100% Renewable Energy Scenarios – Relevance of Plastics for Solar Thermal Technologies

INFO Sheet A2

Description:	*This Info Sheet describes the role of solar thermal systems in 100% renewable energy scenarios, the resulting plastics material demand and possible consequences for the plastics industry.*
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Introduction

In order to estimate the future demand for polymeric materials in solar thermal systems, the Institute of Polymeric Materials and Testing at JKU Linz (AT) and the AEE-Institute for Sustainable Technologies in Gleisdorf (AT) analyzed global and European scenarios that aim at a 100% renewable energy supply by 2050. Those scenarios were compared to European market scenarios established by ESTIF (European Solar Thermal Industry Federation). Based on these scenarios the resulting polymeric material demand until 2050 was calculated, and the results were compared to the potential development of the total global oil reserves and plastics production.

100% Renewable Energy Scenarios

In recent years a variety of energy scenarios were developed. However, few of them describe the pathway to a 100% renewable energy future that includes all major renewable technologies and solar thermal systems in particular. On a global scale, the scenarios *Energy [R]Evolution – A Sustainable World Energy Outlook* (E[R]) by Greenpeace, GWEC and EREC and *The Energy Report – 100% Renewable Energy by 2050* (TER) by WWF International, ECOFYS and OMA were chosen for the calculations. European scenarios often vary in the scope (especially concerning geographic confines) which makes a comparison more difficult. Again, two scenarios were chosen: *RE-thinking 2050 – A 100% Renewable Energy Vision for the European Union* by EREC includes solar thermal scenarios for the former EU 27 member states while the European part of *Energy [R]Evolution* refers to OECD Europe (+37% installed capacity compared to EU 27, mainly due to Turkey).

Potential for Polymeric Materials

Based on conventional solar thermal systems and the assumption that the mass of the polymeric collector equals 0.7 times the mass of the conventional collector, the plastic demand per m^2 collector area was evaluated for pumped and thermosyphon systems, both. Additionally, assumptions for the energy yield per year and installed peak-power (global: 2.61 PJ/(GW·a); Europe: 2.19 PJ/(GW·a)), the development of the share of pumped/thermosyphon systems (global: 50%/50%, Europe: 60%/40% by 2050) and the life expectancy (20 years) were defined. Considering the current phase of polymeric collector development, mass production and installations on a worldwide scale are assumed to kick off by 2020.

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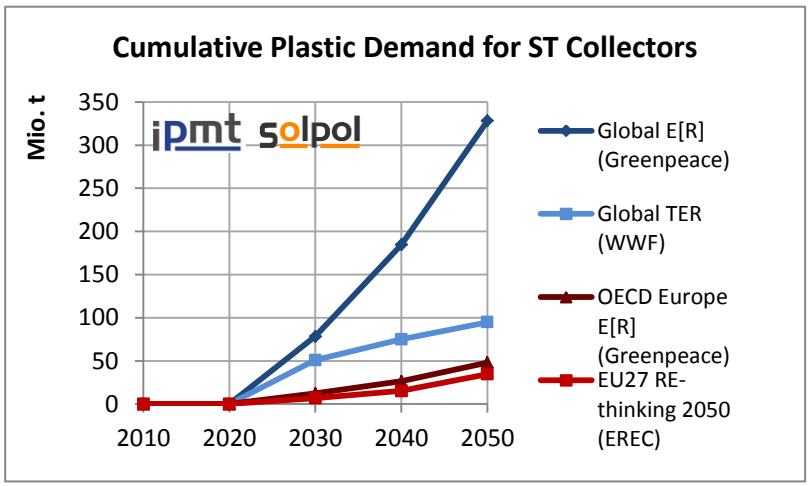

Figure 1: Cumulative plastic demand for solar thermal collectors between 2010 and 2050 on a global and European scale

In the calculations, the baseline capacity is covered by conventional collectors while the residual part of the 100% scenarios is covered with collectors based on plastics. Figure 1 shows the result on a global and European scale. Especially on a global scale, the differences between the two scenarios are significant. This shows the big uncertainty of such energy scenarios covering several decades. Up to 2050, a cumulative plastics demand ranging from about 100 and 330 Mio. t was estimated.

Consequences for the Plastics Industry

The realization of such 100% scenarios has a big impact on the material demand of all renewable technologies, including solar thermal. The annual plastics production worldwide in 2012 was 288 Mio. t. At the moment, a fraction of about 20.3% of the European plastics production is used in the "Building and Construction" sector, which results in an annual global demand of about 60 Mio. t. In this market sector cost-efficient commodity plastics (e.g., polyolefin) are dominating. Assuming the Global E[R] (Greenpeace) scenario an additional annual quantity of about 10 Mio. t has to be provided for the solar thermal industry. This figure clearly indicates the high attractiveness of solar thermal technologies for the plastics industry. A significant benefit of solar thermal energy supply is the saving of fossil resources which, in future, will be primarily used as a feedstock for polymer materials (see Figure 2).

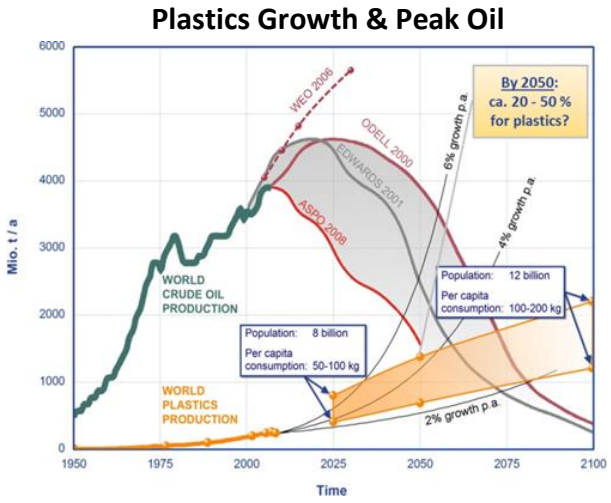

Figure 2: Global oil and plastic production scenarios
R. W. Lang and H. Kicker (2010)

References

"Plastics – the Facts 2013", PlasticsEurope, 2013, Brussels.

"Energy [R]Evolution – A Sustainable World Energy Outlook", Greenpeace, EREC and GWEC, 2012.

"RE-thinking 2050 – A 100 % Renewable Energy Vision for the European Union", EREC, 2010.

"The Energy Report – 100% Renewable Energy by 2050", WWF International, ECOFYS, OMA, 2011.