

# Energy efficiency services as “change agents” for the industry on its path to net-zero by 2050

Stela Ivanova  
German Federal Energy Efficiency Center (BfEE)  
Frankfurter Straße 29–35  
D-65760 Eschborn  
Germany  
Stela.Ivanova@bafa.bund.de

Dominik Rau  
Prognos AG  
Geothestr. 85  
D-10623 Berlin  
Germany  
Dominik.Rau@prognos.com

Martina Erler  
German Federal Energy Efficiency Center (BfEE)  
Frankfurter Straße 29 35  
D-65760 Eschborn  
Germany  
Martina.Erler@bafa.bund.de

## Keywords

decarbonisation, industry, role of energy efficiency measures and services, empirical research, energy efficiency policy.

## Abstract

The deep decarbonisation of the industry is as necessary as it is challenging. It is complex, it is subject to uncertainties, not least technological ones, and it is expensive. The European climate protection regulatory framework has become more concrete. A comprehensive Clean Industry Package was prepared in the context of the “Fit for 55” policy. While the industry’s commitment is encouraging and growing with the increasing regulations and the tightening of climate goals, still the one single path towards the deep decarbonisation of European industries has not yet been identified. Apart from expanding the use of renewable energies, energy efficiency is essential for achieving the European and national climate goals. In this context, this paper argues that energy efficiency services can act as the “change agents” the industry needs for its transformation towards climate neutrality.

The German Federal Energy Efficiency Centre (BfEE) has monitored the market for energy efficiency services and measures for over five years. Together with a scientific team from Prognos AG, ifeu institute and Kantar the BfEE examines issues, such as applied energy efficiency measures and technologies as well as the conjunction with energy efficiency services. It studies the role of energy efficiency for different key customer groups, inter alia the German manufacturing sector that is represented by 700 enterprises annually in the survey.

Based on our surveys this paper discusses the following questions: How does the relevance of energy efficiency differ across industry sectors? How far is climate change integrated in business strategies? How does the usage of energy efficiency services drive corporations to implement more comprehensive energy efficiency measures and to invest more in energy efficiency? Finally, the paper demonstrates how energy efficiency services can make a distinct contribution to the deep decarbonisation in the industry and how these can be supported effectively by policies.

## Introduction

### ENERGY EFFICIENCY (SERVICES) AS AN UNDERESTIMATED NECESSITY

Germany is an ambitious contributor to the global efforts to fight climate change by reducing greenhouse gas (GHG) emissions and is committed to becoming climate neutral by 2045 already. Climate neutral therefore refers to net-zero GHG emissions as outlined in the European Commission’s climate strategy. While climate neutrality and climate protection are fashionable, energy efficiency holds a niche existence in the broader public. However, experts are aware that energy efficiency improvements represent important contributions to reduce GHG emissions as they counteract rising energy demand due to income and population growth. The International Energy Agency (IEA) termed energy efficiency “the first” fuel (IEA, 2021a). In line with this goes the impulse of the Agora “Energiewende 2030: The big picture” that “efficiency first” will be the key principle for the industry (Agora Energiewende, 2017).

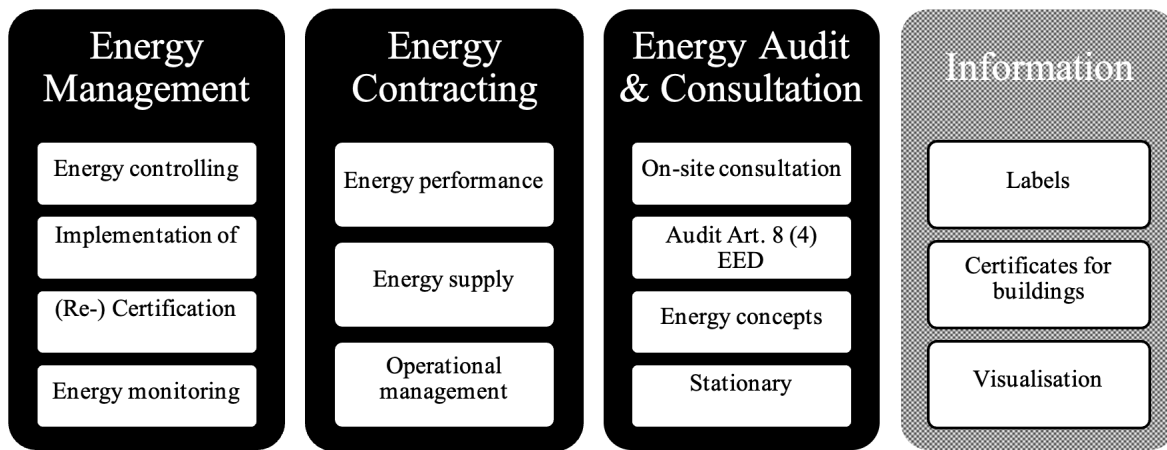


Figure 1. Overview of the main sub-markets with their corresponding services.

### GERMAN INDUSTRY

In Germany, the industry's GHG emissions account for about 24 %, what is equivalent to 172M tones of CO<sub>2</sub>-equivalents in 2020 (Umweltbundesamt, 2021). Thus, the industry follows the energy supply sector accounting for the second highest amount of emissions by sector. Considering the development of GHG emissions, the industry could reduce its emissions from 2017 to 2020. However, the path to decarbonisation until 2045 requires significant further action.

