

The energy transition in Germany:

Security of Supply and Affordability at Risk

The Federal Ministry for Economic Affairs and Energy (BMWi¹) in Germany is in charge of the energy transition (die Energiewende). BMWi recently published its eighth "Monitoring Bericht"² (Bericht: report) on progress and plans for the energy transition.

The Bundesrechnungshof (BRH)³ (a Federal Auditing Office) has expressed criticism of the BMWi management of the energy transition. Its new report⁴ has highlighted the insufficient measures for maintaining *security of supply for electricity* and the *high cost of electricity* in Germany.

Targets and results

	2018	2019	2020	2030	2040	2050
GREENHOUSE GAS EMISSIONS						
Greenhouse gas emissions (compared with 1990)*	-31.5%	-35.1%	at least -40%	at least -55%		Greenhouse gas neutrality
RENEWABLE ENERGY						
Share of gross energy consumption	16.8%	17.4%	18 %	30 %	45 %	60 %
EFFICIENCY AND CONSUMPTION						
Primary energy consumption (compared with 2008)	-8.7%	-11.1%	-20%		-30% →	-50%

Table 1 - German main targets for the energy transition. See the complete table in annex 1.

BMWi's Monitoring Bericht highlights the following results:

- 42% of the gross electricity consumption were based on renewable energy in 2019.
- The consumption of primary energy was 2.6% lower in 2019 than in 2018. However, the 20% reduction since 2008 will not be reached.
- The greenhouse gas emissions in 2019 were 35.1% below the level in the reference year 2019. The Covid19 pandemic supports the trend towards a 40% reduction by 2020.
- The German demand for energy was covered at any time, so a high security of supply was achieved. The law on coal exit will be followed by a law on reinforced regional structures.
- The electricity prices for households were practically unchanged in 2018 and increased by 3.2% in 2019. The variations reflect changes in the energy markets beyond control by the state.

The report leaves the reader with the impression that the energy transition passes off as planned and that the realized measures are sufficient. The report seems to ignore some essential problems.

However, from the electricity market and from the German purchase of "special regulation" in Denmark, we know that the German power system does not perform that well. "Special

¹ BMWi: Bundesministerium für Wirtschaft und Energie

² https://www.bmwi.de/Redaktion/DE/Publikationen/Energie/achter-monitoring-bericht-energie-der-zukunft.pdf?__blob=publicationFile&v=24

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

⁴ <https://www.bundesrechnungshof.de/de/veroeffentlichungen/produkte/sonderberichte/2021/bund-steuert-energie-wende-weiterhin-unzureichend>

regulation" means that owners of Danish wind turbines are paid for curtailing production. The magnitude of the curtailment in Denmark is about 1.5 TWh per year.

Another indicator is the volatility of spot prices (table 2). The German spot market is one single price zone, which cannot reflect the balances in different parts of Germany or the bottlenecks in the power grids. Therefore, the market cannot contribute to an optimal dispatch of power, and other measures, such as redispatch and feed-in-management, must relieve the stress on the grids.

Spot Prices	Period	
	01-01-2020	DE
	31-03-2020	
Average	€/MWh	26,58
Minimum	€/MWh	-55,05
Maximum	€/MWh	68,64
St.Dev.	€/MWh	15,15
Negative	Hours	128

Table 2 - German electricity spot prices 2020

The reports from BRH are important because they highlight some of the problems, which BMWi wants to play down.

Security of supply for electricity

BRH discusses three important properties (my interpretation):

- Security of supply in the electricity market, i.e. the ability of the electricity market to balance the power system
 - Reliability of supply, i.e. adequacy of production and transmission capacities
 - System security, including power system stability and resilience
- Security of supply in the electricity market

BMWi has analysed some critical scenarios, such as delayed grid extension, reduced interconnector capacity and reduced dispatchable power stations. It is a general objection of BRH, that these deviations should be analysed in combinations.

Dispatchable power is of particular importance for balancing the power system. There is a conflict between emission planning and security planning. In order to fulfil climate goals, the coal-fired capacity must be phased out faster than required for security of supply. According to BRH, the capacity deficit will be 4.5 GW in 2024 (fig. 1).

BRH suggests a worst-case simulation of the following combination of deviations from the reference scenarios:

- Coal exit before the end of 2035
- Delayed development of renewable energy sources

