Energiewende: The Manufacturing Sector at Risk?

Hubertus Bardt, Cologne Institute for Economic Research

Hanno Kempermann, Cologne Institute for Economic Research Consult

Contact: Dr. Hubertus Bardt,
Head of Research Unit Environment, Energy, Resources
Cologne Institute for Economic Research
Konrad-Adenauer-Ufer 21
50668 Cologne
Germany
Phone: +49 221 4981-755
Fax: +49 221 4981-594
bardt@iwkoeln.de

Abstract

The abandonment of nuclear power and the new focus on renewable energy sources represent a fundamental change in the structure of Germany’s electricity supply. In the wake of this change in energy policy (which is widely referred to as energy turnaround), prices immediately started to rise and further increases are to be expected in the years ahead. In the case of the manufacturing sector, this cost burden has been mitigated by exempting the energy-intensive sectors which are mostly affected. However, this causes high levels of uncertainty for large electricity consumers as their current exceptional status may be called into question at some point in the future.

Moreover, the price and cost effects of the German energy policy are not only restricted to energy-intensive enterprises. While the metal production, parts of the chemical industry, and others have to deal with higher price risks, other industries are closely linked to these electricity consumers in complex value chains. Large segments of the manufacturing sector work closely with energy-intensive companies. These dense networks particularly bear fruit in the joint development of innovations, one of the German industry’s main competitive advantages.

This strength of the German economy may turn into a risk if the future of electricity-intensive industries is hampered by rising national energy prices. A potential relocation of energy-intensive companies to other countries would thus also weaken the competitiveness of other areas of the German industry. These risks need to be compared with the new market opportunities provided by the energy turnaround. The industry sees such opportunities especially in renewable energies and techniques for improving energy efficiency.
Overview and Methods

The energy transition in Germany aims at an energy supply which produces most electricity with renewable energies by mid-century. What seems to be a smooth transition for the electricity sector, can have a fundamental influence on the manufacturing sector. All large consumers of electric energy face additional risks regarding security of supply and additional costs. A stable supply of electricity is essential for production processes, public infrastructure, and private households (Petermann et al., 2010). While a decrease in security of supply is a rather subtle process, threats from additional costs caused by higher energy prices are more obvious. Political debates about an additional burden for energy-intensive industries to finance feed-in tariffs for renewable energies add strategic risks which make decisions to invest in Germany more difficult. This is most critical for energy-intensive industries. However, industries with a lower share of electricity costs may face a negative impact on their competitiveness if value chains are disrupted because of energy politics. On the other side, additional opportunities can also arise from the energy transition, which have to be weighed against the threats caused by increasing electricity prices.

The analysis of the indirect risks and opportunities arising from the energy transition for non-energy-intensive industries is based on a broad survey, which has been conducted in 2012. Depending on the questions and filters applied, 250 to 1,500 executives of the manufacturing sector in Germany have been analysed (Bardt / Kempermann 2013). Most of the results allow differentiating between two types of companies, type-D and type-0. There are three success criteria which describe type-D companies (Baal / Lichtblau, 2012): they are working on international markets, they invest above average in research and development, and they are more innovative than other companies. About 60 per cent of the companies in the manufacturing sector can be classified as type-D. In contrast, type-0 companies do not meet more than one of the criteria. These companies are significantly less successful regarding turnover, employment, profits, and prospects.

Additionally, some of the results will be differentiated by the following industries: chemical products, machinery, metals and metal products, and electronics and vehicles. All results will be extrapolated based on employment data. This allows quantifying the results according to the respective significance for the manufacturing sector.

Direct cost effects

Today, many companies realise the first effects of the Energiewende. The German energy transition includes the fading out of nuclear energy until 2022. As far as electricity production is concerned, however, its main focus is to increase the share of energy production from renewable energies to more than 80 per cent by 2050.

One of the main problems for the manufacturing sector here are increasing energy prices. While market based net electricity prices have remained fairly constant over the last years, there has been a significant increase of taxes and other government related charges. More than 80 per
cent of the companies face rising energy prices. This share will probably grow in the next years (Fig. 1).

