

4th European Energy Forum – On The Way to COP21

Global energy transitions

Presentation
Paris, March 12, 2015

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Agenda for today

- **Lessons learned from the German „Energiewende“**
- Global Energy Transitions
- Conclusion

Germany has set ambitious targets in relation to the energy transition

Objectives of energy transition in Germany

Consumption

- **Primary energy consumption** has to decrease
 - by 20% by 2020
 - by 50% by 2050
- **Power consumption** has to decrease
 - by 10% by 2020 and
 - by 25% until 2050



Renewable energy

- The share of **renewable energy in the total energy** consumption should reach
 - 18% by 2020
 - 30% by 2030
 - 45% by 2040
 - 60% by 2050
- In **power generation**, the share of **renewable energy to gross power consumption** should be
 - 40-45% by 2020
 - 50% by 2030
 - 65% by 2040
 - 80% by 2050



CO₂

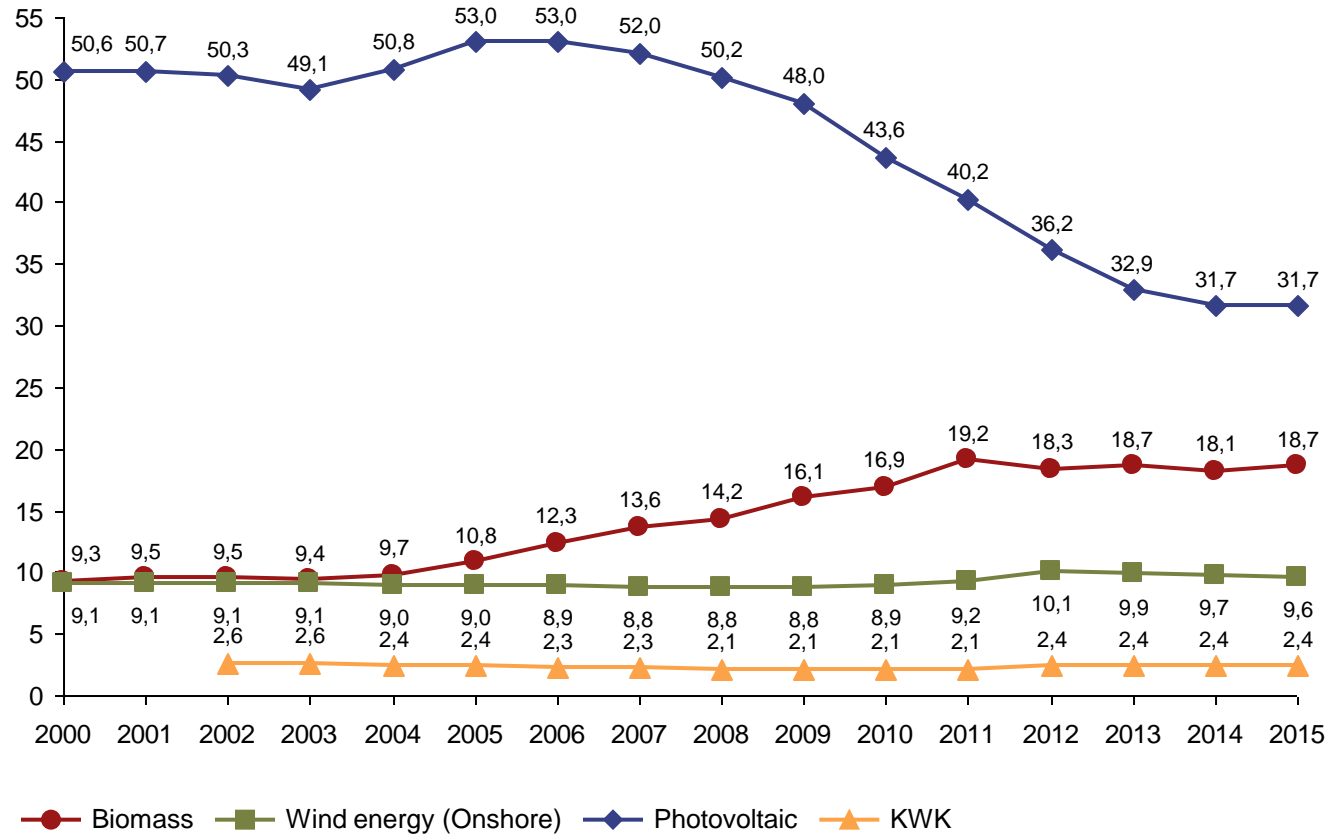
- The **CO₂ emissions** should compared to 1990 **fall by**
 - 40% by 2020
 - 55% by 2030
 - 70% by 2040
 - 80-95% by 2050
- **Nuclear phase-out**, installed capacity to decrease to
 - 21.5 GW by 2010
 - 12.7 GW by 2012
 - 0 GW by 2023



The main instrument in German policy is the Renewable Energy Sources Act (EEG)

Feed in tariff from EEG and subsidies KWK¹

In ct/kWh



- EEG: law for the development of renewable energy
- Feed in tariff guaranteed for 20 years
- Priority feed in of renewables

