

National Showcase - Germany

**A SHOWCASE FOR THE ANALYSIS OF MULTIPLE IMPACTS
OF ENERGY EFFICIENCY IN GERMANY**

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ABBREVIATIONS

BAFA	Federal Office of Economics and Export Control (<i>Bundesamt für Wirtschaft und Ausfuhrkontrolle</i>)
BEG	Federal funding for efficient buildings (<i>Bundesförderung für effiziente Gebäude</i>)
BEG EM	BEG for Individual Measures
BEG NWG	BEG for Non-Residential Buildings
BEG WG	BEG for Residential Buildings
BEV	Battery Electric Vehicles (passenger cars)
BHO	Federal Budget Code (<i>Bundeshaushaltsordnung</i>)
BMWE	Federal Ministry of Economic Affairs and Energy
BMWK	Federal Ministry of Economic Affairs and Climate Protection
BMWSB	Federal Ministry of Housing, Urban Development and Building
DEA	Danish Energy Agency
dena	German Energy Agency (<i>deutsche Energieagentur</i>)
EE	Energy Efficiency
EE1	Energy efficiency first principle
EED	EU Energy Efficiency Directive
EnEfG	German Energy Efficiency Act (<i>Energieeffizienzgesetz</i>)
EnWG	German Energy Industry Act (<i>Gesetz über die Elektrizitäts- und Gasversorgung</i>)
FCEV	Hydrogen Fuel Cell Electric Vehicles
GDP	Gross Domestic Product
GEG	German Buildings Energy Act (<i>Gebäudeenergiegesetz</i>)
GWh	Gigawatt-hour
IA	Improvement action
KfW	Credit Institute for Reconstruction (<i>Kreditveranstalt für Wiederaufbau</i>)
kWh	Kilowatt-hour
LCOE	Levelised cost of energy
LCOCO ₂	Levelised cost of CO ₂
MBs	Multiple Benefits
MWh	Megawatt-hour
MI	Multiple Impacts
NPV	Net present value
PHEV	Plug-in Hybrid Electric Vehicles
RES	Renewable Energy Sources
VDE	Association for Electrical, Electronic and Information Technologies (<i>Verband der Elektrotechnik, Elektronik und Informationstechnik e.V.</i>)
VDI	Association of German Engineers (<i>Verband Deutscher Ingenieure</i>)
WPG	German Heat Planning Act (<i>Wärmeplanungsgesetz</i>)
YLL	Years of lost life

EXECUTIVE SUMMARY

The German showcase analyses three energy efficiency programs—BEG, the Environmental Bonus, and EEW—spanning residential, transport, and industrial sectors to illustrate policy implementation and outcomes in the context of the energy efficiency first principle. Ex-post evaluation data were collected and entered into MICATool with minimal steps to align inputs to the required formats. The tool then generates an expanded set of impacts beyond which are assessed in the evaluation reports (target achievement, impact, and cost-effectiveness) and include social, economic, and environmental indicators as well as the monetisation and a cost-benefit of key indicators.

The MICATool supports decision-making by highlighting the impacts most relevant to the policy decision and indicating which options are most advantageous given the impacts and parameter sensitivities. The tool accommodates data limitations by leveraging a validated default-value database to produce an initial high-level assessment, while additional data can be added to refine results and enable sensitivity analyses. Through the assessment with the MICATool, insights are gained to highlight that the BEG performs best towards improving energy poverty in the residential sector, the Environmental Bonus decreases mortality and hospital admissions from air pollution reductions and BEG and EEW contribute greatest towards stimulating GDP and employment. Additionally, the monetisation of key indicators enables cross-program comparisons and the incorporation of externalities into decision-making.

1. INTRODUCTION

1.1. What are Multiple Impacts of Energy Efficiency and why are they important?

Multiple Impacts (MIs) or Multiple Benefits (MBs) of Energy Efficiency (EE), indicate the full set of advantages deriving from energy efficiency policy measures. Also called non-energy, or co-benefits, these refer to, among others, increases in employment, GDP, productivity and energy security, positive impacts on health, ecosystems and crops¹. The calculation of the MIs is performed via monetisation and aggregation of EE outcomes, as well as cost-benefit analyses.

Capturing MIs is deemed essential when assessing and comparing various investment options, pathways, or policies to achieve energy and climate policy objectives, and notably climate neutrality. The calculation of MIs is considered invaluable, as a too-narrow scope of analysis might lead to short-sighted decisions that may deliver higher benefits in the short term but fail to contribute to long-term goals, or that may seem profitable in one aspect, whereas being negative or less beneficial when considering other aspects, such as a societal viewpoint. Thus, in many cases, the non-energy or non-climate benefits of the measures and policies could yield higher values than the mere energy-related benefits², and should, thus, be taken into consideration within planning processes.

1.2. The MICATool – how does it work and for what should it be used?

The MICATool refers to the development of a comprehensive approach for estimating MIs of EE by providing a publicly available and easily usable online tool. The goal of the tool is to improve scientific knowledge and methods, enabling decision-makers to conduct simplified analyses for different data and policy scenarios, to compare and assess the relevance of the MIs and strengthen reporting and monitoring at three governance levels: EU, national and local.

The overarching methodology of the tool pertains to the quantification and monetisation concept of the MIs of EE improvements or renewable energy sources (RES), which is currently under development and will be integrated into the tool at a later stage. This concept defines the quantification chain from input data to outputs in the form of **quantified, monetised and aggregated** MIs. This approach allows for an **ex-ante** quantification of future impacts for various scenarios and policy measures at three governance levels (EU, national, and local), as well as an **ex-post** evaluation of already achieved impacts based on input data entered by tool users.

1 Ürge-Vorsatz, D., Chatterjee, S., Thema, J., Suerkemper, F., Thomas, S., Teubler, J., Couder, J., Bouzarovski, S., Mzavanadze, N., & Below, D. von. (2017). *More than energy savings: Quantifying the multiple impacts of energy efficiency in Europe*. CEU Research Pure Portal. <https://research.ceu.edu/en/publications/more-than-energy-savings-quantifying-the-multiple-impacts-of-ener>

2 Chatterjee, S., & Ürge-Vorsatz, D. (2021). Measuring the productivity impacts of energy-efficiency: The case of high-efficiency buildings. *Journal of Cleaner Production*, 318, 128535. <https://doi.org/10.1016/j.jclepro.2021.128535>

The following steps summarise the application of the methodology within the tool:

- *First step: MIs are quantified based on impact factors or functions directly linked to specific input parameters (e.g. energy savings) \rightarrow impacts = f (simple inputs).*
- *Second step: Monetised impacts are calculated from the quantified impacts, applying a monetisation factor (e.g. EUR per tCO₂ avoided) \rightarrow monetised impacts = (quantified impacts) x (monetisation factor)*
- *Third step: Monetised impacts are aggregated to provide an overall result.*

For the performance of the calculations and results prompting, the tool deducts **information from various databases** (e.g. Eurostat, EU-SILC, Danish Energy Agency (DEA) Catalogues, ODYSSEE-MURE) **and models** (e.g. PRIMES, GAINS), based on the preferred assessment type (ex-post or ex-ante). More information regarding the execution and structure of the calculations can be found in this link: doc.micatool.eu.

The MICATool, providing results on impacts borne into not only the economy but also society and the environment, enables planners and actors engaged in planning, policymaking and investment processes to **easily select the types of impacts they want to factor in** the assessment.

The **flexible approach** of the MICATool makes it possible to **include MIs in any assessment**, even when the users have limited data specific to their case. They can then get a first rough assessment and decide whether some of the impacts should be investigated further. When users have already more data at hand, they can enter them into the tool and get more accurate results. Moreover, users can also use the tool to explore how sensitive the results are to key parameters or input data.

Regardless of the situation, the MICATool can be used to **initiate the discussion** among stakeholders about what impacts can make a difference in the decision, and what options stand out as most beneficial, depending on considered impacts and the sensitivity to key parameters.

2. THE NATIONAL SHOWCASE FOR GERMANY

Discussion on the status quo of the analysis of multiple impacts of energy efficiency and the implementation of the energy efficiency first principle in the member state Germany

According to Germany's National Energy and Climate Plan (NECP), the Energy Efficiency First (EE1st) principle – as now formally anchored in Article 3 of the Energy Efficiency Directive (EED) - serves as the overarching guideline across all energy sectors (BMWK 2024; European Union 2023). Germany implements EE1st and the EED through the German Energy Efficiency Act (EnEfG), which sets binding national primary and final energy reduction targets. However, up to now it does not include a direct transposition of Art. 3 EED, which would oblige the federal government to systematically examine demand-side measures (including their MIs) before supply-side, or infrastructure investments are undertaken. Nevertheless, the EE1st principle is already partially reflected in some other national

measures and legislation.

In the building sector, the German Buildingtargets for primary and final energy reductions Energy Act (GEG) promotes efficient energy use alongside renewable energy deployment, supported by federal funding programmes for efficient buildings. In the heating sector, the Heat Planning Act (WPG), effective since January 2024, operationalises this principle by requiring systematic heat planning, mandatory estimation of energy savings potentials, and identification of areas with high energy-saving potential—explicitly referencing the EE1st principle for municipalities with more than 45,000 inhabitants. In energy infrastructure planning, the network development plan incorporates demand-side resources and efficiency measures, including electromobility, heat pumps, battery storage, and demand-side management in industry. The ongoing amendment to the Energy Industry Act (EnWG) further establishes a System Development Strategy that embeds the EE1st principle into coordinated scenario frameworks, ensuring consistent consideration of EE across all infrastructure planning processes (BMWK 2024).

