FRAUNHOFER INSTITUTE FOR SOLAR ENERGY SYSTEMS ISE

Electricity production from solar and wind in Germany in 2011

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  - Annual power curves
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  - Exemplary weekly power curves
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The gross electricity generation in 2011 was 612 TWh, the gross electricity consumption was 605 TWh.

Due to the strong growth of the renewables, an export surplus of 3.8 TWh was achieved.

Wind turbines produced 48.9 TWh in 2011 (37.8 TWh in 2010).

Their production increased by 29% compared to 2010.

Wind energy produced 8.1% of the gross electricity generation.

Photovoltaic (PV) plants produced 19.3 TWh in 2011 (11.7 TWh in 2010).

The production increased by 65% compared to 2010.

Solar energy produced 3.2% of the gross electricity generation.

Hydro power produced 18.1 TWh in 2011 and ranges now behind PV for the first time. The share of the gross electricity generation was 3.0%.
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Solar power plants produced 65% more electricity in 2011 compared to 2010. They reached a share of 3.2% of the gross electricity production.

Wind turbines increased their production by 29% compared to 2010. They reached a share of 8.1% of the gross electricity production.

Graph: B. Burger, Fraunhofer ISE; Data source: BMWi Energiedaten, Revision: 25.01.2012
The installed solar power increased by 7.5 GW from 17.5 GW in 2010 to 25.0 GW in 2011.

The installed wind power increased by 1.9 GW from 27.2 GW to 29.1 GW.

Graph: B. Burger, Fraunhofer ISE; Data source: BMU: Renewable energies 2011, Revision: 02/2012
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Monthly Production Solar

The maximal monthly solar production was 2.6 TWh in May 2011
The minimal monthly solar production was 0.31 TWh in December 2011

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
The maximum production of wind turbines was 8 TWh in December 2011
The minimum production was 2.5 TWh in June 2011

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
The maximal electricity production of conventional sources was 36.8 TWh in January 2011.

The minimal production was 26 TWh in June 2011.

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
The maximal monthly load was 44.8 TWh in January 2011.
The minimal monthly load was 38.2 TWh in June 2011.

Graph: B. Burger, Fraunhofer ISE; data: ENTSO-E
Die maximal electricity production of solar and wind was 8.3 TWh in December 2011.

Die minimal production was 3.7 TWh in November 2011.
Monthly Production Solar, Wind and Conventional

Legend: Conventional > 100 MW  Wind  Solar

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
The maximal monthly solar energy share of the load was 6.4% and was reached in May 2011.

The minimal monthly solar energy share of the load was 0.74% and was reached in December 2011.

Graph: B. Burger, Fraunhofer ISE; solar data: EEX Transparency Platform; load data: ENTSO-E
The maximal monthly wind energy share of the load was 19% and was reached in December 2011.

The minimal monthly wind energy share of the load was 6.5% and was reached in June 2011.

Graph: B. Burger, Fraunhofer ISE; wind data: EEX Transparency Platform; load data: ENTSO-E
The maximal sum of solar and wind energy share of the load was 19.8% in December 2011.

The minimal sum of solar and wind energy share was 8.7% in November 2011.

Graph: B. Burger, Fraunhofer ISE; solar and wind data: EEX Transparency Platform; load data: ENTSO-E
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The maximal weekly solar electricity production was 0.65 TWh in calendar week 16 from 18th to 24th of April 2011.

The minimal weekly production was 0.05 TWh in Calendar week 51 from 19th to 25th of December 2011.

Graph: B. Burger, Fraunhofer ISE; solar data: EEX Transparency Platform
The maximal weekly wind electricity production was 2.2 TWh in calendar week 50 from 12\textsuperscript{th} to 18\textsuperscript{th} December 2011.

The minimal weekly production was 0.14 TWh in calendar week 39 from 26\textsuperscript{th} of September to 2\textsuperscript{nd} of October 2011.
The maximal weekly electricity production from conventional sources was 9.1 TWh in calendar week 4 from 24\textsuperscript{th} to 30\textsuperscript{th} of January 2011.

The minimal weekly production was 5.6 TWh in calendar week 22 from 30\textsuperscript{th} of May to 05\textsuperscript{th} of June 2011.

