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Trend Study Photovoltaic Recycling

Plants – Projects – Market factors – Players

Extract

June 2023

ecoprogram GmbH

Trend Study Photovoltaic Recycling

The recycling of solar panels is one of the most promising recycling markets of the future. This growth will be driven further in the coming years by the booming use of photovoltaics worldwide. As a result of the global PV boom, all currently available forecasts assume a sharp increase in waste volumes from 2030 and exponential growth in subsequent years.

ecoprogram has analysed the global plant market for PV recycling plants to gain greater insight on the opportunities and the market development. More than 120 plants and projects were identified worldwide.

The study sheds light on the technical aspects of PV recycling and also provides a current assessment of market factors, the state of development and competition. In an extensive data appendix, the study includes up-to-date information on the global plant inventory as well as on current projects in six world regions.

The Trend Study Photovoltaic Recycling includes:

- A description of the essential technologies for the recycling of solar panels.
- Data on more than 120 solar recycling plants and projects worldwide, including capacities, input material and commissioning (where known).
- An analysis of the key market drivers for the recycling of solar panels.
- An outlook on the global potential of this growth market.
- A description of the most important competitors worldwide and in six regional markets.
- All plants and projects are included in the study. The complete data set can optionally be purchased as an MS Excel file.

The study is [available](#) in **English and German language starting from 1,200.– €***. With a subscription to our [w&b Monitor](#) you will receive a discount starting at 600.– €*.

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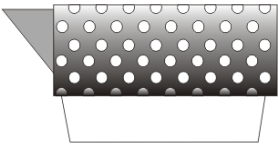
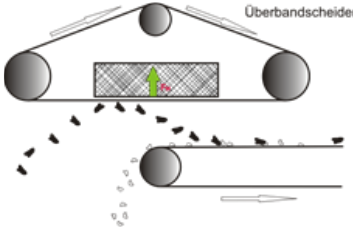
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[...]

Figure 6: Selected mechanical sorting methods

Plant technology	Diagram	Description	Output
Sieve classification	For example: drum screen 	Using sieves, the material flow is separated based on predetermined sizes. There are different sieve shapes: drum sieves, vibrating sieves, etc.	Coarse and fine fraction
Magnetic separation		Mass flow sorting, in which magnets are used for separating metal from the waste stream.	Iron and steel
[...]	[...]	[...]	[...]

Below, we will describe the recycling of a crystalline PV module as an example:

Mechanical recycling

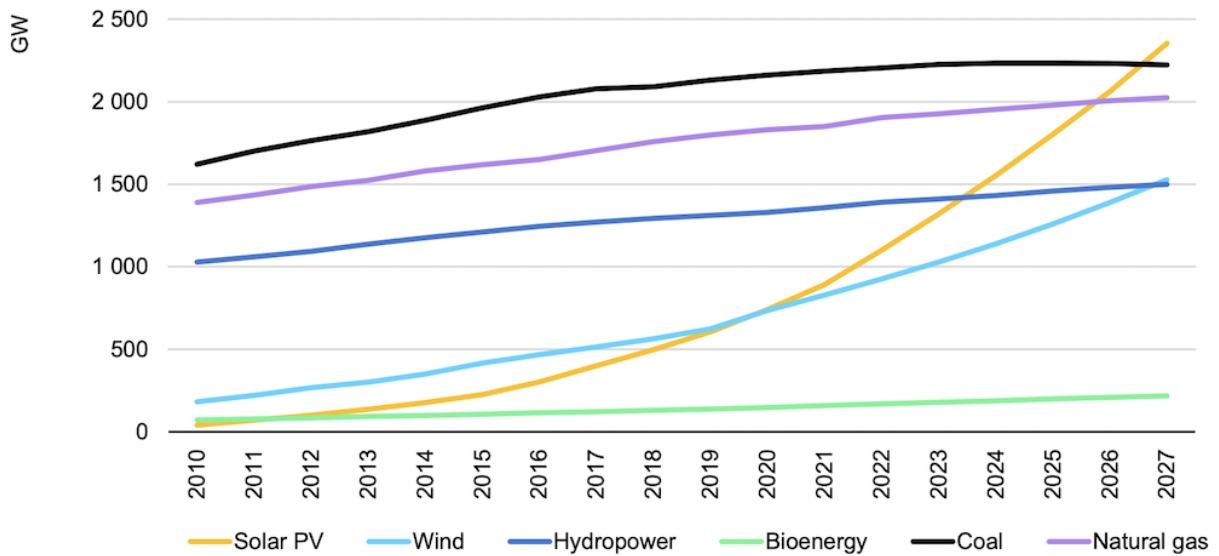
- At first, the modules are disassembled into their individual parts. [...]
- [...]

