»» CO_2 Barometer 2013 – Manufacturing Industry Edition

German manufacturing companies' perspective on the energy transition

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1. Introduction

Developed as part of a cooperative project of KfW Bankengruppe and the Centre for European Economic Research (ZEW), the KfW/ZEW CO_2 Barometer has been analysing the situation of German companies regulated under the European Union Emissions Trading System (EU ETS) on an annual basis since 2009. The study's objective is to closely monitor firm behaviour in carbon markets in order to regularly provide detailed information to policymakers, businesses and the research community. In the framework of the KfW/ZEW CO_2 Barometer, KfW Bankengruppe and the ZEW have developed a second annual survey as a complementary study that starts with this report: the KfW/ZEW CO_2 Barometer – Manufacturing Industry Edition. The aim is to shed light on recent developments in the German manufacturing industry that are driven by European climate and energy regulations as well as the German energy transition in particular. The study is based on a survey among German manufacturing firms. The results are presented in this report which is published subsequent to the KfW/ZEW CO_2 Barometer – Carbon Edition. The survey questions in the present version address energy price expectations, investment in energy efficiency and the companies' opinion on the German energy transition. These are the main results of the KfW/ZEW CO_2 Barometer 2013 – Manufacturing Industry Edition:

- On average, no correlation could be observed between expectations on the development of energy consumption and the implementation of energy consumption targets.
- About 60 % of all companies conduct energy efficiency checks, larger companies slightly more often (61 %) than small and medium-sized companies (56 %).
- Of those companies that have invested in energy efficiency in the production process, the majority (70 %) have energy consumption targets, indicating that concrete targets may trigger additional investments in energy efficiency.
- The proportion of medium-sized and large companies that have invested in improving energy efficiency in the production process (about 60 %) is higher than that of smaller companies (15 to 22 %).
- In the companies' assessment of the German energy transition, the majority considers grid expansion to be the biggest challenge and the EEG levy the main driver of electricity prices.
- Oil, gas and electricity supply security is reported by 94 to 100 % of the companies to have either remained steady or increased in the last two years. The proportion of companies that reported increased electricity supply security is in fact 17 percentage points higher than the share of companies reporting a decrease (23 % compared to 6 %).

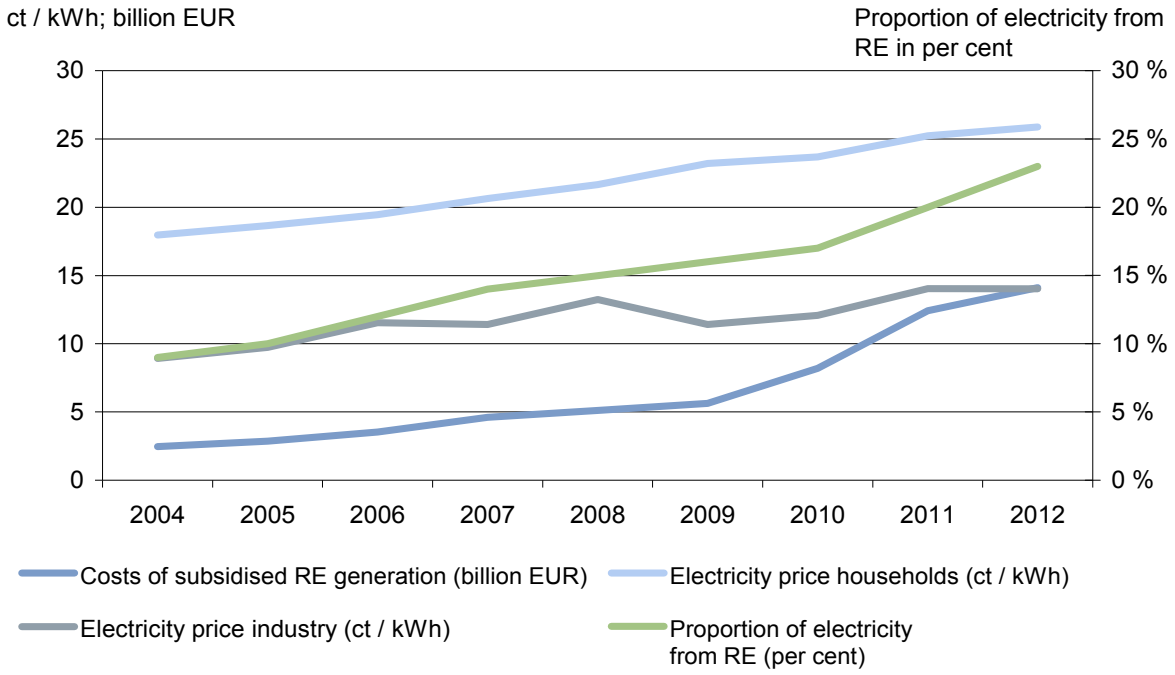
The survey covers a broad range of topics addressing energy issues. About 1,500 manufacturing companies were invited to participate in the survey. Approximately 24 % of the firms that responded to the survey belong to a group of companies. In order to avoid contacting a firm multiple times, only one responsible manager per firm was surveyed. In this first interview round, 70 companies have responded to the questionnaire. Firm behaviour in energy markets was analysed considering firm size and relevant regulation.

The KfW/ZEW CO_2 Barometer 2013 – Manufacturing Industry Edition is structured as follows:

Section 2 gives a short review of recent regulatory and market developments. The development of industrial energy consumption and energy prices in Germany is briefly summarised in section 3. Section 4 analyses respondents' energy price expectations and their investments in energy efficiency. Finally, companies' opinions on the German energy transition are described in section 5. Section 6 concludes.

2. Recent market and policy developments

The restructuring of the German energy system to incorporate a major share of renewable energy (RE) in the energy mix and strong energy efficiency improvements while phasing out nuclear power is known as the *energy transition*. The process mainly refers to the transformation of the power sector from nuclear and coal generation to generation from renewables by 2050. The 2050 targets thus mainly consist in reducing greenhouse gases by 80 to 95 % against 1990 levels, reducing primary energy use by 50 % relative to 2008 and lifting the share of renewables to at least 80 % in electricity consumption and 60 % in final energy use. The feed-in tariffs provided for under the German Renewable Energy Act (EEG) have significantly promoted investment in RE plants but have also resulted in significant electricity price increases for final consumers through the EEG levy[1] in recent years. The EEG levy increased from about 2 euro cents / kWh in 2010 to 5.3 euro cents / kWh in 2013 and will increase to 6.2 euro cents / kWh in 2014 (ÜNB 2013). Figure 1 shows the increase of the subsidy provided to RE systems through feed-in tariffs, the development of industry and household prices in Germany as well as the significant increase of RE generation as a proportion of total electricity generation.



