



## Evaluation of the German Funding Scheme for Energy Efficiency in the Economy: Classical versus Competitive Financial Measures

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### ABSTRACT

The Federal Funding Scheme for Energy Efficiency in the Economy (EEE) is a core scheme for enhancing energy efficiency and for reducing greenhouse gas emissions in German companies. Among others, it offers funding for “energy optimizations of plants and processes” in companies. Due to a harmonized set-up and a common evaluation methodology, the EEE provides the opportunity to take a closer look at almost identical grant-based, credit-based and competition-based funding lines. The paper aims to investigate the differences in the uptake of these dissimilar modes of funding by eligible companies. It thus seeks to make an empirical contribution to further understanding the advantages and disadvantages of market-based and classical funding instruments. The results suggest, among others, that despite the almost identical set-ups, the reached target groups differ by funding mode. This implies that the different modes seem to meet the needs of different companies. Consequently, without further discussing the public costs of funding policies, offering several funding modes may enlarge the impact of funding schemes.

### Introduction

Under the European Green Deal, the Member States of the European Union (EU) made a commitment to net zero greenhouse gas (GHG) emissions by 2050 and, as an intermediate step, to reduce net GHG emissions by at least 55 percent by 2030 compared to 1990<sup>1</sup>. Germany, as a major contributor to European emissions, amended its Federal Climate Protection Act in 2021<sup>2</sup>. It thereby increased its previous GHG reduction target from 55 percent by 2030 to at least 65 percent compared to 1990 levels and brought forward the target of achieving GHG neutrality in 2045. As a result, the energy efficiency target for 2030 set out in the Energy Efficiency Strategy 2050 (Federal Ministry for Economic Affairs and Climate Action 2019), i.e. the reduction of primary energy consumption by 30 percent compared to 2008, must be revised upwards (Federal Ministry for Economic Affairs and Climate Action 2021).

A central funding scheme contribution to enhancing energy efficiency and reducing GHG emissions in German companies is the Federal Funding Scheme for Energy Efficiency in the Economy (EEE, Figure 1). It came into force in 2019 as a successor to the German Energy Efficiency Fund (EEF) (Voswinkel 2018). The EEE offers

<sup>1</sup> Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 (‘European Climate Law’). Official Journal of the European Union, L243/1 of 9.7.2021.

<sup>2</sup> First Act amending the Federal Climate Protection Act of 18 August 2021. BGBl. Part I No. 59 p. 3905ff.

three modes of funding: Grant-based lines, credit-based lines and a competition-based line. The classical grant- and credit-based approaches alone seek to reduce annual GHG emissions by 2.8 million tonnes of CO<sub>2</sub> and final energy demand by 11 TWh through 24,000 measures by the end of 2023. The targeted average funding efficiency is 25 euro per tonne of CO<sub>2</sub> saved per year calculated over a lifetime of ten years. In terms of set-up, the EEE consists of four modules that offer direct investment grants and low-interest loans with a repayment subsidy for investments in energy-efficient and renewable technology projects (Figure 1.). More specifically, the modules include support for a) energy-efficient cross-cutting technologies (Module 1), b) process heat from renewable energies (Module 2), c) sensors and control equipment including energy management software (Module 3) and d) energy optimizations of processes and plants (Module 4).

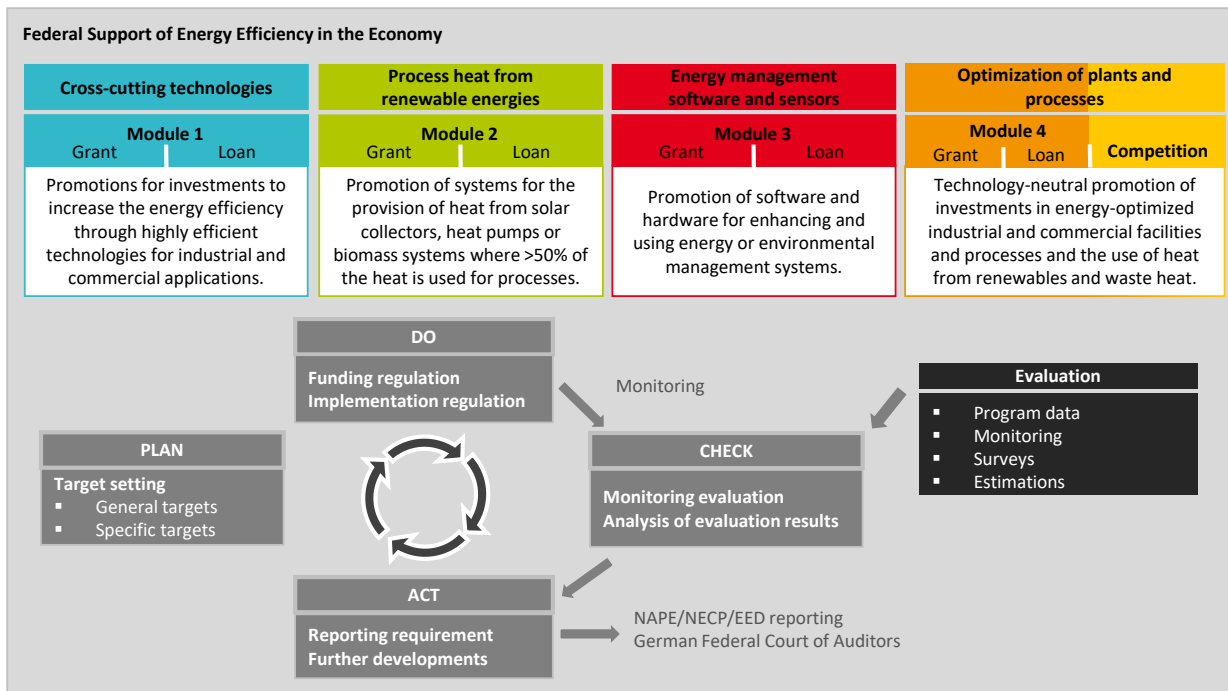


Figure 1. Overview of the EEE and its evaluation process. *Source:* Own illustration.