Since 85% of the German GHG emissions are energy-related emissions (Umweltbundesamt, 2021), energy savings and thus energy efficiency measures are crucial to reduce emissions and achieve the national and international climate and energy efficiency goals. Thereby, the industry consumes about 28 % of the final energy, with process heating accounting for more than 2/3 of the industry's energy consumption and propulsion purposes for about 22 % (AGEB, 2021). Encouragingly, the energy used per gross production value in the German industrial sector has decreased over the last 30 years.

This goes in line with the IEA finding that total global energy use and economic development have been decoupling the last 20 years (IEA, 2021a). Nevertheless, projections show clearly that further efforts are necessary for the transformation of the industry and that great potentials exist. Often energy consumers are not aware of their energy saving potentials. One way for leveraging these saving potentials are energy efficiency services (EES). These are third-party services that aim at or include the implementation of energy efficiency measures. Energy efficiency services vary from simple online checks or the modernisation of heating systems to complex service packages, such as energy performance contracting.

Since energy efficiency represents a key to GHG emissions in the industrial sector, we discuss whether energy efficiency services can act as "change agents".

## Framework of the study

### BACKGROUND OF THE STUDY

One of the key points of the current European Energy Efficiency Directive is to increase the efficiency of energy use in the Member States by establishing the necessary legal frame-

work and the creation of appropriate conditions to enhance the market for energy services. Against this backdrop, in 2010 Germany passed the "Law on energy services and other energy efficiency measures" (EDL-G), which was an important step for the further development of the market for energy services and the necessary improvement of energy efficiency in general. The Federal Energy Efficiency Center (BfEE) is responsible for monitoring and evaluating the market for energy services, energy audits and other energy efficiency measures in accordance with this legislation (§ 9(5) EDL-G). Based on the findings, the BfEE develops proposals for the development of measures that stimulate the market and contribute to an increasing energy efficiency in the different consumer sectors. The BfEE has conducted annual surveys for the EES market since 2016 with the support of a scientific consortium.

### METHODS

The survey focuses on energy contracting, energy consulting and energy management as the so-called "high value" services that predominantly shape the market and define the three major sub-markets with a broad spectrum of corresponding services (Figure 1). For each of these services, both the supply and demand side are investigated using a broad methodological approach, including telephone and online-based interviews (Table 1). To further verify and enrich the empirical findings, information is collected either through desk research or expert interviews for qualitative assessments.

On the supply side, the market survey primarily studies enterprises with a dedicated focus on increasing energy efficiency. These can vary from simple online energy checks or the modernisation of a heating systems to complex service packages, such as energy performance contracting. Every year around 260 service providers are surveyed by conducting in-depth telephone interviews and a minimum of 750 via online questionnaires.

On the demand side, the study focuses on the following customer groups: private households, companies and public institutions. Approximately 2,500 private households, 2,750 private companies and more than 500 public organisations<sup>1</sup> are polled

1. On the level of Federal government, the institutions are being surveyed via online questionnaires.

Table 1. Scope of the study in 2021.

	Sample size	Target group
<b>Supply side</b>		
Providers (telephone-based interviews)	264	Utilities, Technology providers, Contractors, Energy auditors, Energy management
Providers (online based interviews)	1,399	Active Energy consultants and auditors
	113	Other Energy consultants and auditors
	1,512	In total
<b>Demand side</b>		
Commercial sector (telephone-based interviews)	2,221	SME
	531	Non SME
	2,752	In total
Private households (telephone-based interviews)	1,605	Owners
	1,013	Tenants
	2,618	In total
Public sector (telephone and online based interviews)	504	Nationwide: Federal state, Länder and Local authorities

via telephone interviews annually (Table 1). In total, there are at least 6,800 (2020) to 7,650 (2021) respondents with over 77,500 interview minutes. Therefore, the monitoring report of the BfEE is the most comprehensive analysis in this area in Germany.

For the purposes of this paper, we focus on the demand side, especially within the German industry. A total of 2,750 enterprises, including 250 large enterprises (non-SMEs) are surveyed annually. The surveyed companies are categorised and quoted according to several predefined areas of businesses, which are determined using the classification of economic sectors of the German Federal Statistical Office, edition 2008. In the category “industry”, the study includes about 700 companies and distinguishes between “energy intensive” and “other” industry. In 2021, data was gathered from 274 companies of the energy intensive industry and 566 companies from the remaining industry branches. The category “energy intensive industry” includes solely manufacturing industries, such as the production of food and beverages, paper products, coke and petroleum products, chemical and pharmaceutical products, rubber and plastic, mineral products, especially cement as well as manufacturing and processing of metals, such as steel. The category “other industries” also focuses on manufacturing, but in the areas of tobacco, textile, clothing in general, leather, wood, printed products, electronic and optical products (computers), electrical equipment, machine construction, motor vehicles, furniture and other products as well as the repair and installation of machinery and equipment.

In terms of content, the study encompasses a wide range of topics such as energy demand and consumption, usage of energy services and implementation of energy saving measures, offering prices and behavioural aspects of the different market

actors. Especially interesting are the motivations and barriers regarding energy efficiency perceived by the different groups. These findings are decisive for the development of appropriate policy instruments that can incentivise investments for enhancing energy efficiency.