Industry price: for electricity consumption between 160 and 20,000 MWh.
Household price: for electricity consumption of 3,500 kWh.

Source: BDEW (2013)

Figure 1: Electricity prices and RE subsidies

Whereas households have to pay the full EEG levy, energy-intensive industrial consumers pay only a charge of 0.05 to 0.5 cents / kWh (i. e. for electricity consumption of at least

[1] According to the EEG the different RE sources receive differentiated guaranteed long-term price payments, i. e. feed-in tariffs. Through the EEG levy final consumers provide the difference between the wholesale market price at the electricity exchange and the fixed feed-in tariffs.

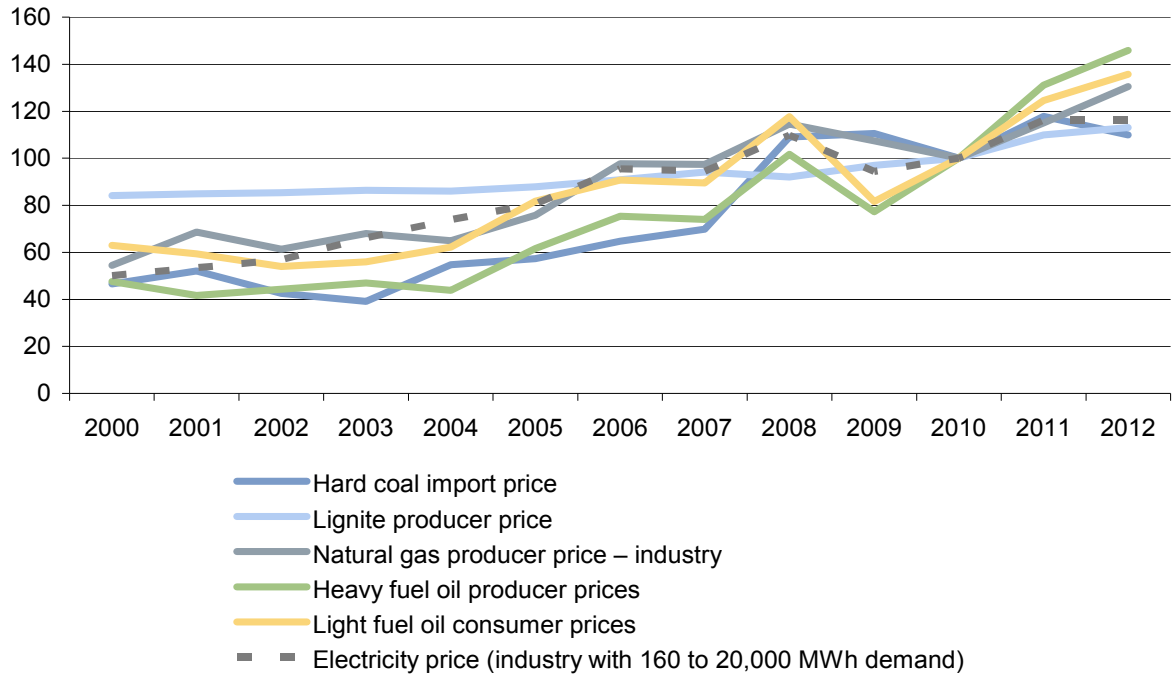
1 GWh and with a ratio of energy costs as part of gross value added of at least 14 %). Industry exemptions have increased significantly in recent years. In 2005, 297 companies paid reduced EEG levies. In 2012, the number increased to 734 exemptions, more than doubled to 1,716 exemptions this year (BAFA 2013) and may increase to more than 2,700 exemptions in 2014 (FAZ 2013).

Moreover, the injection of electricity from RE requires further investment in the electricity grid. In addition, power fed into the grid fluctuates with periods of wind and sunshine, requiring flexible power generation from fossil fuels. However, these marginal fossil-fuelled power plants may not have sufficient load hours to pay the investment back. Hence, investment may be insufficient when further nuclear capacity is shut down. Risks to supply security may increase as long as demand is not sufficiently elastic. Policymakers, academics and the industry are therefore discussing the need for capacity markets to remunerate investment in power plants. However, marginal fossil fuelled power plants are currently being decommissioned due to overcapacities in the German power market. Nevertheless, it is not clear whether there will be a lack of investment in the next decade.

Analysing last year's carbon emissions in Germany (728 mn t), we see an increase on 2011 (721 mn t) despite a significant increase in RE use in the energy mix (Eurostat 2013 and UBA 2013). The shale gas boom in the US has led to lower coal demand and lower coal prices. In addition we see low carbon prices as a result of the oversupply of certificates in the European Emissions Trading Scheme (KfW/ZEW, 2013). With a view to reforming the EEG, the present coalition agreement (CDU 2013) contains plans to adjust promotion rates and to assess industry exemptions, although concrete measures are not yet defined. The European Commission, i. e. the DG Energy and DG Competition, is currently reviewing the EEG and its industry exemptions for its efficiency and effects on the European market, as well as for its compatibility with state aid rules. The DG Energy has just published new guidelines for the design of European electricity markets recommending the implementation of more EU market compatible policies (EC 2013).

