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Institute for Advanced Sustainability Studies IASS in Potsdam

The German Energiewende

Dominik Schäuble Transdisciplinary Panel on Energy Change



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1. What is the Energiewende?

2. What has been accomplished?

3. What are major challenges?



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What is the Energiewende?





A complete **transformation of the energy system** of a highly industrialized country: **from nuclear and fossils to renewables**

> The Energiewende is a long-term energy and climate strategy







- Mitigating Climate Change more than 80% of GHG emissions are energy related
- Reducing nuclear risks
- Improving energy security reducing dependence on fuel imports



- Increase predictability of energy costs in the long run fossil price trajectory is highly uncertain
- Leading position in the growing market of efficient and sustainable technologies



Ethics commission 2011:

"The energy transition is a huge effort. It will only succeed through a **collective effort** spanning all levels of politics, business and society."

The Energiewende can only be sustained if the imperatives are accomplished to a high degree during the transition

Energiewende The Long-term Targets



German energy transition: high certainty with long-term targets Long-term, comprehensive energy and climate targets set by the German government in 2010 Source: BMU Target in % Share of renewables in % -40 Greenhouse Trend -80 100% gases In terms of (compared to 1990) primary energy 2020 2030 2040 2050 German Energy Transition CC BY 5A energytransition.de

> Political consensus on long-term targets creates confidence



What has been accomplished?

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Reduction of GHG-Emissions



Remarkable emissions reductions have been achieved: -27% until 2014 (wrt 1990)

The Nuclear Exit – halfway



Clear phase-out plan, no serious disputes

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Power generation [TWh]



- > 3-fold increase in renewable power generation between 2004 and 2014
- > Wind and solar PV with high growth potentials

The German Electricity Mix 1990 - 2014



> 2014: 28% of gross electricity consumption produced from RES, but still 43 % from coal

The German Energy Mix 2014



> Energy is more than electricity: stronger efforts in **heating** and **transport** needed

Investments and technology development





German investment induced a steep learning curve for solar PV

Levelized cost of electricity



Source: Fraunhofer ISE, 2013; IRENA, 2012; WEC/BNEF, 2013; DIW, 2013.

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- LCOE comprises:
 - Capital costs
 - Fuel costs
 - CO2-costs
 - Fixed operation costs
 - Variable operation costs
 - Capacity factor
- Wind and utility scale solar PV are cost competitive with new conventional power plants

Public participation and support Ownership renewable capacity 2012



Source: Agora 2015, trend.research/Leuphana, 2013

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A considerable share of renewable capacity is at least partially owned by citizens and cooperatives

Broad support for the Energiewende indicated in numerous surveys

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EEG surcharge on consumption 2015: 6.2 Ct/kWh



Households, trade and commerce and small and mid-size industry pay and relieve energy-intensive industry

Security of supply System interruption and electricity exports





Source: Agora 2015, CEER 2015



Source: Agora 2015, AGEB 2015

High quality of supply and increasing exports

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What are major challenges?

Emissions reductions Power sector





- Almost 40% of emissions from energy industry
- High and stable emissions from the power sector due to high coal generation



- Recent development determined by Energiewende policies and fuel/CO₂prices
- Coal generation must be reduced to curb emissions from power generation

Emissions reductions Lignite reserve

- Process: Heated argument between Ministry for Economics and Energy, Utilities(RWE)/Unions and Environmentalists
- Deal: Some lignite power plants taken out of the market, transferred to a reserve and decomissioned after four years in reserve
- Scope:
 - 2.7 GW
 - 12 t CO2/a in 2020
 - 0.05 Ct/kWh surcharge for consumers

Insufficient in terms of emissions reduction, more expensive than necessary, nevertheless a first step to phase-out coal

3 - Weste

heinland



5 - Süden





Efficiency



> To reach efficiency targets for 2020 strong additional measures are needed

Grid development



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Connection of regions with strong wind generation in the North and East with highdemand regions in the West and South

Federal Network Agency confirmed the need for **2800 km of new transmission lines** and 2900 km of optimization and strengthening of existing lines, main focus on North-South corridors

Locally strong **opposition** against new **overhead lines**

- Upgrading the grid is efficient
- Local protests have to be taken seriously

Source: Bundesnetzagentur, 2014

Variable renewables and flexibility

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Challenging **balancing of supply and demand**

- grid expansion
- demand-side management
- flexible back-up capacity
- storage (heat and power)
- Flexibility will be a key property of the future electricity system
- How to incentivize and finance the most efficient flexibility options?

Source: Agora Energiewende



- > The Energiewende is a long-term energy and climate strategy
- > The long-term targets enjoy broad political and public support
- > The nuclear phase-out plan is undisputed
- German investment induced steep and steady learning curves for solar PV and wind: Wind and utility scale solar PV are cost competitive with new conventional power plants
- A considerable share of renewable capacity is at least partially owned by citizens and cooperatives
- Remarkable emissions reductions have been achieved, but future efforts remain ambitious: Coal generation must be reduced to curb emissions from power generation; stronger efforts in heating and transport needed
- > Flexibility will be a key property of the future electricity system

Thank you for your attention!



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