This paper takes a close look at the “energy optimization of plants and processes”: While Modules 1 to 3 offer funding for specific technologies, Module 4 has a technology-neutral approach that requires an individual energy-saving concept as a prerequisite to a grant or loan. In parallel, there is also a competitive funding line with similar conditions as Module 4. However, in this competitive line, market-based elements are introduced whereas the classical lines provide funding based on traditional eligibility criteria only. In the competition, the concepts are ranked according to their funding efficiency in the competitive model. Only the most competitive offers obtain funding. The competitive line of the EEE has its roots in the former energy efficiency auction program “Step up!” which was in force in Germany from 2016 and 2019 and had a similar funding competition process (Heinrich et al. 2019). Comparable energy efficiency auctions have also been established in Switzerland (“ProKilowatt”; Radgen et al. 2016) and recently in Denmark (Energistyrelsen 2022).

As the EEE spends public funds, it is evaluated on a regular basis. The current evaluation is carried out annually along a common methodology originally developed for the EEF (Schlomann et al. 2020). This helps to limit differences in the results due to differences in the evaluation approach (e.g. Andrei et al. 2021). The harmonized set-up of both the evaluation framework and specifically the three technology-open funding lines for the “energy-related optimizations of plants and processes” offers an opportunity to analyse almost identical grant-based, credit-based and competition-based funding approaches in a harmonized manner with regard to the following research question: Can we observe differences in the uptake of grant-based, credit-based and

competition-based funding in the case of the German Federal Funding Programme for Energy Efficiency in the Economy? In other words, the aim of this paper is to make an empirical contribution to the discussion of the advantages and disadvantages of market-based and classical funding instruments. The empirical results are derived from the first two rounds of evaluations of the EEE, i.e. the reporting periods 2019 and 2020. Such an investigation can help to understand which approaches are particularly suited for which type of target group and to draw conclusions on the implications for future funding instruments.

Subsequently, an overview of the concerned funding lines will be given first. Then, the methodology underlying the evaluation of the EEE in its entirety and data sources relevant for this paper in particular will be described. Finally, a presentation and discussion of the results is followed by the conclusions.

## Grant, credit and competitive funding for optimizing plants and processes in the EEE

In the following, the three different funding lines, i.e. the grant-based, credit-based and competition-based lines, are described based on the funding directives from January 2020, i.e. the latest revision for the years under investigation (Table 1; bold text refers to table entries).

The **legal basis** for the classical grant/credit and the competitive lines are codified in separate, but similar funding directives. Both directives are recurrently updated to refine and update the funding scheme. While the directive for the grant/credit line<sup>3</sup> covers all Modules, i.e. 1 to 4, the competitive line<sup>4</sup> is limited to the equivalent of Module 4. During the periods 2019 and 2020, which are the focus of this paper, there have been several versions of the funding directives. While these documents are the legal basis for the implementation, operational details are specified in additional guidelines, forms, frequently asked question documents and fact sheets. It should be noted that the directive for the competitive line came into force approximately three months later than the classical line, i.e. the competitive line was not available throughout the entire year 2019 as opposed to the classical line. Both directives have distinct **quantitative targets** that are difficult to review side by side since the classical directive applies to all modules while the directive for the competition only covers the optimization of plants and processes. The **target groups** of all three lines, however, are identical and focus on companies with premises located in Germany as their main target group.

**Funding** in both the grant and competitive lines is offered as direct payments to cover part of the eligible investments. In case of the credit line, a low interest loan is granted to the applicant and part of the credit's repayment is covered as funding. Eligible costs are the appropriate and directly necessary extra investments to achieve the higher level of energy efficiency. As the optimization lines are technology-open, the **eligible investments** are specified along topics for funding, not specific technologies. The topics include, in short, investments in energy-efficient processes, waste heat utilization, process-related heating, cooling and ventilation including the use of renewable energies, measures to avoid energy losses and the development of an energy-saving concept and implementation support. In the two relevant funding directives, the eligible investments are described very similarly in terms of content and wording for both the grant/credit and the competitive line, i.e. they cover the same areas.

A common **precondition** to the application in all three lines is the submission of an energy-saving concept. It contains a qualitative and quantitative description of the status quo and the foreseen measures including the calculated energy demand before and after the implementation as well as the expected CO<sub>2</sub> savings. The energy-saving concept is to be elaborated according to guidelines by an accredited external energy consultant or internally by a company using a management system according to ISO 50001 or EMAS.

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<sup>3</sup> Directive on the Federal Funding Programme for Energy Efficiency in the Economy - Grant and loan of 22 January 2020. BAnz AT 31.01.2020 B2. pp. 1-9.

<sup>4</sup> Directives on the Federal Funding Programme for Energy Efficiency in the Economy - Funding Competition of 22 January 2020. BAnz AT 31.01.2020 B1. pp. 1-7.

