

Report from the German Federal Auditing Office: Poor Management of “Energiewende”

The Federal Ministry for Economic Affairs and Energy (BMWI¹) in Germany is in charge of the Energy transition (die Energiewende). The ministry regularly circulates progress announcements (fig. 1). Besides, BMWI publishes a comprehensive monitoring report² every year.

The Bundesrechnungshof³ (a Federal Auditing Office) has expressed criticism of the BMWI management of the energy transition in a 50 pages report: “Report on the coordination and control of the energy transition by the Federal Ministry for Economy and Energy” (German version⁴, not yet available in English).



Fig. 1 - Increasing investments in RE

The two institutions judge the progress of the energy transition rather differently. The two reports can together give a wider view on the transition process.

Bundesrechnungshof emphasizes some formal shortcomings in BMWI’s planning process, but neither BMWI nor Bundesrechnungshof seem to understand, that the result will depend on a harmony between production system, transmission system and trading system, and that all stages of the transition must be considered.

Some unfavourable effects of the transition process are obvious already now, such as volatile market prices, unintended flows in parallel AC grids in some neighbouring countries, limitations on international trade due to virtual bottlenecks at the national borders and increasing costs of feed-in management and redispatch.

Maintaining a reasonable harmony between production pattern, transmission capacity and market rules during a radical change of the production system may be difficult, but it should be possible to minimize unintended effects by keeping the interdependence of production, transmission and trade in mind.

The trade limitations and loop flows are not only German problems, but concern also several other countries. The harmony in Germany’s power system is a European matter.

¹ BMWI: Bundesministerium für Wirtschaft und Energie

² <https://www.bmwi.de/Redaktion/DE/Publikationen/Energie/sechster-monitoring-bericht-zur-energiewende.html>

³ <https://www.bundesrechnungshof.de/en>

⁴ <https://www.bundesrechnungshof.de/de/veroeffentlichungen/sonderberichte/energiewende/2018-sonderbericht-energiewende>

The Sixth Annual Monitoring Report from BMWI

The Sixth Annual Monitoring Report from BMWI was published in June 2018. It is a bulky document in German with 226 pages. An English version of the fifth monitoring report⁵ (1990-2015) is available.

BMWi has set a number of milestones for the development of energy consumption and emission of greenhouse gases (GHG) in Germany. The quantitative targets after 2016 refer to the years 2020, 2030, 2040 and 2050. The defined indicators are

- GHG emissions compared with 1990
- Shares of renewable energy (RE) in gross energy consumption and in electricity consumption
- Six targets for the development of energy consumption

German GHG emissions in 2016

As the concern about the climate change is a driving force, the GHG emission must be the most important indicator. Most of the German GHG emissions in 2016 (82%) came from the energy sector. Of the 82%, $\frac{2}{5}$ were from electricity, $\frac{2}{5}$ from heating and $\frac{1}{5}$ from transport (fig. 2).

Most of the reduction since 1990 was achieved by the electricity sector and particularly by wind energy (fig. 3).

Phasing out the use of lignite can reduce the GHG emission from the electricity sector, while electricity export and decommissioning nuclear power will have the opposite effect.

