Technology Collaboration Programme
by iea

International Energy Agency
Photovoltaic Power Systems Programme

Task 1 Strategic PV Analysis and Outreach

PVPS

National Survey Report of PV Power Applications in AUSTRIA

2022

Hubert Fechner
Austrian PV Technology Platform

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 IEA PVPS participating countries are Australia, Austria, Belgium, Canada, Chile, China, Denmark, Finland, France, Germany, Israel, Italy, Japan, Korea, Malaysia, Mexico, Morocco, the Netherlands, Norway, Portugal, Singapore, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, and the United States of America. The European Commission, Solar Power Europe, the Smart Electric Power Alliance (SEPA), the Solar Energy Industries Association and the Copper Alliance are also members.

Visit us at: www.iea-pvps.org

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 Austrian National Survey Report for the year 2022. Information from this document will be used as input to the annual Trends in photovoltaic applications report.

Authors

- **Main Content:** Hubert Fechner, Austrian Technology Platform Photovoltaic
  - **Data:** Most PV-related Data from: Innovative Energietechnologien in Österreich Marktentwicklung 2022; Biomasse, Photovoltaik, Solarthermie, Wärmepumpen und Windkraft, Report of the Austrian federal ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology, environment, energy, mobility, innovation and technology; Authors: P. Biermayr, C. Dißauer, M. Eberl, Enigl, H. Fechner, B. Fürnsinn, M. Jaksch-Fliegenschnee, K. Leonhartsberger, S. Moidl, E. Prem, C. Schmidl, C. Strasser, W. Weiss, M. Wittmann, P. Wonisch, E. Wopienka
  - **Electricity data:** EAG-Monitoringbericht 2023, Berichtsjahr 2022, § 90 ABS 2 Erneuerbaren Ausbau-Gesetz - Dr. Wolfgang Urbantschitsch, LL.M, Prof. DI Dr. Alfons Haber, MBA, E-Control, Austrian Regulator

COVER PICTURE

PodBau © Konstantin Kurasch (picture provided by neoom AG -https://neoom.com/en/) - 3 MWp PV system and Storage system with 1.6 MW output and 3.6 MWh capacity in Eberstalzell/Upper Austria

TABLE OF CONTENTS

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 2022 statistics if the PV modules were installed and connected to the grid between 1 January and 31 December 2022, although commissioning may have taken place at a later date.

1.1 Applications for Photovoltaics

The Austrian PV market is still dominated by roof top installations, but 2022 for the first time a significant number of larger ground mounted PV systems were reported; nevertheless, more than 83,7% are still roof top, 1,3 % are building integrated (BIPV facade and roof) and 14,9% percent are ground mounted PV systems. Other applications are in an infant state, first Agri-PV installations and some larger carport solutions are demonstrated so far. However, the federal ministry of Climate Action (Austrian Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology) and local governments are more and more promoting alternative applications, always with the feature of being integrated into the - already existing or planned - built environment.

Currently, mainly due to dynamic development of the energy prices, there is a high dynamic on all PV markets visible, dominated by a wide public discussion about possibilities to connect and feed-in into the public grid as well as the acceptance of large ground mounted PV systems and the discussions with the agricultural sector about Agri PV. The building industry increasingly sees electricity generation on the building envelope as a sensible future extension, without which a modern building will hardly be accepted.

1.2 Total photovoltaic power installed

Market Data acquisition is done by a project of a group of academic stakeholders on behalf of the Austrian ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology. This national survey is dedicated to the technologies of PV, wind, solarthermal, heat pumps and bioenergy and is done annually since the year 1992.

The survey is based on data from the various national and regional funding agencies and the green electricity processing agency (OeMAG) as well as on surveys among planners, producers and installers. The market figures are also coordinated with the surveys of the regulatory authority, receiving data from electricity grid operators.

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 mainly with surplus grid feed-in)

Table 1: Annual PV power installed during calendar year 2022

		Installed PV capacity in 2022 [MW]	AC or DC
	Decentralized	851,8	DC
	Centralized	156,8	DC
	Off-grid	0,5 (est.)	DC
	Total	1009,1	DC

Table 2: PV power installed during calendar year 2022

			Installed PV capacity [MW]	Installed PV capacity [MW]	AC or DC
Grid-connected	BAPV	Residential	838,5	n.a.	DC
		Commercial		n.a.	DC
		Industrial		n.a.	DC
	BIPV	Residential	12,5	n.a.	DC
		Commercial		n.a.	DC
		Industrial		n.a.	DC
	Utility-scale	Ground-mounted	157,3	83	DC
		Floating		0	DC
		Agricultural		0	DC
Off-grid		Residential	0,5	n.a.	.
		Other		n.a.	-
		Hybrid systems		n.a.	-.
Total			1009,1		DC

Table 3: Data collection process

If data are reported in AC, please mention a conversion coefficient to estimate DC installations.	-
Is the collection process done by an official body or a private company/Association?	For PV data responsible: University AS Technikum Vienna

Link to official statistics (if this exists)	https://nachhaltigwirtschaften.at/resources/iea_pdf/schriftenreihe-2023-36a-marktstatistik-2022.pdf
	The survey was carried out by evaluating all national and regional funding agencies via a survey of planners and installers; Furthermore, a comparison was made with the figures from the regulator (E-Control), which determines these from the annual statutory reports from the network operators.