Figure 1: **Direct consequences of the Energiewende**

„Does the Energiewende has direct consequences for your company?“; share of answers in per cent

![Diagram showing direct consequences of the Energiewende](image)

Source: IW-Zukunftspanel 2012.

Almost one in four companies has identified better market opportunities due to the energy transition. One company out of six believes in increasing turnover in the short term. Medium term prospects are a little better. The share of companies that fear threats for existing markets is similar. In the short run, about 10 per cent expect a decline in employment and turnover. In the medium run, these shares are higher: 24 per cent of the companies fear lower employment figures, while 16 per cent expect a decrease in turnover.

The largest increase of consequences is expected in the future stability of energy supply. Only 12 per cent of the companies see a short term decline of security as a consequence of the Energiewende. In the medium run, this share is about 20 percentage points higher: a third of the companies assumes constrains of electricity supply. Rising energy costs are among the main challenges for the manufacturing sector. This is especially true for energy-intensive companies. Costs that apply only in Germany and not in other countries can become a significant threat if energy is the main cost factor for the company.
Table 1 shows more detailed results, indicating significant differences between selected industries and types of companies. While, for example, more than 40 per cent of all companies from the electronics and automotive industry believe in additional market opportunities, over 40 per cent of the metal industry expect threats for existing markets. Turnover developments show differences as well: about one out of three electronics or automotive companies has realised rising turnover due to the Energiewende. In contrast, this was only true for one out of eleven companies in the metal industry and one out of 20 in the chemical industry.

Table 1: **Direct effects of the Energiewende**
in per cent

<table>
<thead>
<tr>
<th></th>
<th>Manufacturing sector</th>
<th>Type-0</th>
<th>Type-D</th>
<th>Chemical industry</th>
<th>Metals and metal products</th>
<th>Machinery</th>
<th>Electronics and vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Additional market opportunities</strong></td>
<td>24,8</td>
<td>18,8</td>
<td>26,8</td>
<td>21,9</td>
<td>17,5</td>
<td>28,4</td>
<td>42,1</td>
</tr>
<tr>
<td><strong>Threats for existing markets</strong></td>
<td>22,9</td>
<td>16,0</td>
<td>24,2</td>
<td>33,3</td>
<td>41,8</td>
<td>10,1</td>
<td>13,6</td>
</tr>
<tr>
<td><strong>Additional turnover</strong></td>
<td>16,5</td>
<td>11,2</td>
<td>19,0</td>
<td>4,4</td>
<td>9,0</td>
<td>17,4</td>
<td>35,8</td>
</tr>
<tr>
<td><strong>Loss of turnover</strong></td>
<td>8,1</td>
<td>8,4</td>
<td>7,2</td>
<td>6,0</td>
<td>8,6</td>
<td>4,7</td>
<td>16,7</td>
</tr>
<tr>
<td><strong>Rising energy costs</strong></td>
<td>81,1</td>
<td>72,2</td>
<td>83,3</td>
<td>81,2</td>
<td>77,9</td>
<td>70,8</td>
<td>91,8</td>
</tr>
<tr>
<td><strong>Decreasing employment</strong></td>
<td>11,2</td>
<td>9,0</td>
<td>13,0</td>
<td>15,5</td>
<td>17,7</td>
<td>4,1</td>
<td>12,5</td>
</tr>
<tr>
<td><strong>Reduced security of supply</strong></td>
<td>11,8</td>
<td>6,0</td>
<td>14,3</td>
<td>18,5</td>
<td>18,9</td>
<td>3,4</td>
<td>11,8</td>
</tr>
</tbody>
</table>

Source: IW-Zukunftspanel 2012.

Companies that are innovative, do research, and work internationally gain more benefits from the energy transition than others. Almost 20 per cent of these type-D companies managed to increase their turnover, as against 11 per cent of type-0 companies. Rising energy costs are
more important for type-D than for type-0 companies. About 83 per cent of the more successful businesses face higher costs. The share among type-0 companies is about 11 percentage points lower.