Table 1. Comparison of the different lines for “energy-related optimizations of plants and processes”.

	Grant	Credit	Competition
<b>Mode</b>	Classical approach		Competitive approach
<b>Support</b>	Direct investment grant	Low-interest loan with repayment subsidy	Direct investment grant
<b>Legal basis</b>	<ul style="list-style-type: none"> <li>- Directives on the Federal Funding of Energy Efficiency in the Economy of 22 January 2020 BAnz AT 31.01.2020, Funding Competition (B1) / Grant and Credit (B2)</li> <li>- Directives on the Federal Funding for Energy Efficiency and Process Heat from Renewable Energies in the Economy of 26 March 2019 BAnz AT 29.03.2019, Competition (B1) / Grant and Credit (B2)</li> <li>- Directive for Funding Energy Efficiency and Process Heat from Renewable Energies in the Economy BAnz AT 31.12.2018, Grant and Credit (B1)</li> </ul>		
<b>Quantitative targets</b>	Across all Modules, not limited to Module 4: <ul style="list-style-type: none"> <li>- Realizing 24,000 measures</li> <li>- Reducing GHG emissions by 2.8 Mt per year</li> <li>- Reducing final energy demand by 11 TWh</li> <li>- Average funding efficiency of 25 euro per year and tonne of CO<sub>2</sub> calculated over a lifetime of 10 years</li> </ul>		Until 2023: <ul style="list-style-type: none"> <li>- Reduction of CO<sub>2</sub> emissions by 0.7 Mt</li> <li>- Reduction of final energy demand by 3 TWh</li> </ul>
<b>Target group</b>	<ul style="list-style-type: none"> <li>- Private companies</li> <li>- Municipal companies</li> <li>- Freelance professionals if the business premises are predominantly used for freelance activities</li> <li>- Contractors who carry out measures specified in this guideline for an eligible company</li> </ul>		
<b>Eligible investments</b>	<ul style="list-style-type: none"> <li>- Shifts towards efficient process technologies and energy-optimized production processes, by e.g. using energy-efficient plants and machines, replacing individual components, operating energy-efficient processes, optimizing measurement and control technologies including energy management software.</li> <li>- Measures for waste heat utilisation, e.g. the integration of waste heat for providing heat including all necessary measures in the area of plant or building technology, feed-in to heat grids including their connection, measures for converting waste heat to electricity (e.g. ORC technology).</li> <li>- Measures concerning the heat supply, cooling and ventilation of plants if these are predominantly used directly for the production, processing or refinement of products.</li> <li>- Measures for the energy-efficient provision of process heat or cooling, e.g. energy-efficient heat and cooling, optimisation of heat or cold storages.</li> <li>- Measures to avoid energy losses in production, e.g. due to insulation of plants and distribution lines, hydraulic optimisations, renewed compressed air pipes.</li> <li>- The development of an energy-saving concept and implementation support by an external energy consultant.</li> </ul>		
<b>Precondition</b>	Energy-saving concept		
<b>Eligible costs</b>	Up to 10 m. euro		
<b>Maximum funding</b>	<ul style="list-style-type: none"> <li>- Non-SMEs: share of up to 30% (max. 3 m. euro) up to 500 euro per annually saved tonne of CO<sub>2</sub></li> <li>- SMEs: share of up to 40% (max. 4 m. euro) up to 700 euro per annually saved tonne of CO<sub>2</sub></li> </ul>		<ul style="list-style-type: none"> <li>- In case of successful participation in the competition: share of up to 50% (max. 5 m. euro)</li> </ul>
<b>Side conditions</b>	- Minimum payback time of 2 years without funding		- Minimum payback time of 4 years without funding
<b>Implementing agency</b>	German Federal Office for Economic Affairs and Export Control (BAFA)	German development bank (KfW)	VDI/VDE-IT

Source: Own summary based on the Directives for the EEE as of January 2020.

The major differences of the funding lines, apart from the general set-up, are the funding conditions. While the **maximum eligible costs** are commonly limited to 10 m. euro, the **maximum funding** differs. In the grant and credit line, there is a common double ceiling for funding. A first ceiling is introduced by limiting the funding to 30% of eligible costs for non-SMEs. A second ceiling is a funding rate of 500 euro per annually saved tonne of carbon dioxide emissions. If the funding rate were to be higher, it would be cut to this ceiling. For small and medium-sized enterprises (SMEs), the share is 10 percentage points higher compared to non-SMEs and the

second ceiling is increased to 700 euro. In the competitive line, the values can be up to 50% of the eligible costs. Yet here, the applicant has to propose a competitive project with a ratio of savings and funding requirements that is then subject to the competitive selection among the proposals. The selection of the successful application in the competition is based on a round-based selection principle. This means that all applications that have been received within a defined period are collected and ranked by their funding efficiency. If the requested budget exceeds 50% of the foreseen budget in a round, a round may be closed early. By the end of 2020, eight rounds had been completed with a budget of 7 m. euro per round and a duration of 1 to 3 months per round. The decisive criterion for receiving funding is the funding efficiency of the submitted proposal, expressed by the amount of funding per achieved CO<sub>2</sub>-savings and years. For this purpose, all submissions within the same round are ranked according to their funding efficiency and are attributed funding as long as the budget has not yet been depleted. As a **side condition**, a minimum payback time of 2 years without funding for the grant/credit lines and of 4 years for the competitive line has to be achieved.

