

# The Economic Potential of Thin Film PV in Germany

*Executive Summary*

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## Photovoltaics and the German energy transition

The share of renewable energies in German gross electricity consumption has increased from 24 percent to 36 percent between 2012 and 2017.<sup>1</sup> The coalition agreement of March 2018 plans to further increase the share of renewables in electricity generation, reaching 65 Percent by 2030.

In 2017, power generation from photovoltaics (PV) amounted to 40 TWh (18 percent of all renewable power generation and 7 percent of all power generation). The cumulative PV capacity installed was 42.3 GWp in 2017.<sup>2</sup> Thin film PV contributed an estimated 10 Percent (around 4.3 GWp) to this.<sup>3</sup> In the same year, 1.66 GWp of new PV capacity required investments of 1.7 billion Euro.<sup>4</sup>

## Key characteristics of thin film PV

PV is the conversion of light into electricity using semiconducting materials. PV encompasses several technologies with different characteristics which are evolving rapidly as the global PV industry is growing. Thin film solar cells are made by depositing one or more thin layers, or thin film, of photovoltaic material on a substrate, such as glass, plastic or metal.<sup>5</sup> Key characteristics of thin film PV are:

- **Competitiveness:** Economies of scale and technological improvements have decreased module prices and thin film technology competes in performance with other electricity generation technologies.<sup>6</sup>
- **Environmental footprint:** Thin film technology requires little active material in a cell. Low material input of thin film panels reduces ecological footprint.<sup>7</sup>
- **Innovative potential:** Emerging thin film technologies have a significant potential for further technological improvement and cost reduction.<sup>8</sup>

## The thin film PV value chain in Germany

The thin film PV value chain in Germany comprises activities over the whole PV life-cycle. The PV life-cycle encompasses raw material sourcing, manufacturing of modules, the deployment, operation and dismantling of PV systems as well as end-of-life disposal or recycling. Other important segments of the value chain are manufacturing of components, manufacturing of machinery and equipment for the production of modules and research and development. These products serve as inputs to the module manufacturing process in Germany and abroad.

Our analysis of firms operating in Germany shows that the German thin film industry serves both the German and the global market and covers all segments of the PV value chain.

## Policy scenarios and implications for PV installation

The worldwide expansion in PV capacity amounted to around 100 GWp in 2017, representing a year-on-year market growth of over 30 percent.<sup>9</sup> Steep global market growth is expected to continue. Fraunhofer ISE estimates a rise in the global cumulatively installed capacity to 5,200 GWp by 2035.<sup>10</sup> Large investments in PV are foreseeable also in Germany. Agora Energiewende finds that in order to increase the share of renewable energies to 65 percent of gross electricity consumption by 2030, an annual PV expansion of 5 GW between 2020 and 2030 is necessary.<sup>11</sup> This expansion path and assumed investment costs of 1 billion Euro/GWp imply an estimated annual economic potential of PV of EUR 5 billion in the upcoming years.

## The future economic potential of PV in Germany

PV is an ecologically sustainable technology for electricity generation. Thin film technology competes in performance with other electricity generation technologies and exhibits a high innovative potential. Thus, PV is one of the major future energy generation technologies and the global PV market will exhibit high growth. In Germany, substantial investments in PV will be undertaken to reach the goals of the energy transition (*Energiewende*).

The German thin film PV industry is highly innovative and serves both the German and the global market. Firms operating in Germany cover all segments of the PV value chain. Moreover, the German industry can draw on a well-established knowledge base with top-level research and development.

Jointly, these factors determine a high economic potential of PV in Germany. A supportive, technology neutral policy framework would foster the realisation of this potential with respect to jobs and economic growth in Germany.

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- <sup>1</sup> Federal Environment Agency (2018): Erneuerbare Energien in Zahlen, available online <https://www.umweltbundesamt.de/themen/klima-energie/erneuerbare-energien/erneuerbare-energien-in-zahlen#textpart-1>, last accessed 6.12.2018.
- <sup>2</sup> Fraunhofer Institute for Solar Energy Systems ISE (2018c): Energy Charts, last updated 30 Nov 2018.
- <sup>3</sup> PVthin (2018): Status-quo Thin-Film PV Deployment in Germany, calculation based on installations by First Solar, Calyxo, Solibro, Würth Solar and Avancis, unpublished.
- <sup>4</sup> Federal Ministry for Economic Affairs and Energy (2018b): Zeitreihen zur Entwicklung der erneuerbaren Energien in Deutschland unter Verwendung von Daten der AGEE-Stat, August 2018.
- <sup>5</sup> Fraunhofer Institute for Solar Energy Systems ISE (2018b): Photovoltaics Report, August 2018.
- <sup>6</sup> Ibid.
- <sup>7</sup> United Nations Environment Programme UNEP (2016): Green Energy Choices: The benefits, risks and trade-offs of low-carbon technologies for electricity production. Report of the International Resource Panel.
- <sup>8</sup> Federal Ministry for Economic Affairs and Energy (2018a): Bundesbericht Energieforschung 2018, Juni 2018.
- <sup>9</sup> Fraunhofer Institute for Solar Energy Systems ISE (2018a): Levelized Cost of Electricity- Renewable Energy Technologies, March 2018.
- <sup>10</sup> Ibid.
- <sup>11</sup> Agora Energiewende (2018): Stromnetze für 65 Prozent Erneuerbare bis 2030 Zwölf Maßnahmen für den synchronen Ausbau von Netzen und Erneuerbaren Energien, Juli 2018