Several research and policy efforts aim to quantify the MIs of EE, but each typically focuses on only a subset of effects rather than providing a fully comprehensive picture. Studies commissioned by the Federal Ministry for Economic Affairs and Climate Action (BMWK) often quantify macroeconomic and employment impacts, system cost reductions and lower energy import dependence. In the buildings sector, work by the German Environment Agency (UBA), the German energy agency (dena) and others examines health and comfort benefits, reduced air pollutants, higher property values and impacts on energy poverty. Long-term energy system and grid studies (e.g. “Langfristszenarien”) quantify system-level benefits such as reduced peak loads, avoided grid expansion and lower overall system costs due to demand reduction. In addition, evaluations on specific EE funding programmes do include indicators for jobs, value added, innovation and social distribution effects (e.g. (Heinrich et al. 2025a; Heinrich et al. 2025b; Neusel et al. 2024; Rao et al. 2024)). However, these analyses usually cover specific sectors, time horizons and impact categories, so that MIs are captured in a fragmented way rather than through a single integrated quantitative framework.

2.1. Multiple impacts of energy efficiency programs

2.1.1. Selection of energy efficiency programs

The showcase for Germany focuses on three energy efficiency programs:

- [Federal funding program for energy efficient buildings \(BEG\)](#)
- [The Directive to promote the sale of electric-powered vehicles \(Environmental bonus\)](#)
- [Federal funding for energy and resource efficiency in industry \(EEW\)](#)

These measures were selected since they represent efforts targeted at different sectors (residential, transport, and industry) giving a broader overview of the implementation and outcomes of EE

policies and their (multiple) impacts as well as to demonstrate the implementation of the EE1st principle in Germany.

2.1.1.1. EE program 1: Federal funding program for energy efficient buildings (BEG)

Description of the energy efficiency programme

The “Federal funding program for energy efficient buildings (BEG)” is a fiscal instrument that was implemented by the Federal German Ministry for Economic Affairs and Energy (BMWE, formerly BMWK) in 2021 as a funding mechanism to support energy and climate protection objectives as well as economic policy objectives to support the construction industry. The BEG bundles together previously established funding mechanisms for energy efficiency and renewable energy in the building sector and promotes the installation of technologies, energy measures on the building envelope and windows, the refurbishment of buildings to specific energy efficiency levels and the construction or initial purchase of climate-friendly buildings. It goes further than previous funding mechanisms by also providing financial support for the installation of climate-friendly heating technologies, optimisation of existing heating systems, measures for the building envelope and the installation of optimized equipment and plant engineering.

The program in its current form comprises four subprograms focusing on different building types and occupiers and measures: residential buildings (BEG WG), non-residential buildings (BEG NWG), individual measures (BEG EM) all under the jurisdiction of the BMWE, and BEG Climate-friendly new construction, which is the responsibility of the Federal Ministry of Housing, Urban Development and Building (BMWSB).

The focus for this case is on the funding program for energy efficient residential buildings. This is assessed as two improvement actions including measures for improving the building envelope through insulation (improvement action 1) (IA) and measures for the heating system (installation of heating and system technologies, heating optimisation and combinations thereof) (improvement action 2) and centres on assessing the impacts of measures applied to existing buildings only. To avoid double accounting, this assessment looks at funding for “single” measures only³. Funding applications for multiple measures in the “combined” category cannot be accurately attributed to one specific category and are therefore not reflected further here since they are double accounted in the annual evaluation report (Prognos; ifeu; FIW; ITG, 2022a). Most of the funding for individual measures goes to private households (~95%), with the rest going to commercial, local government and other applicants. Of the applicants for funding from private households, the funding measures are mainly procured by owner-occupiers and to a lesser extent landlords. The socio-economic distribution of the measures indicates how far lower-income owner-occupiers benefit, but the lack

³ According to Prognos; ifeu; FIW; ITG, 2022a, p. 19: **Combined and Uncombined Individual Measures:** When funding individual measures, various purposes are often combined. A combination of measures, for example from the main categories building envelope and heating technology, cannot be clearly assigned to a single main category. In a simplified tabular representation, such cases are assigned to both main categories and may be counted twice. As a result, the sum of the main categories is larger than the reported overall total. Note: combined individual measures represented 4.2% of all funding measures.

of information on tenants’ incomes means it remains unclear to what extent landlord-owned properties also reach lower-income households.

Input data for the MICATool

The analysis in the MICATool requires data for energy savings, fuels affected (if available), number of dwellings affected, investment costs and subsidy quota, which were available to evaluate the BEG through several existing evaluation reports (Prognos; ifeu; FIW; ITG, 2022a, 2022b, 2023a, 2023b, 2024a, 2024b). The majority of the necessary input data was derived from the evaluation reports for 2021–2023 and could be used directly for two improvement measures: the renovation of the building envelope and the increase in heating efficiency. It was necessary to calculate the share of the total investment costs subsidised and use assumptions for the number of households experiencing energy poverty benefiting from each improvement action. The evaluation reports recorded the income groups of the subsidy recipients, which showed that no households with a monthly income of less than €1,000 were represented and that most recipients belonged to higher income groups. It is therefore unclear to what extent households affected by energy poverty (albeit limited to the income dimension of energy poverty) benefit directly from the measure, as shown in Figure 1. However, there may be indirect benefits, for example if tenants live in buildings whose landlords have taken advantage of the subsidy for their rental properties. The default values in the tool initially correspond to the estimated total proportion of the population affected by energy poverty according to default values based on EU-SILC and the SEED-MICAT approach to define these (Vondung 2022). To make the assessment somewhat more realistic, these values were combined with the distribution of the measure by income group as reported in the evaluation. In addition, some data was merged to ensure that it was consistently assigned to the measures.

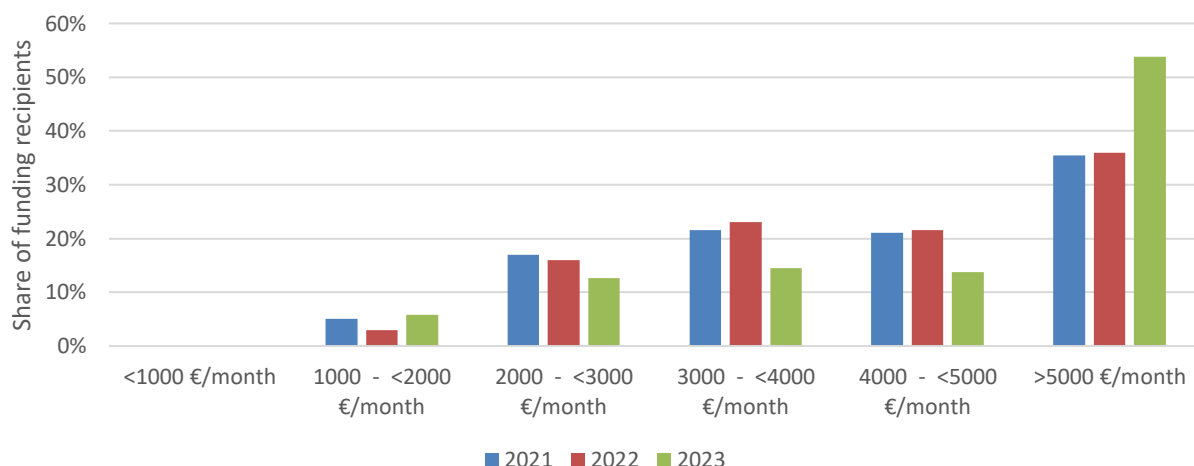


Figure 1: Average distribution of the BEG funding by income group for both improvement actions

A summary overview of the data used in the MICATool for the BEG between 2021 and 2023 in Germany is given in Table 1. This data shows the annual and total energy savings (total savings for

both measures and by energy source for the heating replacement), annual and total investment costs, number of dwellings affected (benefiting from each improvement action), as well as the subsidy quota and the estimated share of households experiencing energy poverty affected. Default values for various parameters, such as the share of fuels removed through the heater efficiency and exchange improvement action, and more are provided in the tool but can be adjusted if better or more relevant data is available. For the share of the different energy carriers, default values from the tool were used.

Table 1: Input data for the BEG Evaluation with the MICATool Germany (2021-2023)

	2021	2022	2023
Improvement action 1: Building envelope			
Annual end-use energy savings (MWh)	626,000	1,667,000	1,276,000
Annual investments (Mio. €)	7,092	24,900	16,059
Total number of affected dwellings	193,720	430,172	354,532
Total investments (Mio. €)	7,092	31,992	48,051
Total end-use energy savings (MWh)	626,000	2,293,000	3,569,000
Subsidy quota (%)	0.298	0.300	0.345
Estimated share of households experiencing energy poverty affected (%)	0.027	0.044	0.081
Improvement action 2: Heating efficiency (system technology, heating optimisation)			
Annual end-use energy savings (MWh)	1,426,000	7,836,000	3,265,000
Annual investments (Mio. €)	5,228	39,989	6,987
Total number of affected dwellings	247,772	1,025,609	302,746
Total investments (Mio. €)	5,228	45,217	52,204
Total end-use energy savings (MWh)	1,426,000	9,262,000	12,527,000
Subsidy quota (%)	0.410	0.217	0.345
Estimated share of households experiencing energy poverty affected (%)	0.057	0.054	0.061

Sources: (Heinrich et al. 2025a; Heinrich et al. 2025b; Heinrich et al. 2023a, 2024a, 2024b; Heinrich et al. 2023b), own calculations.

Assessing the resulting energy savings and average investments per dwelling and per kilowatt-hour (kWh) shows that the investment per kWh saved for improvements to the building envelope averages 13€, whereas for the heating efficiency and exchange, the investments per kWh saved average 7€, as shown in Table 2.

Table 2: Average energy savings investments costs per improvement action for the BEG evaluation (2021-2023)

	2021	2022	2023
Improvement action 1: Building envelope			
Average annual energy savings per dwelling (kWh)	3,231	3,675	3,648
Average investment per dwelling (€)	36,610	51,278	49,111
Average investment per dwelling and kWh saved (€/kWh)	11	14	13
Improvement action 2: Heating efficiency (system technology, heating optimisation)			
Average annual energy savings per dwelling (kWh)	7,361	7,274	7,948
Average investment per dwelling (€)	26,987	72,476	53,355
Average investment per dwelling and kWh saved (€/kWh)	4	10	7
Total			
Average annual energy savings per dwelling (kWh)	4,648	6,090	6,301
Average investment per dwelling (€)	27,905	40,695	39,246
Average investment per dwelling and kWh saved (€/kWh)	6	7	6

Source: own calculations based on Prognos; ifeu; FIW; ITG (2022a), Prognos; ifeu; FIW; ITG (2022b), Prognos; ifeu; FIW; ITG (2023a), Prognos; ifeu; FIW; ITG (2023b), Prognos; ifeu; FIW; ITG (2024b), Prognos; ifeu; FIW; ITG (2024c).