Table 4: The cumulative installed PV power in 4 sub-markets

Year	Off-grid [MW] (including large hybrids)	Grid-connected distributed [MW] (BAPV, BIPV)	Grid-connected centralized [MW] (Ground, floating, agricultural…)	Total [MW]
1992	0,338	0,187	0	**0,525**
1993	0,423	0,346	0	**0,769**
1994	0,59	0,453	0	**1,043**
1995	0,755	0,586	0	**1,341**
1996	0,888	0,831	0	**1,719**
1997	0,992	1,196	0	**2,188**
1998	1,193	1,648	0	**2,841**
1999	1,393	2,189	0	**3,582**
2000	1,649	3,219	0	**4,868**
2001	1,835	4,263	0	**6,098**
2002	1,962	8,357	0	**10,319**
2003	2,131	14,66	0	**16,791**
2004	2,645	18,415	0	**21,06**
2005	2,895	21,126	0	**24,021**
2006	3,169	22,416	0	**25,585**
2007	3,224	24,477	0	**27,701**
2008	3,357	29,03	0	**32,387**
2009	3,605	48,991	0	**52,596**
2010	3,812	91,686	0	**95,498**
2011	4,502	182,67	0	**187,172**
2012	4,722	358,163	0	**362,885**
2013	5,19	620,784	0	**625,974**
2014	5,489	779,757	0	**785,246**

2015	5,535	931,563	0	**937,098**
2016	6,487	1089,529	0	**1096,016**
2017	6,963	1262,008	0	**1268,971**
2018	7,197	1439,935	8	**1455,132**
2019	7,697	1676,296	18,1	**1702,093**
2020	8,197	2030,337	30,5	**2042,934**
2021	8,697	2659,9	114	**2782,6**
2022	9,197	3511,68	270,82	**3791,7**

Table 5: Other PV market information

	2022
Number of PV systems in operation in Austria	250.000 by end of 2022 (est.)
Decommissioned PV systems during the year [MW]	No numbers available
Repowered PV systems during the year [MW]	No numbers available

Table 6: PV power and the broader national energy market

	Data	Year (last year of available data)
Total power generation capacities in 2022 [GW]	30	31.12.2022
Total renewable power generation capacities (including hydropower) [GW]	22,8	31.12.2022
Total electricity demand [TWh]	71,057 including own consumption and grid losses (without pump storage electricity needs) 63.299 (Electricity end consume)	31.12.2022
New power generation capacities installed [GW]	1,256	2022
New renewable power generation capacities (including hydropower) [GW]	1,256	2022
Estimated total PV electricity production (including self-consumed PV electricity)	3,98 TWh	31.12.2022

Total PV electricity production as a % of total electricity consumption	5,6% of final end consume 6,3% of total electricity use	31.12.2022
Average yield of PV installations (in kWh/kWp)	1.050	-

Data: E-Control (Austrian regulatory authority) EAG Monitoringbericht 2023

1.3 Key enablers of PV development

PV needs to be seen as significant part in the energy transition process which has many links to other important developments:

- Decentralized PV-Storage systems > 37.130 systems (Survey on behalf of the ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology")
- Residential Heat Pumps all heat pumps (residential and industrial for heating and hot water preparation) – 61.677 (2022 in numbers) - total: 441.068 (Survey on behalf of the ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology")
- Electric cars (number); battery only cars (no hybrid): 148.070 Statistic Austria, 31.10.2023;

2 COMPETITIVENESS OF PV ELECTRICITY

2.1 Module prices in Austria

Table 7: Typical module prices (in € per kWp excl. VAT)

Year	Lowest price of a standard module crystalline silicon	Highest price of a standard module crystalline silicon	Typical price of a standard module crystalline silicon
2022 Austrian manufacturers Global manufacturers	- -	3700 (specific module for Building integration) -	439 298

2.2 System prices in Austria

Table 8: Turnkey PV system prices of different typical PV systems

Category/Size	Typical applications and brief details	Current prices [€/kWp]
Off-grid 1-5 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.	n.a.
Residential BAPV 5 kW 10 kW	Grid-connected, roof-mounted, distributed PV systems installed to produce electricity to grid-connected households. Typically roof-mounted systems on single-family homes.	1669 1448
Residential BIPV 10 kW	Grid-connected, building integrated, distributed PV systems installed to produce electricity to grid-connected households. Typically, on villas and single-family homes.	>2000 (est.)
Small commercial BAPV 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.	1300 (est.)
Small commercial BIPV 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.	>1500 (est.)
Large commercial BAPV 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.	1000 (est.)
Large commercial BIPV 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.	n.a.
Industrial BAPV >250 kW	Grid-connected, roof-mounted, distributed PV systems installed to produce electricity to grid-connected industrial buildings, warehouses, etc.	800 (est.)
Small centralized PV 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.	700 (est.)
Large centralized PV >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.	n.a.

