Polymeric Materials for Solar Thermal Applications
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Background: Solarthermal growth

20% Annual growth:
390 GW ~ 560 Mm² in 2020

How to provide the raw materials?
Energy consumption

Figure 1. World Marketed Energy Consumption, 2005-2030

Figure 8. World Carbon Dioxide Emissions, 2005-2030


# Cost scenarios

## Materials

<table>
<thead>
<tr>
<th>Material</th>
<th>Metal</th>
<th>Plastics</th>
<th>Savings</th>
<th>Savings %</th>
</tr>
</thead>
<tbody>
<tr>
<td>absorber</td>
<td>38</td>
<td>22</td>
<td>16</td>
<td>42%</td>
</tr>
<tr>
<td>transp cover</td>
<td>23</td>
<td>14</td>
<td>9</td>
<td>39%</td>
</tr>
<tr>
<td>casing</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>33%</td>
</tr>
<tr>
<td>sealing</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>insulation</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>other</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Material total</strong></td>
<td><strong>76</strong></td>
<td><strong>49</strong></td>
<td><strong>27</strong></td>
<td><strong>36%</strong></td>
</tr>
</tbody>
</table>

## Labor

<table>
<thead>
<tr>
<th>Cost</th>
<th>Metal</th>
<th>Plastics</th>
<th>Savings</th>
<th>Savings %</th>
</tr>
</thead>
<tbody>
<tr>
<td>labor</td>
<td>15</td>
<td>9</td>
<td>6</td>
<td>40%</td>
</tr>
<tr>
<td>Total production</td>
<td>91</td>
<td>58</td>
<td>33</td>
<td>36%</td>
</tr>
<tr>
<td>overhead</td>
<td>50</td>
<td>50</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Panel cost</strong></td>
<td><strong>141</strong></td>
<td><strong>108</strong></td>
<td><strong>33</strong></td>
<td><strong>23%</strong></td>
</tr>
</tbody>
</table>

## Installation

<table>
<thead>
<tr>
<th>Cost</th>
<th>Metal</th>
<th>Plastics</th>
<th>Savings</th>
<th>Savings %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation</td>
<td>100</td>
<td>70</td>
<td>30</td>
<td>30%</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>241</strong></td>
<td><strong>178</strong></td>
<td><strong>63</strong></td>
<td><strong>26%</strong></td>
</tr>
</tbody>
</table>
Objectives

- Assessment of the **applicability** and the **cost reduction potential** of polymeric materials for solar thermal systems
- Novel polymer based **designs**
- Evaluation of **less expensive materials**
- Assessment of **durability and reliability**
- Promote increased **confidence** in the use of these products
- Development and application of appropriate **testing and certification methods**
- Identification of **less expensive manufacturing** processes
Collector components

Assembly Process
- Absorber and thermal insulation inserted into collector trough
- Back plate bonded to collector trough

Material Selection (example)
- glazing of collector trough: transparent PA
- structure of collector trough: PA coloured
- back plate: PA coloured
Integrated storage collectors
Mass production

Design-Concept

Creation of suitable materials

Processing Development

Coating application
thermotropic polymeric materials allowing for
temperature control of a collector

thickness insensitive spectrally selective paints (TISS)
and glazing with self-cleaning properties

adhesion of functional polymeric materials to polymeric
substrates

ageing behaviour of functional polymeric layers and
glazing under service relevant loading and
environmental conditions
Building integration
Subtask division

SUBTASK A
• Information
• Dr. Michaela Meir
• Norway

SUBTASK B
• Collectors
• Dr. Stephan Fischer
• Germany

SUBTASK C
• Materials
• Prof. Dr. mont. Gernot Wallner
• Austria

OPERATING AGENT: Dr. Michael Köhl, FhG ISE, Germany
Subtask A:

State of the art: Polymeric materials in solar thermal applications

Taskforce on total cost accounting approach (incl. LCA)

Taskforce on standards, regulations and guidelines

Database of successful architectural integration

Dissemination of information
Subtask A:

Polymeric materials for solar thermal collectors –
Market overview and life cycle study

Dr. Michaela Meir
NORWAY
Subtask B:

Design of polymer-friendly systems
  pressure-less
  drain-back
  thermosiphon

Development of polymeric collectors
  building integrated
  overheating-control

Design of polymeric absorbers
Subtask B:
Requirements for polymeric based collectors and components, and examples for developed products

Dr. Stephan Fischer
GERMANY
Subtask C:

Tailor-made polymeric materials for collectors and heat storages

Prof. Dr. mont. Gernot M. Wallner
AUSTRIA
Subtask C:

Development of Multi-Functional Polymeric Materials
Processing and Evaluation of Components and Functional Coatings
Methods for Testing and Characterization of Polymeric Materials
Subtask A:

Polymeric materials for solar thermal collectors – Market overview and life cycle study

Dr. Michaela Meir
NORWAY