3. Industrial energy consumption and energy prices in Germany

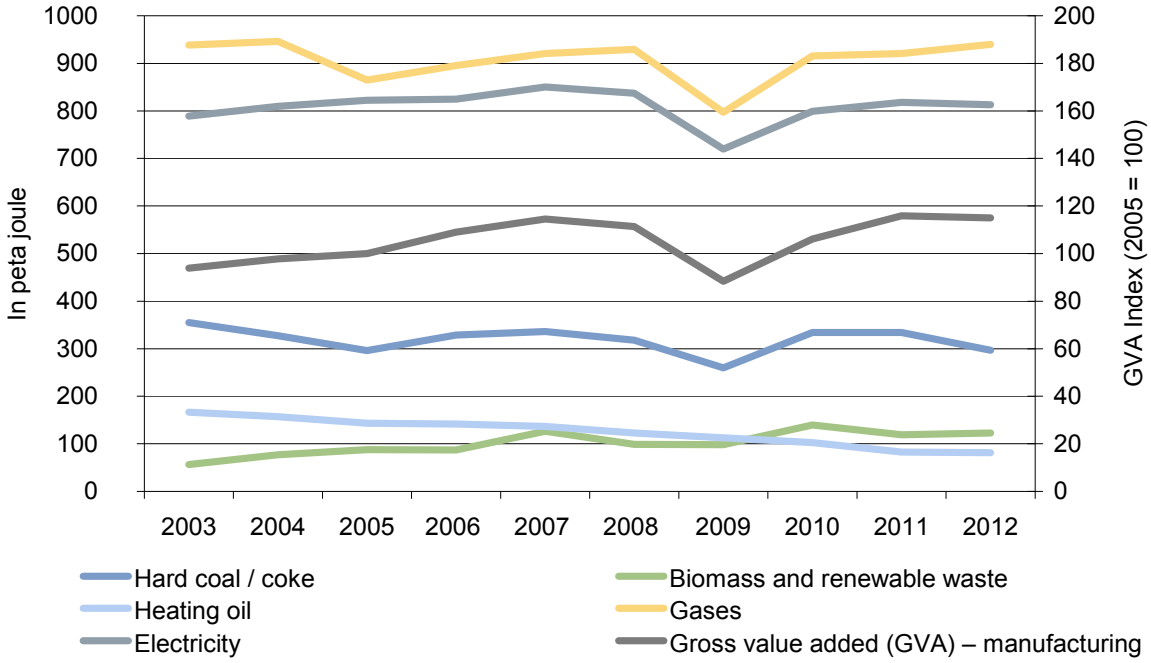
Energy price increases in Germany since 2002 (see Figure 2) are a result of increasing global energy demand, i. e. not only in industrial but especially in transition countries such as China and India. Although energy resources are not yet scarce, the long realisation time of capital-intensive exploration and mining as well as demand increases have led to price increases in the medium term. The price drop in 2009 mirrors the lower production and energy demand during the economic downturn.



Source: Destatis (2013b)

Figure 2: Energy prices in Germany (2010 = 100)

Industrial energy consumption in Germany has remained quite steady in the last decade despite a significant drop in 2009 due to the economic downturn. In addition, the development of energy consumption runs parallel to gross value added as an indicator of productivity (see Figure 3). Thus, energy price increases rather than energy consumption increases in general are a major reason for rising industrial energy costs.

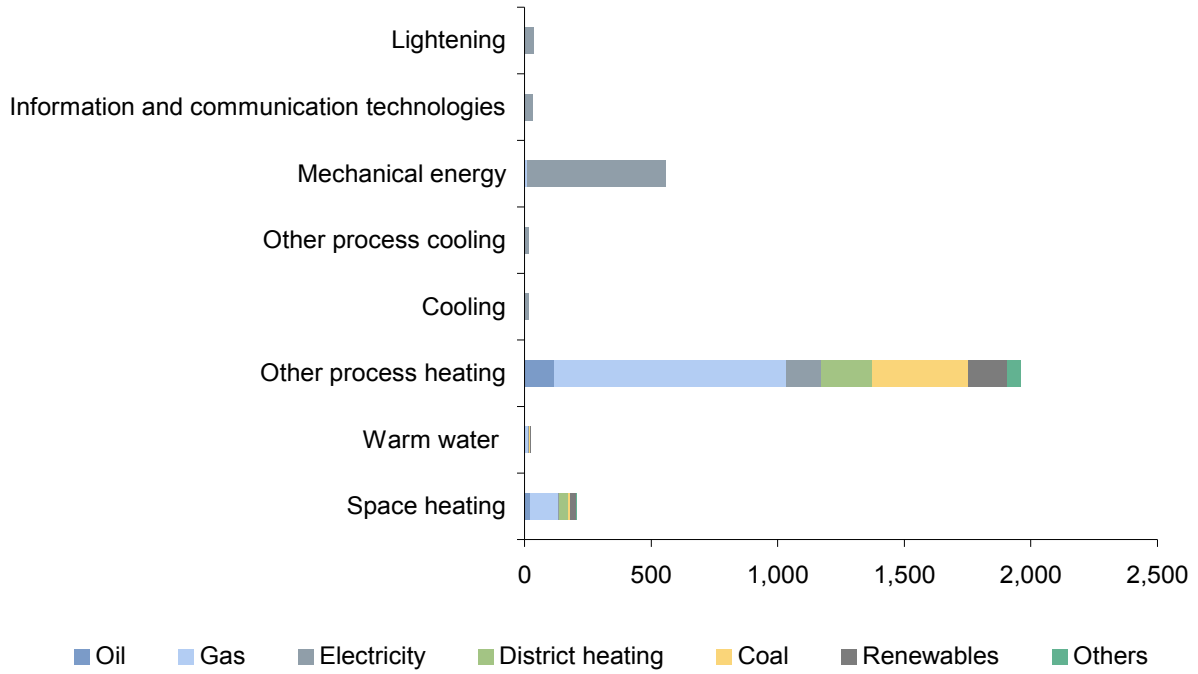


Source: AGEB (2013a), Destatis (2013a)

Figure 3: Energy consumption and gross value added of processing industry in Germany

Industrial energy is primarily used for process heating, which accounted for 66 % of all energy-using processes in 2011. Mechanical energy accounted for 21 % and space heating for 8 % (see Figure 4). Natural gas and electricity are the energy carriers that are mainly consumed by industry (see Figures 3 and 4). Electricity is mainly needed for mechanical processes, lighting and information technologies, whereas gas, coal and district heating are mainly applied for process heating.

The previous German government set very ambitious targets for energy efficiency and the new potential coalition has agreed to further promote energy efficiency measures. The expert commission monitoring the German energy policy and energy objectives states that an annual primary energy productivity increase of 2.5 % is necessary to reach the German 2050 targets. Between 1991 and 2011, the average primary energy productivity gain amounted to only 1.6 %. To reach the specific energy efficiency targets of the power sector, productivity levels in fact have to double (Expertenkommission zum Monitoring-Prozess (2012)). Therefore, for the evaluation of the underlying survey it is important to analyse whether and why companies did or did not invest in energy efficiency.