Other categories existing in Austria. Examples could be: **Hybrid diesel-PV** **Floating Centralized PV** **Agricultural PV** **Industrial BIPV**	-	n.a.

Table 9: National trends in system prices for different applications

Year	Residential BAPV Grid-connected, roof-mounted, distributed PV system 5-10 kW **[€/W]**	Small commercial BAPV Grid-connected, roof-mounted, distributed PV systems 10-100 kW **[€/W]**	Large commercial BAPV Grid-connected, roof-mounted, distributed PV systems 100-250 kW **[€/W]**	Centralized PV Grid-connected, ground-mounted, centralized PV systems 10-50 MW **[€/W]**
2010	3680	n.a.	n.a.	n.a.
2011	2970	n.a.	n.a.	n.a.
2012	2216	n.a.	n.a.	n.a.
2013	1943	n.a.	n.a.	n.a.
2014	1752	n.a.	n.a.	n.a.
2015	1658	n.a.	n.a.	n.a.
2016	1645	n.a.	n.a.	n.a.
2017	1621	n.a.	n.a.	n.a.
2018	1567	1270	900	n.a.
2019	1560	1190	800	n.a.
2020	1507	1190	700-1000	n.a.
2021	1543	1297	900 (est.)	n.a.
2022	1669	1300	1000	n.a.

In the national PV market data, analysis for 5 and 10kWp systems are included. Therefore, in this table, first row represents prices for 5 kWp System, second for 10kWp. There is a significant difference between 10 and 100kWp Systems, which might be better correspond to the data in row 4 (large commercial) the larger they are.

2.3 Cost breakdown of PV installations

The cost breakdown of a typical 5-10 kW roof-mounted, grid-connect, distributed PV system on a residential single-family house and a typical >10 MW Grid-connected, ground-mounted, centralized PV systems at the end of 2022 is presented in the tables below.

The cost structure presented is from the customer's point of view. I.e. it does not reflect the installer companies' overall costs and revenues. The “average” category in Table 10 represents the average cost for each cost category and is the average of the typical cost structure. The average cost is taking the whole system into account and summarizes the average end price to customer. The “low” and “high” categories are the lowest and highest cost that has been reported within each segment. These costs are individual posts, i.e. summarizing these costs do not give an accurate system price.

Table 10: Cost breakdown for a grid-connected roof-mounted, distributed residential PV system of 5-10 kW

Cost category	Average [€/kW]	Low [€/W]	High [€/W]
Hardware			
Module	556,8		
Inverter	320,2		
Mounting material	336,7		
Other electronics (cables, etc.)	-		
Subtotal Hardware	**1213,7**		
Soft costs			
Planning	150 (est.)		
Installation work	305 (est.)		
Shipping and travel expenses to customer	Included		
Permits and commissioning (i.e. cost for electrician, etc.)	included		
Project margin	included		
Subtotal Soft costs	**455**		
Total (excluding VAT)	**1668,9**		
Average VAT	20%		
Total (including VAT)	**2002,68**		

2.4 Financial Parameters and specific financing programs

Table 11: PV financing information in 2022

Different market segments	Loan rate [%]
Average rate of loans – residential installations	-
Average rate of loans – commercial installations	-
Average cost of capital – industrial and ground-mounted installations	-

2.5 Specific investments programs

See 6.1.

2.6 Additional Country information

Table 12: Country information

the year 2022 was characterized by significantly rising electricity prices, up to more than 50 €Cent/kWh in specific cases (e.g. new contracts), later on, rebates were offered as well as reduced prices. By the end of 2022, the prices in general went down, but remaining at a level of at least 30% higher than in 2021. In any case, there now exists a wide range of electricity prices, rebates etc…

Retail electricity prices for a household [€/W]	20--~50 €Cent Remark: Du to the rise in electricity price, in December 2022 an "electricity price brake" was introduced nationwide (until June 2024): For an annual consumption of up to 2,900 kilowatt hours (kWh), only a 10 cents/kWh payment for energy per household metering point is charged. Network charges, taxes and levies are added, as usual
Retail electricity prices for a commercial company [€/W]	>20… €Cent
Retail electricity prices for an industrial company [€/W]	>20…. €Cent
Liberalization of the electricity sector	Austria has a fully liberalized electricity market with free choice of supplier for all customers. Currently about 31 companies are listed at the regulatory homepage offering electricity nationwide. (source: E-control.at - https://www.e-control.at/konsumenten/anbieter-uebersicht)

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 13: Summary of PV support measures