To identify those industries that are affected by rising electricity prices the most, absolute consumption and energy intensity should be taken into account. The chemicals and metal industry alone consume 19 and 18 percent of the electricity delivered by electricity suppliers to the manufacturing sector. Other industries like vehicle construction or paper, food, glass, and machinery production only use between 5.5 and 8.3 per cent of the industrial demand of electricity. Furthermore, energy intensity is very high in the paper and chemicals industry, along with the glass and ceramic, and metal industry.

The new energy policies, and in this conujunction especially the price development of electricity, has become very important for German enterprises. According to a poll conducted by KfW (KfW Bankengruppe / ZEW, 2012, 38), 61 per cent of all German companies think that energy costs are an important factor when decisions about new investments are to be made.

Figure 2: Disinvestment of energy-intensive industries
energy-intensive industries: chemicals, paper, glass and ceramic, and metal industry; net investment in per cent of gross investment

Source: Statistisches Bundesamt, 2013; own calculations.
The development of the net investment of energy-intensive industries reveals a difficult situation and a lacking confidence in high quality of electricity supply and especially in competitive energy prices in Germany (Fig. 2). In non-energy-intensive industries, the net investment has amounted to between -15 and +10 per cent of the gross investment over the last decade. In total, the sum of gross investments since 2000 almost equals the depreciations, which results in a total net investment of 0 in the non-energy-intensive industries. While the capital stock has been more or less stable in other industries, the situation of energy-intensive industries has been very difficult. In most years since 2000, the net investment of the chemical, paper, glass and ceramic, and metal industry has been negative. In these industries, depreciations have been higher than gross investment. In 2005, for example, net investments were about 28 per cent lower than depreciations. Only in 2008, a positive net investment balance could be observed. Over the last decade, only 85 per cent of all the depreciation of energy-intensive industries have been replaced by investments. This is a slow process of disinvestment, which cannot be explained with high energy prices only. But the situation will probably become more critical with a rising national tax burden on energy.

Indirect effects on value chains and innovation

The Energiewende has not only direct (price) effects on energy-intensive industries. There will also be indirect consequences when current value chains or networks are affected. The German economy is characterized by a broad structure of different industries and intensive supply chain networks, which allow a high degree of specialisation and division of labour. The specialisation or concentration on core competences allows for competitive advantages. On the other side, specialisation in value chains leads to additional dependencies. In case of an important supplier dropping out, the value chain cannot be sustained. Negative economic consequences for a number of companies in the affected value chain become possible and probable.

More than 80 per cent of the companies asked in the survey have energy-intensive suppliers. They have very close relations within value chains, but further network relations are intense as well: More than 40 per cent of all companies in the manufacturing sector co-operate in networks with energy-intensive industries. About a third of the companies of the manufacturing sector see the risk that German suppliers could drop out of the supply chain. The share of companies that co-operate with energy-intensive industries and fear a negative influence on the stability of the value chains is above average. About 40 per cent of these companies believe in risks for the supply chain. In contrast, only a quarter of the companies without any co-operation with energy-intensive industries believe so.

The Energiewende can become a real threat for the stability of existing value chains. Companies expect to be indirectly affected, if energy-intensive companies were to lose competitiveness and relocate from Germany due to rising energy costs. Since close relations between energy-intensive and other companies are evident, insecurity cannot be limited to certain sectors. More than a third of all companies in the manufacturing sector expect negative consequences on their own business success, if energy-intensive industries were to lose competitiveness in Germany. 13 per cent believe that their domestic research and development networks are endangered as energy-intensive industries have specific core functions in these networks (Table 2).
Table 2: Influence of energy-intensive companies relocating abroad in per cent

<table>
<thead>
<tr>
<th></th>
<th>Negative effects on success of own business</th>
<th>Negative effects on R&amp;D networks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metals and metal products</td>
<td>59,3</td>
<td>35,4</td>
</tr>
<tr>
<td>Chemical products</td>
<td>38,6</td>
<td>15,3</td>
</tr>
<tr>
<td>Machinery</td>
<td>29,0</td>
<td>10,1</td>
</tr>
<tr>
<td>Electronics and vehicles</td>
<td>32,9</td>
<td>13,6</td>
</tr>
<tr>
<td>Manufacturing sector (total)</td>
<td>35,7</td>
<td>12,9</td>
</tr>
</tbody>
</table>

