Energiewende

Germany’s energy system and the status of the energy transition

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Sacramento, Aug 5th 2015
Five reasons for the Energiewende

- Development of new technologies as new sources of growth and employment
- Energy policy can be both sustainable and economically successful
- Reduce dependency on energy imports
- Reduce carbon emissions and reach climate protection targets
- Phase-out nuclear power generation

The Energiewende is a long-term strategy based on public acceptance.
Drivers of the Energiewende – mitigate climate change

The Energiewende helps to reach climate protection goals.
German GHG Emissions (2014) by sector (MtCO₂ eq.)

Total: 912 Mt

- Energy industry: 355 Mt (39%)
- Industry: 187 Mt (21%)
- Transport: 164 Mt (18%)
- Households: 88 Mt (10%)
- Trade and services: 35 Mt (4%)
- Agriculture: 70 Mt (8%)
- Other: 13 Mt (1%)

CO₂ emissions are largely caused by the energy, industry and transport sectors.
Energy imports and domestic production in Germany

The Energiewende hits many birds with one stone as renewables and efficiency reduce Germany’s energy dependence.

Source: AGEB 2012, AGEB 2014
Benefits - reduce costs of energy imports

Renewable sources of energy saved €10 billion of fossil fuel imports in 2012 and over €9 billion in 2013.

Source: BMWi 2014
The energy transition follows a transparent, long-term strategy with specific targets.

### 2050 Energiewende targets

<table>
<thead>
<tr>
<th>Climate</th>
<th>% greenhouse gas reduction (vs. 1990)</th>
<th>Achieved 2014</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-27%</td>
<td>-40</td>
<td>-55</td>
<td>-70</td>
<td>-80</td>
<td>to -95</td>
<td></td>
<td></td>
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</table>

| Renewable Energies | % gross electricity consumption | 27.8% | 35    | 40 to 45 | 50    | 55 to 60 | 65    | 80    |
|                   | % final energy consumption       | 12,4%* | 18    | 30    | 45    | 60    |

| Energy Efficiency | % primary energy consumption (vs. 2008) | -9 %   | -20   |       |       |       |       |
|                  | final energy productivity         | 0.2%* p.a. |       | +2.1% p.a. |       |       |       |
|                  | building renovation               | ~1%* p.a. |       |       |       |       |

- 2013


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Important policy documents in Germany

Energy Concept (2010) and energy package (2011)

10 point agenda (2014)

Climate action programme (2014)


Energy Green Paper (2014)
Four areas to increase flexibility

Different flexibility measures are suitable for varying shares of volatile renewables.
Installed Capacity in Germany

89 GW conventional

87 GW RES

80-85 GW maximum load
The Federal Law Requirements Plan lists 36 grid extension projects for 2023 and is revised annually.

- 36 line project planning for the high voltage transmission grid
  - 8 pilot projects for low-loss transmission (underground cables)
  - 1 pilot project for high temperature conductors

Source: IET- International Energy Transition, Netzausbau.de
Main federal-level energy efficiency measures

Buildings
- Energy consulting
- KfW programmes for construction and renovation
- MAP (Market Incentive Programme)
- Energy saving legislation

Products and appliances
- Energy consulting (Energy Efficiency Campaign)
- NTRI: National Top Runner Initiative
- Energy Efficiency Labelling Ordinance
- Ecodesign Directive (eff. classification)

Industry and business
- Energy consulting services
- KfW credits and loans (Effizienzprogramm, BAFA)
- Obligatory energy audits
- European emissions trading (ETS)

Transport
- Labelling (EU Directive Fuel Economy)
- Regulation of consumption
- Motor vehicle taxation
- E-mobility strategy
- Mobility and fuel strategy

Energy efficiency policies find a balance between consultation, information, incentives and regulation.
### NAPE: Efficiency measures and their expected savings