In the following, the paper offers a deeper look in the relevance of energy efficiency for the German industry and the motivations behind using energy efficiency services. Furthermore, the study offers insights into the implantation rates of energy saving measures by the industry and identifies possible driving forces, such as the energy efficiency services.

### The market for energy efficiency services and the industry sector in Germany

The market for energy efficiency services in Germany generates a total annual turnover of about 9 billion Euros. Compared to previous surveys (BfEE 2016–2021), the market can thus be considered robust and stable. Still, further incentives will be needed in order to utilise the full potential of the market that has been estimated at about 34 billion Euros (BfEE 2021). Scope for growth is being anticipated in the German industry sector as a purchaser for energy efficiency services. Despite the high energy consumption of the industry sector, most of the providers of energy efficiency services state that they consider other business areas as more important customers. As the results in the last survey of the BfEE demonstrate, only providers of energy management services and products rank the groups of energy intensive and other industries as the first and second most important customer (BfEE 2022). Less than 30 % of the providers of energy contracting or energy consultation considers the German industry as one of the most important ones (BfEE 2022).

### RELEVANCE OF ENERGY EFFICIENCY

During the past six years of market monitoring, a comprehensive database has been established. For most of the core subjects of the study, the development can be observed over time. One of these topics is the relevance of energy efficiency. It is evaluated on a scale from 0 = *not important at all* to 10 = *very important*. The known affiliation of each company to a specific business area allows us to identify differences and dynamics between the different economic sectors. Results are shown in Figure 2.

The first thing that stands out is that the energy intensive industry assigns a clearly higher relevance to energy efficiency than other industry and business areas in the survey. Even though the trend here has gone slightly downwards in the last two years, the changes are very small. Overall, the assigned relevance of energy efficiency is significantly higher than in other sectors.

The main difference between the business areas studied here lies in their energy consumption. For the current survey of 2021, the correlation between energy costs and relevance for efficiency was examined in Figure 3. The picture is straightforward: the

higher the share of energy costs in the company's total expenses, the higher the relevance of energy efficiency in companies. Once again, the highest values in each category are found in energy intensive industries. Irrespective of the discussion about business locations and global energy prices, these are evident indications that higher energy prices are leading to greater awareness of internal processes concerning energy and possibly to the realisation of saving opportunities. An amplification of this trend is being expected in the upcoming years. The introduced carbon pricing system in the sectors heating and transport by the German federal government in 2021 would further incentivise the realisation of more energy efficiency projects.

### MOTIVATION

The solution to steadily increasing and excessively high energy costs are efficiency measures. Often, the implementation is preceded or accompanied by consulting or another kind of support within the framework of energy efficiency services. Especially if the saving measures are of more ambitious na-

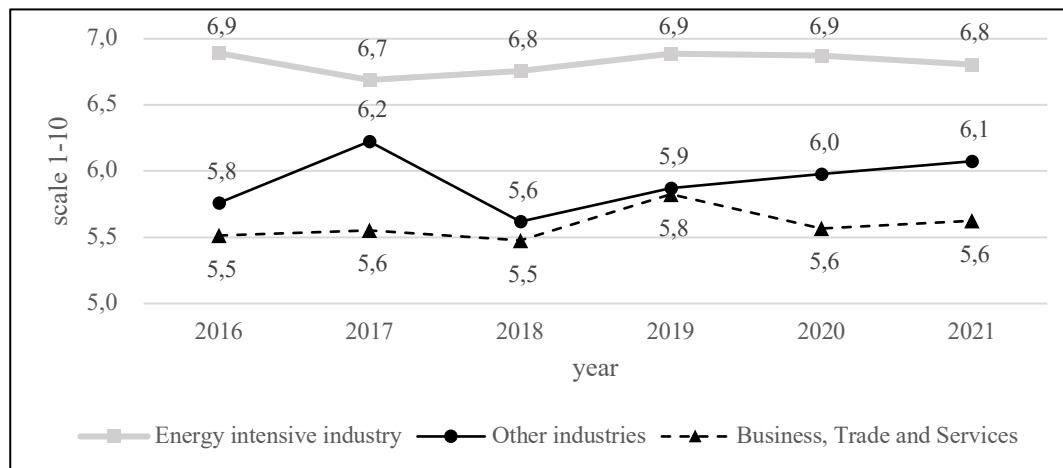


Figure 2. Relevance of energy efficiency in the different business areas.