Category	Residential		Commercial + Industrial		Centralized	
Measures in 2022	**On-going**	**New**	**On-going**	**New**	**On-going**	**New**
Feed-in tariffs	YES		YES		YES	
Feed-in premium (above market price)			YES		YES	
Capital subsidies	YES		YES			
Green certificates	-	-	-	-	-	-
Renewable portfolio standards with/without PV requirements	-	-	-	-	-	-
Income tax credits	-	-	-	-	-	-
Self-consumption	YES	-	YES	-	YES	-
Net-metering	-	-	-	-	-	-
Net-billing	-	-	-	-	-	-
Collective self-consumption and delocalized net-metering	YES	-	YES	-	-	-
Sustainable building requirements	YES (Vienna, Styria, Burgenland, Lower Austria)	-	YES (Vienna, Styria, Burgenland, Lower Austria)	-	-	-
BIPV incentives	YES (according federal RES Expansion law)	-	- YES (according federal RES Expansion law)	-	-	-

3.1 National targets for PV

In 2020 a new law (Renewable Energy Sources Expansion Act) was designed, which enters into force finally in July 2021. It sees a PV target of additional 11 TWh coming from PV until

2030. In 2022 first discussions about targets for 2040 started with a “Transition-Scenario” developed mainly by the environment Agency Austria (Umweltbundesamt) on behalf of the ministry of climate action, showing 41 TWh as a target for PV, which is needed to reach climate neutrality by 2040. An Austrian national “integrated grid infrastructure plan” is currently (mid 2023) available for review and comments.

In order to achieve this target, the value for 2030 was also raised and now stands at 21 TWh, means that an average annual installation rate of around 2 GW must be ensured until 2040. After 2022, the first year with just over one GW, developments to date in 2023 indicate that this 2 GW could be achieved for the first time in 2023. However, these high installation figures are still due to the orders placed in the crisis year of 2022, which is why a continuous 2 GW market is by no means guaranteed.

3.2 Direct support policies for PV installations

The energy policy goal in Austria is set with 100% electricity from renewable energy sources by 2030 and climate neutrality by 2040. Currently - depending on the yearly situation - around 78% is covered by renewable generation (E-Control-Monitoring report 2023) due to the high proportion of hydropower and the contributions from wind and biomass as well as about 5-6% from photovoltaics which needs to be increased by 11 TWh until 2030; according to the new “transition scenario”, 21 TWh needs to be achieved in 2030.
With the Renewable Energy Sources Expansion Act passed in summer 2021, the funding landscape in photovoltaics and electricity storage was significantly changed.
From 2022, either a market premium or the investment subsidy can be used to support a PV system. The market premium is the new subsidy for PV electricity fed into the grid and thus replaces the previously available feed-in tariff subsidy (current feed-in tariff contracts remain untouched).
The market premium is applicable for new PV systems/extensions > 10 kWp; it is a surcharge on the reference market value (roughly comparable to the average electricity price traded on the market). In the course of the application, the applicant must report the level of the economically necessary electricity price of the PV system (takes place via a bid in the course of the general tendering round). The subsidy applications are ranked according to the registered electricity price (cents per kWh). This means that the applications are awarded, starting with the project with the lowest registered electricity price, until the funding volume of the tender is exhausted. A maximum value for the registered electricity price is specified by the legislature. Registered bids with a higher electricity price are invalid. The market premium is paid monthly over a period of 20 years. There are at least 2 auction rounds per year with a total annual auction volume of at least 700 MW.
The maximum prices for the tenders 2022 are set out in Section 4 (1) EAG-PV 2022, which are as follows:
For newly constructed and expanded photovoltaic systems: 9.33 cents/kWh
In the tendering round for photovoltaics, 145 bids with a submitted capacity of 417 MW were submitted, of which 131 bids with an output of 398 MW were awarded. Although the tender volume could not be fully utilised, the lowest award value was 5.63 cents/kWh, the highest 9.33 cents/kWh and the volume-weighted average award value was 7.37 cents/kWh.

The Investment-support is applicable to new PV systems/extensions up to 1,000 kWp as well as electricity storage up to 50 kWh (at least 0.5 kWh/kWp); The amount of the investment subsidy for PV systems varies with the size of the system. The amount of the investment subsidy for electricity storage is fixed. The minimum size of the electricity storage is linked to the performance of the PV system. Fixed subsidy amount only for PV systems up to 10 kWp. For PV systems from 10 kWp there is a maximum subsidy amount, which can be undercut by