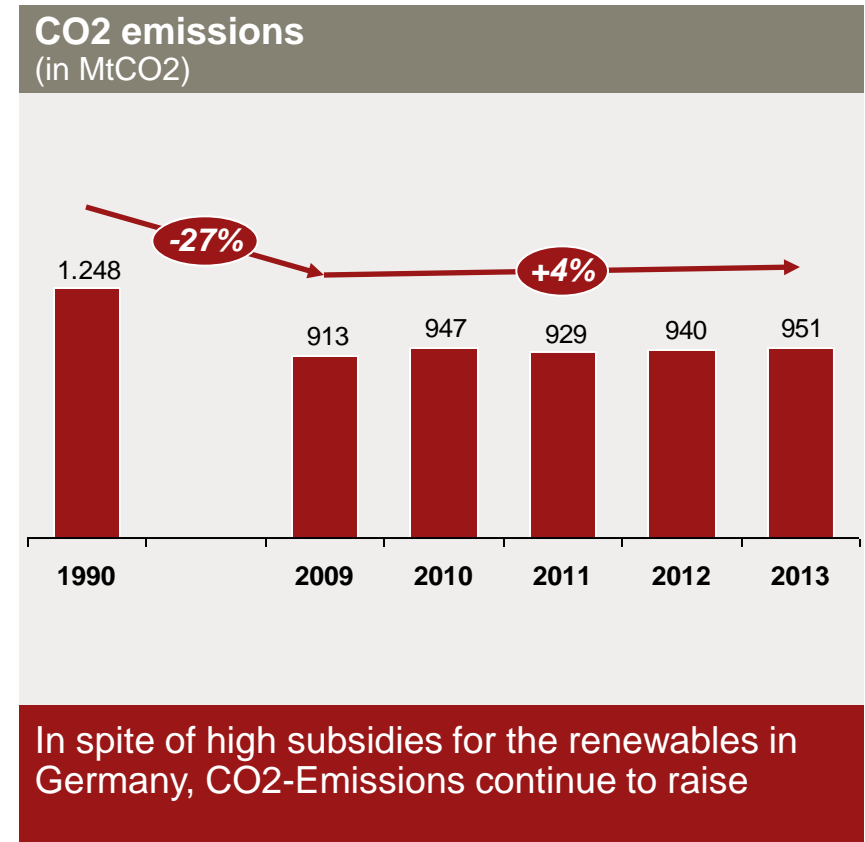
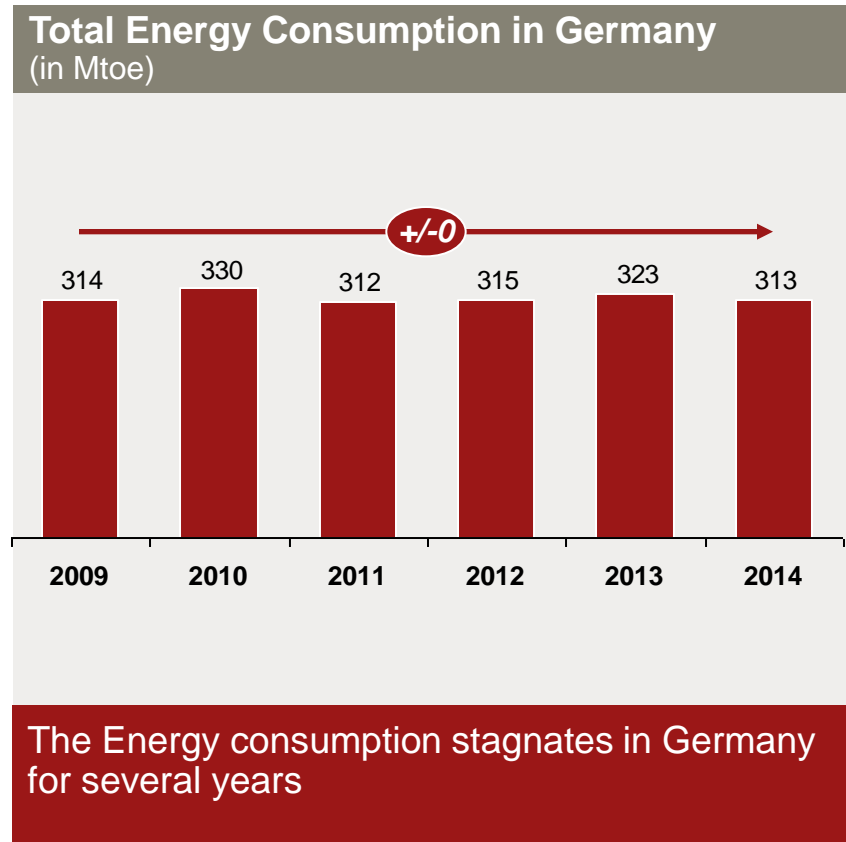
1. 2002-2012 Facilities with a capacity between 50kW – 2MW, from 2012 capacity between 250kW-2MW
Source: BMWi, KWKG

Update to the EEG released by the new German government contains downward revision of renewables growth targets

Released changes to the EEG

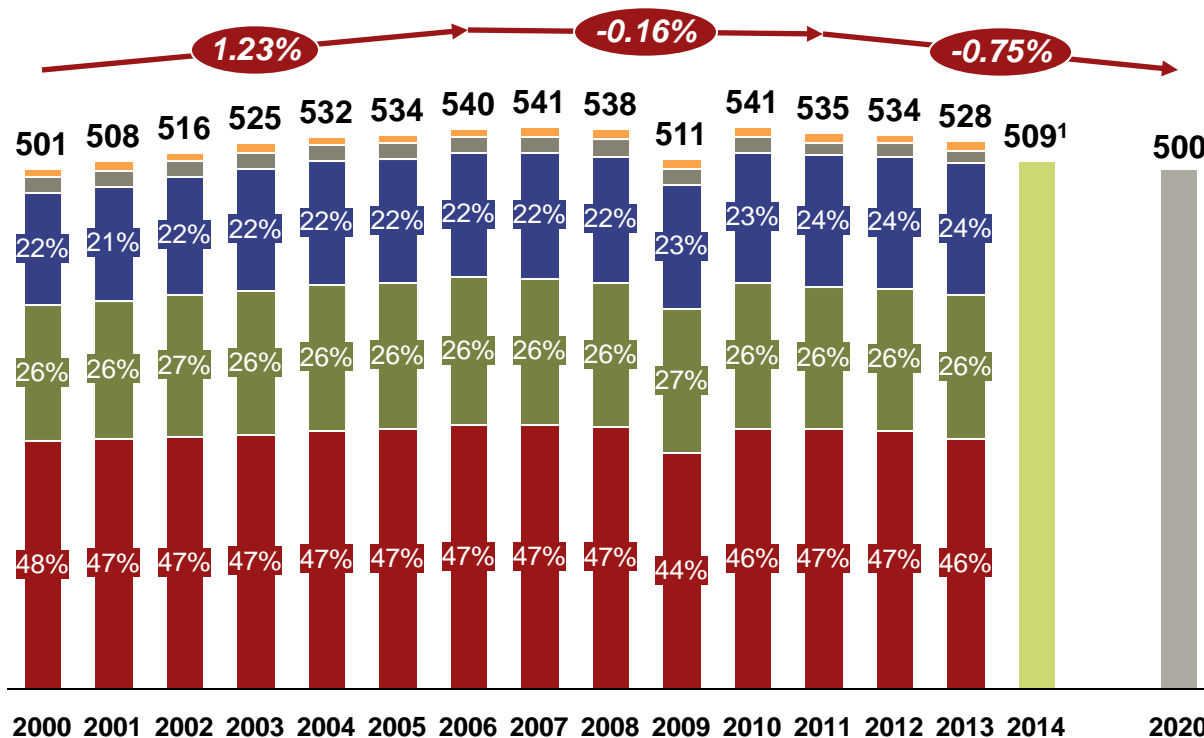
- **Reduction of Growth targets of renewables** (in case of over delivery the subsidies will be reduced)
 - PV 2500 MW annually
 - Onshore wind 2500 MW annually (net, i.e. after deduction of shut down sites)
 - Offshore Wind 6500 MW cumulative until 2020 – adapted to reality, previous target was 10,000 MW
 - Biomass 100 MW annually
- **Integration of renewables into the market**
 - Mandatory Direct marketing for new plants over 500 kW, this threshold is to be reduced to 100 kW by 2017
- **Starting 2017 the auction procedures** should partially replace compensation for electricity fed into the grid with piloting for PV already in 2015
- **Capacity market**
 - Further capacity mechanisms should be decided by 2016; a recent study of the German Federal Ministry of Economics views the capacity market rather skeptical
 - EOM market should become more flexible, demand-side management measures should be expanded