<table>
<thead>
<tr>
<th>Measure</th>
<th>Savings (PJ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality assurance and optimising of energy consulting</td>
<td>4.0</td>
</tr>
<tr>
<td>Incentive programme for energy-efficient renovation</td>
<td>0-40</td>
</tr>
<tr>
<td>Continuation and increased funding of the CO2 building renovation programme</td>
<td>12.5</td>
</tr>
<tr>
<td>Promoting “energy performance contracting”</td>
<td>5.5-10</td>
</tr>
<tr>
<td>National energy-efficiency label for old heating installations</td>
<td>10.0</td>
</tr>
<tr>
<td><strong>Total: Quality assurance and optimising of energy consulting</strong></td>
<td><strong>32-76.5</strong></td>
</tr>
<tr>
<td>National top runner initiative</td>
<td>85.0</td>
</tr>
<tr>
<td>Introduction of a competitive tendering scheme for energy efficiency</td>
<td>26-51.5</td>
</tr>
<tr>
<td><strong>Total: National top runner initiative</strong></td>
<td><strong>111-136.5</strong></td>
</tr>
<tr>
<td>Upgrading the KfW energy efficiency programmes</td>
<td>29.5</td>
</tr>
<tr>
<td>Energy efficiency networks initiative</td>
<td>74.5</td>
</tr>
<tr>
<td>Obligation to perform energy audits for non-SMEs</td>
<td>50.5</td>
</tr>
<tr>
<td><strong>Total: Upgrading the KfW energy efficiency programmes</strong></td>
<td><strong>154.5</strong></td>
</tr>
</tbody>
</table>

A balance of information, support and regulation.

Source: Ecolys 2015 based on BMWI 2014
Renewable energy development in Germany

The share of renewables is growing in all sectors, but fastest in electricity.

Source: Ecolys 2015 based on AGEE-Stat 2015
Expansion of renewable energy sources in Germany

The number of renewable power plants has grown exponentially over the past 14 years.

Source: 50hertz, Boris Schucht 2015
Gross job creation in the German renewables sector

The renewables sector has positive employment effects in Germany.
Renewables are increasingly competitive with conventional powerplants.

Source: Fraunhofer ISI 2014

RES levelised cost of electricity in Europe 2014, 2020, 2030
Opening up the EEG for European Neighbours

- Germany will open up at least 5% of the EEG for foreign investment from 2017 onwards
- Reason for opening up:
  - Europeanize the 'Energiewende'
  - Yield to the pressure of the EU commission
- In 2016 there will be a 'pilot opening' for PV
- Conditions for opening up:
  - International treaty
  - Mutuality
  - Physical import of electricity

Average annual value of solar irradiation for an optimally aligned PV module in kWh/m².
There are various options to store energy: electro mechanical, mechanical, electro magnetical, electrical, thermal, and chemical options.
Storage technologies differ widely in duration of discharge, storage capacity, costs and commercial viability.

Characteristics of power storage technologies

Source: Sterner, Stadler et al 2014
Global new investments in renewables 2004-2014

Developing countries are catching up as RES are becoming less expensive.
Top worldwide renewable power capacities 2014

The biggest players in the RES sectors are some of the most important economies worldwide.
### Key policy measures

<table>
<thead>
<tr>
<th>Description</th>
<th>Contribution to GHG emission reduction (million t CO2 eq)</th>
</tr>
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<tbody>
<tr>
<td>National Energy Efficiency Action Plan (NAPE) (excl. measures in the transport sector)</td>
<td>Ca. 25 – 30 m t</td>
</tr>
<tr>
<td>Strategy on <strong>climate-friendly building</strong> and <strong>housing</strong> (incl. building specific NAPE measures)</td>
<td>Ca. 5.7 – 10 m t</td>
</tr>
<tr>
<td><strong>Transport</strong> sector measures</td>
<td>Ca. 7 – 10 m t</td>
</tr>
<tr>
<td>Non-energy related emissions in - industry, trade/commerce/services, waste mgmt. - agriculture</td>
<td>3 – 7.7 m t, 3.6 m t</td>
</tr>
<tr>
<td>Emission <strong>trading</strong> reform</td>
<td>Dependent on EU</td>
</tr>
<tr>
<td>Further measures, incl. the <strong>electricity</strong> sector</td>
<td>22 m t</td>
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</tbody>
</table>

**Recent policy programmes will reduce emissions by an additional 62-78 million tonnes of CO2 by 2020.**
Thank you for your attention

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