2.1.1.2. EE program 2: The directive to promote the sale of electric-powered vehicles (Environmental bonus)

Description of the energy efficiency programme

The directive to promote the sale of electric powered vehicles (Environmental bonus) came into force on June 30, 2016. The Environmental bonus was a fiscal measure by the German government for the electrification and decarbonisation of road transport. In addition to its climate protection policy objective, the Environmental bonus was also designed as an industrial policy instrument. Due to the governmental budget cuts, the Environmental bonus was discontinued one year earlier than planned by the federal government on December 17, 2023.

With the Environmental bonus, private households and companies applied for and were granted a financial subsidy when purchasing or leasing an electric powered vehicle, which was supplemented by a discount from the manufacturer. A total of €10.2 billion in government funding was approved in the period from 2016 to 2023 (supplemented by €5.3 billion in manufacturer rebates). These subsidies were used to support the registration of a total of 2.2 million electric powered vehicles. Of these 2.2 million vehicles, 1.4 million were battery electric passenger cars (BEV), 0.8 million plug-in hybrid electric vehicles (PHEV), and just under 500 vehicles with hydrogen fuel cells (FCEV), as shown in Table 3.

Table 3: Number of subsidised electric-powered vehicles by year and engine type (2016-2023)

	2016	2017	2018	2019	2020	2021	2022	2023	Total
BEV	4,217	18,903	27,425	43,936	134,390	327,300	467,184	377,533	1,400,888
FCEV	-	12	15	39	67	39	196	107	475
PHEV	3,031	13,514	11,361	17,916	109,089	281,570	335,138	-	771,619
Total	7,248	32,429	38,801	61,891	243,546	608,909	802,518	377,640	2,172,982

During the funding phase, the funding guideline was adapted several times and changes were made to both the funding rates as well as the eligible electric powered vehicles and the eligible groups. Over the years of the programme, the distribution of the measure by income group was recorded and higher income groups consistently received over 99% of the available funding, as shown in Figure 2. BEVs (and FCEVs) have always received higher state subsidies (2,000 to 6,000 EUR) than PHEVs (1,500 to 4,500 EUR) to promote the purchase of lower-emission vehicles. The subsidy for PHEVs concluded at the end of 2022. Since 01.09.2023, the promotion of BEVs has been limited to private individuals. Vehicles with a net list price of less than 40,000 EUR were subsidised more, while those over 60,000 EUR or 65,000 EUR (since 04.11.2019) were excluded from the subsidy.⁵

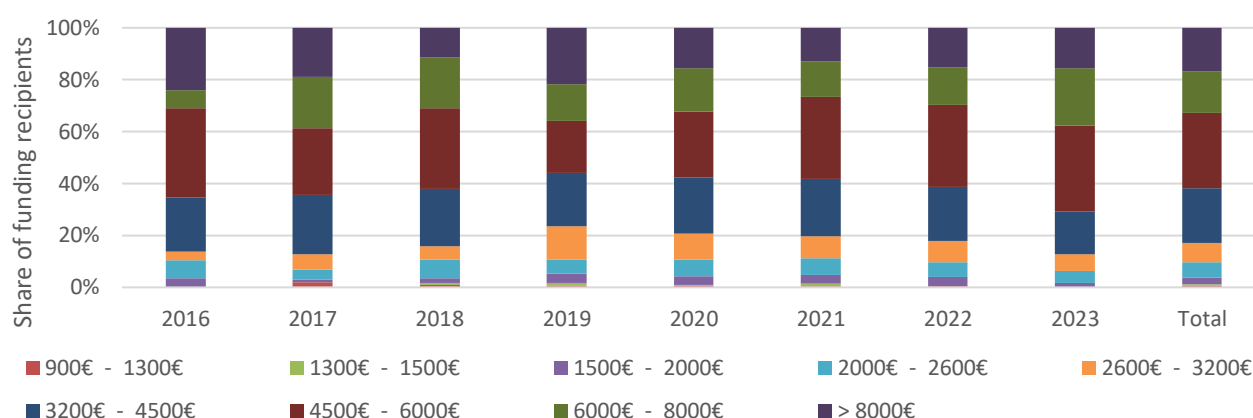


Figure 2: Distribution of the Environmental bonus by income group

The dissemination of all electric-powered vehicles has led to net annual energy savings of 10,903 GWh in 2023, as shown in Table 4 (Rao et al. 2024).

Table 4: Total annual energy savings from the use of electric-powered vehicles in Germany 2016-2023 (GWh)

	2016	2017	2018	2019	2020	2021	2022	2023
Gross	10	57	376	769	3,552	7,065	13,754	17,401
Net	5	29	144	404	1,497	4,489	8,670	10,903

Input data for the MICATool

The main objective of the measure summarised in the MICATool is as one improvement action for fuel switching and therefore focuses on the analysis of the impacts resulting from the uptake of BEVs only. To apply the tool, data about the measure needs to be included for the average energy savings, investment costs, subsidy quota and the distribution of the energy savings and new installed fuel by fuel type, as given in Table 5. The share of fuel among fuel removed indicates the percentage of each energy carrier saved through the implementation of the improvement action. Default values for various parameters are provided in the tool but can be adjusted if better or more relevant data is available.

Table 5: Input data for the Directive to promote the sale of electric-powered vehicles (Environmental bonus)

	2016	2017	2018	2019	2020	2021	2022	2023
Improvement action 1: Fuel switch								
Annual end-use energy savings (MWh)	47,899	217,737	330,020	566,530	1,509,529	3,777,287	5,546,733	4,638,854
Annual investments (Mio. €)	105	488	774	1,400	3,930	10,300	16,500	13,900
Annual number of approved applications	4,217	18,903	27,425	43,936	134,390	327,300	467,184	377,533
Total end-use energy savings (kWh)	47,899	265,635	595,655	1,162,185	2,671,714	6,449,000	11,995,734	16,634,587
Total investments (Mio. €)	115	593	1,367	2,767	6,697	16,997	33,497	47,397
Average technology lifetime	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Subsidy quota (%)	0.09	0.08	0.08	0.07	0.20	0.20	0.18	0.12
Share among fuel removed (%)								
Oil	1	1	1	1	1	1	1	1
Share among fuel installed								
Electricity	1	1	1	1	1	1	1	1

Source: (Rao et al. 2024)

2.1.1.3. EE program 3: Federal Funding for Energy and Resource Efficiency in Industry (EEW)

Description of the energy efficiency programme

Federal funding for energy and resource efficiency in industry (EEW)⁴ is a fiscal instrument that pursues energy, climate and economic policy objectives. The EEW supports companies in industry and commerce with measures to save energy, resources and GHG emissions. The EEW was created in 2018 by merging various BMWK funding programs around energy efficiency. It is divided into variants for tender schemes and grants and loans, and comprises six funding modules:

- Module 1: Cross-sectional technologies
- Module 2: Process heat generation from renewable energies
- Module 3: Measurement and control technology, sensors and energy management software
- Module 4: Energy and resource-related optimisation of systems and processes
- Module 5: Transformation plans
- Module 6: Electrification of small companies
- Tender scheme

Of these, funding recipients in modules 1 to 4 and in module 6 are financed through grants from the Federal Office of Economics and Export Control (BAFA) and low-interest loans with repayment

⁴ https://www.bmwk.de/Redaktion/DE/Evaluationen/Foerdermassnahmen/250130-evaluation-eeew-abschlussbericht.pdf?__blob=publicationFile&v=10

subsidies from KfW. The project management agency VDI/VDE Innovation + Technik GmbH has been commissioned for the tender scheme, which promotes technology-neutral decarbonisation in companies in parallel with module 4, as well as funding module 5. Applications can be submitted by companies based in Germany that are majority-owned by private individuals or municipal companies, as well as freelancers and contractors. Depending on the module, the funding amounts to between 25% and 60% of the eligible costs, with small and medium-sized enterprises (SMEs) receiving a bonus of 10% to 20%. Details on the exact funding conditions can be found in the applicable information sheets and funding guidelines.