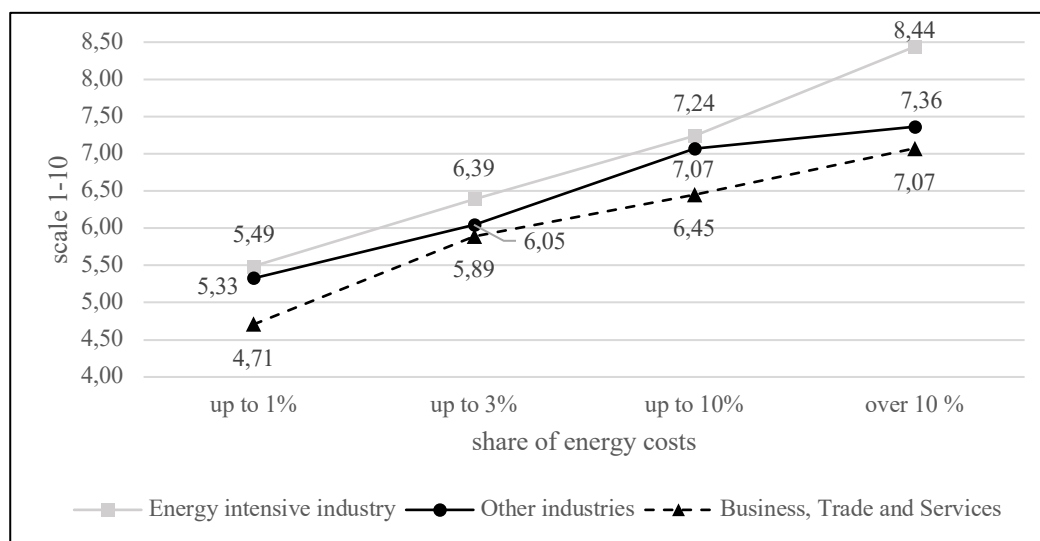


Figure 3. Relevance of energy efficiency according to the different shares of energy costs.

ture and require a specific expertise. When companies are asked what the reasons are for using energy efficiency services, two answers prevail throughout the years: energy costs and a strategy decision for climate protection. Figure 4 shows the frequencies of these two responses over time in the last six surveys. In 2016, the number of response options was smaller, and the methodology of the question was not identical to the subsequent years. Nevertheless, a steady drop in frequencies can be observed until 2019, which can be explained by the unusually low energy prices in these years. Since mid-2020, rising energy prices have been observed worldwide and the relevance of costs as a motivation for using energy services has also increased again. Climate protection targets of companies and the strategic decisions they follow certainly correspond to these tendencies as well. Companies are more prone to the current political and public discussions. With more ambitious climate policies on European and national level, increasing obligations and prices as well as the introduction of a sustainable finance taxonomy in the financial markets it becomes difficult for companies to ignore climate and energy issues in their business strategies.

In summary, the energy price level has a significant influence on all activities around energy efficiency and related services. The higher shares of energy in the total costs and the rising energy prices suggest a higher probability for the implementation of energy efficiency measures and a higher motivation to use energy efficiency services. In what follows, we will examine this thesis in more detail.

## Energy efficiency services as “change agents”

### IMPLEMENTATION OF ENERGY SAVING MEASURES AND INVESTMENTS IN INCREASING ENERGY EFFICIENCY

Over the last six years of annually surveying, no significant changes have been observed in the implementation of energy saving measures in at least 2,750 companies of all economic sectors. As Figure 5 demonstrates most of the companies in 2021 introduced mostly changes in the lighting area (75 %) or acted regarding the information and motivation of the working

force (65 %). We see a significant decrease in responses with the more complex and ambitious measures such as energetic modernisation of the building envelope (39 %) or the heating system (26 %) as well as the optimization of production processes (29 %) (Figure 5).

One way of counteracting this tendency of low realisation rates regarding the more ambitious saving measures is to promote energy efficiency services. In the past years of monitoring the EES market, strong indications have been identified that these services can be the necessary agents of change. This thesis is being examined on the basis of two indicators: 1) the implementation rates of energy saving measures and 2) the mobilised investments towards more energy efficiency. The conducted comparisons differentiate between the commercial sector at large and the distinct business areas.

The results shown in Figure 6 indicate a strong correlation between the use of energy efficiency services and the implementation of more ambitious measures. The Figure differentiates between two groups of companies from all business areas: 1) one that have used energy efficiency services and 2) one that have not used them. Further, it shows their different rates of realised energy efficiency measures. Accordingly, companies that use energy efficiency services are three times more likely to optimize their production processes in comparison to the group that did not use any of the energy efficiency services. This analysis encompasses the three services – energy consultation, energy management and energy contracting.

Figure 7 indicates a similar picture. It compares the same two groups of companies again, but this time using the indicator of investments made in increasing energy efficiency. This analysis is based on the average values of stated investments by companies in the last 5 years (2016–2021). The results are indicating a strong correlation between the use for energy efficiency services and the increase in investments towards energy efficiency made by companies. This is not only true for the energy intensive industry, but for the commercial sector at large. Interestingly, for the area of business, trade and services the use of energy efficiency services doubles the investments.

In sum, the companies that use energy efficiency services tend to invest more in increasing energy efficiency. The energy