After the mechanical process, thermal and chemical methods can be applied. [...]

Figure 7: Shredding of e-scrap



Source: hrophoto – stock.adobe.com.

Figure 11: Cumulative power generation capacity, GW, by technology, 2010-2027


Source: IEA Renewables 2022.

3.2 Recycling legislation

Worldwide, except for a few countries and regions, there are no binding laws and regulations for the collection and transport of end-of-life solar modules.

This is also since many countries only started using solar energy commercially on a larger scale later than certain European countries, for example. Therefore, [...]

However, the legal framework is considered a strong market factor for recycling.

The following legislation would have a positive impact on the PV recycling industry:

- The introduction of landfill bans for solar modules
- A recycling obligation or the introduction [...]
- Minimum recycling rates for certain components
- Regulations to limit [...]
- Stricter regulations for [...]

In addition, greater promotion and financing of research and development would also have a positive impact on the PV recycling market, for example [...]

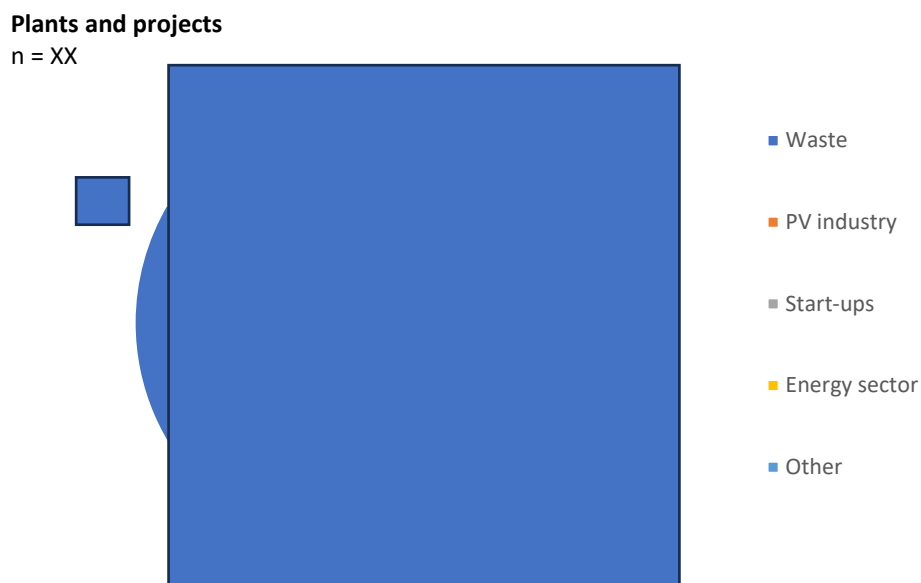
With this data, [...]

6 Competition

We have identified the operators or project engineers for all XX plants and projects for the recycling of solar modules and then categorised this actor to an industry, mainly via the identified shareholders:

- Waste
- PV industry
- Start-ups
- Energy sector
- Other

Figure 20: Operators by industry worldwide



-

Waste

With XX plants and projects, the waste and recycling industry is the largest group by far. There are several reasons for this. [...]

This is also reflected by the recycling process the industry [...]

