Introduction to Deutsche CSP

January 2018
Agenda

I Portrait of DCSP

II Competence profile of German CSP industry
Agenda

I Portrait of DCSP

II Competence profile of German CSP industry
Scope of Deutsche CSP

Leading German CSP companies and research institutes founded „Deutsche CSP“ with 3 key objectives

- **Foster research, development and demonstration** of technologies for solar-thermal generation of electricity and heat

- Raise public **awareness** of the particular **benefits of CSP technologies** for energy-economics and socio-economics

- Establish a **close interaction** among the association members and other organizations on national, European and international level, such as ministries, official bodies and other industry associations
History of Deutsche CSP

Starting as an informal network in June 2012, Deutsche CSP became an industry association in September 2013.

June 2012:
Foundation of industry network „Deutsche CSP“

November 2012:
Press announcement and position paper
First public appearance @ Dii conference 2012

September 2013:
Foundation as industry association „Deutsche CSP“ with official legal status and budget
Members of Deutsche CSP

Deutsche CSP represents 28 German companies and institutes with activities in CSP

- BASF SE
- CSP Services GmbH
- ERK Eckrohrkessel GmbH
- enolcon gmbh
- FICHTNER SOLAR GmbH
- Fraunhofer ISE
- German Aerospace Center (DLR)
- Grenzebach BSH GmbH
- hogrefe Consult
- HAWE Hydraulik SE
- IA Tech GmbH
- ILF Beratende Ingenieure GmbH
- innogy SE
- KAEFER Isoliertechnik GmbH & Co. KG
- Kraftanlagen München GmbH
- KSB Aktiengesellschaft
- Lahmeyer International GmbH
- Leoni Kerpen GmbH
- M+W Germany GmbH
- pro target AG
- ROBA Piping Projects GmbH
- schlaich bergermann partner - sbp sonne gmbh
- Solar-Institut Jülich of Aachen University of Applied Sciences
- Solarlite CSP Technology GmbH
- Suntrace GmbH
- toughTrough GmbH
- TSK Flagsol Engineering GmbH
- TÜV Rheinland Industrie Service GmbH
Members of Deutsche CSP

Deutsche CSP represents 25 German companies and institutes with activities in CSP
Board of the Association

Board of Deutschen CSP

<table>
<thead>
<tr>
<th>Chairman</th>
<th>Co-Chairman</th>
<th>Analysis</th>
<th>Finance</th>
<th>Markets</th>
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</thead>
<tbody>
<tr>
<td>Dr. Joachim Krüger</td>
<td>Jürgen Hogrefe</td>
<td>Prof. Dr.-Ing. Robert Pitz-Paal</td>
<td>Martin Schlecht</td>
<td>Oliver Baudson</td>
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</tbody>
</table>

Introduction to Deutsche CSP, January 2018
Our offer

As an association, Deutsche CSP represents German companies and institutes engaged in CSP technology

- We represent on a broad basis German companies and institutes that are active in the CSP market
- We provide a consolidated overview about the competences of German CSP industry
- We are a competent discussion partner regarding all aspects of energy generation from solar thermal power plants
  - Markets + regions
  - Technology + roadmaps
  - Potentials + projects
- Based on our long-lasting engagement in CSP, we have a detailed insight into boundary conditions of CSP projects. Thus we are able to explain critical success factors to all actors in politics and energy economics
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I  Portrait of DCSP

II  Competence profile of German CSP industry
Activity fields of German CSP companies

German companies and institutes address all relevant applications and technologies in the market

<table>
<thead>
<tr>
<th>Technology option</th>
<th>Application</th>
<th>Configuration</th>
<th>Heat transfer fluid</th>
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</thead>
<tbody>
<tr>
<td>Parabolic trough</td>
<td>Utility-scale electricity generation</td>
<td>Stand-alone Solar without storage</td>
<td>oil</td>
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<tr>
<td>Fresnel</td>
<td>De-centralized electricity generation</td>
<td>Stand-alone Solar with storage</td>
<td>molten salts</td>
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<td>Tower</td>
<td>Process heat / cooling</td>
<td>Hybrid (solar combined with fossil or biogene fuels)</td>
<td>direct steam</td>
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<td></td>
<td>Sea water desalination</td>
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<td>air</td>
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<td></td>
<td>Water treatment</td>
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<td>(for tower technology)</td>
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Deutsche CSP member companies are active across the entire CSP value chain.

Member companies of Deutsche CSP are active across the entire CSP value chain.

<table>
<thead>
<tr>
<th>Services / Components</th>
<th>EPC</th>
<th>project development</th>
<th>owner</th>
<th>site, resource</th>
<th>operation &amp; maintenance</th>
<th>turbine, power block</th>
<th>storage, heat exchanger</th>
<th>electricity, sensors, controls, automation</th>
<th>pipelining, valves, insulation</th>
<th>pumps, hydraulic drive, heat exchanger</th>
<th>heat transfer fluid</th>
<th>receiver, receiver</th>
<th>collector, heliostat, solar field</th>
<th>consulting</th>
<th>engineering &amp; support</th>
<th>materials &amp; automation</th>
<th>test &amp; measurement, quality control tasks</th>
<th>sharing technology</th>
<th>infrastructure, others</th>
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</table>

These services / components are provided or manufactured and offered with warranties.
Lieferanteil Deutscher Unternehmen

Beispiel Noor 1, Marokko:

- 160 MW, 3 Stunden Speicher
- Rund 40% der Leistungen von Deutschen Unternehmen

- Schott: Receiver tubes
- Siemens: Turbine
- BASF: Salt
- FLABEG: Mirrors
- Alstom: HV busbars
- ABB: Circuit breaker
- KSB: Pumps
- MunichRe: Insurance
- Flowserve: Pumps and valves
- Schneider: Solar field control system
- Krohne: Rotameters, Flowmeters
- WIKA: Pressure gauges and temperature elements
- VEGA: Level transmitters
- GEA: Condenser
- Fichtner: Consultant
- Schlaich Bergermann: Consultant

List may not be complete
German contribution to market success

German CSP companies secure CSP market success based on their innovation competence at components and engineering.

- German companies drive all relevant innovation topics in the scope of components and engineering.
- Quality criteria and methods developed in Germany are applied in many CSP markets.

German companies...
... enable excellent yields by supplying highly efficient components.
... facilitate successful projects based on a highly professional supply chain.

German politics is strongly engaged in supporting CSP technology within Germany and abroad.