Energy consumption in Germany is stagnating, or even decreasing in certain years; but CO2 emissions still raise slowly



Power consumption in Germany is experiencing a slight decrease, also due to increasing self generation of PV

Power consumption in Germany (2000-2020, in TWh)



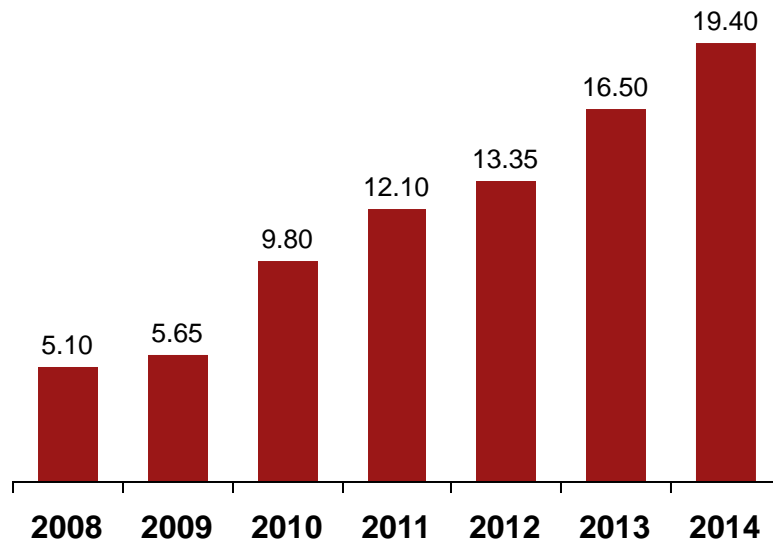
- Assumption is long term economic growth of 1.0%
- Increasing decoupling between economic output and energy consumption
- Efficiency gains, especially in the household sector
- Constant consumption in the industrial sector

1. Estimate
Source: EWI Referenzszenario, A.T. Kearney

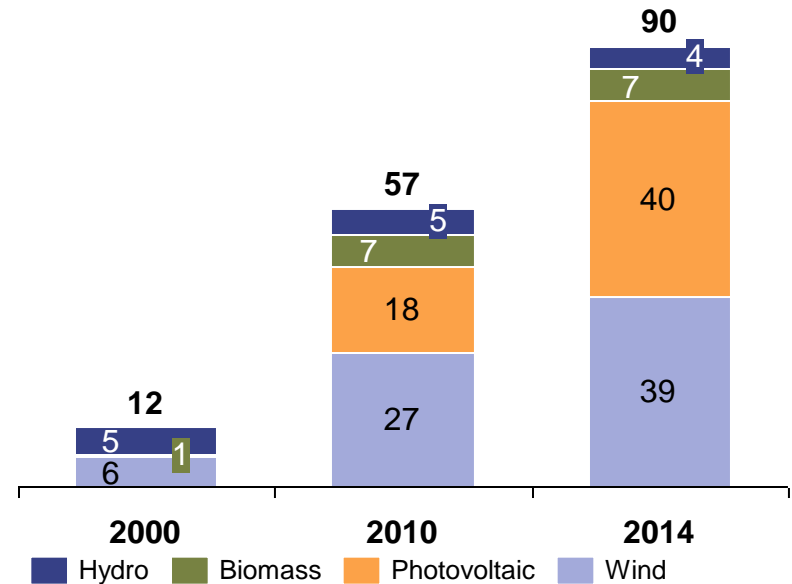
With the help of subsidies renewables power generation capacity increased sevenfold between 2000 and 2014

