2024.

Lastly, for the tax deduction for green technology, about 5 889 227 000 SEK has been allocated between 2021–2024 for PV systems (see Table 16). These two last subsidies are reductions in tax, and hence not a budget cost, but of course effects the Swedish state budget.

Including all the subsidies described above, **the Swedish PV market had received approximately 12 234.4 million SEK in total by the end of 2024.**

Dividing this amount on the total population it would mean in total 1 155 SEK/capita, or on average 57.8 SEK/capita and year since 2005 (the introduction of the first subsidy to PV in Sweden).

Relative to installed capacity at the end of 2024 (4 830 720 kW), PV-specific subsidies amount to 2 544 SEK per kW. Assuming a conservative system lifetime of 25 years and an average annual yield of 850 kWh per kW, the currently installed PV systems are expected to generate a total of 102.65 TWh over their lifetime. On this basis, the subsidies paid to date are equivalent to approximately 0.119 SEK per kWh over the lifetime of the installed PV systems.

## 3.10 Grid integration policies

### 3.10.1 Grid connection policies

The standard procedure for connecting a PV system to the grid in Sweden involves notifying the grid owner well in advance of installation. The grid company then specifies the technical requirements for the system. After installation, a final report must be submitted, and the system is inspected. The electricity meter is replaced — at no cost — with a meter capable of measuring surplus electricity fed into the grid. All feed-in is typically measured hourly. If a customer wants to measure total production, including self-consumption, they must cover the cost of an additional meter.

For micro-production PV systems, the Swedish Energy Markets Inspectorate (Ei) previously required grid operators to connect systems without charging for grid reinforcement, even if upgrades were necessary. However, recent Ei decisions have modified this practice. Following a 2023 EU Court ruling and Article 18.1 of the EU Electricity Regulation, Ei clarified in September 2024 that connection charges must reflect actual costs and be applied non-discriminatorily. Consequently:

- **Connection fees for grid reinforcement**: In areas where the local grid requires reinforcement to accommodate PV production, the grid operator can now charge a connection fee reflecting the actual reinforcement costs. These fees can be substantial, potentially reaching tens of thousands of SEK for single-family homes.
- **Fuse upgrades**: If a PV installation requires a larger fuse than the existing one, the grid operator may charge a fee for the upgrade.
- **Right to review**: PV system owners can request a review of connection terms if fees appear unreasonable. Disputes can be escalated to Ei.
- **Standardized procedures**: Grid operators must follow standardized procedures, including providing a timeline for application processing, to make the connection process as predictable and efficient as possible.

Despite the new Ei ruling, according to most DSOs the author has consulted, they do not plan to charge single customers for grid expansions. Instead, costs for grid reinforcement are typically financed collectively by all customers in the grid, maintaining a more equitable cost-sharing approach.

For centralized PV systems, grid reinforcement may still be necessary and can be both costly and complex. Data from a 2019–2020 study of six PV parks in Sweden showed that connection costs varied widely depending on the grid operator and project location, ranging from approximately 9,600 €/MWp to 56,600 €/MWp, with an average of 29,600 €/MWp [47].

In summary, while Sweden has a clear legal framework for PV grid connection, the recent Ei decisions theoretically allow for individual charges, but in practice, most DSOs continue to finance grid expansions collectively, reducing the burden on single PV owners.

### 3.10.2 Grid access policies

#### *3.10.2.1 Curtailment of Renewable Electricity in Sweden*

In Sweden, grid operators (both DSOs, and the TSO, Svenska Kraftnät) have the legal right to curtail or limit electricity generation from renewable energy sources if necessary for the security and stability of the grid. This applies to both large-scale and small-scale installations, including PV systems, but must be done in a non-discriminatory and proportionate manner.

For small-scale PV systems, curtailment is rare, as local grid constraints are generally limited. However, in areas with grid congestion or capacity limits, DSOs may require temporary reductions in generation to maintain grid stability. No general rule mandates compensation for curtailed electricity from small producers, though agreements may exist for larger installations.

For utility-scale PV and other large renewable generation, curtailment is more relevant. Grid operators can reduce output according to operational needs, often based on contractual arrangements or grid codes. In these cases, affected producers may receive compensation for lost production depending on the terms agreed with the DSO or the TSO.