Source: IW-Zukunftspanel 2012; IW Consult, 2012

Table 3: Innovation capacities of energy-intensive industries in per cent

<table>
<thead>
<tr>
<th></th>
<th>Type-0</th>
<th>Type-D</th>
<th>Manufacturing sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation capacities of energy-intensive industries are important for the success of the own business.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very important</td>
<td>6,6</td>
<td>25,4</td>
<td>23,6</td>
</tr>
<tr>
<td>Somewhat important</td>
<td>42,6</td>
<td>47,7</td>
<td>46,7</td>
</tr>
<tr>
<td>Hardly important</td>
<td>43,8</td>
<td>24,6</td>
<td>27,2</td>
</tr>
<tr>
<td>Not at all important</td>
<td>7,0</td>
<td>2,3</td>
<td>2,5</td>
</tr>
</tbody>
</table>

Co-operation with energy-intensive industries leads to innovation impulses.

<table>
<thead>
<tr>
<th></th>
<th>Type-0</th>
<th>Type-D</th>
<th>Manufacturing sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, regular impulses</td>
<td>4,7</td>
<td>9,4</td>
<td>9,7</td>
</tr>
<tr>
<td>Yes, occasional impulses</td>
<td>20,4</td>
<td>38,1</td>
<td>36,7</td>
</tr>
<tr>
<td>No impulses</td>
<td>74,9</td>
<td>52,5</td>
<td>53,6</td>
</tr>
</tbody>
</table>

Source: IW-Zukunftspanel 2012; IW Consult, 2012
Energy-intensive industries are important for other parts of the manufacturing sector to remain competitive in the long run. Their innovation capacities are considered particularly relevant (Table 3). The share of companies of the manufacturing sector that name the innovation potential of energy-intensive industries in Germany as an important factor for their own company is more than 70 per cent. Innovative chemicals or metal producing companies contribute to the success of a large part of the German economy. The most successful companies (type-D) would be more affected than other businesses as innovation capacities of energy-intensive industries are important for three quarters of these companies. Moreover, about 45 per cent of the companies in the manufacturing sector receive important innovation impulses from co-operating with energy-intensive companies.

With energy-intensive industries relocating away from Germany, structures of existing value chains would have to be rearranged. Furthermore, domestic research and development networks would be weakened since innovation impulses of energy-intensive industries for the manufacturing sector in Germany would be reduced. As a consequence, the innovation potential and competitiveness of the whole economy would be weakened, too.

Table 4: Influence of the location of energy-intensive industries in per cent

<table>
<thead>
<tr>
<th></th>
<th>Type-0</th>
<th>Type-D</th>
<th>Manufacturing sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>We would source energy-intensive products abroad, but would not pursue common research and development.</td>
<td>11,8</td>
<td>12,9</td>
<td>12,5</td>
</tr>
<tr>
<td>We would source energy-intensive products abroad and would conduct common research and development.</td>
<td>1,7</td>
<td>16,9</td>
<td>15,3</td>
</tr>
<tr>
<td>It depends on the country the supplier would relocate to (distance, regulation etc.).</td>
<td>27,3</td>
<td>28,6</td>
<td>29,3</td>
</tr>
<tr>
<td>It does not matter in which country the supplier is located.</td>
<td>59,2</td>
<td>41,6</td>
<td>42,8</td>
</tr>
</tbody>
</table>

Source: IW-Zukunftspanel 2012; IW Consult, 2012

The results discussed so far show that energy-intensive industries play a vital role for the value chains and innovation activities of the German economy. In this context, it is not irrelevant where these suppliers are located. Less than 43 per cent of the manufacturing sector think that it does not matter in which country the energy-intensive companies they co-operate with are located.
Almost a third of the companies state that future co-operation is depending on the country which the energy-intensive suppliers would relocate to. One in eight companies of the manufacturing sector would import products, but would not rebuild common research and development. A slightly higher share would do both, no matter where these parts of the value chain are based (Table 4).