The three lines are operated by different **implementing agencies** (cp. Appendix: Figure 6). The Federal Office of Economic Affairs and Export Control (BAFA) processes applications for grants, while requests for credits are processed by the development bank KfW. The applications for grants are reviewed by BAFA and approved if the funding requirements have been met. After completing the project, the applicant submits various documents including a proof of use. Upon validation by BAFA, the grant is paid. The credit line at KfW is operated in a similar way, but a bank is involved as an additional intermediary to ensure the guarantees for the loan. After a positive decision by this bank, the application is reviewed and validated by KfW and the interest rate is set based on the applicant's economic conditions. In case of a positive conclusion, the beneficiary receives a repayment subsidy for the loan. The funding competition is administered by VDI/VDE-IT, an implementing agency supporting the public body. In case of the competition, submissions submitted within a specified deadline are subjected to a technical review by VDI/VDE-IT, an implementing agency supporting the public body. In case of a positive review, the submission is included in the current competitive round following the previously outlined process. If successful, the applicant may claim funding up to half of the approved total during the implementation. Upon completion, the beneficiary needs to submit a proof of use. If evaluated positively by VDI/VDE-IT, the remaining grant is paid. To conclude, the three funding lines promote the energy-related optimization of plants and processes in a technology-neutral manner and address the same topics and groups. Yet the competitive line offers potentially higher funding to companies (max. of 5 m. euro without CO<sub>2</sub>-ceiling), but it comes with the risk that the submission does not succeed in the competitive selection. In contrast, obtaining funding has a relatively low risk of failure in the classical funding lines if the requirements have been met.

## Methodology

The results in this paper originate from the evaluation of the EEE. The latter follows a common methodological framework for the evaluation of energy efficiency measures by the German Federal Ministry for Economic Affairs and Climate Action (BMWK) (Schlomann et al. 2020). This framework covers an analysis of the target achievements (A), the effectiveness (B) and the efficiency (C) of the measures under investigation. It was developed for the predecessor of the EEE, the German Energy Efficiency Fund. It seeks to establish a harmonized basis for the evaluation of policy measures for energy efficiency measures while still taking into account the diversity of individual measures. This methodology with its nine steps is also in use for the evaluation of the EEE. For the specific purpose of the EEE, additional indicators and minor changes, e.g. enhanced impact descriptions have been added, yet the structure remains unchanged. Since the results presented later have been derived from results of the overall evaluation, notably steps 5 to 7, a summary overview of the methodology is given in Table 2. For further details and methodological challenges, the reader is referred to Schlomann et al. (2017); Voswinkel (2018, 2019, 2020); Hirzel and Schlomann (2022).

The subsequent analysis has been based on information from two sources: Major parts use survey results collected from successful beneficiaries. Moreover, data from programme administration has been used to

provide additional insights. Both data sources are further explained in the following and cover the funding years 2019 and 2020.

Table 2. Overview of the EEE’s overall evaluation methodology.

Step and purpose	Main tasks
<b>1: Characterization:</b> Description of the covered policy measures	<ul style="list-style-type: none"> <li>- General <b>outline of the measure</b> covering its type, target group/sectors, budget, funding bodies/implementation agencies, legal basis, related policy measures and the funding process</li> <li>- Analysis of the <b>impact model</b> of the measure</li> <li>- Consideration of potential <b>distortions</b> (e.g. overlaps, double counting, side-effects such as free-rider effects, spill-overs or follow-up-effects)</li> </ul>
<b>2: Framework data:</b> Definition of common data and assumptions	<ul style="list-style-type: none"> <li>- Definition of <b>harmonized input data</b> (e.g. emissions factors, primary energy converters)</li> <li>- Provision of <b>default choice lists</b> (e.g. lifetimes by type, energy prices)</li> </ul>
<b>3: Targets and requirements:</b> Identification of the targets of the overall programme, its individual policy measures and of the specific requirements to the evaluation	<ul style="list-style-type: none"> <li>- Description of <b>requirements and expectations</b> to the evaluation</li> <li>- Analysis of <b>top-down targets</b> for energy efficiency improvements based on governmental documents, directives and laws</li> <li>- Analysis of <b>bottom-up targets</b> of individual support schemes from ex-ante estimation, funding guidelines</li> <li>- Definition of the <b>main areas of interest</b> for the evaluation</li> </ul>
<b>4: Indicators:</b> Setting up performance values to measure the achievement of targets	<ul style="list-style-type: none"> <li>- Selection of <b>indicators that reflect progress</b> in the areas of interest</li> <li>- <b>Operationalization</b> of the indicators: choice between qualitative/quantitative type, description and delimitation, computational model, type of result, units (quantitative) or scales including interpretation rules (qualitative)</li> </ul>
<b>5: Data collection:</b> Identification and collection of data for establishing the indicators	<ul style="list-style-type: none"> <li>- Establishing a <b>data collection concept</b> based on the selection and set-up of the indicators</li> <li>- Implementation of the <b>data collection process</b></li> </ul>
<b>6: Data review:</b> Processing incomplete or missing information	<ul style="list-style-type: none"> <li>- <b>Review of data</b> (e.g. error correction, missing parameters)</li> <li>- <b>Method</b> selection and implementation of <b>back casting and projections</b> of data where needed</li> </ul>
<b>7: Data analysis:</b> Processing of the data to measure the achievement of the target values	<ul style="list-style-type: none"> <li>- Selection of appropriate <b>method of analysis</b> (descriptive/analytical)</li> <li>- Computation of <b>gross values</b> for indicators</li> </ul>
<b>8: Net impact estimation:</b> Elimination of distortions in the results	<ul style="list-style-type: none"> <li>- <b>Identification of distortions</b></li> <li>- Computation of undistorted <b>net values</b> for indicators</li> <li>- Conclusions for the <b>individual measures</b></li> </ul>
<b>9: Overall assessment:</b> Merging individual result	<ul style="list-style-type: none"> <li>- Determination of <b>areas for aggregation</b> and comparison</li> <li>- <b>Correction for double counting</b> when aggregating quantitative values</li> <li>- Computation of the <b>overall assessment</b></li> <li>- Formulating conclusions for the <b>entire scheme</b></li> </ul>

Source: Hirzel and Schlomann (2022).