the applicant in order to be ranked higher in the ranking of the listed subsidy projects and thus the chance of to increase a grant.
In 2022, OeMAG (the Austrian Processing centre for Eco-Electricity) received around 165,000 applications for investment subsidies for photovoltaic systems and around 61,000 applications for electricity storage systems. The amount of funding applied for totalled EUR 625 million for photovoltaic systems and EUR 163 million for electricity storage systems. (E-Control Monitoringbericht 2023)
In addition to further funding in the nine Austrian federal states, promotion of the climate and energy fund, which has existed for many years primarily for small systems and has supplemented the earlier feed-in tariff promotion; this was only available for systems > 5kWp, and continued in 2022. An investment subsidy for innovative photovoltaic systems from the Climate and Energy Fund ("PV-lighthouse projects") was set up for the first time in 2021 and is intended to build bridges between research and the market and to initiate exemplary and model projects. A high degree of system integration and system usefulness and multiplicability are the goals of the funding. Through monitoring and reports, the knowledge gained should create a knowledge base for further innovative photovoltaic systems. Standard systems are not supported with this grant. A jury of experts selects projects with a high degree of innovation and reproducibility. However in 2022 there was no call in this program, but it is indicated to place a new call latest in 2024.

3.2.1 BIPV development measures

There is just a 100 € bonus for BIPV in the investment support scheme of the climate and energyfund scheme. Other measures to support BIPV can be found in the research sector with some projects on BIPV as well as some activities of the Austrian PV technology platform (www.tppv.at) to support the development of BIPV.

With the new law a 30% bonus on the support was introduced for "innovative PV applications" amongst them BIPV, Agro-PV and Floating PV. Since the first call was launched only in spring 2022, there was no significant effect on the 2022 market development.

With the lighthouse projects of innovative PV Systems mentioned above, the ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology supported innovative projects which are close to the market but still have significant finance needs.

Self-consumption measures

Table 14: Summary of self-consumption regulations for small private PV systems in 2022

PV self-consumption	1	Right to self-consume	YES
	2	Revenues from self-consumed PV	Electricity bill savings
	3	Charges to finance Transmission, Distribution grids & Renewable Levies	NO, as long as beyond the meter; (Up to an amount of 25,000 kWh per year, the generation of electrical

			energy from renewable primary energy sources (e.g. photovoltaic systems) has already been exempt from the electricity tax, provided that this is not fed into the grid but is consumed by the user.) The 25.000 kWh threshold was removed completely in 2021, means no more electricity tax to be paid.
Excess PV electricity	4	Revenues from excess PV electricity injected into the grid	Yes, typically 3-7 €Cent depending on the offer of the utility/Energy service provider
	5	Maximum timeframe for compensation of fluxes	No
	6	Geographical compensation (virtual self-consumption or metering)	-
Other characteristics	7	Regulatory scheme duration	ongoing
	8	Third party ownership accepted	YES
	9	Grid codes and/or additional taxes/fees impacting the revenues of the prosumer	See above.
	10	Regulations on enablers of self-consumption (storage, DSM…)	None
	11	PV system size limitations	Not for PV, support for storage only up to 50kWh
	12	Electricity system limitations	Just for Balcony-PV systems there is a 800W limit
	13	Additional features	-

3.3 Collective self-consumption, community solar and similar measures

The collective use of PV electricity in a multifamilyhouse within the individual appartments was enabled in 2018 by a new §16a at the Austrian ELWOG (Elektrizitätswirtschafts- und Organisationsgesetz); without using the public grid (and therefore no grid costs and taxes) collective-self consumption of PV electricity has been possible since 2018. With the Renewable Energy Sources Expansion Act, passed in summer 2021, collective self consumption by using the public grid is possible.

With the new regulations in 2021, energy communities, according to the European renewable energy directive and the electricity market directive was introduced in Austria.

With the new legal framework, it is possible for the first time for people to join forces and energy across property boundaries to produce, to store, consume and sell.

The new laws define two energy community models: the locally restricted “renewable energy community” (EEG) and the “citizen energy community” (BEG) which is geographically unrestricted within Austria. An EEG may generate, store, consume and sell energy (electricity, heat or gas) from renewable sources. EEGs use the grid operator's facilities (like the electricity grid), but they must always be located within the concession area of a single grid operator.

Renewable energy communities are limited to the “close area” defined by grid levels in the power grid. The participants in a local EEG are connected to each other within network levels 6 and 7 (low-voltage network). If network levels 4 (only the medium-voltage busbar in the substation) and 5 are also included, this is referred to as regional EEG.

Members or shareholders of EEGs can be private or legal persons, municipalities, local authorities or even SMEs. They must be located in the vicinity of the generating plant(s).

A lot is possible as an organizational form for EEGs, from associations to corporations, but the focus is on non-profit status. The main purpose of renewable energy communities is not financial gain, this must be enshrined in the statutes or result from the organizational form of the energy community.

Similar regulations apply to citizens energy communities (BEG). In contrast to the EEG, the BEG may only generate, store, consume and sell electrical energy. It is not limited to renewable sources and can extend over the concession areas of several network operators throughout Austria.