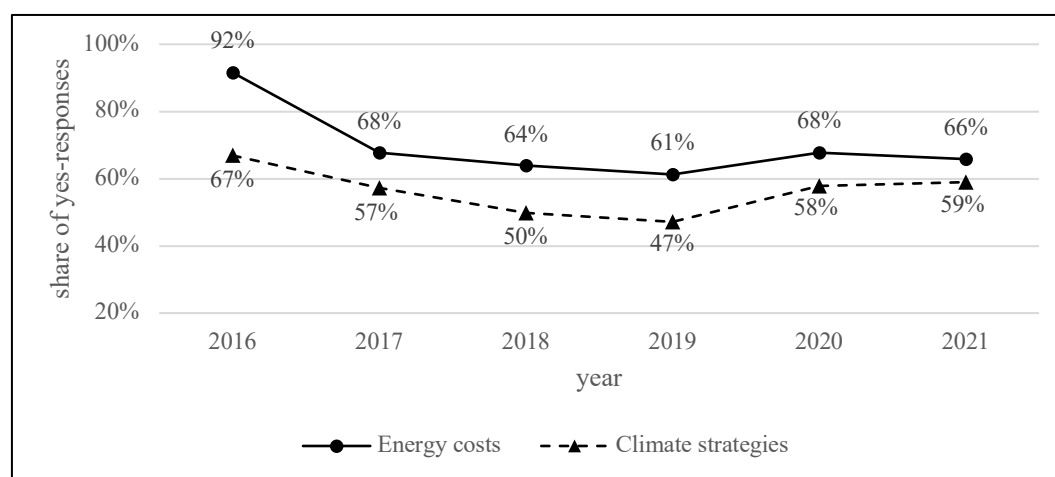


Figure 4. Motivation for using energy efficiency services over the years.

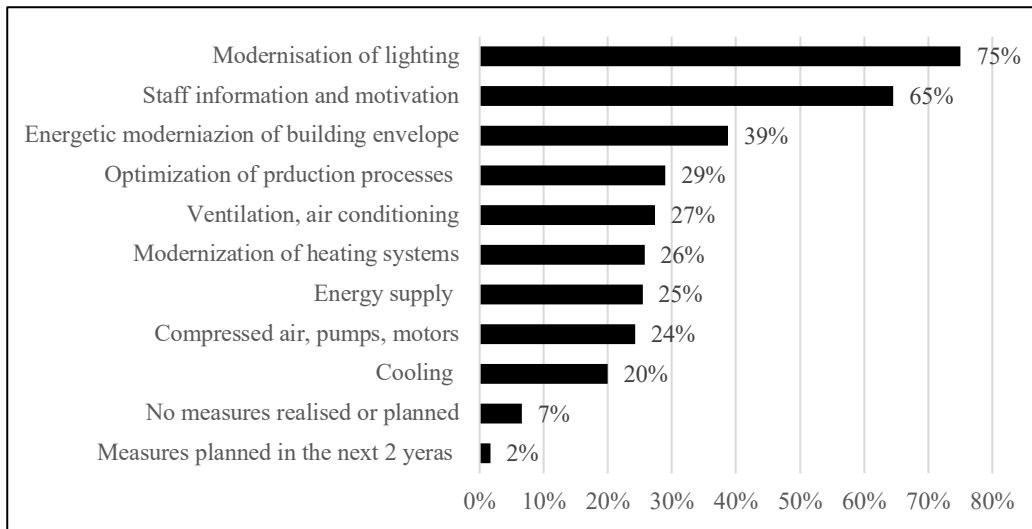


Figure 5. Implemented energy saving measures by companies of all economic areas in 2021.

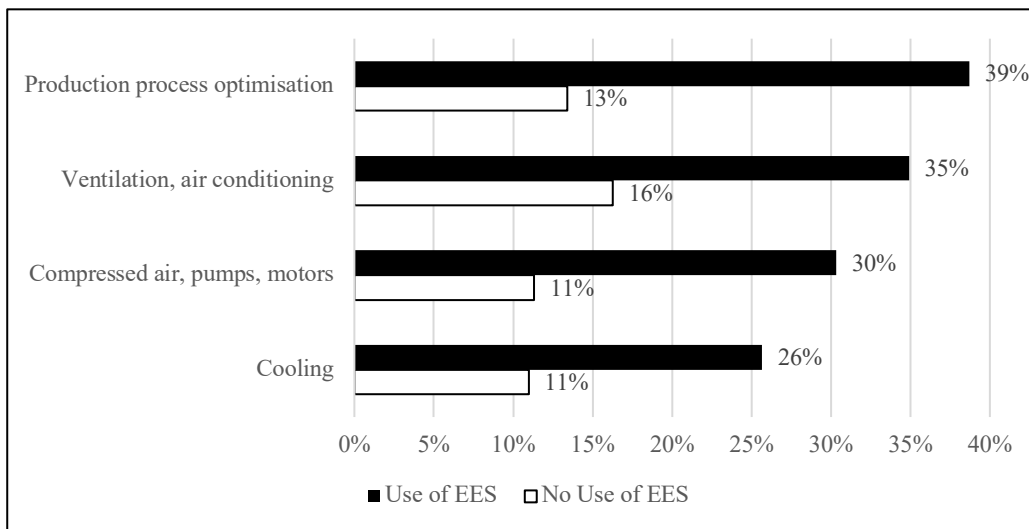


Figure 6. Use of EES and implementation of energy efficiency measures.