With the submission of their applications, the participants consent to contribute to the evaluation of the scheme. To complement data from administrative sources, a **survey** among participants has been implemented as an online survey among those participants who received a positive response to their application.<sup>5</sup> The surveys covered all Modules as well as the funding competitions. They consisted of various common questions across all lines and specific questions addressing particular aspects related of the individual Modules or implementing agencies. Depending on the specific questionnaire, answering all questions was estimated to take between 20 and 30 minutes. The surveys for the year 2019 took place in March and April 2021 and for the

<sup>5</sup> The number of invitations is slightly below the number of successful applications since multiple invitations to individuals (e.g. energy managers responsible for several premises) were minimized and some e-mail addresses were not processed any more. In case of the credit line, only a limited sample could be contacted for 2019.

year 2020 in September to October 2021. Both were open for approximately four weeks. Participants were invited via e-mail accompanied by a FAQ document on the survey and - for the year 2019 - an invitation to participate by the Ministry. Reminders were sent once before closing the survey. The response rate varied between 20% and 45% (Table 3).

Table 3. Overview of the number of invitations and response rates of the survey for the different lines in the optimization of plants and processes for the evaluated years 2019 and 2020.

	Invitations	Completed questionnaires	Response rate
<b>Grant</b>	1988	518	26%
<b>Credit</b>	564	114	20%
<b>Competition</b>	65	29	45%

Source: Survey.

The **administrative data** has been taken from information contained in the funding databases of BAFA, KfW and VDI/VDE-IT. For BAFA and VDI/VDE-IT, information in these databases has been collected from the application portals; for the KfW, it has been derived from the loan agreements submitted by the involved banks. Furthermore, information about the application process are stored in the databases and include information such as:

- information on the beneficiary (e.g. type, name, regional allocation, company size, industry sector),
- classification of the intended use,
- financial information on the submitted project,
- savings (final energy of electricity and fuels, CO<sub>2</sub>) and
- administrative process data.

The quantitative administrative data is mainly used here for the quantification of savings. As part of data preparation, it was reviewed and cleaned first (e.g. for obvious false entries, implausible values or duplicates). For the grant and credit line, the savings are taken from the funding applications; for the competitive line, they also come in part from the certificates of use. Where measured values were available (certificate of use), these were preferred. Otherwise, the pre-calculated values as submitted by the beneficiaries were used.

## Results and discussion

The following results are usually presented by either the relevant funding line or a combination of funding lines, i.e. grant vs. credit vs. competitive line or classical (grant and credit) lines vs. competitive line. It should be noted that the number of approvals in the two years under consideration varies considerably: There are 2006 approved grants, 705 approved loans and for the competition and its slightly shorter implementation period, 65 successful cases. For the sake of comparability, all results are presented in relative terms with the total within the respective group as 100%. This total may vary. For the survey, the total is based on the available answers per question and line or lines. For instance, 83% out of 113 companies applying successfully in the credit line and completing the questionnaire are owner-operated companies (Table 4). The total number of answers is usually lower than the number of completed questionnaires in Table 3. Reasons are that a) some questions were only asked as a follow-up based on previous answers, b) answers were not compulsory or c) participants indicated that they did not know or did not want to answer. For the entries obtained from the administrative data, the number of approved cases is equal to the number of successful applications.

## Characterization of companies submitting an application

Table 4 shows the structure of companies that successfully applied to the different funding lines. In general, it can be observed that the characteristics of the companies applying to the grant and credit line seem largely similar. Yet substantial differences appear when analysing the competitive line. With regard to the structure of the companies, it can be observed that about 70% to 80% of the companies in the classical lines are SMEs while there is only one single SME (corresponding to 2% of the companies) in the competition. The share of contractors and municipal companies in all lines is rather low. While both the grant and credit lines have similar shares of owner-operated companies at about 80%, the share for the competition is below 50%. Likewise, beneficiaries in the competitive line tend to be companies that have a higher share of environmental or energy management systems, specific targets for reducing energy demand and a majority also belongs to energy-intensive sectors with energy costs above 10%. It should be noted that these properties are likely to be interlinked. It can also be observed that payback requirements seem higher for companies applying to the competitive line.

Table 4. Structure of companies with successful applications.

<b>Results from administrative data*</b>			
Share of cases by company that ...	Grant	Credit	Competition
... are SMEs	72% (2006)	79% (705)	2% (65)
... are contractors	0.4% (2006)	0.1% (705)	3% (65)
... are municipal companies	0.9% (2006)	0.7% (705)	3% (65)
<b>Results from survey**</b>			
Share of cases by company that ...	Grant	Credit	Competition
... are owner-operated	78% (516)	83% (113)	46% (28)
... have an environmental or energy management system	49% (482)	52% (102)	100% (25)
... have a specific target for reducing energy demand	60% (419)	57% (90)	88% (24)
... have energy costs above 10%	15% (390)	13% (94)	57% (14)
... require paybacks for efficiency measures below 4 years	50% (424)	39% (89)	71% (28)
* Values in brackets indicate the total number of successful applications.			
** Values in brackets indicate the total number of answers per question.			