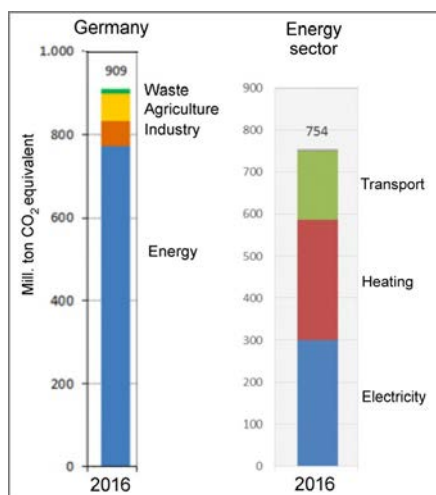


Fig. 2 - Electricity caused about 33% of the German GHG emissions in 2016

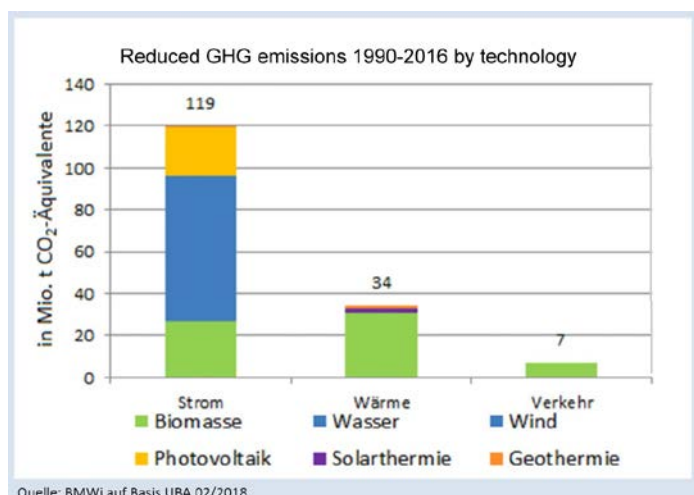


Fig. 3 - Electricity has provided about 83% of the GHG reductions in Germany since 1990

⁵ <https://www.bmwi.de/Redaktion/EN/Publikationen/monitoring-report-2016.html>

The electricity market is missing in the planning process

The monitoring report sets targets until 2020 for electricity, heating and transport (table 1).

Political targets	Climate (40% GHG reduction), nuclear close down (until 2022), competitiveness and security of supply					
Strategical level	Increased share of RE in the energy sector: 18%			Reduction of primary energy consumption: -20%		
Operational level	Electricity	Heating	Transport	Increased efficiency: -2.1%		
	RE ≥ 35%	RE: 14%		Electricity Consumption: -10%	Heating Consumption: -20%	Transport Consumption: -10%

Table 1 - Targets in 2020 for electricity, heating and transport

Grid expansion is mentioned, but without operational targets. The electricity trading system is not mentioned at all under targets, but in a very brief and toothless section 9.4 of the report.

Insufficient grid infrastructure

The expansion of wind power in northern Germany has caused periods of massive electricity transmission to the load centers in the south. The power grid in Germany has not been prepared for such transports.

The production of wind energy in Germany was 103 TWh in 2017, but it takes 57 GW installed wind power (fig. 4). More than 75% of the capacity is located in the northern half of the country.

On the top of that, 42 GW of solar cells have produced 40 TWh electricity (2017).

The German maximum load is about 80 GW. The 99 GW non-dispatchable power has created completely new patterns of electricity transport with much more electricity being moved around including a considerable electricity export.

Unfortunately, there has not been a simultaneous development of the necessary infrastructure. The need for a reinforced grid has been realized long time ago. The monitoring report claims that 40% of the EnLAG (Energy Line Extension Law) projects are ready. It means that 60% are not, and building new transmission lines in Germany is a slow process.

There will be a race between new wind turbines and new transmission lines in the years to come. It is a question if there will ever be sufficient power transmission capacity in Germany.

