The German „Energiewende“ – Climate Change, Energy Efficiency and more

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On the occasion of the
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Low Carbon Markets and the Legacy of Nuclear Power

Salzburg
1. – 5. September 2014
The Background
Facts and History

- 1950/60’s: Coal and steel economy
- Resource-poor → dependence on raw material imports
- Economic backbone: Engineering and Trade
- Strong dependence on exports and international ties
- Geographical location in the centre of Europe
„Energiewende“ started in the 70’s

- 1979 Enquête Commission *Future of Nuclear Energy*
  → phase out technically & economically feasible

- 1987 – 1994 Enquête Commissions “*Protection of the Earth’s Atmosphere*”

  → Crucial question of Energy Transition
Primary Energy Consumption and Import

- Imports: 97%
- Domestic: 3%

Primary energy [Mt SKE]

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<tbody>
<tr>
<td>2002</td>
<td>184</td>
<td>154</td>
<td>107</td>
<td>101</td>
<td>66</td>
<td>57</td>
<td>57</td>
<td>56</td>
<td>61</td>
<td>37</td>
<td>16</td>
<td>54</td>
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<tr>
<td>2012</td>
<td>2%</td>
<td>98%</td>
<td>20%</td>
<td>13%</td>
<td>41%</td>
<td>81%</td>
<td>1%</td>
<td>19%</td>
<td>99%</td>
<td>3%</td>
<td>43%</td>
<td>54%</td>
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- Oil: 33%
- Gas: 21%
- Hard coal: 12%
- Brown coal: 12%
- Nuclear: 12%
- Renewables: 2%
- Others: 2%
Renewable Energy Capacity

Power production in Germany by source 1990 – 2013 (percent)
The Rationale behind the „Energiewende“
Rationale of the German “Energiewende”

- **Broad consensus**: phase out of nuclear until 2022 and base energy system on renewable sources of energy and energy efficiency
- **sustainable climate protection** as key driver
- **economic calculation** as another driver
  - future **competitiveness** will be decided by **costs of energy per GDP**
  - future **independent energy generation at very low costs**
  - **multiplying innovation**: a complete new energy system
  - short term investments – long term benefits
- **comprehensive** and **long term** strategy which ensures **reliability, affordability and security of supply**
  - Not “plugging out Nuclear and coal” and “plugging in Renewables” over night but complex overall system change
  - energy sector is capital intensive, long term planning periods
Overview on state of implementation of GHG/RE/EE targets

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<tr>
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<th>2013</th>
<th>2020</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
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<tr>
<td><strong>GHG Emissions</strong></td>
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<tr>
<td>GHG Emissions (cp. 1990)</td>
<td>-23.8%</td>
<td>at least -40%</td>
<td>at least -55%</td>
<td>at least -70%</td>
<td>at least -80% to -95%</td>
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<td><strong>Renewable Energy</strong></td>
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<td>RES share in gross electricity consumption</td>
<td>25.4%</td>
<td>at least 35%</td>
<td>at least 50%</td>
<td>at least 65%</td>
<td>at least 80%</td>
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<tr>
<td>RES share in final energy consumption (2012)</td>
<td>12.4%</td>
<td>18%</td>
<td>30%</td>
<td>45%</td>
<td>60%</td>
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<tr>
<td><strong>Energy efficiency</strong></td>
<td></td>
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<td></td>
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<tr>
<td>Primary energy consumption (cp. 2008)</td>
<td>-3.3%</td>
<td>-20%</td>
<td></td>
<td>-50%</td>
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GHG emission reduction

- Target: reducing GHG emissions by 40% until 2020 (cp. to 1990) and by 80-95% until 2050
- 2013: 23.8% (cp. to 1990, slight increase cp. to 2012)
RES surpassed nuclear and became second largest electricity generator (25.4%)
Learning curve for RES technology development has been largely paid

• Renewable energy surcharge amounts to 6.24 ct/kWh or € 24 bn. p.a.

• Main cost driver: financing PV learning curve at former high costs (total installed PV capacity: 35 GW)
**Investments of the past pay off: future**
**Renewables much cheaper – economies of scale / learning curve**

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<th>2010</th>
<th>2014</th>
<th>2020</th>
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<tr>
<td>PV (ct./kWh)</td>
<td>24-35</td>
<td>9.5-13.5</td>
<td>~7-10</td>
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<tr>
<td>Wind (ct./kWh)</td>
<td>6-10</td>
<td>5.5-9</td>
<td>~4.5-8</td>
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Future investments in Renewables cheaper than fossil fuel costs

- It has become cheaper to invest in RES than to use fossil fuels
- if framework is right (targets/ investment security)
- Fossil fuel costs are “sunk costs”
Improving energy security and fostering economic growth and jobs

- In Germany RES and efficiency together save 36 bn € fossil fuel costs p.a. (2012) and led to new 800,000 jobs