Source: Own compilation based on evaluation surveys and administrative data for the years 2019 and 2020.

## Perception of the funding lines

Understanding the preparation of submissions to the funding programme can yield additional insights about both the companies and the funding instruments.

An awareness of the different funding opportunities is an essential initial step in the application process. Figure 2 provides an overview of how the beneficiaries became aware of the funding opportunities by funding line (multiple answers possible). It can generally be observed that energy consultants, institutional websites, energy efficiency networks and banks play a central role across all lines. Yet some differences can also be observed. Energy consultants seem to be more relevant for the classical funding lines. For the competition, the results suggest that companies collect information more actively on their own, i.e. by being involved in energy efficiency networks or by retrieving information from websites, associations and events. For the credit line, banks appear to play an important role as well, while they do not seem particularly relevant for creating awareness about the other lines.

Figure 3 takes a closer look at the choice among the different lines. More specifically, the participants in the grant and credit lines were asked whether they considered a submission in the competitive line and vice versa. First, it can be observed that about half of the participants in the classical funding lines is unaware of the competitive line. Second, only a fraction of participants in the classical lines considered a submission in the



competitive line. Third, the share of those considering the classical funding lines in the competition is higher, but also here, the counterpart lines are indicated as unknown.

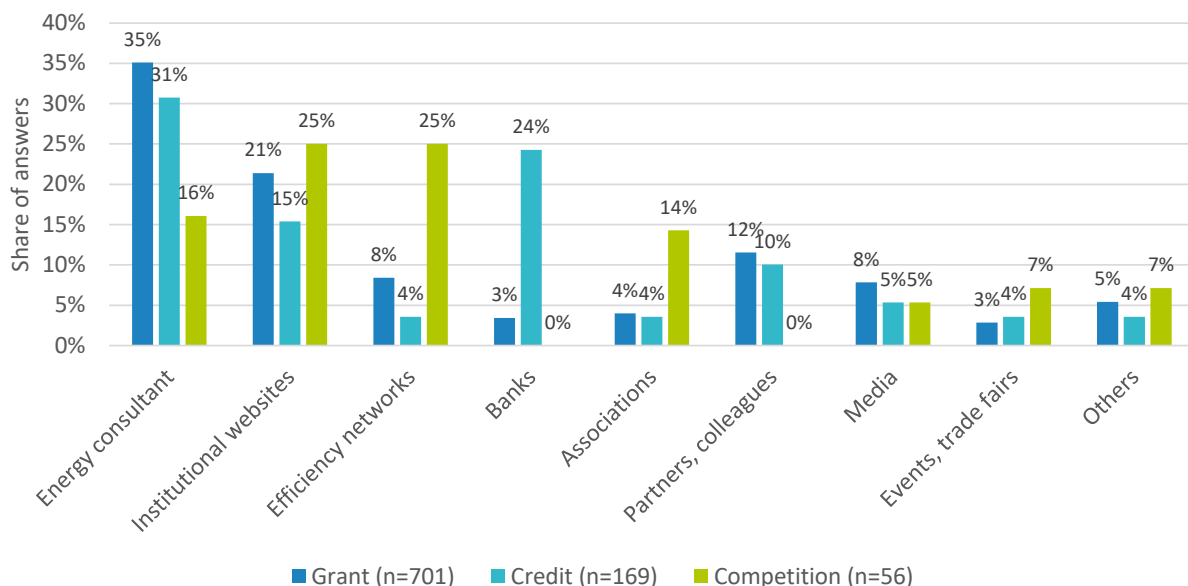


Figure 2. Sources of awareness per funding line (Source: Survey; option to select multiple answers; values in brackets indicate total number of answers per line).

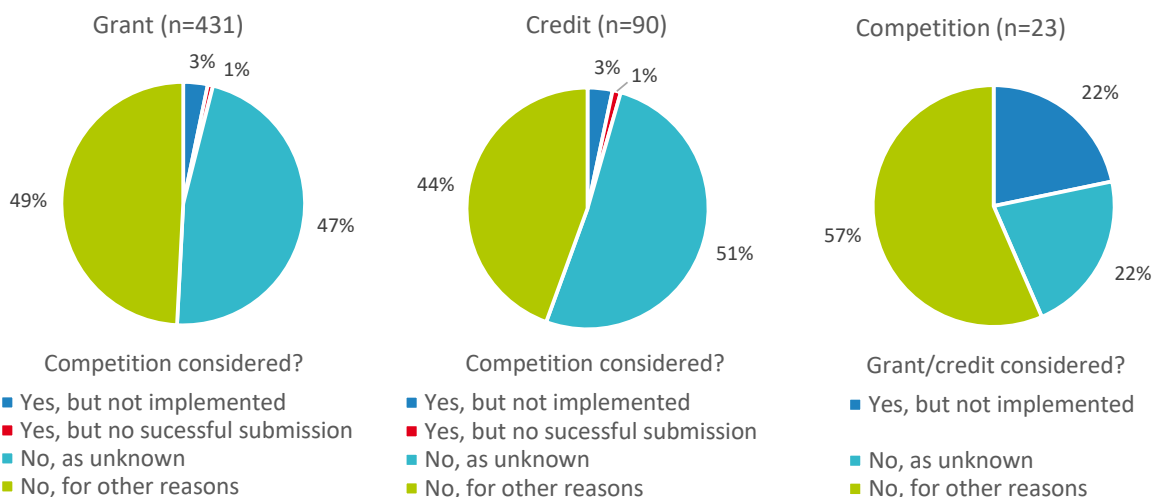


Figure 3. Share of companies in the classical lines that considered the competitive line and vice versa (Source: Survey; values in brackets indicate total number of answers per line).