A National coordination office (“Österreichische Koordinationsstelle für Energiegemeinschaften” – www.energiegemeinschaften.gv.at) exclusively for energy communities, was introduced in May 2021 by the federal ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology in order to reduce the barriers for the implementation of energy communities. In close partnership with all 9 public regional energy consulting services, this federal coordination office developed a lot of guidelines, information materials, videos as well as sample contracts; it also acts very successfully as a moderator between network operators, authorities, service providers and all other stakeholders of the energy community process. By October of 2023 about 600 energy communities are operational, many more are still under development, most of them are driven by municipalities, some between private persons or at small and medium industrial estates.

3.4 Other utility-scale measures including floating and agricultural PV

Within the framework of the federal support programme on “lighthouse projects of innovative PV” several Agro PV and a few floating PV systems were financed. The largest floating PV system (24,5 MWp) was installed in 2022 in Grafenwörth, Lower Austria, with a production start in early 2023. A further Floating system was designed and built in 2022 in Styria and put into operation in summer 2023, producing about 700-800 MWh/a

3.5 Social Policies

No PV specific social policy in Austria

3.6 Indirect policy issues

3.6.1 Support for electricity storage and demand response measures

The support for electricity storage systems is described in 3.2, there is no support for demand response measures so far.

3.6.2 Other support measures

CO_2 pricing ("CO_2 tax") is a key part of the eco-social tax reform that the Austrian government presented in October 2021. From October 1, 2022, CO_2 emissions will cost 30 euros per tonne. The introduction of the CO_2 price was originally planned for July 2022, but was postponed as part of a relief package to October 2022. The CO_2 price is to be increased year by year (2023: 35 euros, 2024: 45 euros) and gradually rise to 55 euros per ton by 2025. In the event of sharp changes in the price of energy, however, a so-called price stability mechanism can also lead to a slower or faster increase in the price of CO_2. to compensate for the additional burdens mentioned and to avoid social hardship a climate bonus payment was introduced in 2022. For the entire calendar year 2022, the climate bonus was paid out in the form of vouchers or direct transfer to an account known to the tax authorities. The high inflation was the reason for the one-off payment of 500 euros in 2022, which was made up of the increased climate bonus (250 euros) and the anti-inflation bonus (250 euros). In 2023, the regional climate bonus will be paid out in its originally planned version with regional differentiation and differentiated according to place of residence. All natural persons who have registered their main residence in Austria for at least 6 months (183 days) in 2023 will receive the climate bonus.

Financing and cost of support measures

The Renewable Energy Sources Act provides for a collection mechanism which, in addition to the flat rate for the promotion of renewables (formerly the green electricity flat rate – "Erneuerbaren Förderpauschale"), consists of a percentage surcharge on the grid utilisation fee and the grid loss fee as well as costs for the guarantees of origin (Herkunftsnachweise).

The "Erneuerbaren Förderpauschale" was set to zero (for 2022 and 2023), since the income from the marketing of the subsidised green electricity exceeds the exceed the subsidy requirement. The burden on a typical household for financing green electricity in Austria, which amounted to around €100 per year in the years up to 2021, was thus reduced to zero in 2022 (and 2023). (E-Control-Monitoring report 2023)

4 INDUSTRY

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

Silicon feedstock, ingot and wafer producer's production information for 2022

There is no Silicon, ingot and wafer production in Austria

4.2 Production of photovoltaic cells and modules (including TF and CPV)

Module manufacturing is defined as the industry where the process of the production of PV modules (the 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.

Total PV cell and module manufacture together with production capacity information is summarised in Table below.

Table 15: PV cell and module production and production capacity information for 2022

PV-Module manufacturer (total national production)	Technology	Total Production [MW]		Maximum production capacity [MW/yr]	
		Cell	Module	Cell	Module
Wafer-based PV manufactures					
Total	Si-Modules	**n.a.**	**208 MW**	**n.a.**	**n.a.**

in 2022 in Austria photovoltaic modules with a total of 208,3 MWpeak were produced. Of this, 112 MWpeak were exported, which is one export rate of about 53,7%. The share of domestic production in the domestic market fell mainly due to the total increase of PV power installations in 2022 compared to the previous year to 9,5% (2021: 14 %).

Currently 4 manufacturers of PV Modules are operational in Austria: Kioto Photovoltaics GmbH, Energetica-Photovoltaic industries, DAS Energy Ltd. as well as Ertex-Solartechnik GmbH; Sunplugged, as a start-up, develops flexible photovoltaic modules for integration into building envelopes, devices and vehicles. Sunplugged's core product is a solar film that can be individually cut to size and is based on CIGS (copper indium gallium selenide) semiconductors.

4.3 Manufacturers and suppliers of other components

Most of the relevant manufacturers are partner of the Austrian PV-Technology Platform. (www.tppv.at)

Amongst them are:

- Fronius: There is significant PV inverter production in Austria, 4,15 GW of production was reported for 2022. The only inverter producer in Austria is Fronius International GmbH. Beside inverters, Fronius offers a wide spectrum of PV-Energy management solutions.