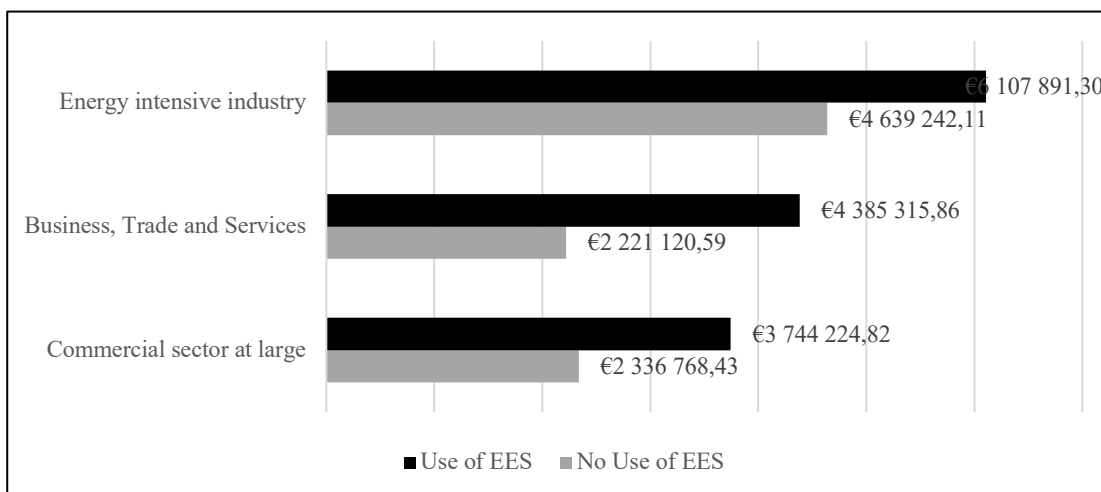


Figure 7. Use of EES and average investments in increasing energy efficiency.



intensive industry with average investment value of over six million Euros is being here the forerunner.

#### USE OF ENERGY EFFICIENCY MEASURES AND POSSIBLE BARRIERS

In general, the use of energy efficiency services in the commercial sector at large has been very low for the past years (Figure 8). Less than 50 % of the surveyed companies stated that they have used any of three main services in the last 5 years. An exception here is to be made for the use of energy consultations in 2017 and 2021. The other two main services, energy management and energy contracting, are even below the 30 % rate.

This tendency poses the question if there are any particular barriers. A resume of the most relevant reasons for companies not using energy efficiency services is offered in Figure 10. Here the companies are divided again in two groups: 1) one covers enterprises from the energy intensive industry and 2) the other

covers enterprises of all business areas. According to the results of both groups most of the enterprises state that they do not use the services in question, due to the belief that they can introduce saving measures without the help of experts (47 % and 61 %) (Figure 9). Interestingly, the strongest reasons against energy efficiency services for the energy intensive industry are the anticipated effort behind the use of the service (55 %) and the lack of budget (43 %). In contrast, most companies of the commercial sector at large consider these services as not economical (35 %) and the energy prices as low (33 %).

These findings just amplify the need for energy efficiency services and the expertise of their providers for the German industry. Services such as energy performance contracting can provide expertise without the need for upfront investments. This can counteract the issues of complex energy efficiency solutions that require more efforts from companies. Since the

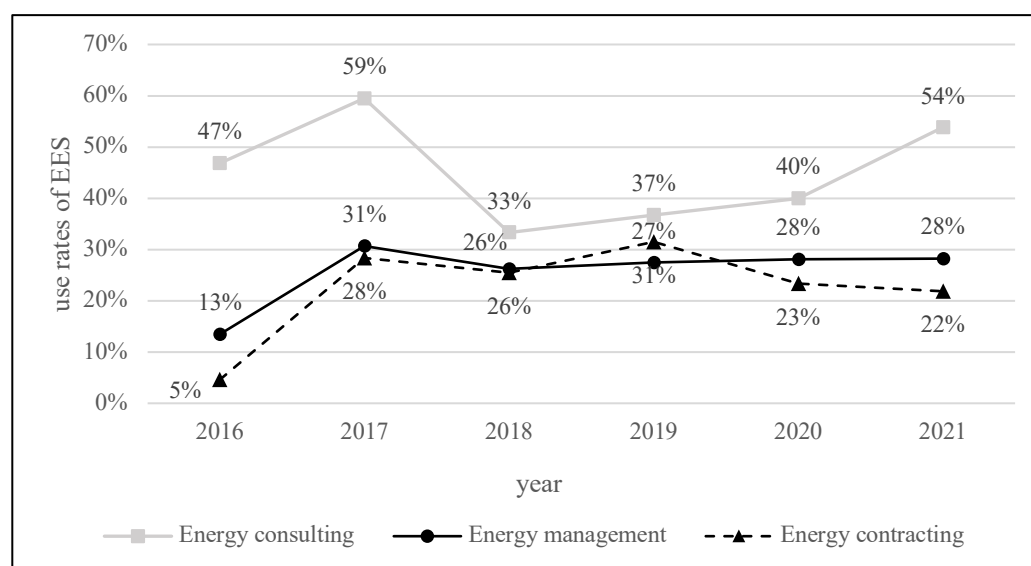


Figure 8. Use of EES in the German commercial sector with all the business areas included.