As part of the measure, almost EUR 2.9 billion in funding was approved between its implementation in 2019 and the end of 2023. In addition, by the end of 2023, administrative costs of 36.7 million EUR were incurred.⁵ New final energy savings (gross savings) between 2019 and 2023 are between 1900 and 4260 GWh/a (whole program, including the tender scheme), according to the latest evaluation.⁶

Input data for the MICATool

An evaluation of the EE programme was conducted and included an assessment of the target achievement, effectiveness and economic efficiency in accordance with Section 7 of the Federal Budget Code (BHO) (Neusel et al. 2024). For the analysis of this funding program in the MICATool, the information from the evaluation report was adjusted by decomposing the funding modules and the additional tender scheme according to the types of EE measures and categories of the MICATool as follows:

- Improvement action 1: Cross-cutting technologies (Module 1 and Module 3)
- Improvement action 2a: Fuel switch (Module 2)
- Improvement action 2b: Fuel switch (Module 6)
- Improvement action 3a: Process-specific savings (Module 4)
- Improvement action 3b: Process-specific savings (Tender scheme)

Improvement action 1 combines the measures from module 1 and module 3 in the funding program. These measures from module 1 include the installation of highly efficient electric motors, pumps, fans and compressed air generators, as well as thermal insulation measures on existing systems, frequency converters for retrofitting electric motors, drives and pumps already in use at the company, and heat exchangers for utilising waste heat from existing systems, while the measures from module 3 include software and hardware related to the installation or use of energy or environmental management systems. Improvement action 2b and 3b are assessed separately from 2a and 3a, respectively, since the measures cannot be fully aligned with the measures defined in the modules due to variations in the parameters, e.g. lifetime of the technologies. The measures included in improvement action 2a include fuel switching with the installation of the systems for generating heat from renewable energies (solar collector systems, heat pumps, geothermal

⁵ https://www.bmwk.de/Redaktion/DE/Evaluationen/Foerdermassnahmen/241217-evaluation-eew-jahresbericht-2023.pdf?__blob=publicationFile&v=6

⁶ Table 170 in: https://www.bmwk.de/Redaktion/DE/Evaluationen/Foerdermassnahmen/241217-evaluation-eew-jahresbericht-2023.pdf?__blob=publicationFile&v=6

systems, biomass combustion systems) and to electricity from fossil-fuel based energy services, whereas the measures for 2b only took place from May 2023 and centre around the electrification of small companies through the placement of existing production facilities that run on natural gas, coal or mineral oil, or on energy sources derived from natural gas, coal or fossil oil (mineral oil), with new facilities that run on electricity or renewable energies. Improvement action 3a (module 4) aims to support small and medium enterprises to develop energy savings strategies, including the replacement of inefficient technologies, and are sector-specific but must lead to savings of at least 15%. The tender scheme described in improvement action 3b includes technology-neutral funding for investment measures aimed at optimising industrial and commercial facilities and processes in terms of energy and resource efficiency, and the use of heat from renewable energies and waste heat. Module 5 was not further considered as it targeted financial support for the planning phase of the implementation of energy efficiency measures.

The data used in the MICATool for the EEW between 2019 and 2023 in Germany is given in Table 6. This data shows for each improvement action the annual and total energy savings, annual and total investment costs, number of approved applications (benefiting from each improvement action), the share of the total investment costs subsidised, technological lifetime and the share of electricity affected through the implementation of the improvement actions. The share of fuel among fuel removed indicates the percentage of each energy carrier saved through the implementation of the improvement action. For the fuel switch improvement actions (2a, 2b), it is necessary to input the share of fuel removed for electricity as 0% (since this fuel is not saved but consumed) and distribute the remainder to the other fuels saved. Default values for various parameters are provided in the tool but can be adjusted if better or more relevant data is available.

Table 6: Input data for the Federal funding for energy and resource efficiency in industry (EEW) (2019-2023)

	2019	2020	2021	2022	2023
Improvement action 1: Cross-cutting technologies					
Annual end-use energy savings (GWh)	454	635	926	735	227
Annual investments (Mio. €)	189	273	297	364	428
Annual number of approved applications	6,093	7,204	8,897	6,892	6,775
Total end-use energy savings (GWh)	454	1,089	2,015	2,750	2,977
Total investments (Mio. €)	189	463	760	1,123	1,552
Average technology lifetime	7	7	7	7	7
Subsidy quota (%)	0.22	0.41	0.42	0.36	0.37
Share of fuel affected (%)					
Electricity	0.30	0.40	0.63	0.67	0.50
Coal	0.06	0.05	0.03	0.03	0.04
Biomass and waste	0.07	0.06	0.04	0.04	0.06
H ₂ and e-fuels	0.00	0.00	0.00	0.00	0.00
Oil	0.06	0.06	0.03	0.04	0.06
Gas	0.42	0.36	0.23	0.19	0.30
Heat	0.08	0.07	0.04	0.04	0.06
Improvement action 2a: Fuel switch					

	2019	2020	2021	2022	2023
Annual end-use energy savings (GWh)	1.1	2.2	2.2	24.6	23.7
Annual investments (Mio. €)	20	121	232	298	847
Annual number of approved applications	54	146	145	162	268
Total end-use energy savings (GWh)	1.1	3.3	5.5	30.1	53.8
Total investments (Mio. €)	20	141	373	672	1,519
Average technology lifetime	8	8	8	8	8
Subsidy quota (%)	0.50	0.47	0.46	0.45	0.43
Share of fuel removed (%)					
Electricity	0.00	0.00	0.00	0.00	0.00
Coal	0.08	0.09	0.08	0.09	0.07
Biomass and waste	0.11	0.11	0.11	0.11	0.11
H ₂ and e-fuels	0.00	0.00	0.00	0.00	0.00
Oil	0.09	0.10	0.09	0.11	0.12
Gas	0.60	0.60	0.61	0.57	0.59
Heat	0.12	0.11	0.11	0.11	0.11
Improvement action 3a: Process-specific savings					
Annual end-use energy savings (GWh)	2,007	1,786	3,800	2,642	4,800
Annual investments (Mio. €)	410	1,368	2,064	2,041	3,251
Annual number of approved applications	595	2,116	3,316	3,714	5,451
Total end-use energy savings (GWh)	2,007	3,793	7,593	10,235	15,035
Total investments (Mio. €)	410	1,778	3,842	5,883	9,134
Average technology lifetime	8	8	8	8	8
Subsidy quota (%)	0.12	0.13	0.16	0.15	0.19
Share of fuel affected (%)					
Electricity	0.87	0.29	0.14	0.19	0.16
Coal	0.01	0.06	0.07	0.08	0.06
Biomass and waste	0.01	0.07	0.09	0.09	0.10
H ₂ and e-fuels	0.00	0.00	0.00	0.00	0.00
Oil	0.01	0.07	0.08	0.09	0.10
Gas	0.08	0.42	0.52	0.46	0.50
Heat	0.02	0.08	0.10	0.09	0.09
Improvement action 2b: Fuel switch					
Annual end-use energy savings (GWh)	-	-	-	-	7
Annual investments (Mio. €)	-	-	-	-	16
Annual number of approved applications	-	-	-	-	251
Total end-use energy savings (GWh)	-	-	-	-	7
Total investments (Mio. €)	-	-	-	-	16
Average technology lifetime	-	-	-	-	17
Subsidy quota (%)	-	-	-	-	0.34
Share of fuel removed (%)					
Electricity	-	-	-	-	0.00
Coal	-	-	-	-	0.07
Biomass and waste	-	-	-	-	0.11
H ₂ and e-fuels	-	-	-	-	0.00
Oil	-	-	-	-	0.12
Gas	-	-	-	-	0.59

	2019	2020	2021	2022	2023
Heat	-	-	-	-	0.11
Improvement action 3b: Process-specific savings					
Annual end-use energy savings (GWh)	231	411	638	455	36
Annual investments (Mio. €)	32	93	53	148	180
Annual number of approved applications	26	39	27	24	51
Total end-use energy savings (GWh)	231	642	1,280	1,735	1,771
Total investments (Mio. €)	32	125	178	326	506
Average technology lifetime	8	8	8	8	8
Subsidy quota (%)	0.44	0.47	0.45	0.55	0.48
Share of fuel affected (%)					
Electricity	0.07	0.11	0.18	0.11	0.47
Coal	0.08	0.08	0.06	0.08	0.04
Biomass and waste	0.10	0.09	0.09	0.10	0.06
H ₂ and e-fuels	0.00	0.00	0.00	0.00	0.00
Oil	0.09	0.09	0.08	0.10	0.06
Gas	0.56	0.53	0.50	0.51	0.31
Heat	0.11	0.10	0.09	0.10	0.06
Total, all					
Annual end-use energy savings (GWh)	2,692	2,834	5,367	3,857	5,094
Annual investments (Mio. €)	651	1,855	2,646	2,852	4,723
Annual number of approved applications	6,768	9,505	12,385	10,792	12,796
Total end-use energy savings (GWh)	2,692	5,526	10,893	14,750	19,844
Total investments (Mio. €)	651	2,506	5,152	8,004	12,727
Average technology lifetime	9	9	9	9	9
Subsidy quota (%)	0.20	0.20	0.21	0.23	0.26
Share of fuel affected (%)					
Electricity	0.07	0.11	0.18	0.11	0.46
Coal	0.08	0.08	0.06	0.08	0.04
Biomass and waste	0.10	0.09	0.09	0.10	0.06
H ₂ and e-fuels	0.00	0.00	0.00	0.00	0.00
Oil	0.09	0.09	0.08	0.10	0.06
Gas	0.56	0.53	0.50	0.51	0.32
Heat	0.11	0.10	0.09	0.10	0.06

Source: (Neusel et al. 2024)

The average energy savings and investments and Megawatt-hour (MWh) saved per approved application due to the implementation of the EEW program is given in Table 7. The investment per MWh saved ranges from 83€-98,328€ per MWh and approved application, where the greatest investments and savings are shown to be derived from fuel switching as indicated in improvement action 2a.

Table 7: Average energy savings and investments per approved application due to the EEW by improvement action in Germany (2019-2023)

	2019	2020	2021	2022	2023
Improvement action 1: Cross-cutting technologies					

	2019	2020	2021	2022	2023
Average annual energy savings per approved application (MWh)	74	88	104	107	33
Average investment per approved application (€)	31,068	37,937	33,382	52,771	63,232
Average investment per approved application and MWh saved (€/MWh)	417	430	321	495	1,888
Improvement action 2a: Fuel switch					
Average annual energy savings per approved application (MWh)	20	15	15	152	89
Average investment per approved application (€)	350,000	793,836	1,500,690	1,725,309	2,855,970
Average investment per approved application and MWh saved (€/MWh)	17,151	53,336	98,328	11,368	32,261
Improvement action 3a: Process-specific savings					
Average annual energy savings per approved application (MWh)	3,373	844	1,146	711	881
Average investment per approved application (€)	503,193	413,043	441,315	360,393	436,177
Average investment per approved application and MWh saved (€/MWh)	149	489	385	507	495
Improvement action 2b: Fuel switch					
Average annual energy savings per approved application (MWh)	-	-	-	-	28
Average investment per approved application (€)	-	-	-	-	62,550
Average investment per approved application and MWh saved (€/MWh)	-	-	-	-	2,219
Improvement action 3b: Process-specific savings					
Average annual energy savings per approved application (MWh)	8,866	10,540	23,642	18,967	703
Average investment per approved application (€)	1,223,077	2,387,179	1,959,259	6,183,333	3,531,373
Average investment per approved application and MWh saved (€/MWh)	138	226	83	326	5,020
Average					
Average annual energy savings per approved application (MWh)	398	298	433	357	398
Average investment per approved application (€)	79,699	142,693	163,981	197,378	294,405
Average investment per approved application and MWh saved (€/MWh)	200	479	378	552	740

Source: own calculations based on (Neusel et al. 2024)

2.1.2. Results of the analysis of the EE measures

The MICATool provides the quantification of social, economic and environmental impacts as well as the monetisation of various indicators. This section will illustrate some specific impacts through sample results and show the overarching impacts of the different measures and how these can be linked to specific outcomes.