Development of renewables in Germany

Renewables subsidies
EUR billion



Installed Capacity
GW

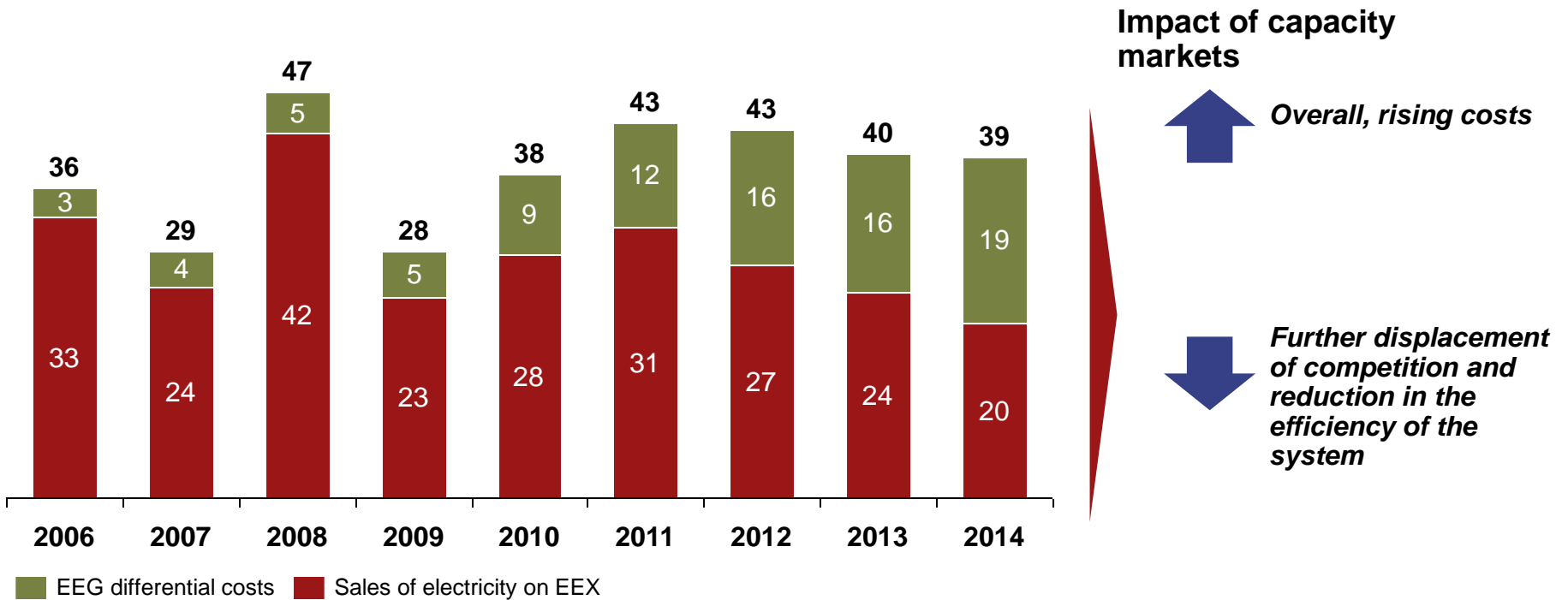


- EEG is driving the growth of renewables in Germany
- Feed in tariffs guaranteed for 20 years take market risks away from investors
- 80% of subsidies in renewables capacities are not invested from traditional utilities, investors are funds, private investors, and others

High proportion of subsidized renewable energy supply has a significant impact on the energy-only market

Total cost of electricity generation in Germany

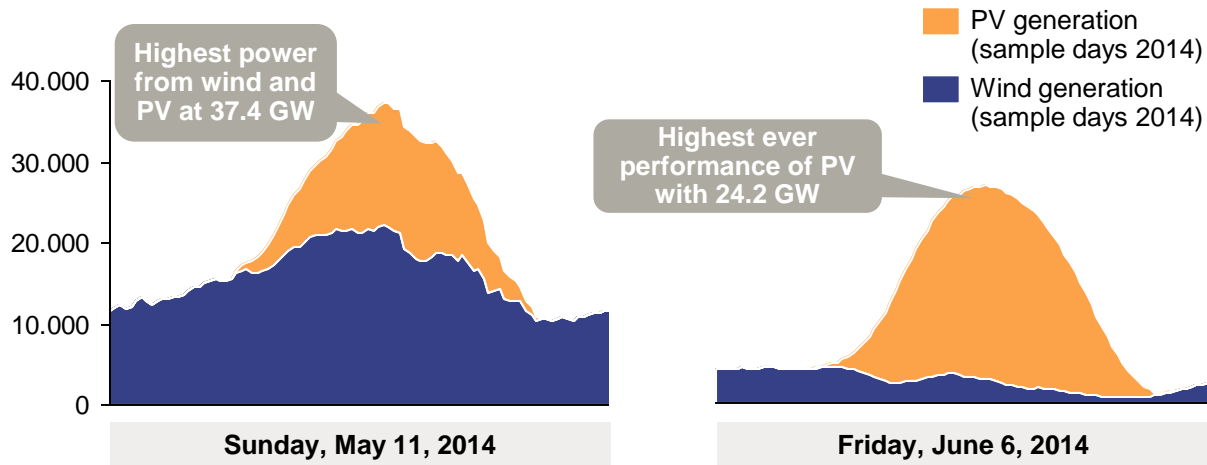
Wholesale market plus EEG stimulation, EUR bn



The EOM in Germany is not producing the right price signals anymore

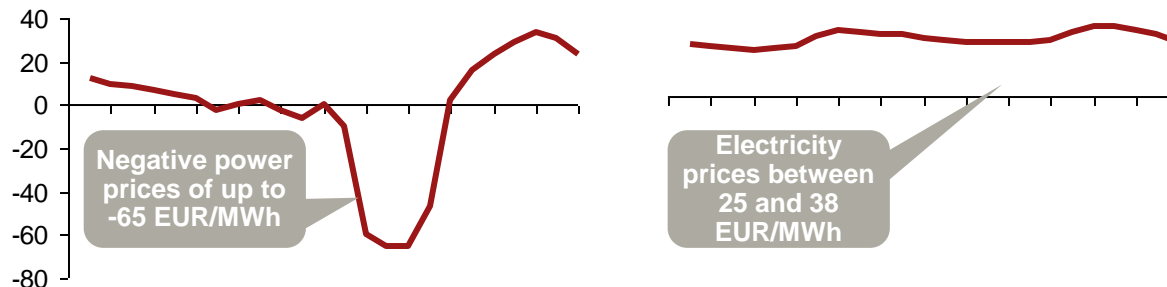
Non-market-indicated expansion of renewables with feed priority leads to situations with "extreme prices"