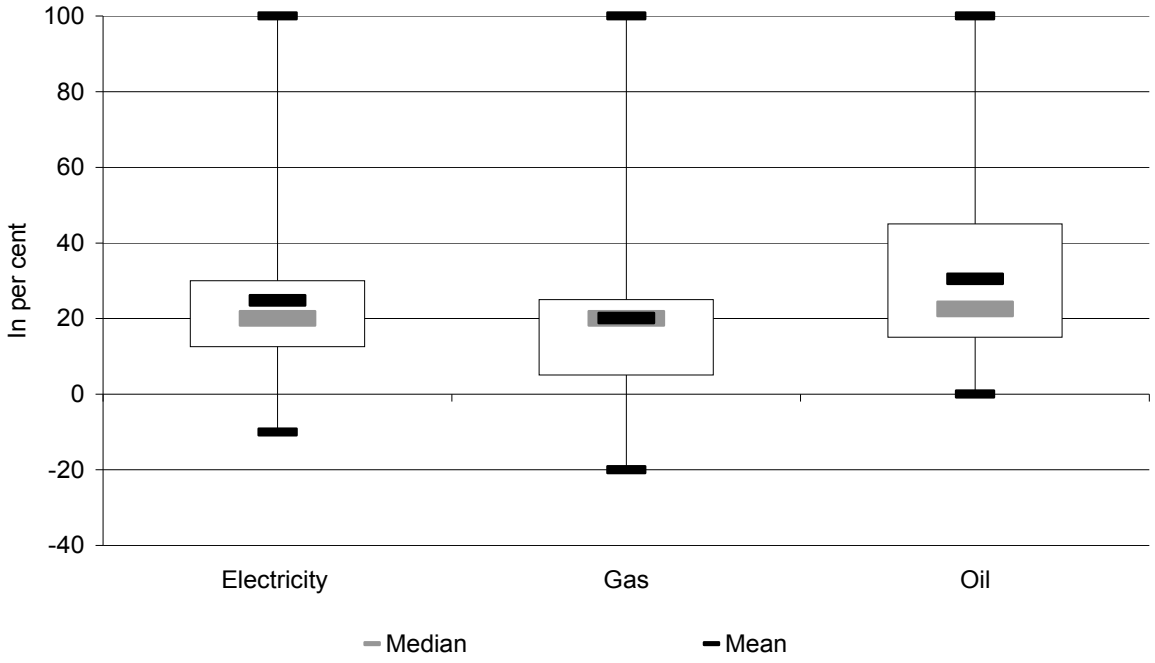


Source: AGEB (2013b)

Figure 4: Industrial energy consumption by usage and energy carrier (in PJ) in 2011

4. Energy price expectations and investment in energy efficiency

The companies' energy price expectations until 2020 range from a 20 % decrease to a 100 % increase. The mean price expectation is the highest for oil with +31 %, followed by electricity with +25 % and +20 % for gas. A further 25 % of the companies expect oil prices to increase by up to 45 %. For electricity, price expectations of the 25 to 75 % quartile of companies range from +13 to +30 % (see Figure 5). Thus, oil price increases are expected to be more severe than electricity or gas price increases.

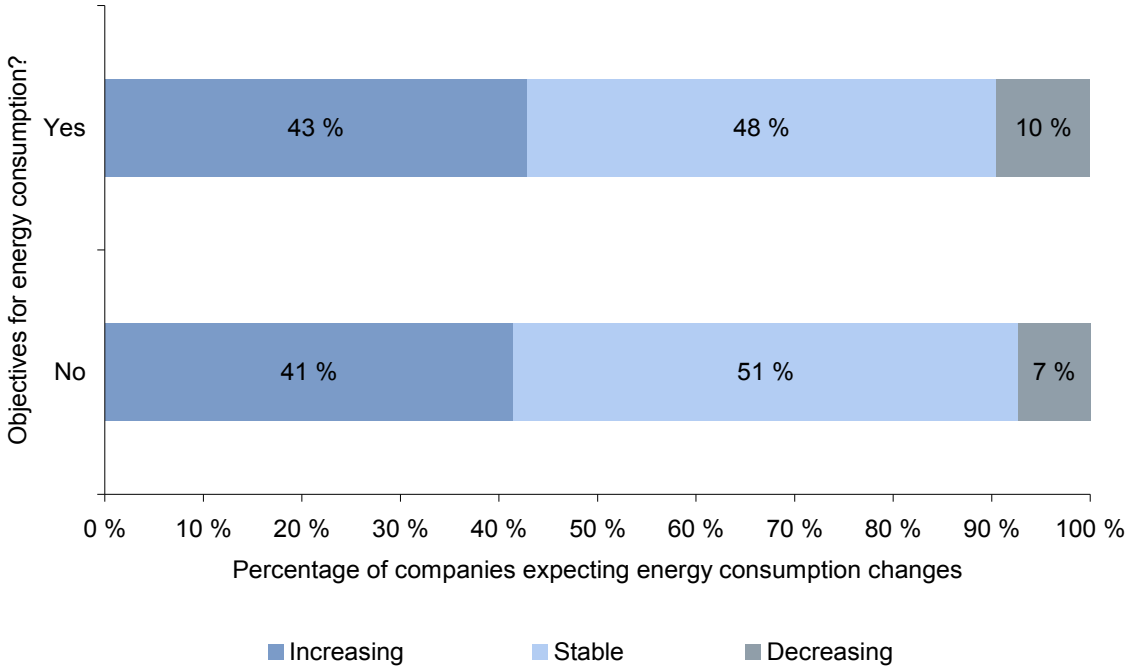


The boxes indicate the 25 % and 75 % quartiles, the lines the 1 % and 99 % percentiles.

Source: KfW/ZEW CO_2 Barometer 2013 – Manufacturing Industry Edition

Figure 5: What price changes (incl. taxes and levies) do you expect for each energy carrier until 2020? Boxplot of expectations of energy price changes

To mitigate energy cost increases as a result of higher energy prices, 33 % of the companies have established energy consumption or energy intensity targets to enhance their energy efficiency. Of those companies that have established energy consumption targets, only 10 % expect their energy consumption to decrease. The percentage of companies that expect their energy consumption to rise is similar for those with and without targets (43 % and 41 %) (see Figure 6). This indicates that, on average, expectations on the development of energy consumption were no major drivers for the implementation of energy consumption targets.

