Technology Collaboration Programme
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International Energy Agency
Photovoltaic Power Systems Programme

Task 1 Strategic PV Analysis and Outreach

PVPS

National Survey Report of PV Power Applications in AUSTRIA

2021

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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.

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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 2021. Information from this document will be used as input to the annual Trends in photovoltaic applications report.

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- **Data:** Most PV-related Data from: Innovative Energietechnologien in Österreich Marktentwicklung 2021; 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

COVER PICTURE

Ertex-Solar, Office Building Fronius International, Pettenbach, Austria, Baumann Glas 1886 GmbH Österreich, Benesch, Stögmüller Architects

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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 2021 statistics if the PV modules were installed and connected to the grid between 1 January and 31 December 2021, 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, even though 2021 for the first time many larger ground mounted PV systems were reported; nevertheless, more than 84,8% are still roof top, 3,9% are building integrated (BIPV facade and roof) and only 11% 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 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 the new national target to increase the PV installations by 11 GW until 2030, there is a high dynamic on all PV markets visible, dominated by a wide public discussion about the acceptance of large ground mounted PV systems and the discussions with the agricultural sector about Agri PV.

1.2 Total photovoltaic power installed

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 (ÖMAG) as well as on surveys among planners, producers and installers. The market figures are also coordinated with the surveys of the regulatory authority. 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.

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)

Table 1: Annual PV power installed during calendar year 2021

		Installed PV capacity in 2021 [MW]	AC or DC
	Decentralized	655,7	DC
	Centralized	83,5	DC
	Off-grid	0,5 (est.)	DC
	Total	739,7	DC

Table 2: PV power installed during calendar year 2021

			Installed PV capacity [MW]	Installed PV capacity [MW]	AC or DC
Grid-connected	BAPV	Residential	626,9	n.a.	DC
		Commercial		n.a.	DC
		Industrial		n.a.	DC
	BIPV	Residential	28,8	n.a.	DC
		Commercial		n.a.	DC
		Industrial		n.a.	DC
	Utility-scale	Ground-mounted	83,5	83	DC
		Floating		0	DC
		Agricultural		0	DC
Off-grid		Residential	0,5	n.a.	.
		Other		n.a.	-
		Hybrid systems		n.a.	-.
Total			739,7		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: University AS Technikum Vienna
Link to official statistics (if this exists)	https://nachhaltigwirtschaften.at/resources/iea_pdf/marktentwicklung-2021_web.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**

Table 5: Other PV market information

	2021
Number of PV systems in operation in your country	200.000 by end of 2021 (est.)
Decommissioned PV systems during the year [MW]	-
Repowered PV systems during the year [MW]	-

Table 6: PV power and the broader national energy market

	Data	Year (last year of available data)
Total power generation capacities in 2021 [GW]	27,051 (+900)	31.12.2021
Total renewable power generation capacities (including hydropower) [GW]	20	31.12.2021
Total electricity demand [TWh]	72,423 including own consumption and grid losses (without pump storage electricity needs) 61.204 (Electricity end consume)	31.12.2021
New power generation capacities installed [GW]	1,003	2021
New renewable power generation capacities (including hydropower) [GW]	1,003	2021
Estimated total PV electricity production (including self-consumed PV electricity)	2,92 TWh	31.12.2021
Total PV electricity production as a % of total electricity consumption	4,7% of final end consume 4,0% of total electricity use	31.12.2021
Average yield of PV installations (in kWh/kWp)	1050	

Data: E-Control (Austrian regulatory authority) EAG Monitoringbericht 2022

1.3 Key enablers of PV development

- Decentralized PV-Storage systems > 20.662 systems (Survey by Enfoss- company on behalf of the ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology")
- Residential Heat Pumps all heat pumps (residential and industrial) - 31.721 (2021 in numbers) - total: 385.171 (Survey by Enfoss-Company on behalf of the ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology")
- Electric cars (number); battery only cars (no hybrid): 76.539 Statistic Austria, 31.12.2021;

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
2021 (Austrian manufacturers)	217	3700 (specific module for Building integration)	317
Global manufacturers	110	420	269

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 villas and single-family homes.	1543 1297
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.	>1800 (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.	1000 (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.	800 (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.	750 (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.	600 (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 your country. 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.