- EU-KOM Impact Assessment for 2030 framework showed: 30% RES-target and ambitious efficiency lead to:
  - 260 bn € more savings of fossil fuels
  - and 500,000 more jobs

  compared to only 27% RES target and less ambitious efficiency
One of the key drivers: the German Renewable Energies (Renewable Source Act (EEG))

Next steps now towards more market integration and cost control

Other key drivers:
Energy efficiency, Energy security, Reduction of energy imports, creating jobs an economic growth, innovative technology
Reform of the EEG – Key elements

• Cost and quantity control
  – quantity control binding Renewable Energies deployment corridors
  – mechanism

• Cost-efficiency
  – focussing on wind and solar: most efficient technologies
  – wind tariffs reduced up to 20%

• Increased market integration

• Exemptions for industry adjusted

→ Compatibility with the EU-framework
Deployment corridors for RES control costs and quantity

- Concrete Renewable Energies corridors in the electricity sector agreed:
  - In 2025: between 40% and 45% RES share in electricity
  - In 2035: between 55% and 60% RES share in electricity

- Consequence:
  - Onshore wind capacity: 2.5 GW per year
  - Solar energy: 2.5 GW per year
  - Offshore wind capacity: 6.5 GW by 2020 and 15 GW by 2030

→ optimal integration and predictability for investors and the electricity market
Measures for quantity and cost control

• Step I: “flexible cap” for all technologies
  – Automatic tariff reduction if newly installed capacity is above corridor
  – Very good experience in the PV sector: tariffs have been reduced by ~70% over the last 5 years: today between 9 – 13 ct/kW (depending on the size of installation)
  – “flexible cap” is now extended to wind

• Step II: tender scheme as of 2017
  – Starting with pilot projects of 400 MW PV (ground mounted) p.a.
  – introduction of tender schemes as of 2017 based on experience made
Cost efficiency

- Focussing on the most cost efficient technologies: Wind and PV

- Onshore wind:
  - support levels reduced between 10-20% at very good sites
  - bonuses abolished or phased out

- Offshore wind:
  - “acceleration model” extended until 2019,
  - Support reduced by 1 ct/kWh in 2018

- PV tariffs already cut by 70% in the last 5 years
Market integration: mandatory market premium

• Market responsiveness is most important for the internal market

• Market premium ensures market responsiveness; RES operators act in the same way as operators of conventional power plants

• So far market premium was optional
  – 80% of wind and ~ 40% of overall installations used optional premium
  – sufficient experience gained

• market premium becomes mandatory

• Sliding premium ensures balanced risks for Renewable energies operators
Balanced exemptions for industry needed

- Affordability of transition costs important particularly for energy intensive industry facing international competition

- Balanced exemptions needed which
  - reflect support costs and
  - avoid distortion of competition

- Intensive discussions also in the context of state aid

→ Compatibility with the EU-framework
Exemptions for industry: key elements

• Conditions
  – Undertaking is operating in one of the sectors of the State Aid guideline sector list (reflecting minimum trade intensity and electricity cost intensity)
  – Share of electricity costs per unit gross added value is at least 16% (for some undertakings: 20%) → increased from 14% (EEG 2012) in the light of increased EEG-levy

• Consequence
  – General principle: undertakings pay 15% of the EEG-levy but max. 4% (“cap”) or 0,5% for most energy intensive industries (“super-cap”)
  – Every undertaking pays the full EEG-levy for the 1st GWh
  – And at least 0.1 ct/kWh for every kWh beyond

→ ensuring minimum contribution of industry and competetiveness
Energiewende: challenges ahead

Integrating “Energiewende” in the internal market
- EU-wide Market integration is most efficient
- Foster EU-wide grid reinforcement and market coupling
- Supportive EU-framework needed!

“Unlock” Energy efficiency potential
- EE is still lacking behind despite cost-efficiency
- Concrete Energy Efficiency Action Plan agreed

Renewable energies
- Cost and quantity control
- Coordination with neighbours

New flexible system needed; energy security is a EU question
- Making use of the flexibility and balancing options of the internal market is most efficient
- Assessment and solution in the European context needed
- More regional cooperation
Grids and market coupling are key for market integration

- Challenge within Germany: transport from North to South
- Loop flows: temporary affecting neighbours
- Key: High Voltage DC-transmission lines (and more AC lines)
- Germany introduced comprehensive new planning system for grids
- European market integration most cost efficient
  - Interconnectors (!)
  - Market coupling
  - Liberalisation
Case for Energy Efficiency

• Future competitiveness will be decided by primary energy/BIP: by 2050 Germany wants to need only half (50%) of today's primary energy for one unit BIP

  ■ Ambitious climate and RES targets can only be achieved cost-efficiently in combination with energy efficiency

  ■ EU KOM impact assessment for 2030 showed: ambitious energy efficiency can reduce costs for fossil fuel imports by 8 to 34 bn € p.a.
Germany decoupled growth from energy consumption

Decoupling of economic growth and energy consumption achieved:
- Energy productivity increased by 46% since 1990
- Primary energy consumption reduced by 3.3 (cp. to 2008) while economy has grown by 50% (since 1990)
Energy Efficiency – first progress but additional measures needed