Those indicating that they considered the other type of funding line were further asked why they perceived their chosen line as more favourable. The results in Table 5 seem to suggest the following: In choosing the classical grant and credit lines, the companies seem to focus on reliability, i.e. robust financial planning and keeping time schedules. The few available answers in the competitive line seem to indicate a less risk-averse behaviour with a focus on higher funding rates. Due to the limitation to those participants considering the other lines, the total number of answers is relatively low and thus the robustness of results is limited.

Table 5. Perception of the advantages of the classical vs. the competitive funding and vice versa

The ... line is more suitable for the site than the other due to ...	Grant/Credit	Competition
... the higher reliability of financial planning*	88% (17)	-
... the higher chance of success	87% (15)	33% (3)
... the higher reliability of the time schedule*	78% (18)	-
... the easier company-internal enforcement (financing, budgeting)	53% (19)	25% (4)
... the lower administrative effort	53% (19)	50% (4)
... positive earlier experiences with the offer	53% (17)	40% (5)
... the more attractive achievable funding rate	47% (17)	100% (4)
... recommendations (e.g. by energy consultants, contractors)	47% (17)	25% (4)
... due to company-internal requirements	19% (16)	33% (3)
* Only asked to participants in the grant or credit line.		

Source: Survey; multiple answers possible; values in brackets indicate total number of answers per line.

## Implementation and impact

After the decision about the line has been made, the submission of the application needs to be prepared. This includes the energy-saving concept. As pointed out earlier, companies with a certified energy or environmental management system may elaborate this concept on their own. The others have to involve an approved external consultant. With regard to the involvement of third parties in the application, it can be observed that most of the companies in the classical funding lines rely on this type of support when preparing the submission (Figure 4). A likely explanation lies in needing the energy-saving concept. When considering the previous result that only about half of the participants in the classical lines have a certified energy or environmental management system, the higher need for support seems plausible. As all of the companies in the competitive programme have a management system, their share is lower, yet external technical support still seems relevant.

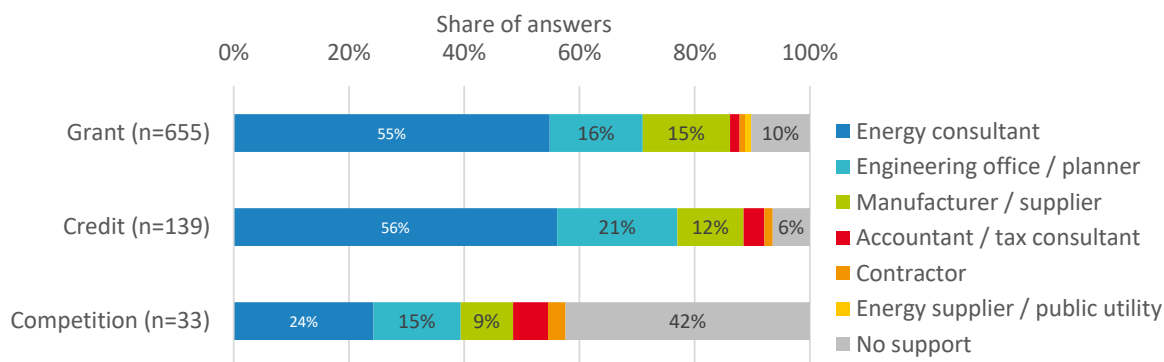


Figure 4. Support of the application by external (energy) service providers (Source: Survey; multiple answers possible; values in brackets indicate total number of answers per line).

Figure 5 shows the most relevant challenges linked to the implementation of energy-saving measures. The results seem rather similar for the classical funding lines on the one hand and the competitive line on the other hand. With regard to the technical perspective, system integration and space requirements seem equally relevant in all three lines, but achieving the required savings seems less challenging for the competitive line. In terms of non-technical challenges, achieving the required payback time seems slightly more challenging for the competition, potentially also due to the higher payback requirements for this line.