All curtailment practices are guided by Swedish grid regulations and the EU Electricity Regulation. These rules emphasize transparency, cost-reflectiveness, and equal treatment for all grid users. While curtailment is a tool to maintain grid stability, Sweden currently applies it selectively, with minimal impact on residential or small-scale PV systems.

#### *3.10.2.2 Grid benefit compensation*

A micro-producer is entitled to reimbursement from the DSO for the electricity that is fed into the grid. The electricity generator is entitled to compensation when supplying electricity equivalent to the power plants' contribution to reduced costs for the DSO. In simplified terms, the compensation should be calculated based on the difference between the DSO's cost when the power plant is connected to the grid compared to the hypothetical equivalent cost if the power plant was not part of the grid. The compensation varies between different DSOs and grids.

#### *3.10.2.3 Aggregated grid subscriptions*

Since January 1st, 2021, it has been possible to subscribe for aggregated grid contracts ("summaabonnemang") for connection points in areas where Svenska Kraftnät previously refused increased grid connection capacities. This option allows customers to consolidate multiple connection points under a single subscription, facilitating the transfer of electricity between these points. Such arrangements are particularly beneficial in areas where grid capacity is limited, enabling more efficient use of existing infrastructure and alleviating local grid congestion.

However, it's important to note that the availability and specific terms of aggregated subscriptions can vary depending on the distribution system operator (DSO) and the technical feasibility of connecting the points in question. Therefore, interested parties should consult with their local DSO to understand the specific requirements and conditions applicable to their situation.

# 4 INDUSTRY

The Swedish PV industry mainly contains of small to medium size installers and retailers of PV modules or systems. Unfortunately, there is a trend of fewer and fewer upstream PV industry companies in Sweden. Several Swedish module manufacturers shut down or went bankrupt around 2010–2012, namely ArticSolar, Eco Supplies, Latitude Solar, PV Enterprise and REC Scanmodule. In recent years several Swedish start-ups, R&D companies and manufacturers of BoS products have been forced to close, e.g., Optistring Technologies AB (in 2017), Box of Energy AB (in 2018), Sol Voltaics AB (2019), Solibro Research AB (in 2019), Solar Wave (in 2019), and Solarus Sunpower AB (in 2020).

On the other hand, there is news of two start-ups, a new module manufacturer in northern Sweden, Nordcell Group AB, which plans to set up a 1.2 GW module manufacturing capacity, and Green14 which is developing innovative process to produce solar-grade polysilicon.

## 4.1 Production of feedstocks, ingots and wafers (crystalline silicon industry)

Sweden did not produce any polysilicon feedstock or wafers in 2024. However, two initiatives may change this in the coming years. The newly established company Green14 is developing a hydrogen plasma process to produce solar-grade polysilicon with a significantly lower carbon footprint. The company operates a pilot reactor at KTH in Stockholm and plans to scale up to demonstration production around 2027. In parallel, the Nordcell Group AB has announced its mission to build a vertically integrated production facility in Sweden, covering all primary stages of solar panel manufacturing, including silicon, ingot, and wafer production. They aimed to start operations in mid-2025 and provide modules for the residential, commercial and utility segments of the PV market, but the project is now on hold due to the unsustainable low module prices on the market.

## 4.2 Production of photovoltaic cells and modules

Module manufacturing is defined as the industry where the process of the production of PV modules (encapsulation) is done. A company may also be involved in the production of ingots, wafers, or the processing of cells, in addition to fabricating the modules with frames, junction boxes, etc. The manufacturing of modules may only be counted to a country if the encapsulation takes place in that country.

In the beginning of 2011, there were five module producers in Sweden that assembled modules from imported silicon cells. In the acceleration of PV module price reductions on the world market in 2011 and 2012, the Swedish module manufacturers struggled (along with the rest of the European module production industry) and at the end of 2012 only SweModule AB of the Swedish companies remained in business. In 2015 also SweModule was filed for bankruptcy, and there is no longer any large-scale module production in Sweden. Renewable Sun Energy Sweden AB, who bought the production equipment and the brand SweModule produced around 0.3 $MW_p$ of commercial modules as part of their product development in 2024.

Furthermore, in October 2019, CIGS thin film equipment manufacturer Midsummer AB established a cell and module production line in Järfälla, Sweden, where they produced approximately 2 MWp of cells and panels in 2024.