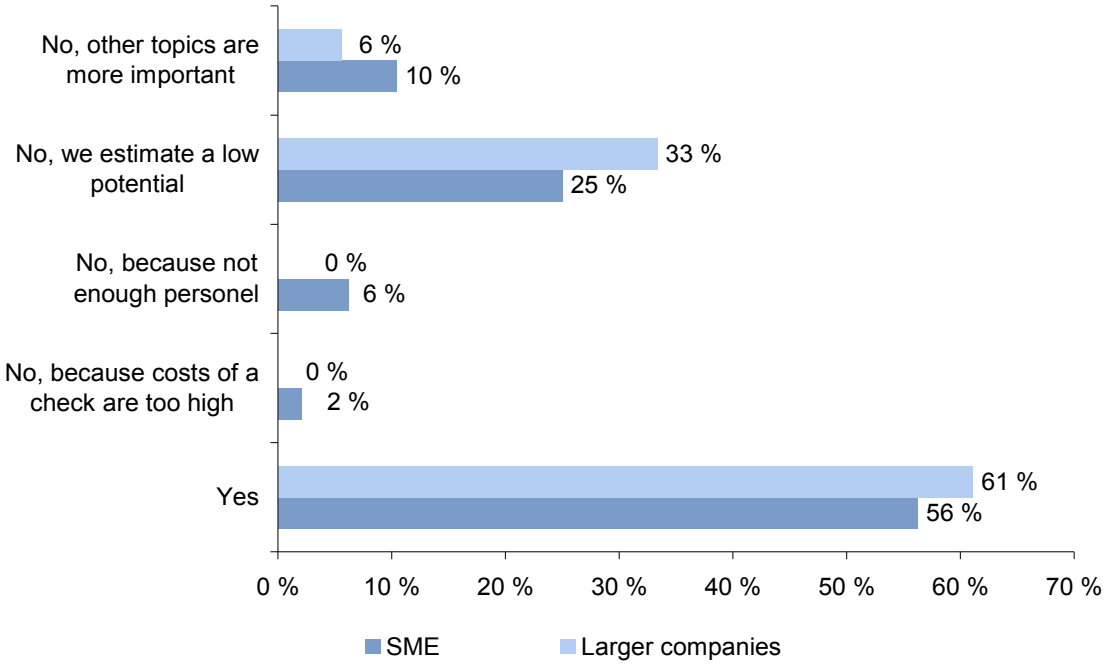


Source: KfW/ZEW CO_2 Barometer 2013 – Manufacturing Industry Edition

Figure 6: Energy consumption objectives and expectations

As most companies expect significant energy price increases, investments in energy efficiency should be of importance. Figure 7 indicates that most companies seek to identify the potential for energy efficiency improvements in their production processes or buildings, i. e. 61 % of larger companies (> EUR 50 mn turnover) and 56 % of small and medium-sized enterprises (SMEs, < EUR 50 mn turnover).[2] One third of larger companies and one fourth of SMEs report that they do not seek to determine energy efficiency potential because they estimate it to be low. Only 6 % of larger companies and 10 % of SMEs have not conducted any such checks because they consider other topics to be more important (see Figure 7).

[2] According to the European Union's definition of SMEs (EC 2003), SMEs are defined as enterprises with fewer than 250 employees and less than EUR 50 mn turnover. Here, the companies are classified only according to their turnover.



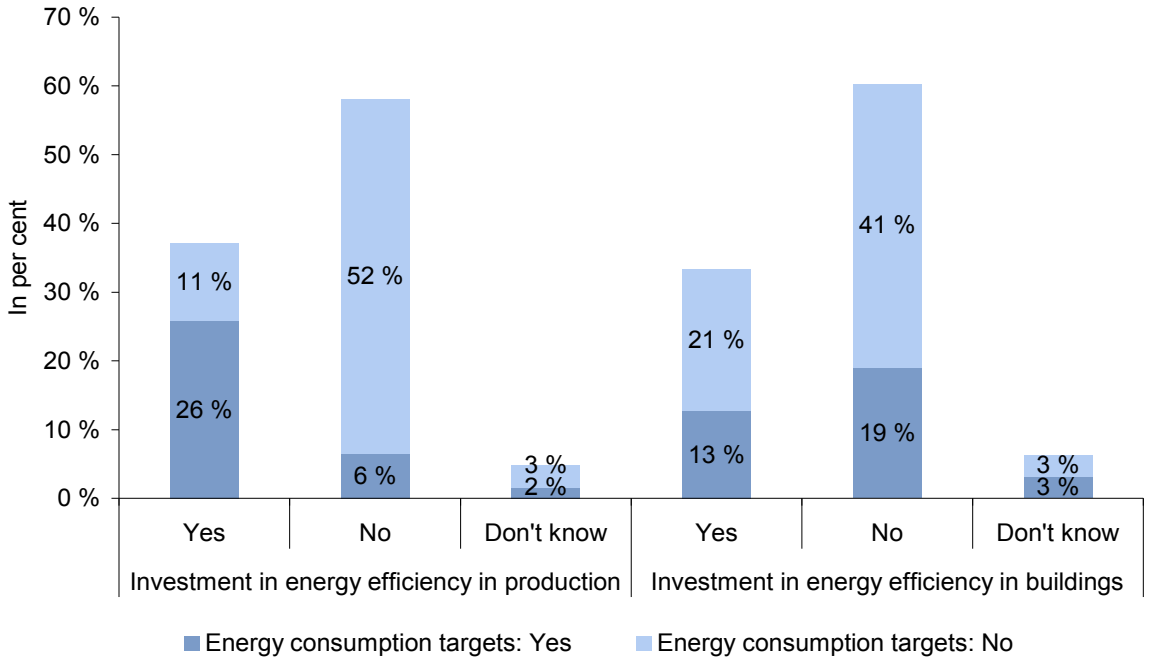
Source: KfW/ZEW CO_2 Barometer 2013 – Manufacturing Industry Edition

Figure 7: Has your company checked the potential for energy efficiency increases (production process or buildings)?

Although no correlation between the establishment of energy consumption targets and companies' expectations on future energy consumption can be seen, such targets can be seen to influence investment in energy efficiency of production processes (see Figure 8): Of all companies with energy consumption targets, 58 % have not yet invested in energy efficiency in production processes, whereas roughly two thirds of all companies with energy consumption targets (37 %) have invested. Notably, the majority of those companies that did not invest in energy efficiency in the production process do not have energy consumption targets (52 of 58 %). Similarly, the majority of those companies that have invested in energy efficiency in production processes have energy consumption targets (26 of 37 %). This could be an indication that concrete targets may trigger additional investment in energy efficiency.

Energy consumption targets can be seen to have no significant influence on efficiency investment in buildings. Between 30 % (19 % of 60 %) and 38 % (13 % of 34 %) of both company categories (those that have invested and those that have not) have energy consumption targets.

Altogether, about 56 % of the participating firms have invested in improving the energy efficiency of either their production processes or their buildings. This percentage is low in comparison to the 67 % of companies regulated under the Emissions Trading Scheme (ETS) that have invested in energy efficiency (KfW/ZEW 2013). Hence, companies that are part of the ETS tend to be more concerned about energy efficiency.