Many companies of the manufacturing sector in Germany are sceptical about common research and development with energy-intensive suppliers from abroad. Table 5 shows the obstacles that impede a better international co-operation. Three of these obstacles are relevant for more than half of the companies of the manufacturing sector: complexity of contracts, large geographical distances, and potentially higher costs. Almost 30 per cent of the German manufacturing sector think that in many countries, technological competences of energy-intensive companies do not meet the necessary standards. This is especially relevant for the machinery and metal industry. In addition, almost 40 per cent of the companies see a lack of trust as main obstacle for further co-operation in research and development.

Table 5: **Obstacles for common research and development with energy-intensive industries abroad**
in per cent

<table>
<thead>
<tr>
<th></th>
<th>Type-0</th>
<th>Type-D</th>
<th>Manufacturing sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complexity of contracts</td>
<td>61,2</td>
<td>58,2</td>
<td>58,9</td>
</tr>
<tr>
<td>Large geographical distances</td>
<td>51,1</td>
<td>49,8</td>
<td>51,7</td>
</tr>
<tr>
<td>Higher costs</td>
<td>44,2</td>
<td>48,2</td>
<td>50,0</td>
</tr>
<tr>
<td>Language barriers</td>
<td>37,5</td>
<td>36,5</td>
<td>39,2</td>
</tr>
<tr>
<td>Lack of trust</td>
<td>30,3</td>
<td>38,1</td>
<td>38,1</td>
</tr>
<tr>
<td>Cultural obstacles</td>
<td>21,6</td>
<td>32,4</td>
<td>32,3</td>
</tr>
<tr>
<td>Deficient technological competences</td>
<td>20,6</td>
<td>30,0</td>
<td>28,5</td>
</tr>
</tbody>
</table>

Source: IW-Zukunftspanel 2012; IW Consult, 2012

Deficient competences in technology are foremost a concern of type-D companies. As they are very human capital-intensive, technological know-how is much more important for them than it is for type-0 companies. Furthermore, type-D companies see more of a lack of trust and cultural obstacles. A reason therefor could be their more extensive experience with international co-operation, especially outside of Europe.
These obstacles are not relevant for international co-operation with energy-intensive industries only, but also for all kinds of co-operation in research and development with foreign partners. Distortions of existing value chains and co-operation due to the relocation of certain industries would cause a long lasting loss for the economy as a whole, as many German companies would not be able to establish adequate networks with international partner firms.

The results of the survey reveal that rising domestic energy prices would not only endanger energy-intensive industries, but also have a negative effect on other parts of the manufacturing sector. The potential relocation of energy-intensive companies would destroy supply chains and innovation networks, which would weaken the innovative potential of important industries. These networks are often based on co-operation between partners from different industries, many of which are part of the domestic energy-intensive sector. In many instances, it is impossible to replace these with new international innovation partners, at least in the short run. This is especially threatening for the more successful and innovation-intensive type-D companies, which are most important for economic development and prosperity in Germany. Securing existing value chains and innovation networks should no longer be underestimated.

Figure 3: Business opportunities caused by the Energiewende
in per cent

Source: IW-Zukunftspanel 2012
Opportunities for the manufacturing sector in Germany

The Energiewende does not only bring risks to the manufacturing sector. New business opportunities are linked with the energy transition process as well. More than 11 per cent of the companies of the manufacturing sector believe in major opportunities for their businesses (Fig. 3). About a third of the companies expect minor opportunities. The majority of about 60 per cent of the manufacturing sector, however, does not see new chances in conjunction with the Energiewende. Only 10 per cent of the type-D companies expect substantial chances, while almost 15 per cent of the type-0 companies are optimistic. This demonstrates that those companies which are especially competitive and successful in today’s markets and which are working in existing international value chains are most sceptical regarding positive effects.