In the national PV market data there are analysis for 5 and 10kWp systems 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 2021 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 [€/W]	Low [€/W]	High [€/W]
Hardware			
Module	552,7		
Inverter	356,1		
Mounting material	380,6		
Other electronics (cables, etc.)	-		
Subtotal Hardware	**1,289**		
Soft costs			
Planning	0,08 (est.)		
Installation work	0,1 (est.)		
Shipping and travel expenses to customer	Included		
Permits and commissioning (i.e. cost for electrician, etc.)	0,05 (est.)		
Project margin	0,024 (est.)		
Subtotal Soft costs	**0,254**		
Total (excluding VAT)	**1542,8**		
Average VAT	20%		
Total (including VAT)	**1851,36**		

2.4 Financial Parameters and specific financing programs

Table 11: PV financing information in 2021

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

Retail electricity prices for a household [€/W]	0,18-0,24
Retail electricity prices for a commercial company [€/W]	0,10-0,19
Retail electricity prices for an industrial company [€/W]	0,10-0,13
Liberalization of the electricity sector	Austria has a fully liberalized electricity market with free choice of supplier for all customers. Currently about 50 companies are offering electricity nationwide.

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 2021	**On-going**	**New**	**On-going**	**New**	**On-going**	**New**
Feed-in tariffs	YES		YES		YES	
Feed-in premium (above market price)						
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 (only in Styria)	-	YES (only in Vienna and Styria)	-	-	-
BIPV incentives	YES	-	- YES	-	-	-

Styria: Obligation to build PV or Solar Thermal systems, for PV. 3…6 m² per 100 m² building floor-area.

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.

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 75% is covered by renewable generation due to the high proportion of hydropower and the contributions from wind and biomass as well as about 3% from photovoltaics which needs to be increased by 11 GW until 2030.
With the Renewable Energy Sources Expansion Act passed in summer 2021, the funding landscape in photovoltaics and electricity storage will be 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 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 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 will continue to exist. An investment subsidy for innovative photovoltaic systems from the Climate and Energy Fund 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.

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 effect on the 2021 market development.

With the lighthouse projects of innovative PV Systems, 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 2021

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 Mai 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 2022 about 100 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 programm on "lighthouse projects of innovative PV" several Agro PV and a few floating PV systems were financed. The start of operation will be in 2022.

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.

Financing and cost of support measures

The new law (EAG) provides for an application mechanism that, in addition to the renewable energy support fee (formerly green electricity fee) from a percentage markup on that Network

usage fee and the network loss fee and costs for the guarantees of origin. The total amount was 913 Mio. € in 2021. (Source: EAG Monitoringbericht 2022). For a typical household with an electricity consume of 3.500 kWh, the financial burden due to the support mechanism for eco-electricity was about 3,5 €Cent/kWh. (out of 24 €Cent typically total electricity cost for a 3.500 kWh household.)

4 INDUSTRY

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

Silicon feedstock, ingot and wafer producer's production information for 2021

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 2021

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.**	**198 MW**	**n.a.**	**n.a.**

in 2021 in Austria photovoltaic modules with a total of 198.1 MWpeak were produced. Of this, 94.7 MWpeak were exported, which is one export rate of about 47.8%. 103.5 MWpeak or about 52.2% of those produced Modules were resold in Austria in 2021. The share of domestic production in The domestic market thus fell slightly in 2021 compared to the previous year to 14.0% (2020: 14.7%).

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. Mass production is planned for 2023.

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, 3.5 GW of production was reported for 2021. 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 been dealing with the development of photovoltaic films for several years.
- 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.

Some more manufacturers and supplies of PV related equipment and technology exist in Austria, e.g. Neoom for PV-storage solutions, Levion for energy management solutions, Prefa Solar roof solutions, HEI Technology International GmbH, MY-PV Solar electronic, etc…

5 PV IN THE ECONOMY

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

5.1 Labour places

Table 16: Estimated PV-related full-time labour places in 2021

Market category	Number of full-time labour places
Research and development (not including companies)	429
Manufacturing of products throughout the PV value chain from feedstock to systems, including company R&D	996
Distributors of PV products and installations	3104
Other	-
Total	**4.529**

Source: Innovative Energietechnologien in Österreich – Marktentwicklung 2021, Biermayr et al., Austrian ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology 2022

5.2 Business value

Table 12: Rough estimation of the value of the PV business in 2021 (VAT is excluded)

Revenues from the sale of PV electricity in Austria in 2021:

The proceeds of the plant operators, which result from the sale of electricity to OeMAG according to OeMAG, the figure for 2021 was around EUR 169.6 million;

Self-consumption is valued with the annual average price for electrical energy in 2021 amounting to 17.0 €cent/kWh, according to Statistics Austria. In the case of self-sufficient systems, 100% self-consumption can be assumed, with surplus feeders with one Self-consumption share of approx. 30%. For surplus feed-in into the power grid, different prices are charged depending on the energy supply company paid, but an average of 4.5 cents per kilowatt hour fed in can be expected according to the federal association PV Austria. The opportunity cost of electricity calculated on this basis of self-sufficient PV systems and surplus feeders will amount to over 109.71 million € in 2021.