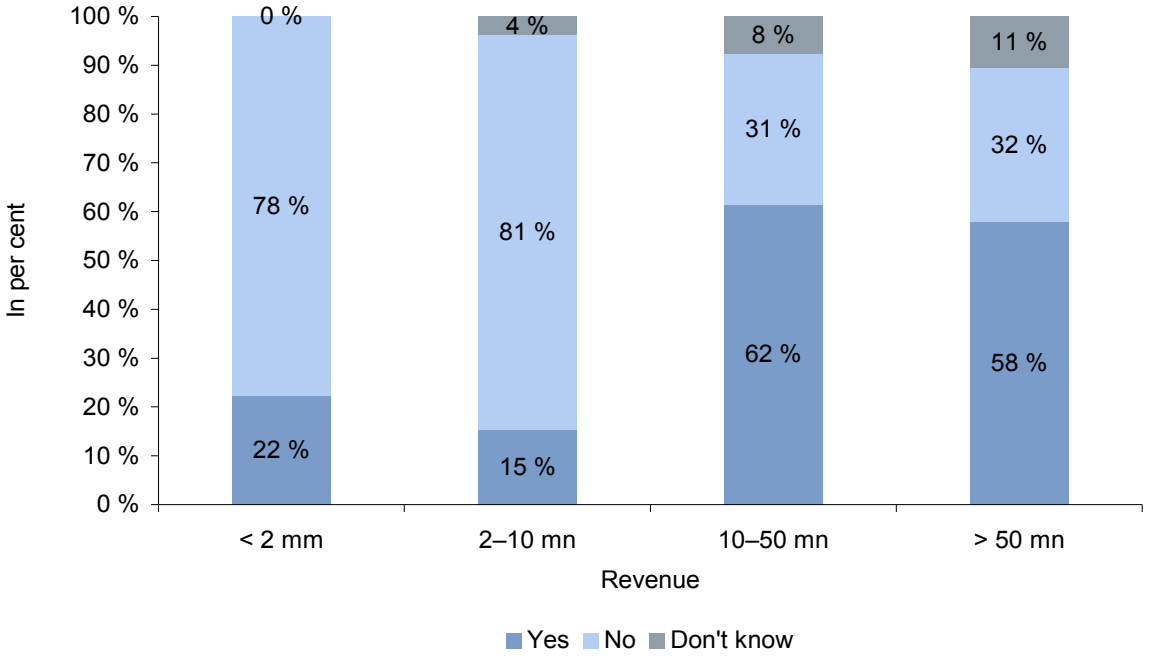


Source: KfW/ZEW CO_2 Barometer 2013 – Manufacturing Industry Edition

Figure 8: Has your company invested in energy efficiency (production process or buildings)?

A significantly higher proportion of energy efficiency investment in the production process was made by medium-sized[3] and large companies (with more than EUR 10 mn turnover) than small companies (see Figure 9). Only 15 to 22 % of small companies reported having invested whereas 62 % of medium-sized and 58 % of large companies reported having invested. Similarly, the recent KfW-Mittelstandspanel (SME Panel) 2013 has shown that in comparison with small companies, large medium-sized companies invest significantly more and make more use of energy consultancy services. According to the report, large medium-sized companies have a greater propensity to invest and many small companies do not have the same operating processes as medium-sized companies that could be optimised through capital-intensive measures (Schwartz and Braun 2013). Thus, relaxing financing restrictions might encourage further investment by small companies.

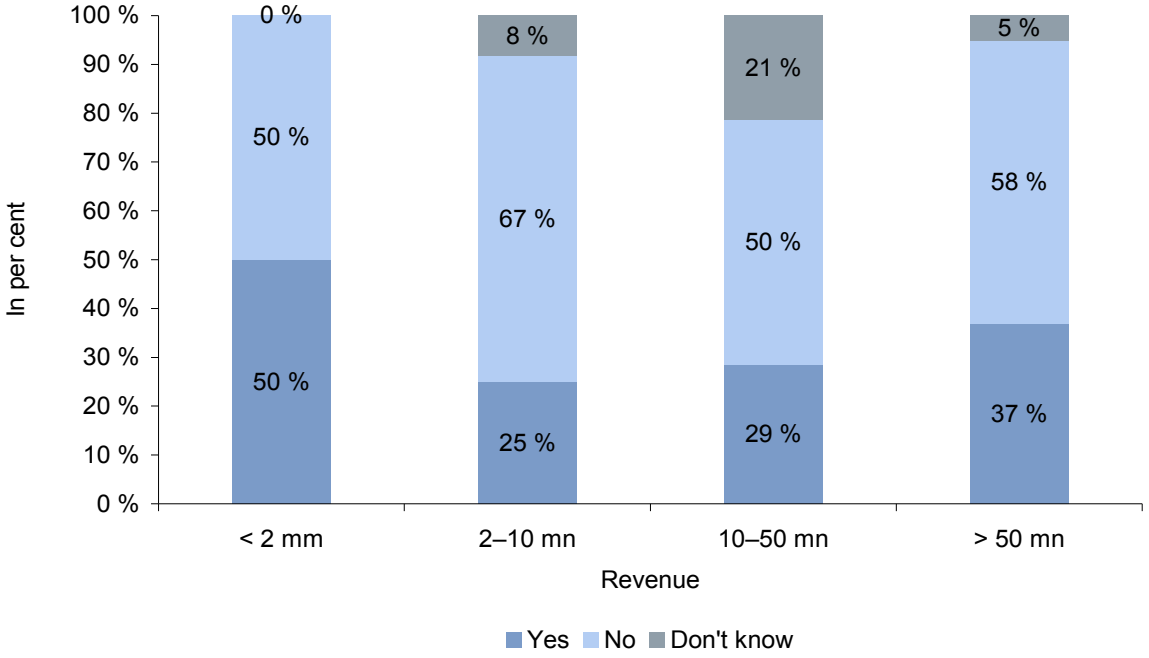
[3] Here, the term 'medium-sized companies' refers to companies with a turnover of between EUR 10 and 15 mn.



Source: KfW/ZEW CO_2 Barometer 2013 – Manufacturing Industry Edition

Figure 9: Has your company invested in energy efficiency (production process)?

For investment in buildings, the differences in investment behaviour by company size are less clear-cut. In each category, 25 to 50 % of the companies reported having invested in energy efficiency in buildings (see Figure 10).