- Aerocompact is a manufacturer of smart mounting solutions
- SolOcean GmbH is a technology company and deals with the development and marketing of an innovative system for generating electrical energy using photovoltaics on water surfaces.
- Ulbrich of Austria Ulbrich is a world leader in PV Ribbon products that interconnect and transmit current for crystalline solar cells and thin film.
- Welser Profile is a leading manufacturer of special profiles, profile tubes and complete profile systems made of steel, stainless steel and non-ferrous metals. On average, up to 5 new solutions leave the Welser works per day and are used reliably in the PV and solar industries, in agricultural and environmental technology, as well as in the construction industry.
- Lenzing Plastics GmbH & Co KG is the world's leading manufacturer of products based on polyolefins and fluoropolymers. Lenzing Plastics has presented a Coloured photovoltaic encapsulation film in late 2022.
- Eder-Blechbau is a specialist for Solar Facade systems as well as for PV carports
- CALMA-TEC Lärmschutzsysteme GmbH produces and supplies PV-powered noise protection wall modules for roads, railways and industrial plants.
- ATB-Becker e.U. stands for the development of PV application technologies since 1987.
- Neoom provides innovative electricity systems from photovoltaic systems to electricity storage and charging stations as well as various platforms for intelligent energy management, including energy communities.
- Prefa provides integrated solar roof solutions

Above mentioned companies are working together in the Austrian PV Technology platform.

Some more manufacturers and supplies of PV related equipment and technology exist in Austria, Levion for energy management solutions, sto for PV Façade system, HEI Technology International GmbH, MY-PV Solar electronic, etc…

5 PV IN THE ECONOMY

5.1 Labour places

Table 16: Estimated PV-related full-time labour places in 2022

Market category	Number of full-time labour places
Research and development (not including companies)	471
Manufacturing of products throughout the PV value chain from feedstock to systems, including company R&D	1368
Distributors of PV products and installations	4236
Other	-
Total	**6075**

Source: Innovative Energietechnologien in Österreich – Marktentwicklung 2022, Biermayr et al., Austrian ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology 2023

5.2 Business value

The business value for 2022 can only be estimated very roughly, as the distortions on the electricity market have led to varying prices on the energy market almost permanently. This has also led to the fact that in 2022, for the first time since 2008, there was an overall decline in PV systems whose (surplus) feed-in was remunerated via OeMAG. The number of contracted PV systems almost halved to 21,821 systems in 2022, as revenues on the electricity market were in some cases significantly higher than under the OeMAG subsidy regime.

Revenues from the sale of PV electricity in Austria in 2022:

The proceeds of the plant operators, which result from the sale of electricity to OeMAG according to OeMAG, the figure for 2022 was around EUR 123 million; For PV systems, which are not under the OeMAG regime, there are no data available. A very rough estimation can be made by the fact, that on average, only around 825 MW of PV is likely to have been contracted under OeMAG in 2022, compared to 1.4 GW at the end of 2021. This figure fell to 582 MW in the 4th quarter. Assuming a linear development of installations in 2022, the mean value of PV capacity in operation in 2022 was around 3290 MW. After deducting 860 MW of installations subsidised by the Climate Fund (in the period 2008 to 2022 according to the climate and energy fund) and a few 100 MW of state and non-subsidised PV installations, around 2.000 MW PV systems receiving revenues directly from the energy market in 2022.

No assumptions are made here about the revenues from these volumes traded on the energy market, as the prices were extremely volatile and no average exchange prices for PV generation times are available.

Self-consumption is valued with the annual average price for electrical energy in 2022 amounting to 37.0 €cent/kWh (residental), according to Statistics Austria. The volatility in electricity prices in 2022 was already discussed in chapter 2.6.

In the case of self-sufficient systems, 100% self-consumption can be assumed, with surplus feeders with one Self-consumption share of approx. 30%.

Table 12: Rough estimation of the value of the PV business in 2022 (VAT is excluded)

Sub-market	Capacity installed	Average price [€/W]	Value	Sub-market
Off-grid	8,697 MW	0,37	3,4 Mio. €/a	-
Grid-connected distributed and centralized	3,782 GW	19,84 (OeMAG) 0,20…0,5 (exchange)	n.a.	-
Value of PV business in 2022				n.a.

6 INTEREST FROM ELECTRICITY STAKEHOLDERS

6.1 Structure of the electricity system

Austria has one Transmission system operator (Austrian Power Grid-APG) and more than 120 Distribution network operators. The balancing energy market in Austria is mainly determined by pumped storage power plants and gas-fired power plants. There are currently 16 natural gas power plants in Austria and 3,4 GW power made by pump hydro storages powerplants. E-Control is the regulatory authority in Austria responsible for the electricity and gas industry. The TSO and the larger DSO's are mainly owned by the federal od regional governments. Many smaller are private companies owned by industry or private persons. Unbundling is by law foreseen, however, several interdependencies between network operator and their former joint energy provider and generator-company still exist; this situation is strictly controlled by the regulatory authority in order not to influence the market competition.