2.1.2.1. Quantification of physical values – Social impacts

The quantification of social impacts centres around health impacts as well as the improvement of living standards and is based on the empirical basis of social impacts documented in the SEED MICAT

fact sheets⁷. The indicators are connected to the general reduction of air pollution (see also environmental impacts) (mortality, hospitalisation and mitigated lost working days), the improvement of indoor climate (reduced cold-weather mortality and asthma cases), or energy welfare (energy poverty indicators). The results for these indicators are summarised in Table 8 for all three EE measures. These indicators, and comparing them across programmes, provides insights into which programme provides the greatest social benefits or improvement of health. As the Environmental bonus and the EEW are not targeting the residential sector they have only impacts for the indicators linked to the general reduction of air pollution.

Table 8: Quantification of social impacts related to energy efficiency measures in Germany (2021-2023) in the MICATool

		BEG 2021 - 2023	Environmental bonus 2016-2023	EEW 2019-2023
Avoided health effects linked to reduced air pollution				
Mortality	<i>Reduction in casualties (#)</i>	78	52	99
Hospital admissions		58	39	74
Avoided lost working days due to air pollution				
Avoided absences	<i>days</i>	27,010	18,892	35,048
Reduction in disability adjusted life years				
Avoided asthma cases	<i>years</i>	118	N/A	N/A
Estimated number of people lifted out of energy poverty				
M/2	<i>people</i>	214,737	N/A	N/A
2M	<i>people</i>	297,790	N/A	N/A
Reduction in excess cold weather mortality				
Reduction in casualties	<i>Reduction in casualties (#)</i>	184	N/A	N/A

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In comparison, building renovations and heater exchanges in the residential sector are expected to contribute not only to a reduction in air pollution, but also to improved living standards (resulting in a reduction of energy poverty) and a better indoor climate, which in turn contributes a reduction of cold weather mortality and avoided asthma cases. The MICATool allows these indicators to be quickly quantified. The results for the BEG quantify the sum of these effects for both improvement action 1 and improvement action 2. These BEG measures overall result in positive social impacts by avoiding negative health effects, absences from work and asthma cases as well as contributing to improved energy welfare and a reduction in the cases of excess cold weather mortality, particularly since these specifically target the residential sector. Mortality, hospital admissions and avoided absences have been quantified for each of the EE programmes and are related to the improvement of air quality related to reduced primary energy generation and are linked to this indicator in Section 2.1.2.3.

By exporting the results from the tool as an Excel file, it is possible to conduct further calculations to give, for example, an assessment of the impacts per unit of energy saved or investments made to ensure comparability across different programmes by placing results on a common scale across each of the programmes. Figure 3 depicts the specific avoided health impacts per unit of energy

⁷ https://doc.micatool.eu/social_indicators/social_indicators_description.html

saved over the duration of each of the three EE programmes. The BEG and Environmental bonus show the greatest improvement to health indicators per unit of energy saved for mortality and hospital admissions largely due to the greater reduction in direct air pollution and greenhouse gas emissions.

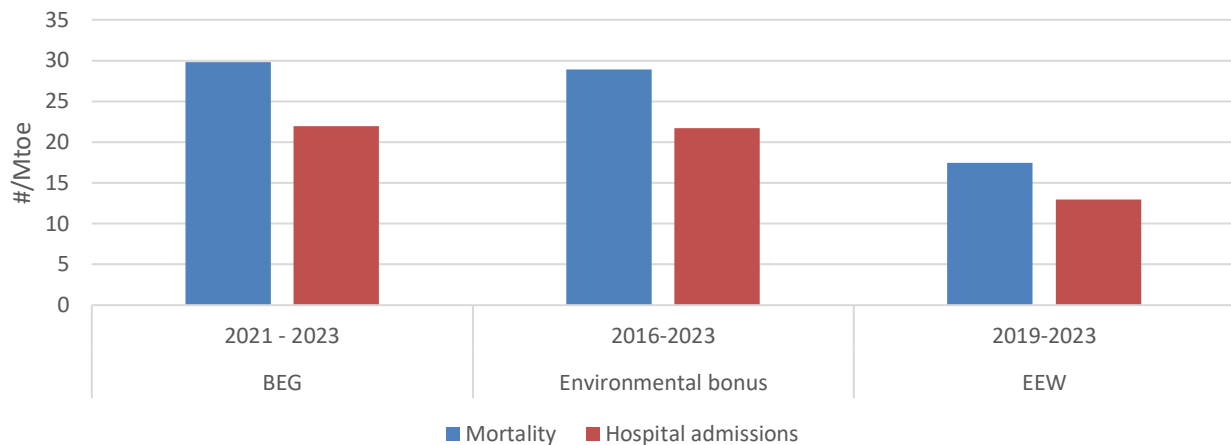


Figure 3: Specific avoided health impacts per unit of energy saved

In 2022, the attributable mortality in Germany related to air pollution was the third highest in Europe for long-term exposure to PM_{2.5}, NO₂ and the highest for O₃ with average years of lost life (YLL) per 100,000 inhabitants of 535, 155, and 231, respectively (EEA 2024). The contribution of each of the EE programmes over the duration of the programme towards the reduction of the estimated YLL per 100,000 inhabitants is 0.031, 0.007, and 0.02 for the BEG, Environmental bonus and EEW, respectively.

As a related indicator to the improvement of health impacts, Figure 4 shows the specific avoided lost working days per unit of energy saved over the duration of each of the three EE programmes, in which the BEG and Environmental bonus programmes perform correspondingly well towards reducing avoided absences from work.

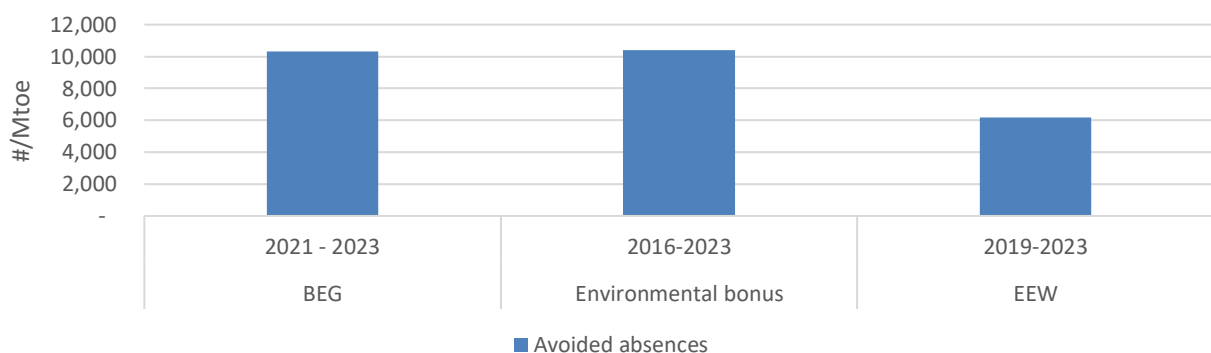


Figure 4: Specific avoided lost working days per unit of energy saved

Energy poverty indicators are only measured in the first EE programme, which is directly related to investments into EE of residential building envelopes and heater exchanges. Since only a small share

of the population is indirectly affected by the EE programme, as explained in Section 2.1.1.1., the number of people potentially lifted out of energy poverty per affected dwelling renovated over the duration of the program is rather modest and represent the share of population experiencing energy poverty related to the input values, as shown in Figure 5.

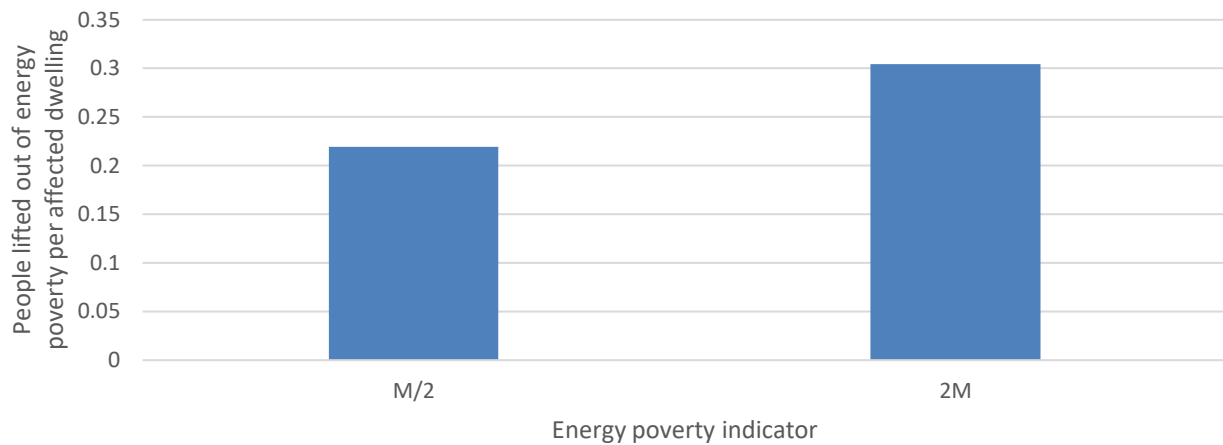


Figure 5: Number of people lifted out of energy poverty per affected dwelling renovated

Further graphical representations of the indicators for these EE programmes can be found in Annex A: Federal funding program for energy efficient buildings (BEG), Annex B: The directive to promote the sale of electric-powered vehicles (Environmental bonus), and Annex C: Federal Funding for Energy and Resource Efficiency in Industry (EEW).