Table 6: **Fields of business with opportunities arising from the Energiewende**
share of all companies that see opportunities, in per cent

<table>
<thead>
<tr>
<th>Manufacturing sector</th>
<th>Type-0</th>
<th>Type-D</th>
<th>Total sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renewable energies</td>
<td>65,6</td>
<td>30,9</td>
<td>39,3</td>
</tr>
<tr>
<td>Energy efficiency</td>
<td>17,5</td>
<td>54,7</td>
<td>45,7</td>
</tr>
<tr>
<td>Energy specific consultancy (e.g. „Green IT“)</td>
<td>10,7</td>
<td>1,4</td>
<td>3,7</td>
</tr>
<tr>
<td>Building restoration (e.g. insulation)</td>
<td>1,9</td>
<td>3,6</td>
<td>3,2</td>
</tr>
<tr>
<td>Other</td>
<td>4,3</td>
<td>9,4</td>
<td>8,2</td>
</tr>
<tr>
<td><strong>Business related services, construction</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Renewable energies</td>
<td>45,6</td>
<td>25,0</td>
<td>36,9</td>
</tr>
<tr>
<td>Energy efficiency</td>
<td>9,0</td>
<td>17,6</td>
<td>12,6</td>
</tr>
<tr>
<td>Energy specific consultancy (e.g. „Green IT“)</td>
<td>8,7</td>
<td>27,0</td>
<td>16,4</td>
</tr>
<tr>
<td>Building restoration (e.g. insulation)</td>
<td>22,3</td>
<td>15,8</td>
<td>19,6</td>
</tr>
<tr>
<td>Other</td>
<td>14,4</td>
<td>14,6</td>
<td>14,5</td>
</tr>
</tbody>
</table>

Source: IW-Zukunftspanel 2012
Table 6 lists the main business areas in which companies see most opportunities related to the Energiewende. Renewable energies and energy efficiency are the most important options here. 85 per cent of the companies in the manufacturing sector that see opportunities focus on these areas. Another 4 per cent expect growing business in energy specific services. With more than 16 per cent, this share is much higher in the group of business related services and construction. Similarly, energy related construction works are only relevant for 3 per cent of the manufacturing sector, as against almost 20 per cent of the other companies. Comparing the different types of companies, it can be seen that the more innovative, international and successful companies (type-D) concentrate on energy efficiency, while the less successful type-0 companies – which expect more chances from the Energiewende – focus on renewable energies.

Conclusions

The German energy transition brings risks and opportunities. Among the companies in Germany, there is much uncertainty about the consequences for the own business. 80 per cent of the companies in the manufacturing sector do not know if opportunities or risks are dominant. Only 1.2 per cent believe that the Energiewende strengthens the business location Germany, while 18.8 per cent expect it to become weaker.

The Energiewende is mostly relevant for the energy sector and for energy-intensive industries, which face higher prices or other risks of cost increases, and fear to lose competitiveness on international markets. Notwithstanding, other companies of the manufacturing sector must be taken into consideration, too, as their innovation capacities partly result from close co-operation with energy-intensive suppliers. Furthermore, new market opportunities arise. The energy transition is a game changer for important parts of the economy and cannot be seen as a technological challenge only. Especially innovative, export oriented and successful companies are closely linked to energy-intensive industries. Co-operative innovation is a competitive advantage, which would be at risk if energy prices were to endanger energy-intensive industries. These forms of co-operation could hardly be replaced by new international value chains in the short term. Co-operative innovation between different industries is one of the strengths of the manufacturing sector in Germany today. If innovation impulses from energy-intensive industries are reduced in the future, the position of other industries on world markets will become weaker.

However, opportunities arising from the energy transition must not be forgotten. In this context, renewable energies and energy efficiency are the most important fields for the manufacturing sector. The less successful international and innovative the companies are, the more opportunities in renewable energies arise. More global and innovative companies, on the other hand, focus on energy efficiency.

References

Bardt, Hubertus / Kempermann, Hanno, 2013, Folgen der Energiewende für die Industrie, IW Positionen – Beiträge zur Ordnungspolitik Nr. 58, Köln

IW Consult – Institut der deutschen Wirtschaft Köln Consult GmbH, 2012, Netzwerke und Wertschöpfungsketten, Köln

KfW Bankengruppe / ZEW – Zentrum für Europäische Wirtschaftsforschung, 2012, CO₂ Barometer 2012, Frankfurt am Main/Mannheim


Statistisches Bundesamt, 2013, Volkswirtschaftliche Gesamtrechnungen, Beiheft Investitionen, Wiesbaden