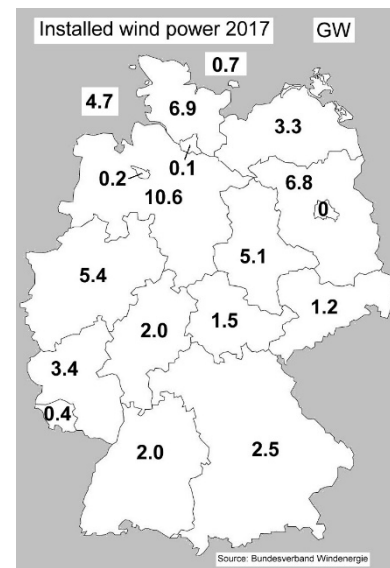


Fig. 4 - The total wind power capacity is 56.8 GW

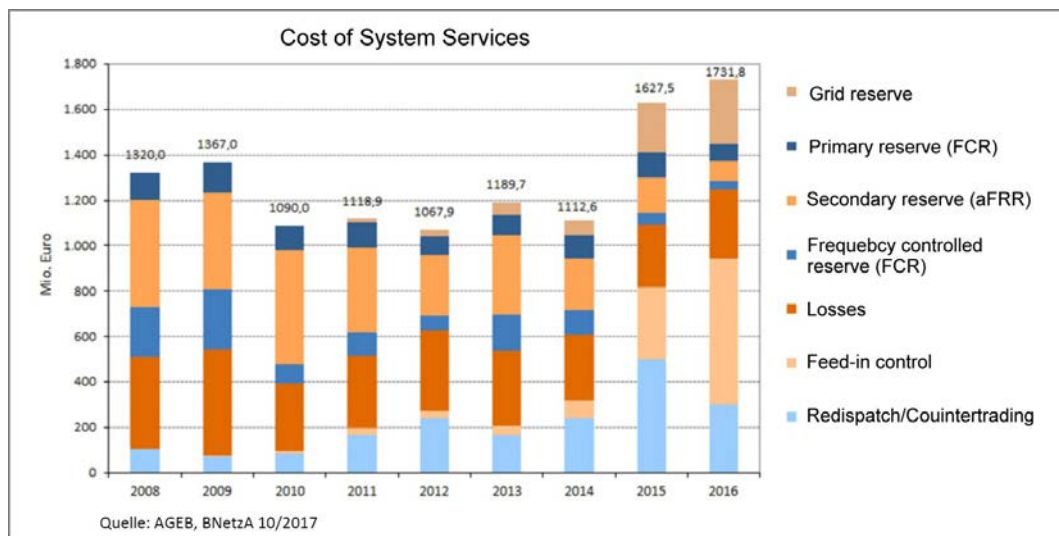


Fig. 5 - Increasing costs for correction of the market outcome

The transition process already caused some unfavourable effects, such as volatile market prices, unintended flows in parallel AC grids in the neighbouring countries, limitations on international trade due to virtual bottlenecks at the national borders and increasing costs of feed-in management and redispatch (fig. 5).

The outcome of the normal market process must increasingly be adjusted by feed-in control and redispatch. This is a good reason to reconsider the market arrangements. However, there is less than one of the 226 pages in the report about the electricity market. It does not identify any problems, and maintaining Germany as one price zone seems to be a policy matter beyond discussion.

The 40% reduction by 2020 will fail

The targets for German GHG emissions are reductions by at least 40% from 1990 to 2020 and 70% until 2040.

Fig. 6 shows the GHG emissions since 1990. The Federal Government realized in 2014 that the 40% target in 2020 seemed to be unattainable. In December 2014, the Government decided about 100 additional measures in order to meet the target in 2020. The measures were effective, but other factors had the opposite effect:

- increased economic activity,
- low fuel costs,
- increasing transport volume and
- slightly increasing population.

The sixth monitoring report estimates the reduction of GHG emission in 2020 at **32%**. This leaves an 8% gap to the 40% target.

GHG reductions seem to be cheaper for heating than for electricity

Information about the economy of the energy transition is limited in the monitoring report, apart from a chart of investments in renewable energy from 2008 to 2016 (fig. 8).