• Concrete measures adopted, e.g.
  – Standards for new buildings: Energy Saving Ordinance “EnEV”
  – low interest rates and grants for energy efficient new buildings above standard (Program KfW 40, 55, 70)
  – Subsidies (1.5 bn €/a 2012 - 2014) for refurbishing buildings (better insulation, more efficient heating)
  – Energy “passport” for buildings provides information

■ But efficiency is lacking behind Renewable energies deployment, more measures needed

• Coalition agreement: developing a concrete Efficiency Action Plan agreed
Security of supply is not only a national but European task

- Currently: sufficient generation capacity in Germany despite shut down of 8.6 GW nuclear (~102 GW firm capacity cover 82 GW peak load)
- Local bottlenecks in Bavaria due to insufficient grid connection (temporary measures adopted)
- Discussion on future market design in the EU-context needed
- Using all flexibility options of the internal market is most efficient
  - generation and demand management
  - Grid reinforcement and market coupling
  - Regional cooperation
Need for a supportive European framework
EU Perspective – Climate and Energy 2030

• Action Programme Climate Change 2020 and “Energiewende” needs to be integrated in the EU-internal market
  – Target setting – GHG-reduction, renewables and energy efficiency – Germany: at least 40 % GHG-reduction; at least 30 – 35 % Renewables and at least 30 % energy efficiency
  – Market integration
  – more coordination
  – increased regional cooperation

• Action Programme Climate Change 2020 and “Energiewende” also needs a supportive European framework
  – Clear and reliable framework → strengthened ETS, targets and reliable governance
  – continuous alignment of climate and energy policies
  – Need for flexibility to adapt climate policy and energy transition to national circumstances
Next steps 2030 framework: setting investment signals

- urgent ETS reform, also taking care of competitiveness
- ambitious 2030 GHG-target of at least 40% (EU domestic)
- also binding targets for RES (at least 30%) and for Energy Efficiency
  - RE+EE more cost-efficient than new nuclear or CCS
  - “no-regrets”: all decarbonisation-scenarios need significant RES and EE (EU Roadmap 2050)
  - Targets allow for predictability, control and a coordinating EU framework
  - a balanced and diversified RES deployment all over Europe ensures most-efficient system costs (less intermittency, less grids and balancing needed)
- more flexibility cp. to 2020 imaginable but also reliability and balanced approach needed → avoid “full-stops” in some countries
The EU Climate and Energy Package 2030

- Negotiations will go on mid September 2014 (Sherpa mode)

- Decision will be taken by the end of October 2014 (European Council – Heads of States)

- Numerous activities and initiatives are taking place (bilateral, multilateral, EU-wide)

- Peru (2014) and Paris (2015) are targeted
The new Climate Change Policy
Projections – Impacts of the present P&M‘s

* „PB 2013 – MMS“ shows a projection based on existing measures (minus 33% versus 1990 to 2020) by sectors
A two step approach

Based on the Coalition Contract (December 2013):

- The „Action Programm Climate Change 2020“ to comply with the 40 % target
- The „Climate Change Plan 2050“ to construct a road to 80 – 95 % GHG reduction by 2050
Conclusion

• Climate Change is the overarching issue – the present development is far away from what is needed
• Focussing on Wind, PV and Energy Efficiency is the most cost-efficient decarbonisation approach
• Learning curves have largely been paid
• Most return on investment: innovation, jobs, energy security
• Cost and quantity control measures ensure optimal integration
• Energy security needs to be solved in the EU context
• More coordination and cooperation needed
• supportive EU-2030-framework with strengthened ETS, 2030-targets for GHG, RES and efficiency as the basis for reliability, flexibility, coordination and a balanced approach
Thank you.
backup
Investments start paying off: PV costs came down

- PV costs came down from ca. 0.48 ct/kWh some years ago to between 0.9 and 0.13 €/kWh for PV today
- PV was the main cost driver; future deployment will be significantly less costly

Source: PVexchange

![Graph showing the decrease in PV costs over time](chart.png)
Total capacity of PV has achieved 36 GW today

Photovoltaic expansion in Germany (1 / 2)

Source: BMU (2013)
Wholesale power market price will further decline

- Renewable energies are one driver of decreasing power market prices since they have no fossil fuel costs (marginal costs = 0)
- Future price before nuclear phase out decision: 53 €/MWh (Base) and 65 €/MWh (Peak)
- Future price today: c. 36 €/MWh (Base) and ca. 47 €/MWh (Peak)
Paradoxon of the Merit order effect

• Part of the support costs is driven by the lower wholesale power market price that RES cause

(overall support costs = support payments - market price for RES-E)

• Calculation for 2012: MOE = 0.9 ct. kWh

• MEO becomes more and more important for support costs
Investing in the future

Worldwide Subsidies for Fossil Fuels and Renewables (in Billion US$)

Source: IRENA, IEA