Fluctuations in the power supply from wind and solar¹ MW



- Renewables
 - Feed-in priority for renewables
 - Disregard of compensation cost
- Merit order effect:
 - Renewables can be set with negative marginal costs
- Price effect:
 - Negative prices in hours of high wind and PV feed

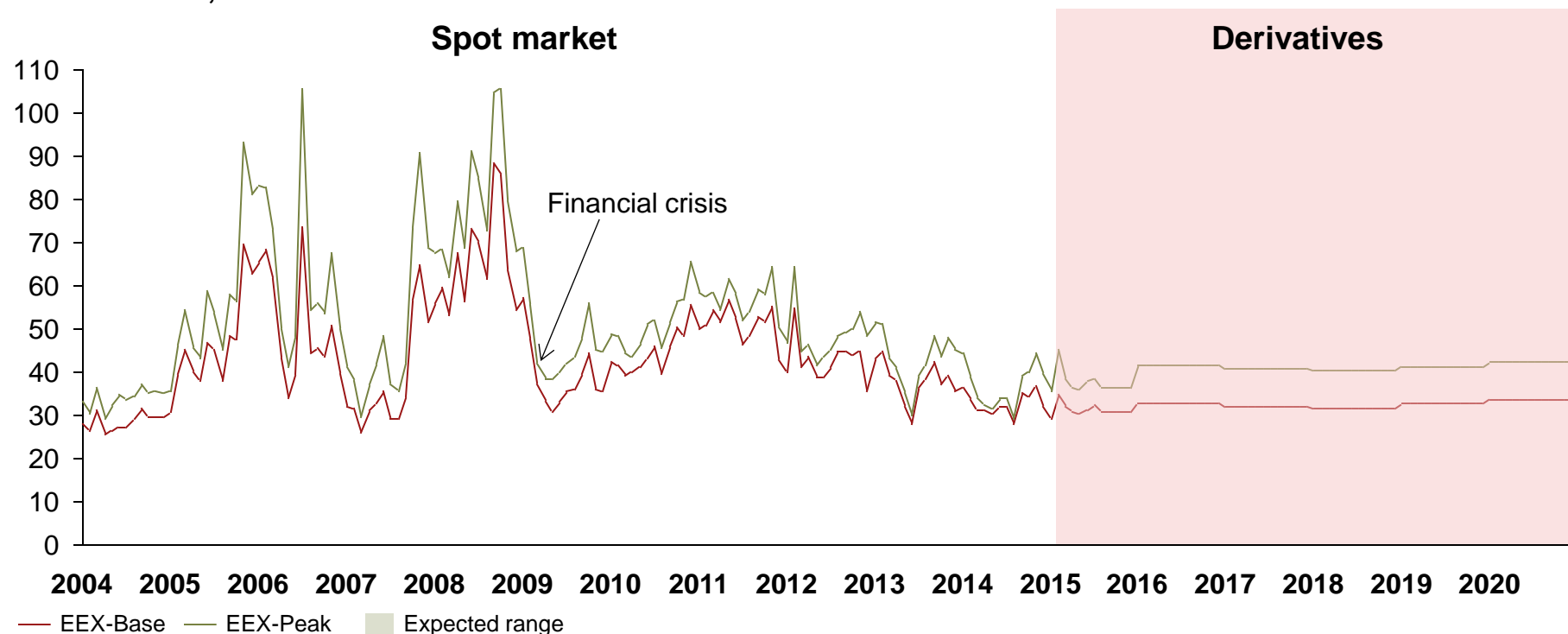
Power price EPEX Spot (EUR/MWh)



1. Quarter-hourly feed in Germany and Austria
 Source: EEX Transparency, A.T. Kearney

The price development in the electricity market sets conventional generation under pressure