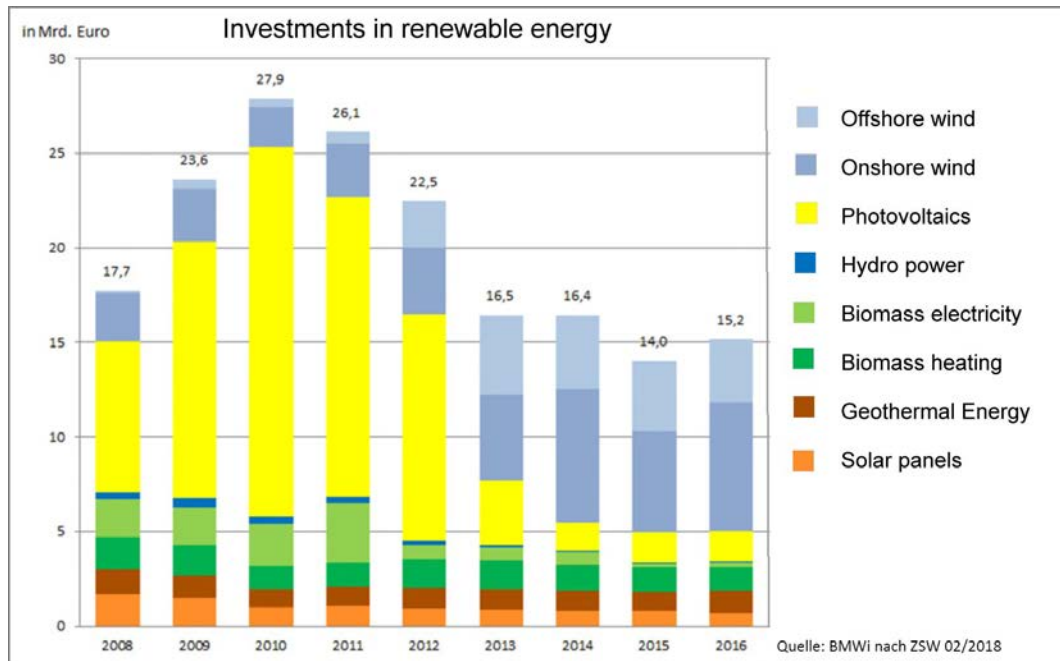


Fig. 8 - The average German RE investment from 2008 to 2016 was 20 billion € per year

The average German investment in RE was 20 billion € per year from 2008 to 2016.

The monitoring report explains qualitatively that the investment will be beneficial to economic growth, currency balance and employment in Germany.

According to fig. 6, the investment in RE for electricity production has been about six times the investment in RE for heating. In fig. 3, the benefit as reduced GHG emissions was about 3.5 times higher for electricity than for heating, but for the years 1990-2016. If the figures are valid, they suggest that the marginal cost of GHG reductions are higher for electricity than for heating.

Bundesrechnungshof: Improvements are unavoidable

The Bundesrechnungshof has its origin in a body, which was established in 1714. Its main duty is to examine federal financial management. It audits both revenue and expenditure totalling over €540 billion.

BMWi has described the energy transition as a very large project with progress for most indicators.

Bundesrechnungshof says in part 1 of the summary:

In spite of considerable commitments of manpower and money, Germany has predominantly not met the targets of the energy transition.

Part 2 is about coordination. It says that BMWI has not yet defined the extent of its coordination.

The extensive part 3 is about management. It concludes:

- The Federal Government should quantify the targets, affordability and security of supply.
- BMWI should with reasonable expenditure use only indicators, which can unfold control effect.
- BMWI should make the cost of the energy transition preferably completely transparent.
- BMWI should consistently use aligned management tools at the milestones of the energy transition.
- BMWI should evaluate if it can use more efficient management tools, such as particularly CO₂ pricing, as additional instrument for implementation of the energy transition.

Part 4 concludes that decisive improvements of coordination and control are unavoidable (unumgänglich). Part 4 urges the Federal Government to act.

The report itself refers in more details to the sixth monitoring report and makes a number of statements, from which the points of the summary have been extracted.

Production, transmission and trade are equally important

There seems to be more shortcomings in the planning process than identified by Bundesrechnungshof. A completely different electricity supply system will need a different infrastructure and a different market arrangement. It is striking that considerations on possible improvements of the trading system are absent.

It may be difficult to maintain a complete harmony between production pattern, transmission capacity and market rules during all phases of a radical change of the production system, but by keeping the interdependence between the three essential elements of the power system in mind, it should be possible to minimize unintended effects during the transition.

The purpose of the market arrangement is to give an optimal utilization of available resources by finding the best possible balance between electricity demand and supply. The framework of the market must consider system constraints including physical limitations in the transmission system. Therefore, maintaining only one price zone for Germany prevents the market from solving the optimization problem, and expensive manual adjustments are necessary.

It is much faster to install a wind turbine than to build a transmission line. The logical consequence is that the rate of installation of new wind power should depend on the progress of the grid reinforcement. When the power grid has been sufficiently reinforced, it will no longer be necessary to split up the market into price zones.

The disharmony of the German power system causes volatile market prices, unintended flows in the AC-grids in neighbouring countries and virtual bottlenecks at the borders, where there is no physical bottleneck. Therefore, a less stressed German power system is essential to most of Germany's neighbouring countries.