Midsummer also operates an Italian subsidiary called Midsummer Italia, founded in 2020 to establish a factory there. In the fall of 2021, the Italian Ministry of Economic Development and the Italian investment institution Invitalia announced they would support the construction of a 50 MW factory with a grant for the project of nearly 22m€. By the end of 2024, Midsummer announced the shipment of the final Swedish-produced machines for thin-film PV manufacturing to Bari, Italy, the production start is planned for November 2025.

In July 2023, the EU Innovation Fund selected Midsummer for a grant of approximately 32.3 m€ to establish a new 200 MW factory in Flen, Sweden. Production is scheduled to start in the first quarter of 2026, following preparatory activities in 2025 such as equipment installation, functionality testing, factory certification, and staff training.

Total PV cell and module manufacturing, along with production capacity information for 2024, is summarized in Table 21, and the historic produced volumes of modules are summarized in Figure 11.

**Table 21. PV cell and module production and production capacity information for 2024**

| Cell/Module manufacturer | Technology | Total Production [MW] | | Maximum production capacity [MW/yr] | |
|---|---|---|---|---|---|
| | | Cell | Module | Cell | Module |
| Wafer-based PV manufactures | | | | | |
| SweModule | Mono-Si | - | 0.3 | - | 150 |
| Thin film manufacturers | | | | | |
| Midsummer | BIPV CIGS | 2.0 | 2.0 | 5 | 5 |
| Cells for concentration | | | | | |
| None | - | - | - | - | - |
| **Totals** | - | **2.0** | **2.3** | **5** | **155** |

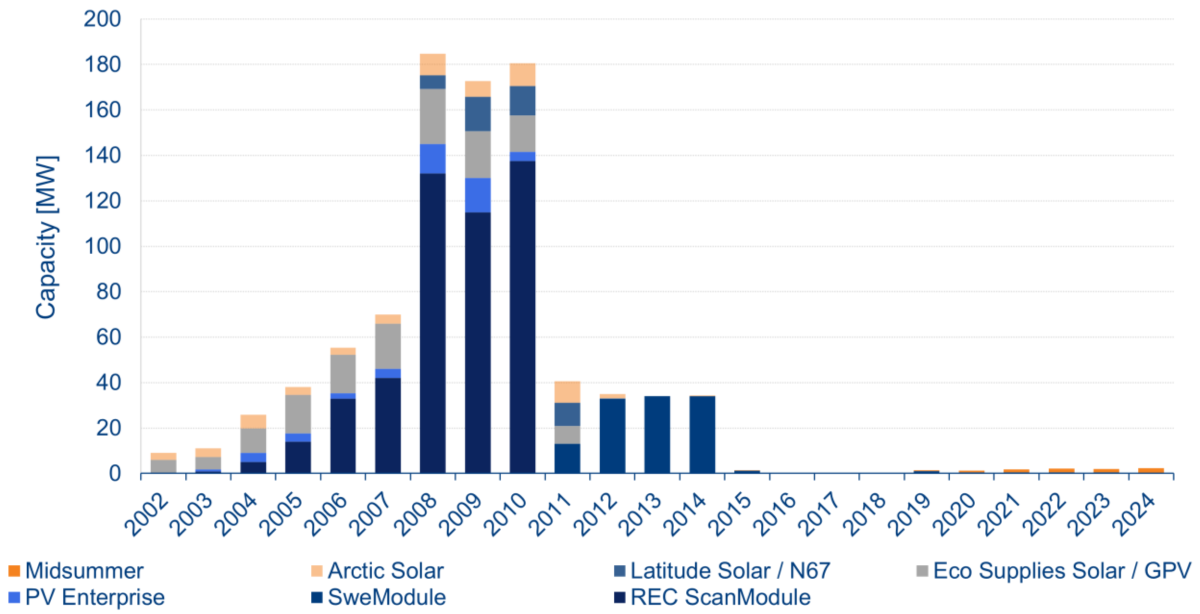


**Figure 11. Yearly PV module production in Sweden over the years.**

## 4.3 Manufacturers and suppliers of other components

Sweden has been a major focal point for European battery ambitions (Northvolt etc.), so the domestic ecosystem includes both cell manufacturing efforts and system integrators/pack assemblers. However, the situation changed rapidly in 2024–2025: Northvolt — previously the flagship Swedish cell producer — has faced severe financial distress and restructuring, affecting the domestic cell manufacturing outlook.