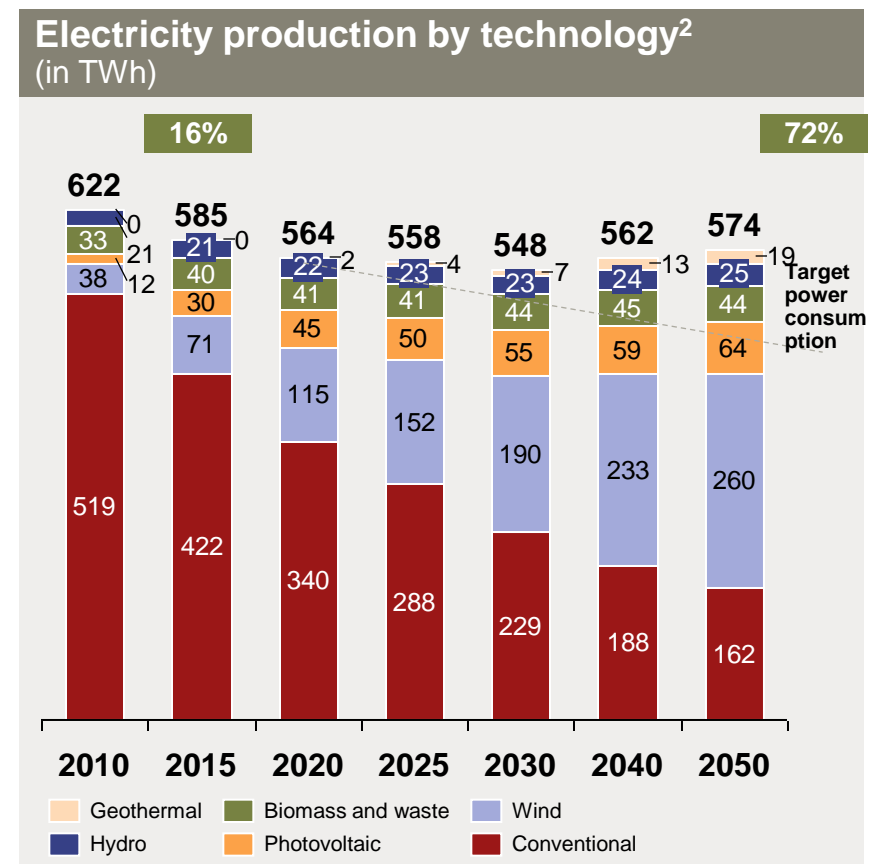
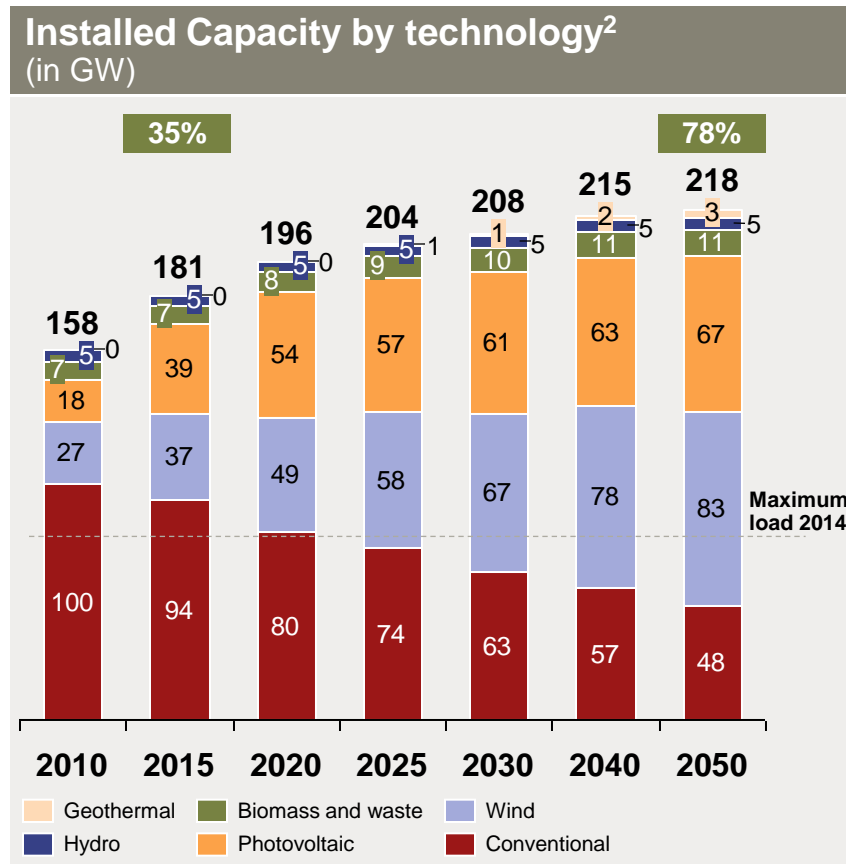
Development of EEX Base spot and futures prices EUR/MWh, 2004-2018



The German power market has a significant impact on other european markets

Further development of renewables will lead to significant excess capacity in the German market

Forecast: electricity generation and capacity in Germany¹



1. BMU Lead Study 2011 - 2011 Scenario A
 2. Figures exclude pumped storage and 'other'
 Source: BMU, AGEE Stat 2012; ENTSO-E; A.T. Kearney

The German „Energiewende“ is going to loose it’s role model status

Conclusions for the european energy systems

- The German „Energiewende“ ist too costly in order to be a case example for an european or global energy transition, but experiences from Germany are highly relevant to find the best solutions
- Energy policy should be led by one and not several targets. CO2-reduction is the common denominator in Europe and in the whole world. For Europe that means reviving the emission trading scheme by reducing the warrants
- Energy policy cannot be done against the evolutions in the global commodity markets. In spite of high subsidies for the renewables in Germany, the generation of electricity by coal-fired plants increases due to the trends in the coal and gas prices, and the CO2-Emission raises.
- Only market-based systems can secure an economic meaningful restructuring of the system :
 - Reduction of the grants to customer or investor towards technology development
 - No feed-in subsidies but grants for investment on an auction based system
 - Central assets -> European-wide auctions
 - Decentralized assets -> national / regional auctions
 - Integration of the renewables in the market through the abolition of the feed-in priority system and the obligation of direct marketing

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- **Global Energy Transitions**
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In a global perspective Energy policy is not so much driven by climate policy as in Europe

Objectives of Energy-/Climate- Policy globally



Security of Supply

- Install new capacities und diversify the energy mix
- Reduce import dependency



Managing Growth of Energy Demand

- Expand supply to meet rising energy demand while keeping costs low
- Electrification of households in emerging countries



Optimize Cost of Energy Supply

- Substantially increased energy efficiency
- Increase competitiveness by using least-cost approaches for supply expansion



Reduction of CO₂-Emissions

- Low CO₂ power generation mix with global growth of conventional, nuclear and renewables in varying speeds
- Reduce local air pollution