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
The maximal weekly load was 10.8 TWh in calendar week 5 from 31st of January to 06th of February 2011.

The minimal weekly load was 8.1 TWh in calendar week 52 from 26th of December 2011 to 01st of January 2012.

Grafik: B. Burger, Fraunhofer ISE; Daten: ENTSO-E
The maximal weekly sum of solar and wind production was 2.2 TWh in calendar week 50 from 12th to 18th of December 2011.

The minimal weekly sum of solar and wind production was 0.37 TWh in calendar week 46 from 14th to 20th of November 2011.

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
Weekly Production Solar, Wind und Conventional

Weekly Production Solar, Wind and Conventional > 100 MW

Legend: Conventional > 100 MW Wind Solar

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
Weekly Solar Energy Share of the Load

The maximal weekly solar energy share of the load was 7.5% in calendar week 16 from 18th to 24th of April 2011

The minimal weekly solar energy share of the load was 0.5% in calendar week 51 from 19th to 25th of December 2011

Graph: B. Burger, Fraunhofer ISE; solar data: EEX Transparency Platform
The maximal weekly wind energy share of the load was 21.5% in calendar week 50 from 12\textsuperscript{th} to 18\textsuperscript{th} of December 2011

The minimal weekly wind energy share of the load was 1.6% in calendar week 39 from 26\textsuperscript{th} of September to 2\textsuperscript{nd} of October 2011

Graph: B. Burger, Fraunhofer ISE; solar data: EEX Transparency Platform; load data: ENTSO-E
The maximal sum of solar and wind energy share of the load was 22% in calendar week 50 from 12\textsuperscript{th} to 18\textsuperscript{th} of December 2011.

The minimal sum of solar and wind energy share of the load was 3.7% in calendar week 46 from 14\textsuperscript{th} to 20\textsuperscript{th} of November 2011.

Graph: B. Burger, Fraunhofer ISE; solar and wind data: EEX Transparency Platform; load data: ENTSO-E
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Electricity Production in Germany: January 2011

- Solar: max. 6.7 GW; 0.37 TWh
- Wind: max. 17.4 GW; 3.6 TWh
- Conventional: max. 62.7 GW; 36.8 TWh

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
Electricity Production in Germany: February 2011

Actual production

- **Solar**: max. 9.9 GW; 0.7 TWh
- **Wind**: max. 22.9 GW; 4.6 TWh
- **Conventional**: max. 61.7 GW; 33.1 TWh

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform

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Electricity Production in Germany: March 2011

**Actual production**

- **Solar**: max. 12 GW; 1.7 TWh
- **Wind**: max. 18.9 GW; 3.1 TWh
- **Conventional**: max. 58.4 GW; 34.4 TWh

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
Electricity Production in Germany: April 2011

**Actual production**

![Graph showing electricity production]

**Legend:**
- Conventional > 100 MW
- Wind
- Solar

- Solar: max. 12.8 GW; 2.2 TWh
- Wind: max. 19.2 GW; 3.5 TWh
- Conventional: max. 53.5 GW; 27.8 TWh

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform

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Electricity Production in Germany: May 2011

Actual production

- Solar: max. 13.2 GW; 2.6 TWh
- Wind: max. 14.5 GW; 3.0 TWh
- Conventional: max. 47.2 GW; 27 TWh

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
Electricity Production in Germany: June 2011

Actual production

- **Solar**: max. 13 GW; 2.2 TWh
- **Wind**: max. 16.4 GW; 2.5 TWh
- **Conventional**: max. 49 GW; 26 TWh

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
Electricity Production in Germany: July 2011

- Solar: max. 12.8 GW; 2.1 TWh
- Wind: max. 14.4 GW; 3.6 TWh
- Conventional: max. 48.9 GW; 27.2 TWh

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
Electricity Production in Germany: August 2011

- **Solar**: max. 12.7 GW; 2.2 TWh
- **Wind**: max. 15.9 GW; 2.8 TWh
- **Conventional**: max. 49.1 GW; 28.3 TWh

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
Electricity Production in Germany: September 2011

Actual production

- Solar: max. 12.4 GW; 1.9 TWh
- Wind: max. 16.3 GW; 2.9 TWh
- Conventional: max. 51.6 GW; 28.9 TWh

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
Electricity Production in Germany: October 2011