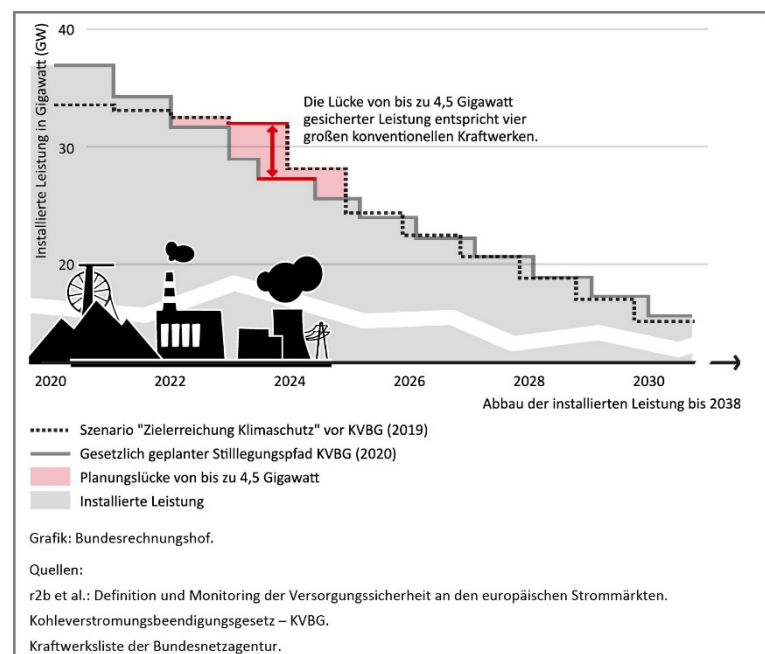


Fig. 1 - Capacity of coal fired power stations in Germany

- Electricity production from wind and photovoltaics based on time series from years with poor wind and solar conditions
- Reduced flexibility for the control of supply and demand of electricity
- Larger population

BMWi answers that they will continuously monitor the security of electricity supply together with the Federal Grid Agency (Bundesnetzagentur). The combined deviations from the reference scenarios will be evaluated in the next Monitoring Report.

b. Reliability of supply

BRH stresses that the following issues are missing in the Monitoring Report:

- Consequences of delayed grid reinforcements
- Are the investments of the grid operators sufficient?
- Will redispatch and feed-in-management be sufficient measures to guarantee security of supply if grid extensions and coal exit are delayed

BMWi refers to its report from 2019 with a more thorough investigation of security of supply.

c. System security

The fast development of non-dispatchable wind power in the northern part of Germany has created a heavy electricity transport from north to south. It has not been possible to extend the transmission grid in the densely populated Germany correspondingly. The closing down of nuclear and coal-fired power stations contributes to a disharmony in the power system and a reduced system security.

In January 2020, BMWi published "Aktionsplan Gebotszone"⁵. A new federal law, valid from 21 March 2021, paves the way for accelerating the approval of 35 new transnational reinforcements until 2030 in order to eliminate bottlenecks in the grids. 10,600 km new high voltage line at a total cost about € 40 billion is planned to be ready for operation by 2025/26.

The capacity shortage in fig. 1 is supposed to be eliminated or relieved by 2025 when essential grid reinforcements have been made. BRH points out that the schedules are specific, but not binding. The acceleration of approval procedures may introduce new uncertainties and have an impact on the progress of the projects. The envisaged capacity shortage may continue after 2025.

It is the understanding of BMWi that Germany has a consistent system for evaluation of the security of supply. BMWi will perform a further development of the system.

⁵ https://www.bmwi.de/Redaktion/DE/Downloads/A/aktionsplan-gebotszone.pdf?__blob=publicationFile&v=10

Affordability of Electricity

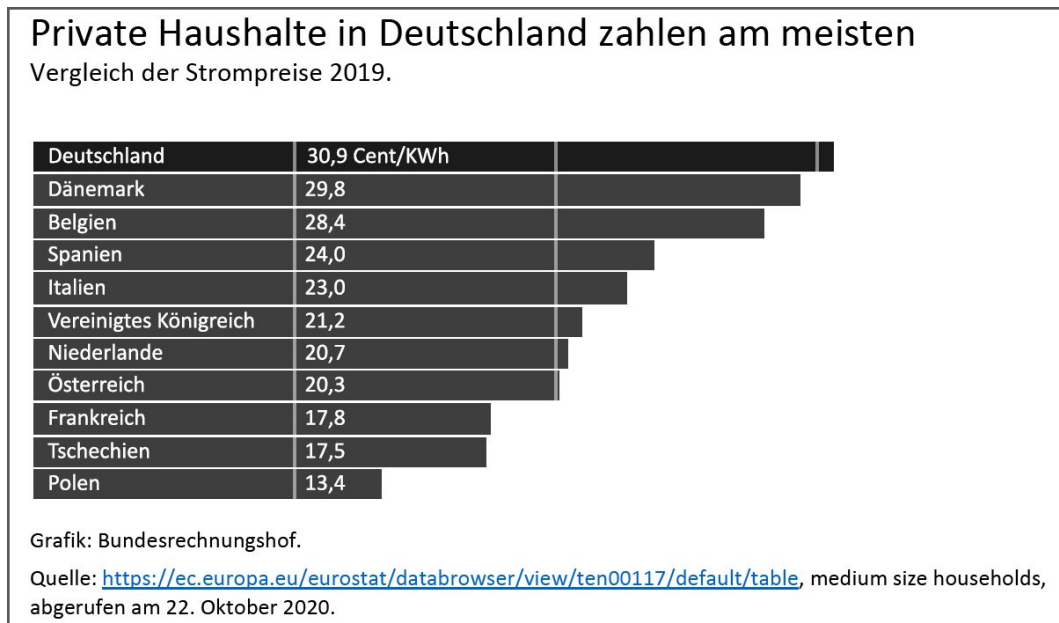


Fig. 2 - Electricity prices in European households in 2019

The electricity prices in private households is just one of several indicators on affordability, used by BRH. Other important indicators are power exchange prices and electricity prices for industries without support schemes.