Key drivers

Key players' moves

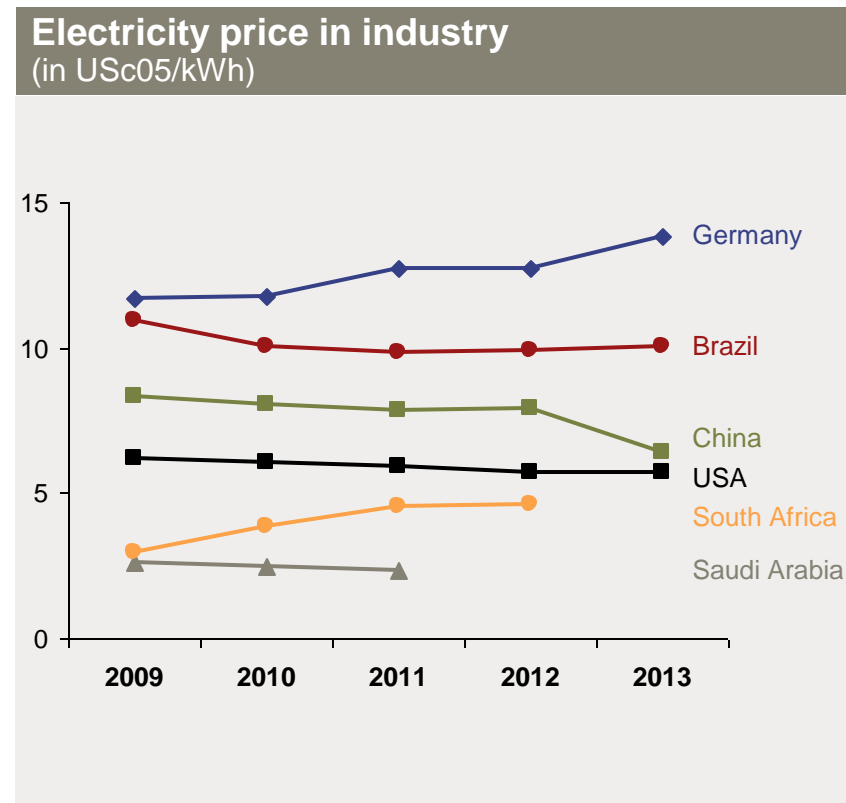
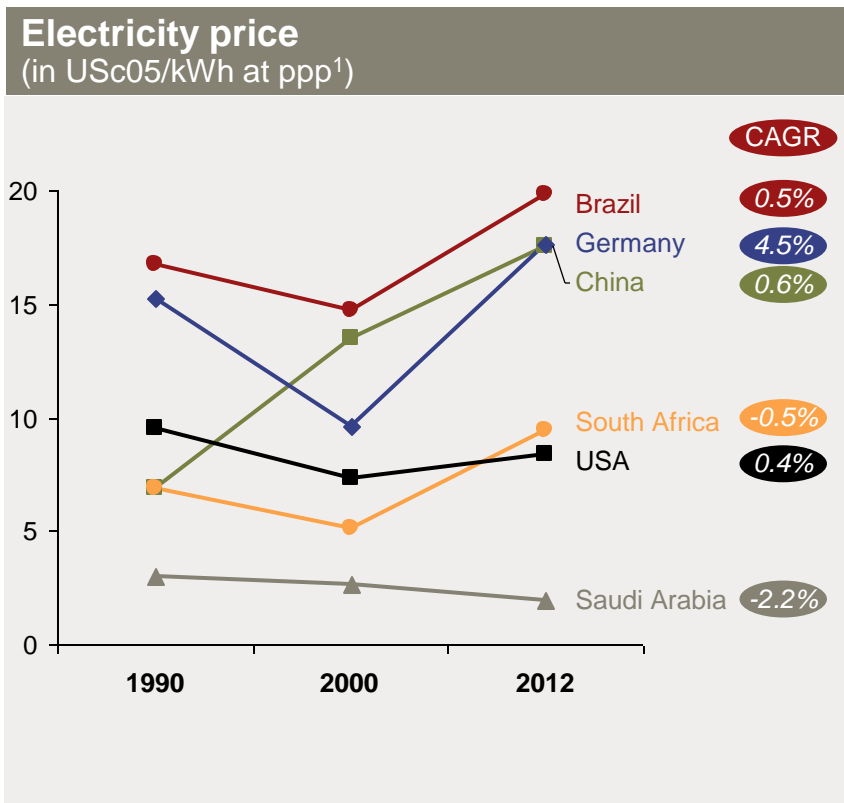
Regulation & Politics

Innovation

Customer behavior

The Ukraine crisis will change the situation in Europe and increase the importance of Energy policy with the objective of security of supply

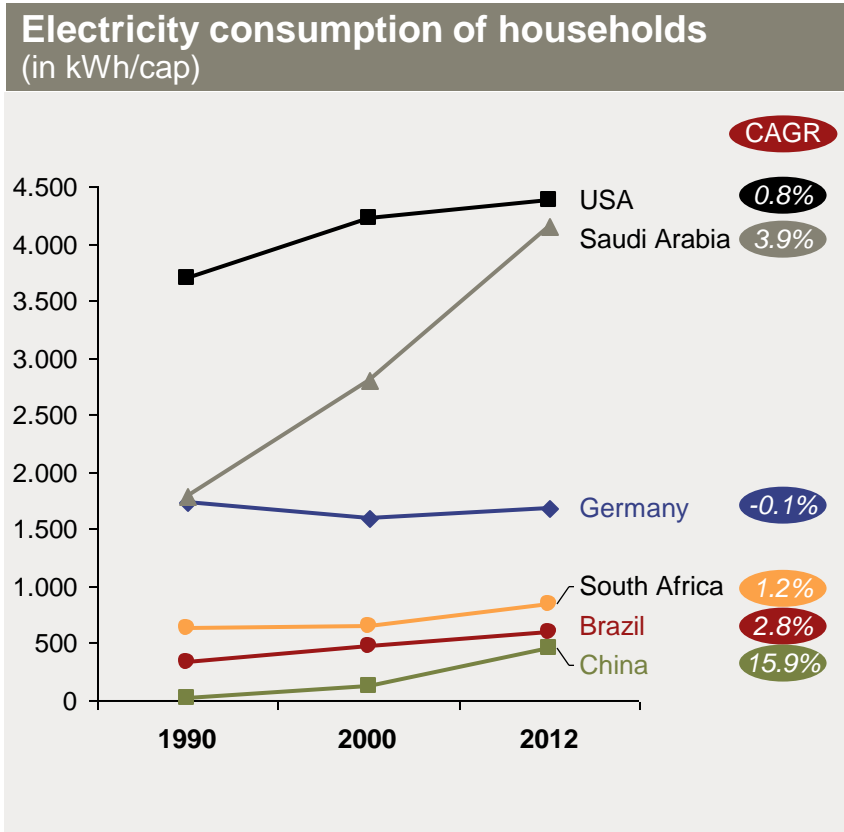
Several countries face a public debate regarding energy costs