# 5 PV IN THE ECONOMY

This chapter aims to provide information on the benefits of PV for the economy.

## 5.1 Labour places

Following the bankruptcy and closure of several Swedish PV module factories in 2010–2011, full-time equivalent (FTE) jobs in PV module production declined sharply. In contrast, employment in PV system sales and installation has grown alongside the expanding Swedish PV market. This market growth has also increased engagement from utility companies, consulting firms, and real estate owners. In many organizations and research institutes, staff work only partially on PV-related activities.

Previous Swedish National Survey Reports (2010–2021) collected data on employment across different segments of the PV market. These surveys documented the decline in PV module manufacturing jobs alongside growth in installation and sales roles as the market matured. They also showed a relatively stable number of positions in machinery and BoS manufacturing, R&D, national and regional agencies, universities, and foundations. Moderate growth was observed for consulting firms, real estate owners, builders, and other workplaces indirectly connected to PV deployment.

Since the discontinuation of these surveys in 2021, it is no longer possible to accurately estimate the number of jobs directly attributable to the Swedish PV market.

## 5.2 Business value

Table 22 presents rough estimates of the total value of the Swedish PV market, derived from installed capacity by market segment (see Section 1.2) and typical system prices within each segment (see Section 2.2).

**Table 22: Rough estimation of the value of the PV business in 2024 (VAT is excluded).**

| Sub-market | Capacity installed [MW] | Average price [SEK/W] | Value [SEK] |
|---|---|---|---|
| Off-grid | 1.2 | 25.0 | 30 000 000 |
| Grid-connected distributed | 711.3 | 13.0 | 9 246 900 000 |
| Grid-connected centralized | 136.2 | 7.0 | 953 400 000 |
| Value of PV business in 2024 in Sweden | | | 10 230 300 000 |

# 6 INTEREST FROM ELECTRICITY STAKEHOLDERS

## 6.1 Structure of the electricity system

In Sweden, electricity is transmitted from major power stations to regional grids (40–130 kV) via the national grid (220 kV and 400 kV). From the regional grids, electricity is delivered to end users through local low-voltage networks (≤40 kV), with standard wall socket voltage at 230 V.

The national grid, which forms the backbone of the electrical system, is owned by the Swedish state and managed by the Swedish TSO, Svenska Kraftnät, while regional and local grids are owned by various power utilities. The Energy Markets Inspectorate (Ei) serves as the regulatory authority overseeing the electricity market. As grid operation is a natural monopoly, each area has a single licensed network owner.

The base electricity price is determined daily on the Nordic electricity market, Nord Pool, and electricity suppliers use this as the basis for retail pricing in a competitive market. The Swedish electricity market was deregulated in 1996, enabling consumers to switch suppliers more easily.

Sweden has over 150 grid owners, but the market is dominated by Vattenfall, E.ON, and Ellevio, which together serve around 60% of all customers. The retail market is similarly concentrated, with Vattenfall, Fortum, and E.ON being the largest electricity suppliers.

## 6.2 Interest from electricity utility businesses

Several utility companies began marketing small turnkey PV systems for residential rooftops as early as 2012, a practice that remains common in 2024.

In 2011, a number of utilities introduced compensation schemes for micro-producers selling excess electricity. This trend continues, with many utilities offering various arrangements for purchasing excess electricity, green electricity certificates, and guarantees of origin (GOs). While specific terms vary, most schemes require that the micro-producer remains a net consumer over the year and purchases electricity from the utility. Some utilities also buy the GOs and green certificates, while others do not.

Since 2014, a few utilities have expanded into centralized PV parks. Those that have pursued this path have tested different financial arrangements and business models, including share-owned PV parks, power purchase agreements (PPAs), and direct PV electricity offers to end consumers. By 2024, the utilities known to have built PV parks exceeding 1 MWp include Affärsverken, Arvika Kraft, Bixia, C4 Energi, E.ON, ETC El, Göteborgs Energi, Jämtkraft, Jönköping Energi, Kalmar Energi, Luleå Energi, Mälarenergi, Tekniska Verken, Vallebygdens Energi, and Vattenfall.