8.2 Asia

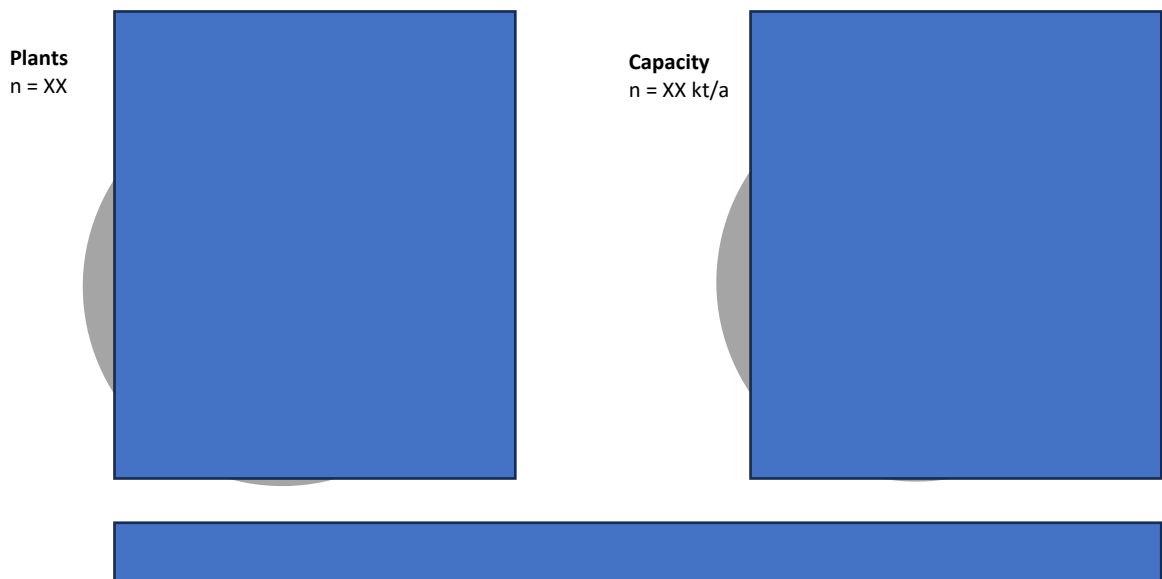
Population [million]	4.304	Operational PV recycling plants	XX
GDP per capita [USD]	7.089	Projects	XX
Installed PV capacity (2022) [MW]	XX	Share of cumulative PV installations worldwide t [%]	XX

Background

The Asian PV recycling market reflects the different developments in the industry worldwide.

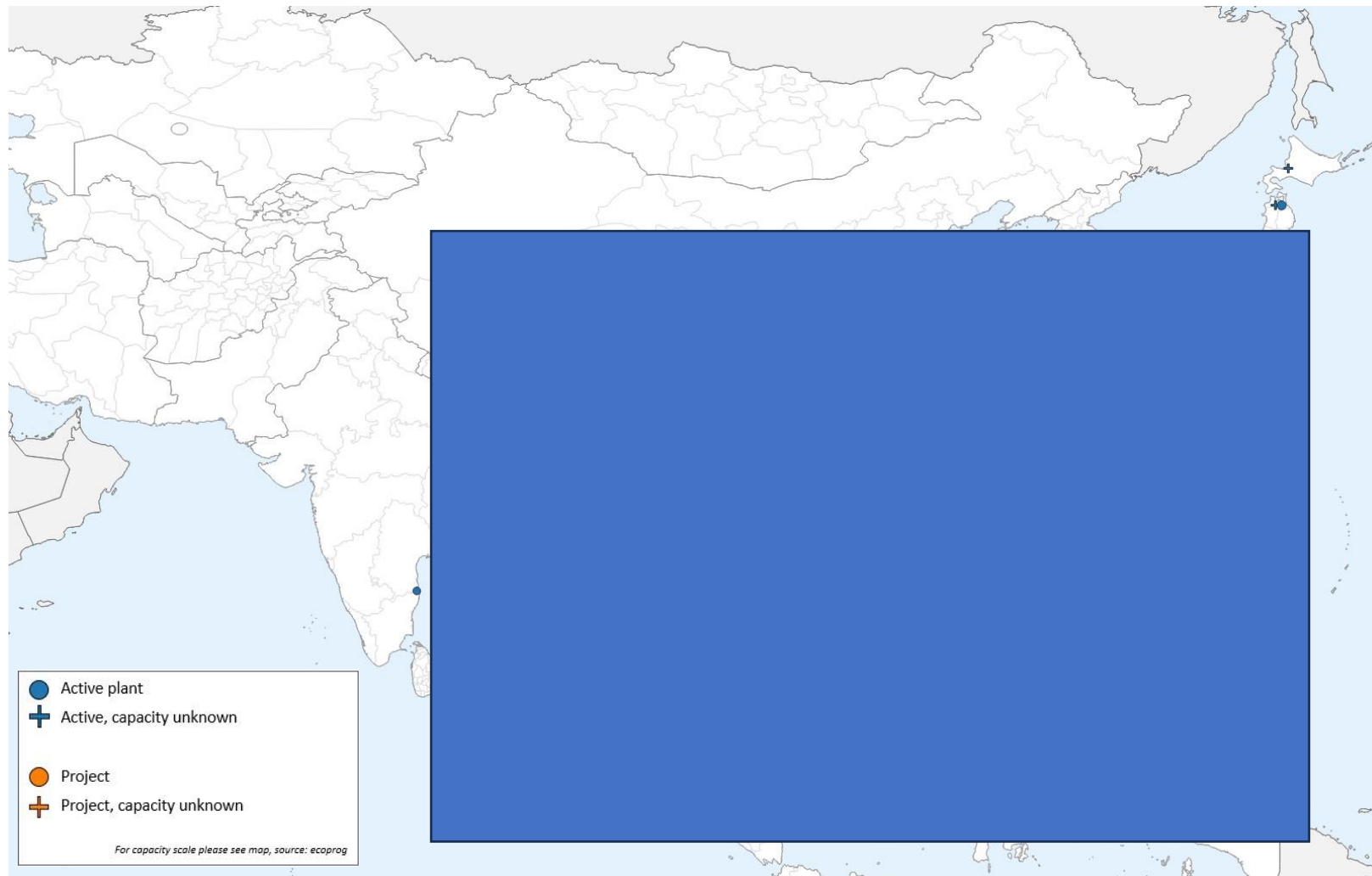
Japan already uses recycling technology commercially. In addition, a lot of research on different recycling approaches has taken place in Japan in recent years. The country relied on the use of photovoltaics at an early stage. Accordingly, [...]