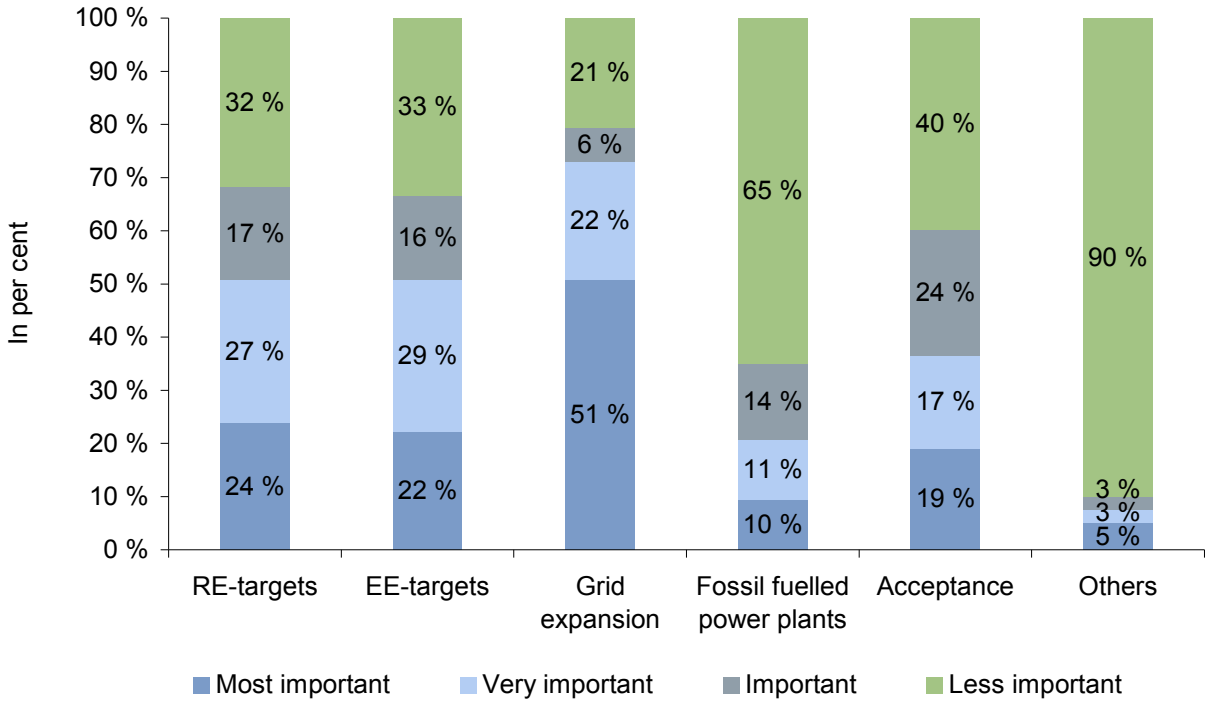
Source: KfW/ZEW CO_2 Barometer 2013 – Manufacturing Industry Edition

Figure 10: Has your company invested in energy efficiency (buildings)?

5. Opinions on the energy transition

The ambitious targets of the energy transition until 2020 and 2050 affect consumer groups differently and the manufacturing sector's opinion on its effects may differ from the opinions of policymakers or private households. Therefore, only the companies' opinions are investigated in this section.

Half of the companies (51 %) consider grid expansion the biggest challenge of the German energy transition, followed by RE targets (24 %) and energy efficiency (EE) targets (22 %) (see Figure 11). Although the introduction of capacity markets (to remunerate the provision of fossil-fuelled power generation capacity) is the subject of intensive public debate, most companies consider lack of investment in fossil fuel capacity to be less of a challenge. This may be because they indeed do not perceive a need for additional fossil fuel capacity or fear that an additional charge may raise electricity costs further. Interestingly, acceptance plays only a minor role in the companies' opinion. Only 19 % of the companies consider acceptance most important and 40 % even consider it less important. Conversely, it is in the public sphere that the costs of the energy transition are being increasingly discussed, and civil interests are a main reason for delays of grid expansions.



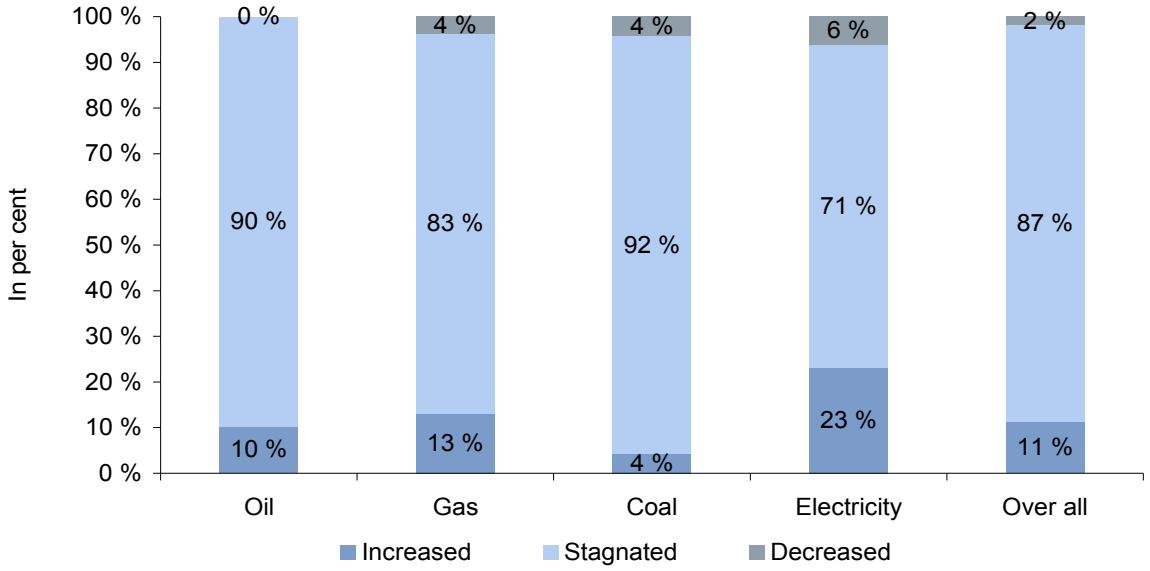
Source: KfW/ZEW CO_2 Barometer 2013 – Manufacturing Industry Edition

Figure 11: Which are the biggest challenges of the energy transition?

More than 94 % of all companies reported that their supply security for all energy carriers has not decreased or has even increased in the last two years. This also holds true for electricity supply security: 23 % of companies reported improved electricity supply security while only 6 % of companies reported a deterioration – a difference of 17 percentage points. These assessments may seem surprising in light of the ongoing debate that supply security is being

more and more affected by the increasingly fluctuating RE injection into the grid and the need for grid expansion and flexibility. The reports of the German regulator (BNetzA, 2012a and 2012b) have addressed increasing interventions to guarantee supply security, such as an increasing need for balancing energy for winter 2011/2012 and winter 2012/2013. The System Average Interruption Duration Index (SAIDI)[4] increased slightly from 14.9 to 15.9 minutes between 2010 and 2012 (BNetzA, 2013b). However, on the low voltage level it decreased slightly from 2.8 to 2.6 minutes. Thus, the participating companies currently might not be affected by grid problems. Another explanation may be an improvement of supply security following the intervention by the regulator in 2012 to establish a power capacity reserve after the precarious supply situation in winter 2011/2012 (BMWi, 2013).[5] In addition, a further reason may be an increasing number of companies relying on self-provision of electricity.