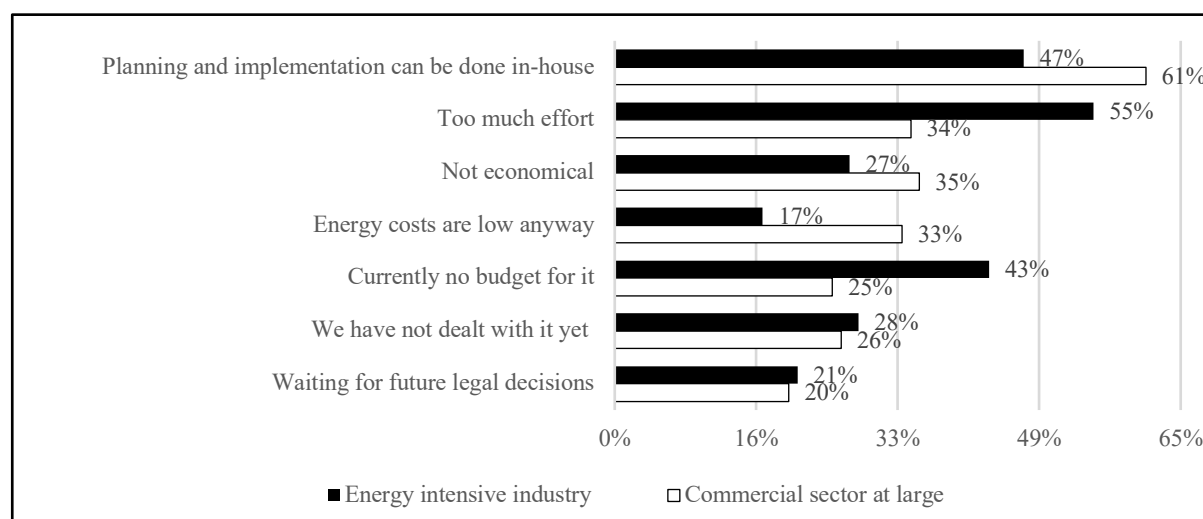


Figure 9. Most common reasons for not using energy efficiency services in 2021.

energy saving solutions for the industry, especially the energy intensive, involve to a great extent production processes, they are more complex and expensive. Therefore, expertise and reliable financing models are needed the most by these companies. This is the reason why energy intensive companies exhibit less support for the introduction of such measures on their own in contrast to the rest (47 % versus 61 %) (Figure 9).

Regardless, there is a need for support in terms of resources and expertise in the commercial sector at large. In this context, the paper offers an introduction of how the policy makers currently are planning to support the industry on its path to net zero emissions.

### Policy framework and outlook

In order to achieve its goal of climate neutrality by 2045 Germany has introduced a variety of instruments to support the decarbonisation of its industry. This requires a comprehensive transformation of production processes, especially for the energy intensive industry. Additionally, to this technological challenge, the time frame for taking action is very narrow, as decisive reinvestments in industry plants are due already in the 2020s. At the same time, the international competitiveness of industries must be maintained and “carbon leakage” (i.e. relocation of production to third countries) must be avoided. For this undertaking to succeed, appropriate framework conditions and incentives are needed at national, European and international level. To this goal, the German government is introducing a comprehensive concept for the decarbonisation of the industry as part of the so-called “Klimaschutz-Sofortprogramm” (or “emergency program for climate action”). Main action fields of this policy and incentive framework are long-term CO<sub>2</sub> reductions, prevention of “carbon leakage”, mobilising finance and investments, managing existing assets and creating markets for new green technologies and products.

To achieve this, the envisioned policy instruments have to be closely interlinked. On the one hand, Germany supports investments in innovative climate protection technologies and pilots with the funding programme “Decarbonisation of the Industry”. Additionally, their timely market introduction will be supported by the so-called carbon contracts for difference (CCfD). They are intended to reduce risks and compensate for the higher operating costs of the new technologies. As shown by Chiappinelli and Neuhoff (Chiappinelli & Neuhoff, 2020) CCfD can improve the incentives for investments in low-carbon solutions. On the other hand, increasing energy efficiency can make important contributions to reducing industrial emissions (IEA, 2021b). In line with this, Germany strongly supports the efforts made by the European Energy Efficiency Directive and for instance promotes energy efficiency services for companies in various ways. Besides the obligation to conduct an energy audit, the BMWK provides funding for energy consultations and the implementation of energy efficiency measures. Since 2019, the funding programme for more “Energy Efficiency in the Industry” has been a successful and central programme for the industry. It has been prolonged in 2021 in order to support the transformation to a climate neutral economy by 2045. To this end, the programme targets the planning and implementation of an organisation’s transformation towards climate neutrality. This in turn reveals that energy efficiency is at the heart

of becoming a climate neutral economy. Companies need the support of experts to find energy efficiency and climate neutral solutions. Therefore, energy consultants as well as environmental and sustainability experts are worth to be considered as required assets for the promotion of progressive business solutions in the field of energy efficiency. To guarantee a qualified and consistent supply, public-sector entities should offer training programmes or the acquisition of certificates etc., similar, as it is the case for energy consultant services. These initiatives should be coordinated with the relevant market groups in the segment of energy consulting services.

Furthermore, the use of energy efficiency services would be directly influenced by the Carbon Leakage Regulation from 2021. The regulation is intended to protect companies whose international competitiveness is threatened by future financial burdens due to increasing CO<sub>2</sub> prices in the heating and transport sectors. In return for the financial relief, companies must operate a certified energy or environmental management system and implement economically feasible energy efficiency measures.

### Summary and conclusions

The paper showed that energy consumption and energy prices are decisive indicators for the relevance of energy efficiency within the German industry. Since most of the GHG emissions are energy related and the industry sector accounts for almost one third of the final energy consumption, the overlap of importance between energy costs and strategic decisions on climate protection is not surprising. Further, due to recent policy changes and public discussions the industry is more prone to integrate climate or energy issues in its business strategies.