2.1.2.2. Quantification of physical values – Economic impacts

The quantification of economic impacts focuses on energy and economic impacts related to the implementation of the measure and is based on the empirical basis of economic impacts documented in the SEED MICAT fact sheets⁸. The indicators assess the impact of EE measures on the energy system and the overall Gross Domestic Product (GDP) over the duration of the programmes and are summarised in Table 9.

Table 9: Quantification of economic impacts related to energy efficiency programs evaluated in Germany (2016-2023) in the MICATool

		BEG 2021 - 2023	Environmental bonus 2016-2023	EEW 2019-2023	
Energy impacts					
Energy intensity	<i>Change in ktoe/ Mio. €</i>	-0.75	-0.89	-0.93	
Import dependency	%	-0.002	0.006	-0.003	
Reduction of additional generation capacity	<i>MW</i>	528	-18,198	3,524	
	Onshore wind	<i>MW</i>	152	-5,405	1,261

⁸ https://doc.micatool.eu/economic_indicators/economic_indicators_description.html

		BEG	Environmental bonus	EEW
		2021 - 2023	2016-2023	2019-2023
Offshore wind	MW	11	-388	91
Solar	MW	365	-12,405	2,173
Economics and employment				
Gross Domestic Product	<i>Added value (Mio. €)</i>	67,331	27,475	8,145
Additional employment	<i>Full-time employment years (years)</i>	1,122,018	410,678	132,373

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Overall, the highest contribution towards the GDP and additional employment, is derived through the BEG programme with an added value of over 67 billion EUR and 1.1 million full-time employment years, respectively. The construction industry contributed an average of 4.9% to the total GDP in Germany between 2021 and 2023 (Destatis 2026), which translates to a 13% share from the BEG. Similarly, the BEG had the greatest contribution towards a reduction in energy intensity with a change of -0.75 ktoe per million EUR and an import dependency reduction of 0.2%.

By exporting the results from the tool as an Excel file, it is possible to conduct further calculations to give, for example, an assessment of the specific impacts per unit of energy saved or investments made so as to ensure comparability across different programmes by placing results on a common scale across each of the programmes. Figure 6 shows the specific impact on GDP per Euro invested for each of the EE programmes, reflecting the economic return (GDP generated) for each Euro of public investment thereby highlighting the relative economic effectiveness of each programme in stimulating economic activity through energy efficiency investments. The results indicate that BEG, Environmental Bonus, and EEW programmes yield average GDP increases of €0.67, €0.58, and €0.64 per euro invested, respectively. While all three programmes contribute positively to economic output, the BEG stands out as the most economically efficient in terms of return on investment. This is likely due to the nature of the programme, which stimulated labour-intensive building renovations which generate broader economic activity. In contrast, the Environmental Bonus, which shows the lowest GDP return, involves measures with shorter value chains or lower domestic economic multipliers. EEW, with a mid-range impact, reflects a more balanced economic effect.

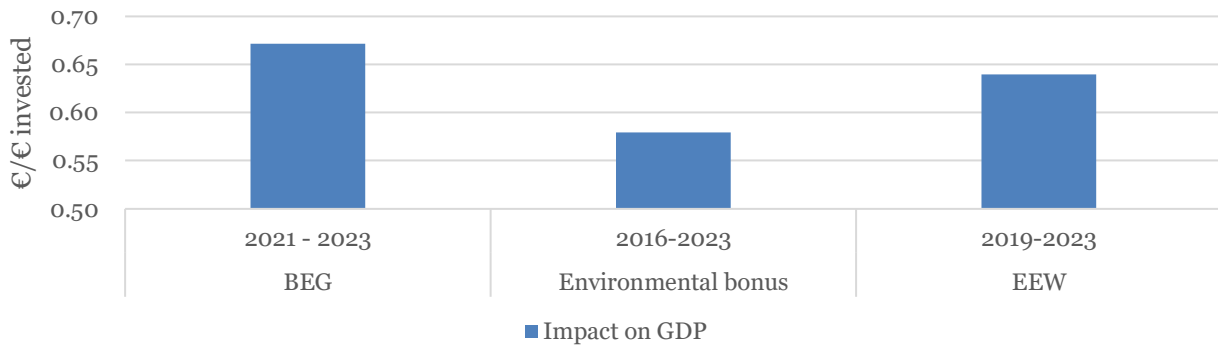


Figure 6: Specific impact on GDP per EUR invested by EE programme

Figure 7 shows the specific impact on additional full-time employment years per million euros invested across the duration of each EE programme. The BEG demonstrates the highest relative effectiveness in generating employment, with 11.2 full-time job years supported per million Euros invested, suggesting that the BEG not only delivers energy savings but also contributes more strongly to employment outcomes compared to the other programmes. The differences across the programmes point to the varying socio-economic co-benefits of the programmes, with BEG standing out as particularly effective in leveraging public investment to support job creation.

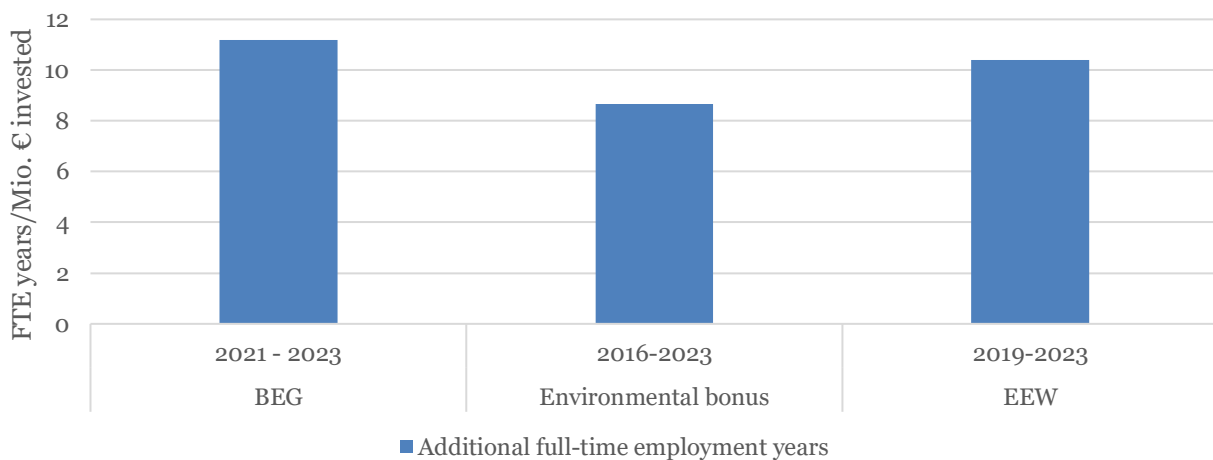


Figure 7: Specific impact on employment per million EUR invested by EE programme

Further graphical representations of the indicators for these EE programmes can be found in Annex A: Federal funding program for energy efficient buildings (BEG), Annex B: The directive to promote the sale of electric-powered vehicles (Environmental bonus), and Annex C: Federal Funding for Energy and Resource Efficiency in Industry (EEW).

2.1.2.3. Quantification of physical values – Environmental impacts

The quantification of the environmental impacts includes an overview of the impacts related to savings in primary energy, contribution to renewable energy source targets, and reduction in air

pollution and greenhouse gas emissions and is based on the empirical basis of environmental impacts documented in the SEED MICAT fact sheets⁹, as shown in Table 10.

Table 10: Quantification of environmental impacts related to energy efficiency programs evaluated in Germany (2016-2023) in the MICATool

		BEG	Environmental bonus	EEW
		2021 - 2023	2016-2023	2019-2023
Energy impacts				
Primary savings	<i>Total ktoe</i>	2,623	1,814	5,686
	Oil	643	5,416	395
	Coal	74	-1,441	692
	Gas	1,382	-840	3,840
	Biomass and renewable waste	459	-172	442
	Renewables	30	-778	92
	Other	35	-370	226
Change in RES targets	%	0.000	0.000	0.001
Emissions				
Reduction in air pollution	<i>kt</i>	7	26	15
	SO ₂	1	-4	3
	NOX	4	30	11
	PM _{2_5}	1	0	0
Reduction in greenhouse gas emissions (CO₂)	<i>kt</i>	6,455	8,423	12,974

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By exporting the results from the tool as an Excel file, it is possible to conduct further analyses to give, for example, an assessment of the energy savings or emissions reductions per investment made so as to ensure comparability across different programmes by placing results on a common scale across each of the programmes. Figure 8 illustrates the specific impacts on CO₂ emissions, while Figure 9 presents the air pollution impacts per unit of primary energy saved by the EE programmes. The Environmental Bonus achieves the largest specific reduction in net CO₂ emissions, primarily due to a substantial decrease in oil consumption, which has a relatively high emission factor. However, this programme is also associated with higher pollution, particularly SO₂, as a result of increased electricity demand and corresponding emissions from the power sector. The BEG and EEW programmes exhibit similar performance in terms of specific greenhouse gas emission reductions and air pollutant impacts. In absolute terms, however, the total reductions in primary energy use and emissions achieved by the EEW are approximately twice those of the BEG. While the industrial sector under the EEW primarily reduces coal, gas, and district heating consumption, the BEG achieves larger oil savings, which contribute to greater emission reductions due to oil's higher emission factor, as highlighted in Figure 10. Figure 10 highlights the specific impact on primary energy savings per unit of investment and exemplifies that overall, the EEW achieves greater savings per unit of investment at 0.45, followed by the Environmental bonus with a net of 0.04 and BEG with 0.03 ktoe/Mio. EUR.