German electricity prices in private households were the highest among EU countries in 2019 (fig. 2) closely followed by Denmark. The EU average was 21.5 Cents/kWh.

BRH expects a further increase of electricity prices in Germany. An increasing amount of renewable energy must be curtailed due to bottlenecks in the grid. 5.4 TWh had to be curtailed in 2018. The cost of redispatch and feed-in-management was € 1.9 billion in 2019.

The grid development was decided about ten years ago. The delays contribute to the high cost of system services. The large German grid companies estimate the total investment in grid extension and reinforcement to between € 75 billion and € 85 billion. Most of that money has not been spent yet.

BRH states that the energy transition is until now mainly an electricity transition. BRH assumes that the end-user-prices for electricity will increase further in the coming years. An essential reason is the current electricity price system with its levies, taxes, duties and remunerations.

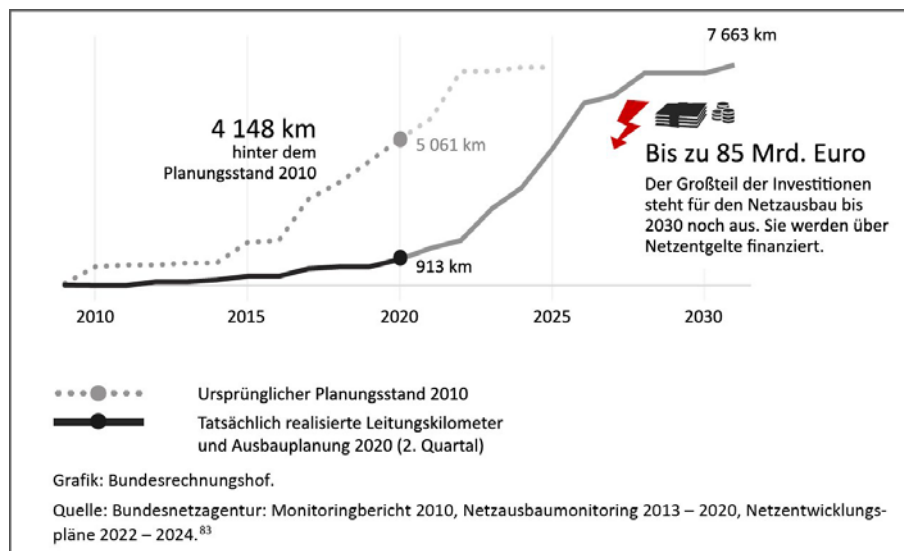


Fig. 3 - Grid expansion in Germany 4,000 km or five years behind schedule

The opinion of BMWi is that affordability cannot be depicted by a single indicator and target value. The available indicators allow a fair assessment of, to what extent electricity is affordable.

Concluding remarks by BRH

BMWi must determine its own understanding of cheap and efficient public supply with electricity. Based on indicators, BMWi must set the level of cheap electricity.

BMWi should strive for a fundamental reform of the elements of energy prices, which are controlled by the state. Otherwise, there will be a risk to lose Germany's competitiveness and the acceptance of the energy transition.

Annex 1

Quantitative targets for the German energy transition and status quo 2018 and 2019

Table 2.2 of BMWI's eighth monitoring report

	2018	2019	2020	2030	2040	2050
GREENHOUSE GAS EMISSIONS						
Greenhouse gas emissions (compared with 1990)*	-31.5%	-35.1%	at least -40%	at least -55%		Greenhouse gas neutrality
RENEWABLE ENERGY						
Share of gross energy consumption	16.8%	17.4%	18 %	30 %	45 %	60 %
Share of gross electricity consumption	37.8%	42.0%	at least -35%	65%**		***
Share of heat consumption	14.8%	14.7%	14%			
EFFICIENCY AND CONSUMPTION						
Primary energy consumption (compared with 2008)	-8.7%	-11.1%	-20%		-30% →	-50%
End energy productivity (2008 – 2050)	1.6% per year	1.4% per year		2,1% per year		
Gross electricity consumption (compared with 2008)	-4.2%	-6.9%		-10%	→	-25%
Consumption of non-renewable primary energy in buildings (resp. primary energy consumption) (compared with 2008)	-26,0%		-23.6% → -55%			
Heat demand in buildings (compared with 2008)	-14.4%	-10.9%	-20%			
End energy consumption in traffic (compared with 2005)	6.1%	7.2%		-10%		→ -40%

Source: BMWI Sep. 2020

* The targets for 2020, 2030, 2040 and 2050 show the current political German targets for greenhouse gas reduction

** Target according to climate protection program 2030 and the renewable energy act 2021 (EEG 2021) .The precondition is a further more determined, efficient, grid synchronous and increasingly market based expansion of renewable energy in the coming years. For this purpose, a further expansion of the electricity grids will be decisive.

*** According to a bill from the federal government of September 2020, the renewable energy act 2021 (EEG 2021) will before 2050 ensure that all electricity, which will be produced or consumed in the federal area, will be greenhouse gas neutral.