The shale gas boom in the United States has significantly affected the US supply situation on the natural gas market. So far, these changes have had no significant effects on the European natural gas supply. On the contrary, there were regional gas shortages in winter 2011/2012 (BNetzA, 2012a). It will be interesting to see whether the overall situation will change for German (and European) companies in the years to come. For the last two years 83 % of the companies reported gas supply security to have remained steady, whereas 13 % of the companies experienced an increased and 4 % a decreased supply security, a difference of 9 percentage points (see Figure 12).



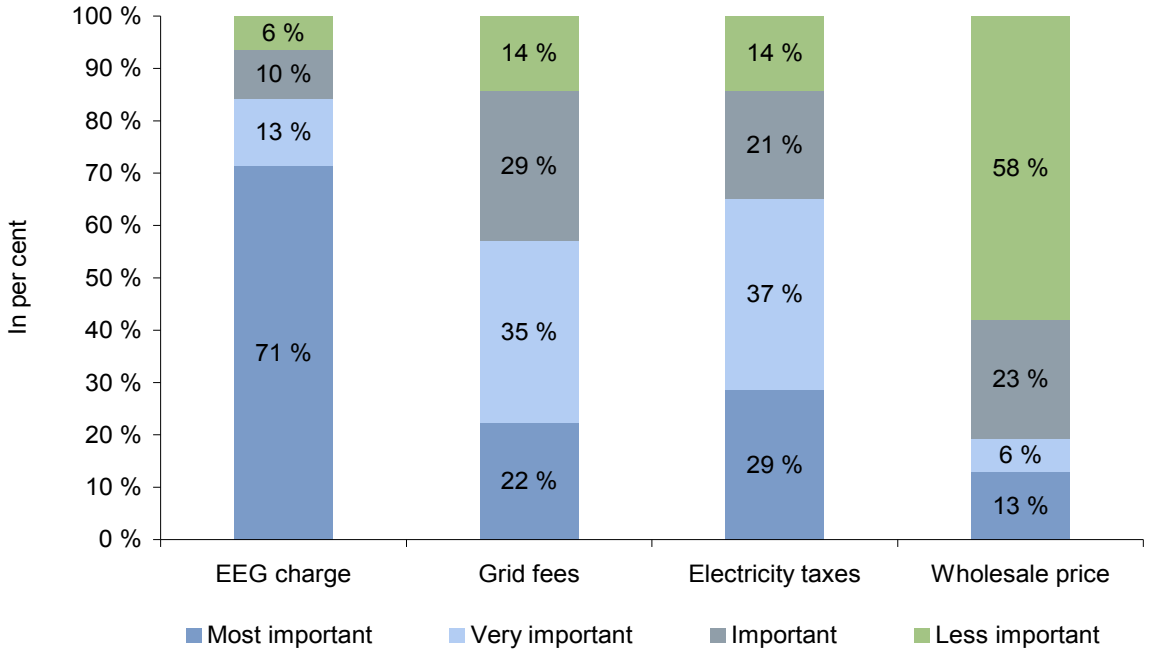
Source: KfW/ZEW CO_2 Barometer 2013 – Manufacturing Industry Edition

Figure 12: How did supply security change in your company in the last two years?

[4] The SAIDI reported here measures average electricity supply disruptions in minutes. It demands that a disruption must last more than three minutes.

[5] The German regulator BNetzA established the Reservekraftwerksverordnung (Reserve Power Plant Directive) in 2013 to guarantee electricity supply security in winter months. It defines the legal framework and regulations according to which the BNetzA and the transmission system operators (TSO) may define certain power plants as a necessary reserve which then need to remain ready to run on demand.

In the German energy debate, in the last months more and more attention has shifted to cost efficiency aspects of the German energy transition. The focus is now on the EEG levy and remuneration system which has led to higher electricity prices for final consumers. The majority of companies responding to the survey reflect this opinion, i. e. 71 % of the firms expect the EEG levy to continue to be the most important driver of electricity prices in the next two years. Grid fees and electricity taxes are classified as most important by 22 % and 29 % of the companies and as very important by an additional 35 and 17 %. Only 13 % of the companies consider wholesale prices a major driver and 58 % classify wholesale prices as less important. Potentially, some firms might even expect a further decline of wholesale prices in the future (see Figure 13).



Source: KfW/ZEW CO_2 Barometer 2013 – Manufacturing Industry Edition

Figure 13: What will be the main drivers of electricity prices in the next two years?

6. Conclusion

German manufacturing companies have to cope with dynamic conditions in energy markets and changing energy policy. In particular, these changes may affect the EEG as a result of a new government or stricter requirements introduced by the European Commission. The German manufacturing companies' assessment of energy price developments and energy efficiency investments and their opinion on the energy transition reveal a further need for investment in energy efficiency and potential adaptations of energy policies.

On average, natural gas is the energy carrier consumed most (as processing energy) by the manufacturing sector, followed by electricity, which is mainly used for mechanics, lighting etc. Energy consumption has increased again after the economic downturn in 2009. With regard to energy prices, most companies expect oil prices to rise the most, i. e. more than electricity and gas prices.

The percentage of manufacturing companies that invested in energy efficiency was lower than the share of companies participating in the ETS (56 % against 67 %). Around 60 % of the companies, SMEs and large companies, conduct energy efficiency checks and 33 % have set energy consumption or energy intensity targets. A correlation between energy consumption targets and investments in energy efficiency in production processes can also be observed. However, most firms expect increasing energy consumption irrespective of whether they have energy consumption targets in place or not. About 60 % of medium-sized and large companies have invested in energy efficiency in production processes, whereas only 15 to 22 % of small companies have invested. With regard to energy efficiency investment in buildings, no structural difference can be seen between the different company sizes.

Grid expansion is considered the biggest challenge of the energy transition. The majority of companies (71 %) expect the EEG levy to continue to be the most important driver of energy price increases. A vast majority of all companies (94 %) regard energy supply security as having remained steady or even increased in the last two years.

Almost one fourth of the companies reported that electricity supply security has actually increased in the last two years. Thus, companies do not seem to regard supply disruptions as a problem at this stage but more of an issue in the coming years as reflected in their assessment of the importance of grid expansion.

However, the companies did not report investment in fossil-fuelled generation capacity to be of major importance. Whether this is because of their apprehension over surcharges on energy prices as a result of the introduction of capacity markets, because of increasing self-provision or because the firms do not see the need for additional investment in fossil fuel capacity needs to be further investigated.

With regard to the firms' energy price expectations, energy efficiency checks and investment behaviour, it can be concluded that energy efficiency will become more and more important and that there may still be potential for further investment in energy efficiency. Why this investment is not yet taking place, i. e. whether it is economically unviable for the firms themselves or whether some kind of market failure is hampering further investment is an area that requires further research.

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