⁹ https://doc.micatool.eu/ecologic_indicators/ecologic_indicators_description.html

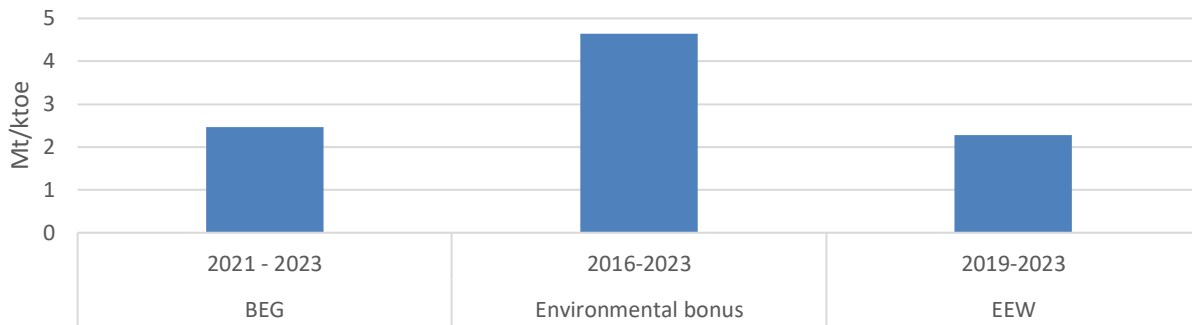


Figure 8: Specific impact on CO₂ emissions per unit of primary energy saved by EE programme

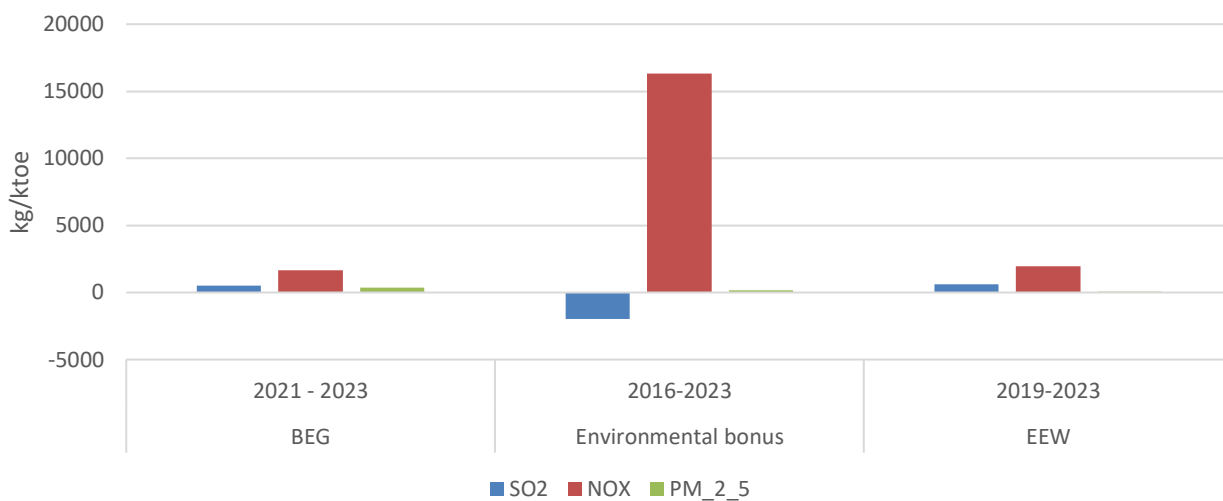


Figure 9: Specific impact on air pollution per unit of primary energy saved by EE programme

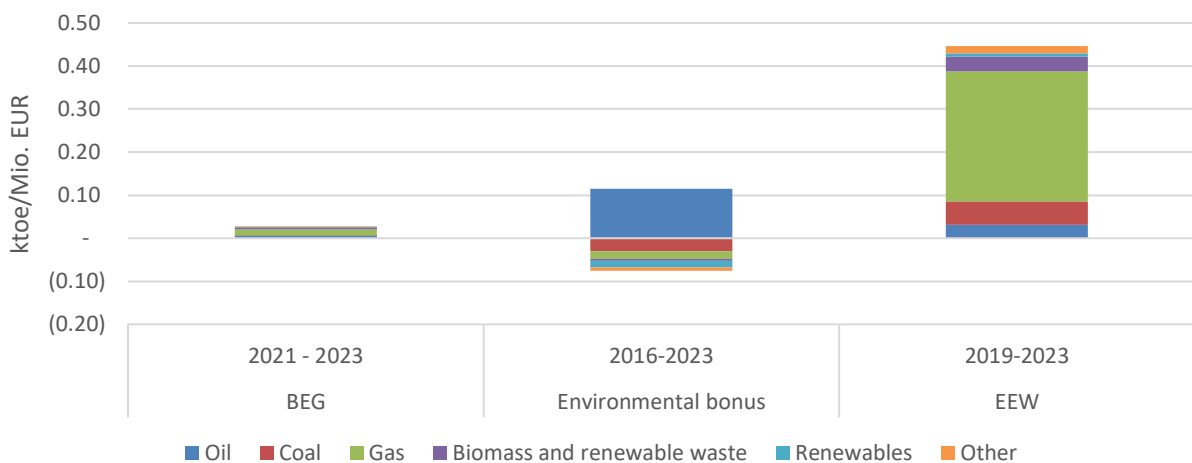


Figure 10: Specific impact on primary energy saved per million EUR invested by EE programme

Further graphical representations of the indicators for these EE programmes can be found in Annex A: Federal funding program for energy efficient buildings (BEG), Annex B: The directive to promote

the sale of electric-powered vehicles (Environmental bonus), and Annex C: Federal Funding for Energy and Resource Efficiency in Industry (EEW).

2.1.2.4. Monetisation – Results of the monetisation of the physical values

Monetising indicators translates non-financial, qualitative, and environmental/social impacts into monetary terms (e.g., EUR). By establishing a single, comparable unit for a broad spectrum of often intangible effects, this approach supports more informed decision-making, enhances cost-benefit analyses, and enables externalities to be incorporated into business or policy assessments. However, not all indicators described above can be monetised, e.g. because they are of a purely theoretical nature and do not generate a direct, measurable benefit, or because assigning a monetary value is either not feasible or not appropriate. This may be the case, for example, when no robust valuation approach is available or when monetisation would distort results through double counting. For example, the environmental indicator “reduction in air pollution” captures the avoided emissions of PM_{2.5}, NO_x and SO₂, but if these effects were also expressed in monetary terms, they would be double accounted, as they are already reflected in the first two social indicators on air quality. Table 11 shows the results of the monetisation of the EE programmes over the (analysed) duration of the programmes given as undiscounted values. The majority of the benefits are generated through the impact on GDP, representing 92%, 75% and 54% for the BEG, Environmental bonus and EEW, respectively. The reduction in energy costs are the savings accrued to the end-user related to the implementation of the EE measures and represent the second greatest benefit, making up 5%, 17% and 27% of the total social benefits for the BEG, Environmental bonus and EEW, respectively. Overall, compared to the investments made, the EEW generated the greatest multiple benefits with a factor of 0.9 benefits generated per million EUR invested.

Table 11: Monetisation of the multiple impacts related to energy efficiency programs evaluated in Germany (2016-2023) in the MICATool

		BEG 2021 - 2023	Environmental bonus 2016-2023	EEW 2019-2023
Reduction of energy costs	<i>Total savings in Mio. €</i>	2,766	3,191	2,612
Reduction of greenhouse gas emissions	<i>Value in Mio. €</i>	1,197	1,962	561
Health effects linked to reduced air pollution	<i>Value in Mio. €</i>	205	208	198
Avoided asthma cases	<i>Value in Mio. €</i>	11	N/A	N/A
Avoided excess cold winter mortality	<i>Value in Mio. €</i>	470	N/A	N/A
Avoided lost working days due to air pollution	<i>Value in Mio. €</i>	3	4	7
Impact on RES targets	<i>Value in Mio. €</i>	58	39	120
Impact on gross domestic product	<i>Value in Mio. €</i>	67,331	27,475	8,145
Total multiple benefits generated per million EUR invested	<i>Mio. €/ Mio. €</i>	0.72	0.69	0.91

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Figure 11 shows the overall comparison of the total investment and the distribution of the multiple benefits for the BEG, Environmental bonus and EEW programmes.

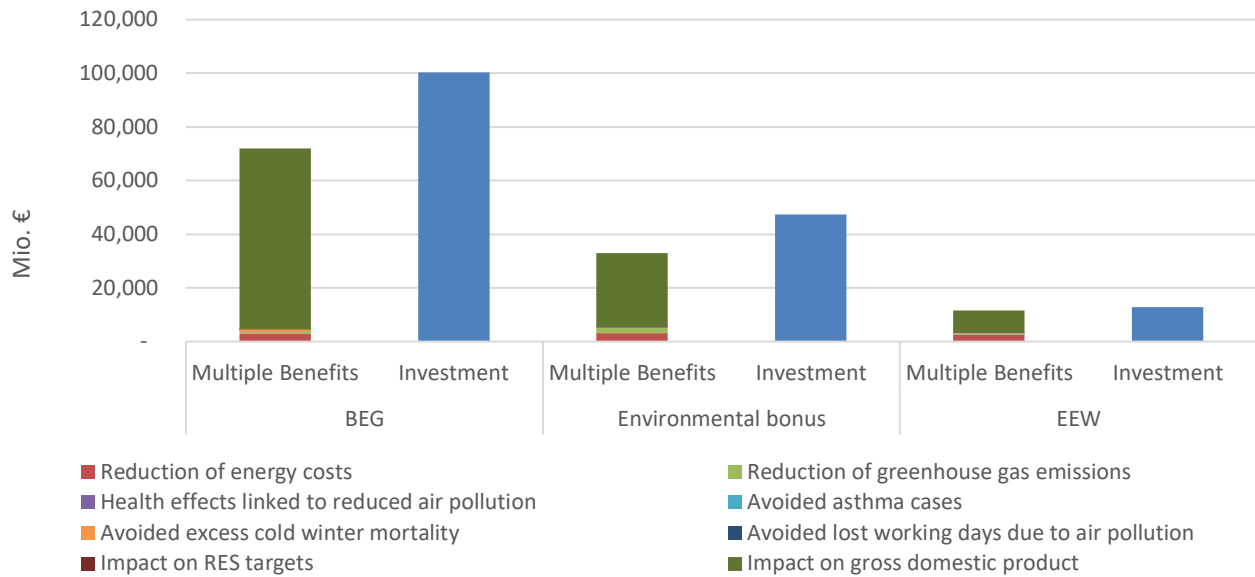


Figure 11: Monetisation of key indicators and comparison of total investment and multiple benefits by EE programme