Sub-market	Capacity installed	Average price [€/W]	Value	Sub-market
Off-grid	8,697 MW	0,17	1,5 Mio. €/a	-
Grid-connected distributed and centralized	2,774 GW	0,2	279,3 Mio. €/a	-
Value of PV business in 2021				280,8 Mio. €/a

6 INTEREST FROM ELECTRICITY STAKEHOLDERS

6.1 Structure of the electricity system

Austria has one Transmission system operator (Austrian power grid) 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 larger PV power plants, the currently (2021) largest PV power plant (14 MW, ground mounted) is jointly operated by the largest electricity utility and the large federal oil and gas company. Many others, slightly smaller are already in operation or in the planning phase. (e.g. a 50 MW system in the east of the country) For energy communities some utilities are already very active, one larger utility has recently founded a new company exclusively dealing with services for the foundation and operation of energy communities.

Others are active in the planning and service process as well, some are in an infant stadium, since the law for energy communities was introduced only in July 2021. A few non utility companies offer peer to peer electricity trading. Amongst them the "E-Friends" who are a community that shares regionally generated green electricity with one another. E-Friends are either electricity producers (for example because they operate a PV system on their roof) or electricity consumers. A specific E-Friends technology is in the meter boxes of your houses and apartments. Ourpower (ourpower.coop) is a platform which brings together private energy producers and consumers who have to choose out of an energy portfolio of different renewable technologies. After entering the postcode and the expected annual consumption, they make an offer of 40% solar, 30% wind, 20% small hydropower and 10% biomass power (if available) from the power plants closest to the postcode on the OurPower marketplace.

Interest from municipalities and local governments

Specifically, the new regulation on energy communities, which enables private actors to share, sell, store and trade electricity (and heat), seems to be very attractive to industries. Hundreds of municipalities are in the process to found energy communities by placing PV on the roofs of their municipality buildings in order to sell and trade local electricity. By that they address the

willingness of many people to use locally produced electricity, as well as they see a benefit in a much higher price stability for PV electricity compared to the fluctuating electricity market prices. Moreover, in case of locally produced energy the price for electricity can be fixed by the organisation which operates the energy community. This creates possibilities for social motivated support by specifically addressing people living in energy poverty. Altogether, municipalities see a new field of activity by entering into the business of electricity.

In a second step, PV together with other locally available renewable generation technologies (wind, bioenergy, hydropower etc…) as well as with storage paves the way towards much higher shares of self-consumption. The implementation of the heating sector (by heatpumps and/or biomass/solar thermal etc…) into this business as well as the integration of the mobility sector by the roll out of E-Charing stations might complete the new tasks of the municipalities in the energy sector.

7 HIGHLIGHTS AND PROSPECTS

7.1 Highlights

In any case, the highlight of 2021 for photovoltaics in Austria was the resolution of the new Renewable Energy Expansion Act. The binding goal of having 100% electricity from renewable sources in Austria by 2030, with PV +11 TWh contributing to this, is for sure a milestone in Austrian energy policy.

Other important developments in the PV sector were the start of the role out of larger ground mounted PV Systems, which did not exist before. Only in 2021, the first system largen that 10 MW was installed in Austria, followed by many more PV systems in the range beyond 5 MW.

As a third highlight one could see the start of a support scheme, which addresses “innovative PV systems” systematically; by a 30% premium on the standard PV support described in the new Renewable Energy Expansion Act as well as by the new support Scheme addressing PV lighthouses/innovative PV systems, which are close to the market.

7.2 Prospects

A survey conducted by the Federal Association of Photovoltaics Austria (PV Austria) among its more than 300 member companies analyzes their challenges: A total of 76 percent of the participating companies name the Price increases as a major challenge in day-to-day business. The bottlenecks in the supply chain were mentioned by 67 percent, Barriers to network access by 62 percent. The PV-Association has been criticizing the inadequacies around the topic of the power grid for years, now they are becoming more and more blatant and the biggest obstacle to the energy transition with solar power, according to the federal Association PV Austria.
It seems to be of utmost importance to prepare the grids for the significant enlargement of the PV sector, having in mind that the 13 GW to be installed in 2030 will not be sufficient for the energy transition, since it is just the step towards 100% renewable electricity. For climate neutrality (officially targeted for 2040) much higher numbers of PV might be needed, no official numbers exist so far, but a range of 30-60 GW of PV seems to be realistic in order to address the energy transition substantially.
Concerning technology and local production of PV equipment, Austria needs to be connected to the European ambitions to relaunch a strong European PV industry. In May 2021, Austria federal ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology joined officially the EU-IPCEI PV process in order to support the enlargement of the Austrian PV industry. Beside this important step, fostering the national PV R&D seems to be crucial in order to support the upcoming of an innovative Austrian PV production.