## 6.3 Interest from municipalities and local governments

As noted in Section 1.4, certain Swedish municipalities stand out in terms of total installed PV capacity and PV capacity per capita. High local PV diffusion is generally driven by peer effects [48], [49] and active local organizations promoting solar energy. Research has shown that initiatives from various local stakeholders have been key in driving PV deployment in municipalities with the highest penetration rates [50]. In many cases, municipally owned utilities have actively supported PV adoption by purchasing excess electricity from PV owners, selling

PV systems, and providing information (see Section 6.2). Other local initiatives include seminars and information meetings organized by municipalities or local actors. One notable example is the Swedish Energy Agency–financed residential PV information campaign in 2017, in which 41% of Swedish municipalities participated, leading to a measurable increase in adoption rates [51].

Some Swedish municipalities and local governments have introduced ambitious goals for PV. Examples are:

- **Örebro County:** 150 GWh of PV electricity by 2030, roughly 4% of the county's electricity use.
- **Uppsala Municipality:** ~30 MWp by 2020 and ~100 MWp by 2030.
- **Linköping Municipality:** PV penetration of 5% by 2025 and at least 20% by 2040.
- **Helsingborg Municipality:** Local PV production to cover 10% of electricity demand by 2035.
- **Kristianstad Municipality:** Municipal production of 2 GWh/year by 2020, increasing to 40 GWh/year by 2030.

In addition, while not a municipality, SKL Kommentus Inköpscentral (SKI) has initiated a procurement process to facilitate the installation of solar systems on municipal buildings across Sweden. This initiative aims to simplify and accelerate the adoption of solar energy within local governments.

Many municipalities have also developed so-called "sun maps" to help stakeholders assess PV potential for their roofs. These maps typically use color scales to represent incoming solar radiation, often accounting for roof tilt and shading from nearby structures.

Sweden has 15 regional energy agencies (Energikontoren) tasked with promoting energy efficiency and renewable energy at local and regional levels. Supported by the Swedish Energy Agency (Energimyndigheten), they coordinate national projects alongside municipal energy and climate advisors.

One of the largest local PV initiatives is Solar Region Skåne, launched in 2007 as a collaboration between the municipality of Malmö, the regional energy agency of Skåne (Energikontoret Skåne), and Lund University. Solar Region Skåne serves as a network and knowledge center for solar energy activities across the Skåne region.

# 7 HIGHLIGHTS AND PROSPECTS

## 7.1 Highlights

After a record-breaking year in 2023 — when 1.6 GW of new PV capacity was installed, doubling the previous record — the Swedish solar market slowed in 2024, adding about 850 MW and reaching a cumulative capacity of 4.8 GW. The downturn reflects the combined effects of high interest rates, lower electricity prices, and general economic uncertainty, which reduced household and corporate investment appetite. The residential segment remained dominant but showed signs of saturation after several years of rapid growth.

Falling hardware prices and continued high availability of modules and inverters helped keep PV systems cost-competitive. By 2024, average installation prices had stabilized near their 2023 lows, supported by strong global supply and eased logistics. The market for battery storage expanded further, building on the momentum from 2023 when installations surged under the tax deduction for green technology, which covers both PV and battery systems. Batteries are increasingly seen as profitable for maximizing self-consumption and participating in flexibility services.

The utility-scale segment continued to mature, with several projects above 20 MW under construction and a growing pipeline of > 100 MW PV parks. However, developers still face permitting delays and grid connection bottlenecks, especially in areas with high connection demand or limited capacity. Despite these barriers, large-scale PV is now largely viable without subsidies, supported instead by corporate PPAs.

On the policy side, uncertainty increased in 2024. The government announced plans to lower the tax deduction for green technology from 20 % to 15 % (effective mid-2025) and to abolish the income tax reduction for micro-producers from 2026.

Sweden’s PV industry remains focused on downstream activities, though new initiatives in polysilicon and module production have emerged, signaling renewed industrial interest.

In summary, 2024 marked a normalization phase for the Swedish PV market after the 2023 boom — characterized by an annual deployment just below 1 GW, continued diversification, and the emergence of new business models for flexibility and shared consumption, but tempered by policy uncertainty and the general dampened economic situation.