The key pillar for the industry to proceed on the path to net zero emissions is energy efficiency. It reduces GHG emissions by further decoupling productivity and energy intensity in the industry sector. Therefore, it contributes significantly to the achievement of the national and international climate goals. This poses the question of how the realization of energy saving measures can be facilitated in the industry. Our findings suggest that energy efficiency services can be the “change agent” in this context.

The further analysis reveals how the use of energy efficiency services positively influences the overall energy efficiency outlook in the commercial and especially in the industry sector. Two main comparisons confirm this thesis. First, the analysis demonstrates that companies, which use energy efficiency services, tend to implement more ambitious energy efficiency measures. Second, the use of energy efficiency services strongly correlates with higher investments made by the respective companies in increasing energy efficiency.

In conclusion, the paper outlines how future policies and subsidies will support the industry towards climate neutrality. Currently, different instruments are in place that facilitate the use of energy efficiency services and the investment in energy efficiency measures. The instruments vary from price signals, coupled with the required use of energy management, over subsidised consultations, to mandatory energy audits. Additionally, with the carbon contracts for difference policy makers will send a strong support signal to the industry and enable more private investments in ambitious climate neutral technologies.



## References

- AGEB, 2021. *AGEB Anwendungsbilanzen 2010–2020*. [Online] Available at: [https://ag-energiebilanzen.de/wp-content/uploads/2020/10/ageb\\_20v\\_v1.pdf](https://ag-energiebilanzen.de/wp-content/uploads/2020/10/ageb_20v_v1.pdf)
- AGEB, 2021. *AGEB Auswertungstabellen zur Energiebilanz 1990–2020*. [Online] Available at: [https://ag-energiebilanzen.de/wp-content/uploads/2020/09/awt\\_2020\\_d.pdf](https://ag-energiebilanzen.de/wp-content/uploads/2020/09/awt_2020_d.pdf)
- Agora Energiewende, 2017. *Energiewende 2030: The Big Picture*. [Online] Available at: [https://www.agora-energiewende.de/fileadmin/Projekte/2017/Big\\_Picture/Agora\\_Big-Picture\\_WEB.pdf](https://www.agora-energiewende.de/fileadmin/Projekte/2017/Big_Picture/Agora_Big-Picture_WEB.pdf)
- Agora Energiewende, 2021. *Parthway to climate neutral Germany*. [Online] Available at: [https://static.agora-energiewende.de/fileadmin/Success\\_Stories/PW/PW\\_DE\\_Climate-neutral-DE/A-E\\_239\\_Succ\\_Stor\\_Pathways\\_DE\\_Climate\\_Neutral\\_Germany\\_WEB.pdf](https://static.agora-energiewende.de/fileadmin/Success_Stories/PW/PW_DE_Climate-neutral-DE/A-E_239_Succ_Stor_Pathways_DE_Climate_Neutral_Germany_WEB.pdf)
- BMWK, 2021. *Eröffnungsbilanz Klimaschutz*, s.l.: s.n.
- Chiappinelli, O. & Neuhaus, K., 2020. *Time-consistent carbon pricing: the role of carbon contracts for differences*. [Online] Available at: [https://www.diw.de/documents/publikationen/73/diw\\_01.c.758532.de/dp1859.pdf](https://www.diw.de/documents/publikationen/73/diw_01.c.758532.de/dp1859.pdf)
- dena, 2020. *dena-Analyse: Klimaneutralität - ein Konzept mit weitreichenden Implikationen*. [Online] Available at: [https://www.dena.de/fileadmin/dena/Publikationen/PDFs/2020/dena\\_BR\\_Analyse-Klimaneutralitaet\\_WEB.pdf](https://www.dena.de/fileadmin/dena/Publikationen/PDFs/2020/dena_BR_Analyse-Klimaneutralitaet_WEB.pdf)
- DENA, 2021. *DENA - the new zero line*. [Online] Available at: <https://www.dena.de/en/newsroom/the-new-zero-line/>
- dena, 2021. *dena-Leitstudie Aufbruch Klimaneutralität - Eine gesamtgesellschaftliche Aufgabe*. [Online] Available at: [https://www.dena.de/fileadmin/dena/Publikationen/PDFs/2021/Abschlussbericht\\_dena-Leitstudie\\_Aufbruch\\_Klimaneutralitaet.pdf](https://www.dena.de/fileadmin/dena/Publikationen/PDFs/2021/Abschlussbericht_dena-Leitstudie_Aufbruch_Klimaneutralitaet.pdf)
- EUROSTAT, 2021. *Eurostat- statistics explained: Climate change – driving forces*. [Online] Available at: [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Climate\\_change\\_-\\_driving\\_forces](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Climate_change_-_driving_forces)
- IEA, 2021a. *Energy Efficiency Indicators: Overview*. [Online] Available at: <https://www.iea.org/reports/energy-efficiency-indicators-overview>
- IEA, 2021b. *Net Zero by 2050*. [Online] Available at: <https://www.iea.org/reports/net-zero-by-2050>
- Umweltbundesamt, 2021. *Energiebedingte Emissionen*. [Online] Available at: <https://www.umweltbundesamt.de/daten/energie/energiebedingte-emissionen#energiebedingte-treibhausgas-emissionen>
- Umweltbundesamt, 2021. *Treibhausgasemissionen*. [Online] Available at: <https://www.umweltbundesamt.de/themen/klima-energie/treibhausgas-emissionen>