Figure 22: Asia, active plants and capacities by country



Singapore is currently pursuing the strategy of developing new, cost-effective recycling technologies on a larger scale. According to November 2022 information by [...]

Figure 21: Asia, overview of plants and projects



Projects

For Europe, we have information on XX specific PV recycling plants.

[...]

Of the identified plants, XX are in [...]

Figure 28: Europe, planned projects and capacities by country

[...]

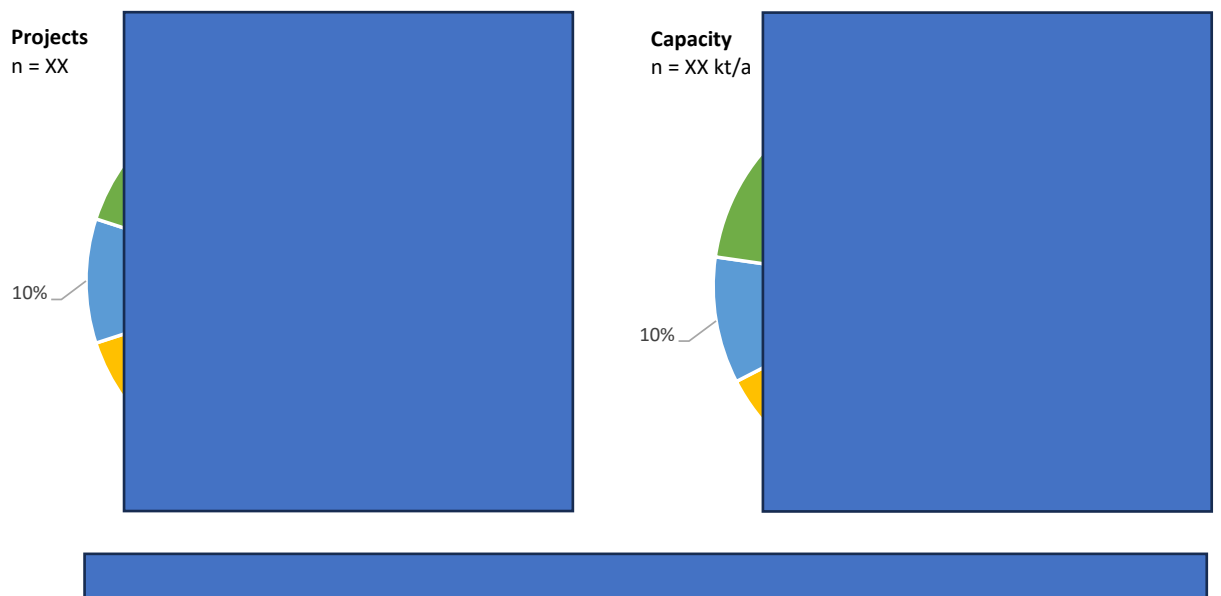


Figure 30: Overview of known projects in Europe

#	Project	Country	Operator	Capacity (t/a)	Start	Status
[...]	[...]	[...]	[...]	[...]	[...]	[...]
3	Tangermünde	Germany	Lux Chemtech GmbH	2024	n/a	planned
[...]	[...]	[...]	[...]	[...]	[...]	[...]
5	Mezőörs	Hungary	Re-Glass	n/a	n/a	approved
[...]	[...]	[...]	[...]	[...]	[...]	[...]