## 7.2 Prospects

Several factors have continued to dampen both private and commercial investments in solar PV during 2024. High interest rates, reduced electricity prices, and general economic uncertainty have contributed to lower profitability and a slowdown in new installations compared to the record growth of 2023. The decline in purchase orders and installation requests first observed in mid-2023 persisted through 2024, confirming a market consolidation phase. Nevertheless, falling hardware prices and an abundant global supply of PV modules and inverters have helped maintain the competitiveness of solar PV, mitigating some of the negative effects of reduced electricity revenues.

In the medium term, market fundamentals remain solid. The 15 % tax deduction for green technology for private individuals continues to provide a foundation for household adoption. However, recent government proposals to lower the tax deduction rate and abolish the micro-production tax credit from 2026 have created uncertainty among investors. Meanwhile, the introduction of internal low-voltage grids for collective self-consumption has enabled shared

PV use in new apartment complexes, marking an important step towards energy communities. Further regulatory alignment with EU rules on jointly acting self-consumers and energy sharing is anticipated and could unlock new business models.

In the longer term, the market is expected to recover as interest rates normalize and new regulatory frameworks take effect. Battery storage, supported by the green-tech tax deduction, is becoming increasingly attractive for households, enabling higher self-consumption and grid flexibility. The rules governing eligibility for the deduction in combined PV-battery systems will play a key role in shaping this market segment.

At the utility scale, Sweden is seeing the emergence of a new generation of large solar parks, with projects well above 20 MW and several exceeding 100 MW now under development. The segment is expanding without direct subsidies, driven by falling costs and long-term power purchase agreements. However, grid connection bottlenecks and lengthy permitting procedures remain major obstacles. International developers view Sweden as an underexploited but promising market within the Nordic region, and industry actors are increasingly organizing to advocate for more efficient permitting and clearer rules for grid access.

# 8 APPENDIX A – DATA SOURCES AND THEIR LIMITATIONS

Several data sources are used in the collection of the statistics presented in this report, all of which have their respective advantages and disadvantages. In the following section, these are discussed to provide an overview of the statistical situation on the Swedish photovoltaic market.

### 8.1.1 Surveys to grid operators regarding grid-connected PV capacity

All the grid-connected PV capacity is collected through surveys sent out by Statistics Sweden, SCB, (Statistiska Centralbyrån) on behalf of the Swedish Energy Agency (Energimyndigheten) to all the Swedish grid operators. As it is mandatory to notify the grid operator when a PV system is connected to the grid, the grid operators should have all the grid-connected PV systems within their grid area registered, and they are obliged to share this information with the Swedish Energy Agency. A recent study, in which remote sensing was applied to identify PV systems in aerial images, has shown that 18 grid-connected systems — corresponding to an average of 0.7% of all grid-connected PV systems — were missing from the registries of the DSOs in three Swedish low-voltage grids (FLN, KHN and FGA) [52]. Additionally, grid operators sometimes register PV systems with incorrect capacities and are not always notified when a system's capacity is increased after the initial grid connection. The same study found that around 85 PV systems in the FLN, KHN, and FGA grids had incorrect capacity registrations. The actual capacity of these misreported systems is estimated to be approximately 980 kW higher, corresponding to 2.7% of the total capacity. This illustrates that while DSO data is generally reliable, it is not entirely complete or accurate.

That methodology with surveys to the DSO has, however, only been carried out for the years of 2016 and thereafter. The historic numbers for the installed grid-connected PV capacity (and off-grid PV capacity) in Sweden until the end of 2015 are exclusively based on the yearly collection of the sales statistics by the Swedish representatives in IEA PVPS task 1. The official statistics of the grid operators, collected by the Swedish Energy Agency, only include segmentation in PV system sizes (power) in the ranges 0–20 kW, 20–1000 kW and >1000 kW.

For 2016 and 2017 weighted average number between the sales statistics and the statistics from the grid operators has been used due to uncertainties about the quality of the grid operators' statistics these years. For a more detailed description see the 2018 version of National Survey Report of PV Application in Sweden [53].

### 8.1.2 Off grid sales statistics

Data for off-grid PV systems are by definition impossible to get from the grid operators. The information about installed off-grid PV capacity is therefore based on cumulative sales statistics that have been collected directly from company representatives throughout the years by the Swedish representatives in IEA PVPS task 1. Off-grid systems older than 20 years are assumed to have been decommissioned by now and are therefore withdrawn from the cumulative sales statistics to obtain the total off-grid capacity in Sweden. The companies that have contributed off-grid data are listed in the older Swedish National Survey Reports for the sales statistics for their respective year. The accuracy of the off-grid capacity is judged to be much lower than for the grid connected capacity.