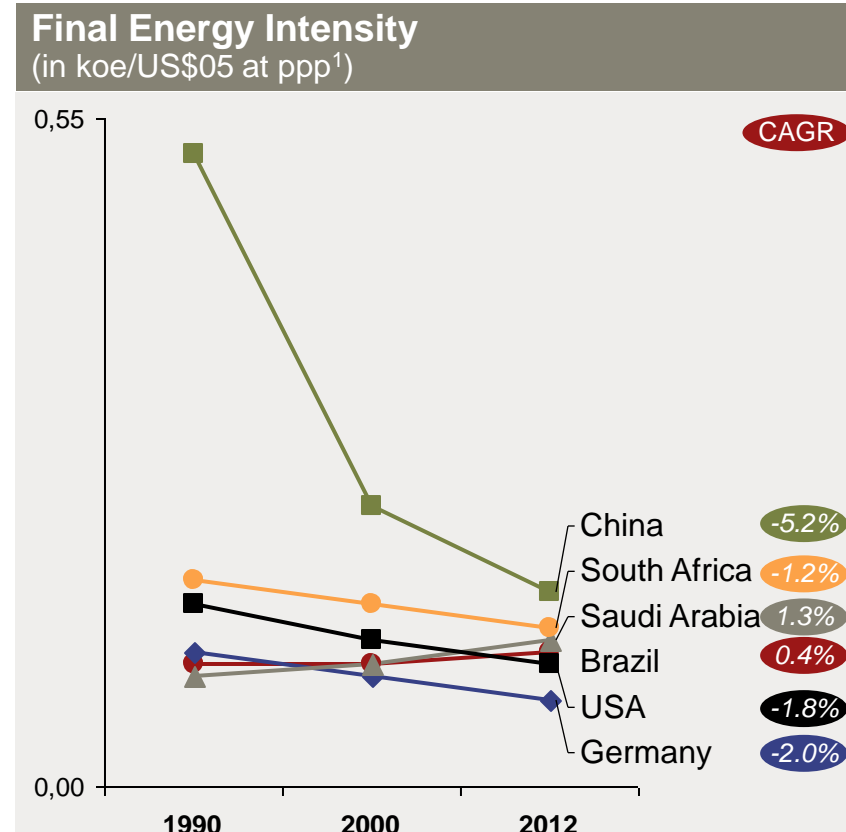
High burdens for end consumers also in emerging countries

High prices in Germany only partly compensated by higher efficiency in consumption

Only Germany could reduce its electricity consumption of households, while efficiency is increasing almost everywhere



Only the US and Germany could maintain or even reduce their electricity consumption



Efficiency improved significantly in almost all countries

Global energy transitions are fact, but motives and objectives differ significantly across countries

1 Overview of motives and objectives of global energy transitions

USA

- Reduction of energy costs and dependency on imports
- Focus: Expansion of shale gas and renewables

Germany

- Climate protection and nuclear phase out
- So far main focus on renewables expansion

China

- Coverage of energy demand and industrial policy
- Central expansion objectives for renewables

Brazil

- Improved security of supply
- Objectives of “least-cost” expansion and inflation control

Saudi-Arabia

- Increase of value creation along the oil value chain
- Expansion of renewables, nuclear and shale gas

South Africa

- Coverage of energy demand and job creation
- Expansion program for renewables

- Security of supply as well as objectives related to industrial policy and economic development are the main motives for global energy transitions
- Climate protection is an important argument in all transitions but globally not the key motivation behind the change
- Nuclear exit is not an explicit target in most countries, but cost considerations favor renewable energies

Germany is not the only country facing fundamental changes in energy supply. But most other countries have a different motivation behind similar objectives

National governments influence the energy transition strongly across all countries – renewables are supported everywhere

2 Overview of drivers and governance of renewable energies

USA

- Patchwork of defined quotas on state level and nationwide tax reliefs for renewable energy
- Shale gas driven by industry

Germany

- Main driver is nationwide “EEG”, enabling “grass roots” investment
- Aiming at market integration and cost reduction

China

- State-defined, planned targets supported by incentives and financing

- Main driver for change in the energy sector is government policy
- Various forms of government support, e.g. quotas, tax reliefs or auctions, are being tried worldwide

Brazil

- Technology-open auctions make onshore wind power possible
- State influence via price interventions

Saudi-Arabia

- Influence through investment decisions of state-owned companies
- Driven by regional development concepts

South Africa

- Integrated state plan with rolling adjustment of targets
- Auctions for renewables

Germany can learn from the experience of other countries, e.g. with regard to auctions. With the exception of the US, a global trend towards central governance can be observed

The need to overcome similar challenges and access to new energy resources provide a global opportunity

3 Overview opportunities and threats

USA

- Shale gas as chance for long-term energy supply
- Uncertainty about political priorities and patchwork of basic conditions

Germany

- Dynamic expansion and high competencies
- Stabilization of system and cost control

China

- Access to cheap technologies
- Overcoming air pollution

- Globally, there are enormous, untapped energy potentials
- Fundamental change in cost structures brings along massive uncertainty which complicates investment decisions

Brazil

- Wind and solar power underdeveloped
- No certainty regarding investments due to political price interventions

Saudi-Arabia

- Opportunities in diversification through renewables and shale gas
- Reduction of subsidies as basis for increasing efficiency

South Africa

- High energy potential through renewables and shale gas
- Acute capacity constraints due to investment bottleneck

Global energy transitions open up opportunities for companies which are able to manage the uncertainties related to energy transitions

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- Global Energy Transitions
- **Conclusion**

This study highlights a “global energy transition”, with important differences as well as strikingly similarities among countries.

Conclusions from the Global Energy Transition

- The countries analyzed can learn from important parallels and differences in terms of policy making, technology deployment and business-model evolution
- In a global perspective, climate protection is an important argument in all transitions but globally not the key motivation behind the change as it is in Europe & Germany
- Security of supply as well as objectives related to industrial policy and economic development are the main motives for global energy transitions
- Four key opportunities appear :
 - Global resource abundance
 - Global learning curves in technology development
 - Maturing policy making based on global experience
 - Global business opportunity for companies that provide relevant technologies, services and know-how to implement energy transitions successfully
- Such a cross-country perspective on energy transitions can bring significant benefits to the countries and the businesses engaging in the exchange.

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