Interest from electricity utility businesses

There are a lot of activities by utilities in the PV sector. Many of them have founded own daughter companies for their renewable energy projects and services. From planning and installing of private and commercial PV systems up to citizens participation in PV powerplant projects. Many larger utilities own and operate smaller to medium PV power plants up to the 10 MW range. Some larger ones are in the planning phase. (e.g. a 120 MW system in the east of the country).

Most larger energy suppliers offer the planning and installation of PV systems for private and business customers, usually in conjunction with feed-in tariffs and current or new power purchase agreements.

Interest from municipalities and local governments

In Austria, the most important decisions regarding the commissioning of PV systems are the responsibility of the federal states. Even if the national targets are now ambitious - 21 TWh by 2030 and 41 TWh by 2040 - these must now be realised at state level. However, most of the official state targets are still significantly lower than the PV targets for Austria, which have been allocated to the federal states.

With its solar power offensive (Wiener Sonnenstrom-Offensive), the City of Vienna has taken an important step towards optimal use of the potential in its urban areas.

In general, priority is given to utilisation on already built-up areas (buildings and other infrastructure), but it is clear that the targets can only be achieved through expansion on open spaces as well. Ground mounted PV-Power plants should generally contribute to increased biodiversity and/or be operated in combination with agriculture.

A showcase example for strategic planning is the district of Freistadt in Upper Austria (67,000 inhabitants, 1,000 km²), where a “PV on open space strategy” was developed in two years of work in consensus with all relevant stakeholders, which should lead to more electricity being generated locally together with wind power in 2040 than is needed, as the neighbouring urban area of the provincial capital Linz is also to be supplied partially out of this region. A regional energy co-operative is to ensure that most of the plants are built and operated cooperatively.

7 HIGHLIGHTS AND PROSPECTS

7.1 Highlights

In any case, the highlight in 2022 was exceeding the 1 GW installation rate for the first time, which was associated with an enormous boost in orders for the local industry. The geo-political crises of this year leading to extreme energy prices were responsible for the increased awareness of energy and the fact that many people and entrepreneurs decided to purchase a PV system. The fact that the fall in energy prices has in turn significantly slowed down this development shows that this price shock has by no means triggered a sustainable development. Special efforts need to be made to build a sustainable national 2 GW market, which is needed in order to fulfil the national 41 TWh target for 2040.

7.2 Prospects

PV Grid integration

One of the main hurdles to further expansion is the question of PV's capacity to be absorbed by the electricity grids.
It is increasingly becoming standard practice for electricity grid operators to set limits on the maximum feed-in, which are justified by the fact that violations of the voltage band could occur at times of maximum feed-in. Regarding the timeline of PV, it is clear that these times are only extremely short (frequently some hours or even minutes per year) and that the grid is not utilised at many times according to its potential due to this fixed curtailment. Real-time knowledge of the conditions in the electricity distribution grids is the basis for better utilisation of the electricity grids, as is already being implemented in Australia, for example, with the “flexible PV export” model.

A boost for local energy management

Further grid expansion is necessary in any case, not only for PV but also for E-mobility, heat pumps and other industrial electricity applications, but local load management should be promoted on a large scale, especially as the absorption of all electricity peaks from PV leads to economic disproportionality. Due to low or negative prices on the electricity exchange at times of high PV irradiation, it is clear that the value of the electricity traded at these times is becoming less and less, especially as the times of high PV generation in Austria are synchronised with the times of high generation in neighbouring countries, which are expanding PV to the same extent. Local load management (storage, utilisation of flexibilities of all kinds) should therefore be given absolute priority and should go hand in hand with the grid extension efforts.

The role of PV in the context of the overall energy transition and the interplay with wind and other RE, storage technologies and other flexibilities

PV is more and more seen as the key for the energy transition. Even in Austria with its quite high share of hydropower, PV might finally contribute by more than a third to the national electricity production, according to the national “integrated grid infrastructure plan”. The collaboration of PV with all other RES-generation, specifically wind power plants, with storage and other flexibilities might become crucial for the energy transition. The use of flexibilities even on the household level (E-charging, heat-Pumps, home-storages) as well as on the industrial area due to electrification of processes should become a priority.

The question of social acceptance and the commitment of citizens:

Even if the political goals have now been set (in Austria: climate neutrality by 2040), implementation is taking place on a broad scale in the regions. This requires the corresponding knowledge of local stakeholders and the broad acceptance of the population.
Local targets and removal of barriers in the commissioning processes are crucial.
The BMK's "Reallabore" programmes and other research initiatives are working on the local implementation throughout Austria, other initiatives like the “Freistadt- PV-Strategy” (see chapter 6) are also paving the way towards a local energy transition.

PV Industry and research

Austria would like to play an active role in this ongoing strategy to rebuild a continuous and strong European PV value chain. To this end, the connection to EU initiatives to rebuild strong European production must be strengthened.