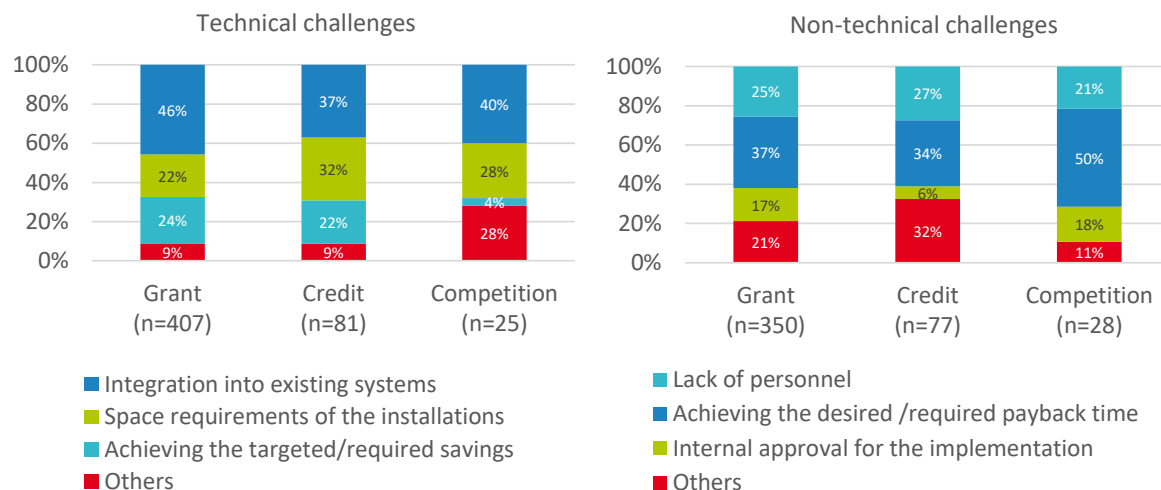


Figure 5. Most relevant technical (left) and non-technical challenges (right) per funding line (Source: Survey; values in brackets indicate total number of answers per line).

With regard to the impact of the implementation, Table 6 shows the average gross impact per approval and funding line in the year 2020. It can be observed that the impact in terms of energy savings, GHG reductions and energy cost savings of the implemented projects seems substantially different for the three lines. While the grant line with its highest number of cases has the lowest specific values per approval, the credit line shows higher averages while the cases covered by the competition consistently show the largest impact.

Table 6. Structure of the average annual (gross) reduction per approval (first year savings).

Average annual (gross) reduction per approval ...	Grant	Credit	Competition
... of electricity demand in MWh/a	177	492	1143
... of fuel demand (final energy) in MWh/a	529	828	9397
... of GHG emissions in t CO <sub>2</sub> -eq./a	205	384	4800
... of energy costs in 1000 euro/a	52	120	566

Source: Own compilation based on administrative data for the year 2020.

## Limitations of the analysis

Before proceeding to the conclusions, the limitations of this research need to be underlined. First, as pointed out in the beginning, the EEE offers a good opportunity to conclude on different types of funding lines because - apart from the funding mechanisms - the three lines are very similar. Furthermore, all three lines have been evaluated by using the same approach, which helps to minimize biases due to different evaluation approaches. Yet this can also be considered as a limitation in itself because the analysis is limited to a sample of companies concerned by one policy measure in Germany only, i.e. country-specific or measure-specific factors might apply and affect the results. Second, the analysis is limited in terms of the number of companies involved. While there are elevated numbers of companies in the grant and credit lines, the number of companies in the competitive line are limited. The available samples limit the potentials to go beyond descriptive statistics, in particular when it comes to aspects that are only available from a subset of the entire population per line. Third, the analysis focuses on cases of successful applications only, i.e. any companies failing to comply with the requirements including any formal or measure-related requirements or that fail in the competition are not included. Fourth, despite the similarities in the funding set-up, there are differences. With regard to the overall number of applications, the competitive line started a few months later than the classical lines. Yet the impact

of this should be limited, since this concerns only a fraction of the entire period of observation. Also with regard to the other aspects, the funding decision depends on several implementing agencies that - despite harmonization - run their lines within their own organizational embedding. The payback requirements are also a factor that diverges. The different funding rates, however, are more of a feature, because otherwise, there would be no incentive to apply for the more risky competitive line where about one fifth of the submissions were not admitted to the competition and roughly, another third did not have a positive outcome. Fifth, it is likely that in particular the characteristics for describing the companies are not independent. For example, a company that has an energy management system is often more energy-intensive and is likely to have a specific target for reducing energy demand and/or carbon dioxide emissions as part of its internal management policy. In that case, these characteristics describe similar types of companies from different perspectives.

## Conclusions

The aim of this paper was to investigate the differences between “classical” and “competitive” funding lines using the example of the German Federal Funding Programme for Energy Efficiency in the Economy. With regard to differences between the “classical” and the “competitive” approach, it can be observed that despite the almost identical set-up and the limitations of this investigation, there seem to be differences between the reached target groups of the funding lines. In particular they concern the classical grant and credit lines in comparison to the competitive line. It seems that the competitive line is especially appealing to large, energy-intensive companies. The beneficiaries in this line might also be less-risk averse and seek to realize energy efficiency projects that tend to be larger in terms of energy and energy cost savings as well as GHG reductions. The grant and credit lines, on the contrary, seem more relevant for smaller, less-energy intensive and, more often, owner-operated companies. Thus, the different lines do not necessarily compete with each other. Rather, they seem to meet different requirements of companies. In terms of implications for the design of funding instruments, that suggests that both classical as well as competitive funding programmes have their merits. For policy action that primarily seeks to focus on fewer projects that generate large savings, the competitive approach as used in the EEE seems well suited. If the aim is to involve different types of companies and SMEs in particular, classical funding set-ups seem a more promising choice. To achieve the substantial change that is required for achieving the ambitious climate targets and without discussing the public costs of funding policies that are not covered in this paper, a combination of options might be a good choice for maximizing the overall impact. Yet further research would be valuable to broaden the empirical basis in terms of sample size, to cover experiences from different schemes and countries and to analyse the different set-ups with regard to their implementation efficiency.

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## Appendix A: Illustration of successful funding processes



Figure 6. Comparison of a successful funding process in the grant, credit and competitive lines. *Source:* Own illustration.