Actual production

displayed month: October 2011

- Solar: max. 12.6 GW; 1.5 TWh
- Wind: max. 18.1 GW; 4 TWh
- Conventional: max. 57.7 GW; 30.7 TWh

Legend: Conventional > 100 MW  Wind  Solar

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
Electricity Production in Germany: November 2011

- **Solar**: max. 8.1 GW; 0.8 TWh
- **Wind**: max. 19.7 GW; 2.9 TWh
- **Conventional**: max. 62.6 GW; 34.4 TWh

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
Electricity Production in Germany: December 2011

Actual production

- Solar: max. 4.65 GW; 0.31 TWh
- Wind: max. 21.3 GW; 7.98 TWh
- Conventional: max. 57.8 GW; 30.6 TWh

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
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Diurnal courses 2011

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
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Electricity Production in Germany: Calendar Week 8

- **Solar:** max. 9.9 GW; 0.29 TWh
- **Wind:** max. 8.3 GW; 0.65 TWh
- **Conventional:** max. 61.5 GW; 8.7 TWh

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
Electricity Production in Germany: Calendar Week 9

- **Solar:** max. 11.1 GW; 0.38 TWh
- **Wind:** max. 8.2 GW; 0.5 TWh
- **Conventional:** max. 58.4 GW; 8.6 TWh

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
Electricity Production in Germany: Calendar Week 10

**Actual production**

- **Solar**: max. 12.0 GW; 0.35 TWh
- **Wind**: max. 18.9 GW; 1.2 TWh
- **Conventional**: max. 58.2 GW; 7.9 TWh

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
Electricity Production in Germany: Calendar Week 11

- Solar: max. 11.1 GW; 0.25 TWh
- Wind: max. 11.1 GW; 0.65 TWh
- Conventional: max. 57.3 GW; 7.7 TWh

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
Electricity Production in Germany: Calendar Week 12

- Solar: max. 11.9 GW; 0.48 TWh
- Wind: max. 6.3 GW; 0.45 TWh
- Conventional: max. 51.2 GW; 7.2 TWh

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
Electricity Production in Germany: Calendar Week 16

- Solar: max. 12.6 GW; 0.65 TWh
- Wind: max. 7.3 GW; 0.46 TWh
- Conventional: max. 49.3 GW; 6.4 TWh

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
Electricity Production in Germany: Calendar Week 18

- Solar: max. 13 GW; 0.64 TWh
- Wind: max. 9.8 GW; 0.65 TWh
- Conventional: max. 47.2 GW; 6.4 TWh

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
Electricity Production in Germany at Whitsun

**Actual production**

<table>
<thead>
<tr>
<th>Day</th>
<th>MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thursday</td>
<td>60,000</td>
</tr>
<tr>
<td>Friday</td>
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<tr>
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<td>Whit Sunday</td>
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<td>Whit Monday</td>
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<tr>
<td>Tuesday</td>
<td>10,000</td>
</tr>
<tr>
<td>Wednesday</td>
<td>10,000</td>
</tr>
</tbody>
</table>

Legend: Conventional > 100 MW, Wind, Solar

- There was no risk of a blackout during Whitsun.
- Solar plants stabilize the grid, since they deliver peak load.

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform

No blackout at Whitsun!!!
Electricity Production in Germany: Calendar Week 50

- Solar: max. 2.9 GW; 0.05 TWh
- Wind: max. 20.8 GW; 2.2 TWh
- Conventional: max. 56.2 GW; 7.3 TWh

Graph: B. Burger, Fraunhofer ISE; data: EEX Transparency Platform
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Electricity Production in Germany: Sunday, 08.05.2011

- Solar: max. 12.9 GW; 101 GWh
- Wind: max. 9.7 GW; 185 GWh
- Conventional: max. 32.9 GW; 667 GWh

Graph: European Electricity Stock Exchange EEX, http://www.transparency.eex.com

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Electricity Production in Germany: Monday, 09.05.2011

**Actual production**

- Solar: max. 13.2 GW; 106 GWh
- Wind: max. 8.7 GW; 121 GWh
- Conventional: max. 45.2 GW; 955 GWh

**Planned production**

Graph: European Electricity Stock Exchange EEX, http://www.transparency.eex.com
Thank you for your Attention!

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