No official statistics on off-grid PV systems were collected for 2022 or 2023, so the numbers for these years were assumed to be in line with previous years by the authors. For this report, an effort was made to gather sales statistics. While some companies involved in the sale and installation of off-grid systems provided input, fewer respondents were willing to share information compared to historically. Based on the available data, combined with assumptions and upscaling from the 2020 and 2021 statistics, the authors derived an estimate for 2024.

### 8.1.3 Labour places

As in the case of off-grid installations, the data collection of labour places is based on cumulative sales statistics that have been collected directly from company representatives throughout the years by the Swedish representatives in IEA PVPS task 1. This methodology provides no exact measure on the amount of labour places, nor does aim to do so. It is rather an effort to provide a representational picture on the development and the direction in which the market is heading. If the company representative is not contactable, the information is retrieved from open-source registers of companies' key figures of annual reports and company information.

The data collection is thereby limited to the IEA PVPS Task 1 representative's insight of the market and ability to detect new market actors.

No collection of labour places statistics was made for 2022 and the number for 2022 is, therefore, an estimate made by the authors of the report, and no estimate could be made in 2023 and 2024, as is explained in Section 5.1.

### 8.1.4 Database of the Swedish direct capital subsidy

To obtain market segmentation, there is another data source in addition to the surveys sent to grid operators regarding grid-connected PV capacity, discussed in Section 8.1.1. In the database of the Swedish direct capital subsidy (see older Swedish National Survey Reports) all PV systems that have been granted support from the start of the subsidy programme in 2009 until now are recorded. By cross-referencing between this database and Sweden's national business directory, a business sector can be assigned to each system owner. By doing this, the database can be divided into centralised, industry, commercial or residential systems.

A problem with the database of the Swedish direct capital subsidy is however that a lot of systems have been recorded in an incorrect way, for example with the wrong power rating, granted subsidy, or organisation. When it is obvious that the information has been recorded incorrectly, these systems have manually been removed for the analysis within this report.

Furthermore, the direct capital subsidy has now been closed, and a lot of in capacity is missing in this database, especially for the year 2021. Hence, the segmentation results should be viewed as estimates calculated by the authors. The fact that no new systems are added makes it impossible to use the database of the Swedish direct capital subsidy as a source for segmentation after 2021.

### 8.1.5 PV system prices

When it comes to PV system prices, the yearly survey that goes out to the Swedish installers and retailers is the source used for this and previous Swedish National Survey Reports. These surveys have been conducted the same way since 2010, and they collect statistics about prices that the installer and retailer companies regard as typical for some standard PV systems for their company. The reported prices have for the years 2010–2017 been weighted with regards to the number of $kW_p$ each company installed in that market segment. For the 2018–2024 numbers, the reported prices have not been weighted (as the collection of installation data from the installation companies ended after 2017) and the reported prices are a regular average.

### 8.1.6 Cesar

Cesar is Sweden's accounting system for electricity certificates and guarantees of origin. In Cesar, plant owners are given their respective electricity certificates based on the registered plants' reported electricity production. In Cesar, the account holders electronically transfer their electricity certificates and guarantees of origin to the person they have agreed to sell the certificates to. Also, it is in Cesar that electricity certificates are annulled for fulfilment of quota obligations.

The Swedish Energy Agency is responsible for managing and developing the electricity certificate system in Sweden and since January 1$^{st}$, 2015, they have also been responsible for Cesar.

### 8.1.7 Tax credit & deduction for micro-producers & for green technology

*Statistikportalen*, the data base managed by the Swedish Tax Agency (Skatteverket) is used for examining the tax credit for micro-producers of renewable electricity and the tax deduction for green technology. They provide the number of control entities that have eligible for the tax credit, as well as the amount that has been paid. Since the intention is to obtain the total amount that has been disbursed in tax credits and between what amount of system owners, the methodology for data collection is considered satisfactory and without major challenges.

However, some simplifying assumptions are made when the share of systems that receive the tax credit is calculated. This is explained in section 3.2.2.

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