[...]

Competition

For this study, we have categorised the actors that operate or are currently building PV recycling plants in Europe by their origin.

In this region, too, most operators are companies from the waste industry. In total, we have assigned XX plants or projects to players in this industry. [...]

Figure 31: Europe, operators by industry

Plants and projects

n = XX



Source: ecoprolog

[...]

PV Recycling Plants

Seraing, Belgium

Status: active
Main input: solar panels
Start of operation: 2012

Operator:
Solarcycle
Rue du Teris, 45
4100 Seraing
info@solarcycle.be
www.solarcycle.be

Remarks:
The first phase started in 2012. As of late 2020, the plant has recycled a total of 50,000 PV modules at a current recycling rate of 86%. According to the company's website, however, the process already achieves a "minimum" recycling rate of 95 %. Most of the panels for recycling come from France. The metal is supplied to foundries, the glass is crushed and reused in the form of fine sand in road bitumen. With its "Phenix" research project, Solarcycle intends to increase the recycling rate to up to 98%. Solarcycle is a partnership of industrial partners Recma and Comet as well as research partners Liège University, GreenMat, Bruxelles University and Service 4Mat.

[...]

Halluin, France

Status: active
Main input: solar panels
Start of operation: 2021

Remarks:
Soren launched a tender process for three new PV recycling plants in France in February 2021 (in Halluin, Portet-sur-Garonne and Saint-Loubès).

Operator:
Galoo
Première, Av. Port Fluvial
59250 Halluin
halluin@galoo.com
www.galoo.com

[...]

Bad Lobenstein, Germany

Status: active

Main input: solar panels (Si-based only)

Remarks:
De-pollution and separation of recyclable materials, silicon-based PV modules only. Subcontracting to own primary treatment plant for de-pollution and separation of recyclable materials, for PV modules not suitable for preparation for reuse.

Operator:
MWH Mittermeier e.K.
Poststraße 32a
07356 Bad Lobenstein
mm-rohstoff@t-online.de

[...]

Regensdorf, Switzerland

Status: active
Main input: solar panels, electric and electronic devices

Remarks:
No dedicated plant for solar recycling. The company treats electrical and electronic devices including solar panels.

Operator:
Immark AG
Bahnstrasse 142
8105 Regensdorf
info@immark.ch
www.immark.ch

[...]

Scunthorpe, United Kingdom

Status: active
Main input: solar panels, cable, frame

Remarks:
The company dismantles the solar equipment at the clients' premises and supplies the equipment for recycling at the company's site. The company was founded in December 2016.

Operator:
Recycle Solar Technologies
Woodhouse Road
DN16 1BD Scunthorpe
info@recyclesolar.org.uk
www.recyclesolar.co.uk

PV Recycling Projects

[...]

Tangermünde, Germany

Status: planned
Main input: solar panels
Start of operation: 2024

Remarks:

According to information from February 2023, the Tangermünde plant should be able to recycle all types of solar modules produced up to 2022.

Operator:

Lux Chemtech GmbH
Alfred-Lange-Straße 18
09599 Freiberg
info@lc-freiberg.de
lc-freiberg.de

[...]

Orosháza, Hungary

Status: approved
Main input: solar panels

Remarks:

According to the operator, all necessary permits and recycling equipment is ready at the site. However, there is no updated time schedule available as of April 2023. As of 2020, there was reportedly no solar recycling capacity installed in Hungary.

Operator:
Re-Glass
Hrsz 0460/10
5900 Orosháza
info@reglass.hu
reglass.hu

[...]

Albalate del Arzobispo, Spain

Status: planned
Main input: solar panels
Start of operation: 2024

Remarks:

Capacity (solar panels/year): 50,000. As of early 2023, the so-called Centro Europeo de Reciclaje Fotovoltaico (Cerfo) is to be built at the San Cristóbal industrial estate. This plant is already the second phase of the project and is supposed to operate 24 hours a day. The goal is to recycle 87% of the PV material. The plant should initially be capable of processing 1,060 t/year (47,520 panels per year).

Operator:

Centro Europeo de Reciclaje Fotovoltaico (Cerfo)
C. Estación del Nte., 6
44500 Andorra
info@ibersyd.com
www.cerfo.com

[...]

Prices and product information

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