2.1.2.5. Cost-benefit analysis – Results of the cost-effectiveness

The cost-benefit analysis offers information about the annuity, net present value (NPV), levelised costs of energy savings and carbon dioxide, cost-benefit ratio and benefit-cost ratio¹⁰. The weighted annuity is the annualised value of a project's costs and benefits expressed as yearly payments over its lifetime. For the annuity, a negative value means annual benefits exceed costs, signalling financial viability, while a positive value indicates the opposite. For the NPV, a positive value indicates the projected earnings exceed the costs, while a negative value indicates the opposite. As seen in Figure 11, the impact on GDP has the greatest influence. The purpose of the EE programmes also included a large component to not only increase EE but also to stimulate the economy, which can be identified with this indicator. To compare the impacts of the various components of the MI, the CBA is assessed first for the impact of energy cost reductions only and is presented in Table 12. These indicators without the impact of GDP are presented in Table 12 and vary widely by EE programme and by improvement action within the EEW EE programme due to the nature of the programme (e.g. in EEW2a there was much greater uptake in the last two years (>+1000%), which overall skew the results leading to very high levelised costs of both energy and CO₂). Given the weighted annuity (excluding the impact on GDP), the BEG shows the most significant benefit overall (negative annuity) with a positive NPV. The levelised cost of energy (LCOE) represents the average cost per kilowatt-hour of energy produced or saved over a project's lifetime and serves as a benchmark to compare technologies, while in the MICATool it additionally incorporates energy savings, renewable generation, and multiple impacts, which can outweigh costs and yield negative LCOE values, with the reported figure averaged over the programme duration and weighted by each year's new annual

¹⁰ The CBA assessment includes default indicators for reduction of energy costs, reduction of GHG emissions, health effects, asthma cases, cold winter mortality, avoided lost working days, impact on RES and are calculated by default with a discount rate of 3%.

savings. The most beneficial impact for LCOE is seen in the Environmental bonus through the significant savings in oil. Excluding the outliers for the fuel switch in EEW (2a, 2b) and the Environmental bonus, the average LCOE and Levelised Costs of CO₂ emission savings (LCOCO₂) are 53 EUR and 217 EUR, respectively, which is in line with the estimated social costs of GHG¹¹ of 300 EUR in 2024.

Table 12: Overview of Cost-benefit indicators from the MICATool without the impact of GDP

		BEG	Environmental bonus	EEW1	EEW2a	EEW3a	EEW2b*	EEW3b
Weighted Annuity	<i>Mio. €</i>	-€ 26	€ 461	-€ 48	€ 39	-€ 71	€ 686	-€ 30
Net Present Value	<i>Mio. €</i>	€ 504	-€ 5,504	€ 300	-€ 275	€ 497	-€ 9,033	€ 212
LCOE	<i>EUR/MWh</i>	-€ 22	€ 222	-€ 81	€ 8,268	-€ 24	€ 485	-€ 85
LCOCO₂	<i>EUR/t CO₂</i>	-€ 99	€ 973	-€ 323	€ 447,268	-€ 109	€ 13,170	-€ 336
CBR	<i>Absolute</i>	1.1	1.8	0.6	-92.2	0.8	0.0	0.4
BCR	<i>Absolute</i>	1.0	0.5	1.6	-0.01	1.2	-563.6	2.5

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* Note: The EEW2b programme performs relatively worse in some respects as it was only active in the final year of funding programme and focused on fuel-switching only, resulting in a compressed investment period and limited time for benefits to materialise compared to the multi-year programmes.

3. CONCLUSIONS

The showcase for Germany focuses on three energy efficiency programs—the Federal funding program for energy efficient buildings (BEG), the Directive to promote the sale of electric-powered vehicles (Environmental bonus), and the Federal funding for energy and resource efficiency in industry (EEW)—which were selected because they target different sectors (residential, transport, industry), providing a broader overview of the implementation and outcomes of energy efficiency policies and their impact on supporting the achievement of the energy efficiency first principle in Germany. Each programme consisted of various energy efficiency measures categorised by their type and sector. The data for the analysis was drawn from ex-post evaluations of the programmes and were entered into the tool with minimal additional steps to align the input data with the required formats of the tool, and as such was relatively simple to complete the necessary information for the tool to operate.

The outputs of the MICATool provided an overview of the multiple impacts for various social, economic and environmental indicators beyond those assessed in the evaluation reports, which focussed on the three dimensions of target achievement, impact and cost-effectiveness control in accordance with Section 7 of the Federal Budget Code (BHO). In addition to the primary and final energy savings, GHG emissions, and costs evaluated in the reports, the MICATool gives insights to further social impacts (health, mortality and morbidity), economic impacts (GDP, employment, energy intensity, import dependence) and environmental impacts (additional air pollutants, RES

¹¹ <https://www.umweltbundesamt.de/daten/umwelt-wirtschaft/gesellschaftliche-kosten-von-umweltbelastungen#methodik-zur-schtzung-von-klimakosten->

target), as well as the monetisation and a cost-benefit analysis. These results showed which EE programme has substantial impacts (both positive and negative) in specific dimensions of interest from a societal perspective. For example, while only the BEG improved the energy poverty dimensions for the residential sector, the Environmental bonus gave the most significant reductions for the mortality and hospital admissions due to air pollution owing to the greater reduction in oil-based fuel consumption. The BEG followed closely by the EEW programme contributed the most towards increasing the GDP and employment, so the added societal benefit of further investing in these programmes has economic knock-on effects that can be quantified with the MICATool. The monetisation of the results within the MICATool it is possible to establish a single, comparable unit for a broad spectrum of often intangible effects, which supports a more informed decision-making, enhances cost-benefit analyses, and enables externalities to be incorporated into business or policy assessments.

MICATool's flexible approach enables the inclusion of MIs in any policy assessment, even with limited case-specific data, by leveraging a rich database of validated default values to provide an initial, high-level assessment of which impacts warrant further investigation. As additional data become available, users can input them to obtain more accurate results and to explore sensitivity to key parameters. Regardless of data availability, the tool facilitates stakeholder discussions on which impacts matter for the decision and which options appear most advantageous given the impacts and parameter sensitivities.

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ANNEXES

ANNEX A: FEDERAL FUNDING PROGRAM FOR ENERGY EFFICIENT BUILDINGS (BEG)

Further information on this EE programme can be found in 2.1.1.1 EE program 1: Federal funding program for energy efficient buildings (BEG).

A.1 Quantification of multiple impacts for the BEG in Germany (2021-2023)

A.1.1. Social impacts

Table 13: Quantification of the social impacts for the BEG in Germany (2021-2023) in the MICATool

		2021	2022	2023
Avoided health effects linked to reduced air pollution				
Mortality	<i>Reduction in casualties (#)</i>	5	32	41
Hospital admissions		4	24	30
Avoided lost working days due to air pollution				
Avoided absences	<i>days</i>	1,902	11,174	13,934
Reduction in disability adjusted life years				
Avoided asthma cases	<i>years</i>	15	58	45
Estimated number of people lifted out of energy poverty				
M/2	<i>people</i>	10,992	111,752	91,993
2M	<i>people</i>	16,225	150,464	131,101
Reduction in excess cold weather mortality				
Reduction in casualties	<i>Reduction in casualties (#)</i>	12	88	84

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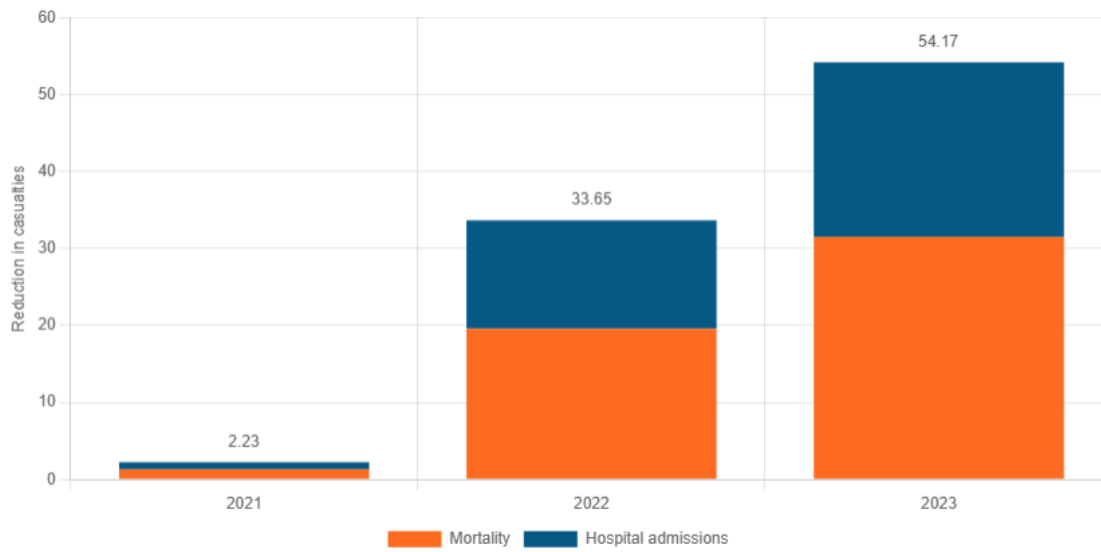


Figure 12: Health effects linked to reduced air pollution (BEG)

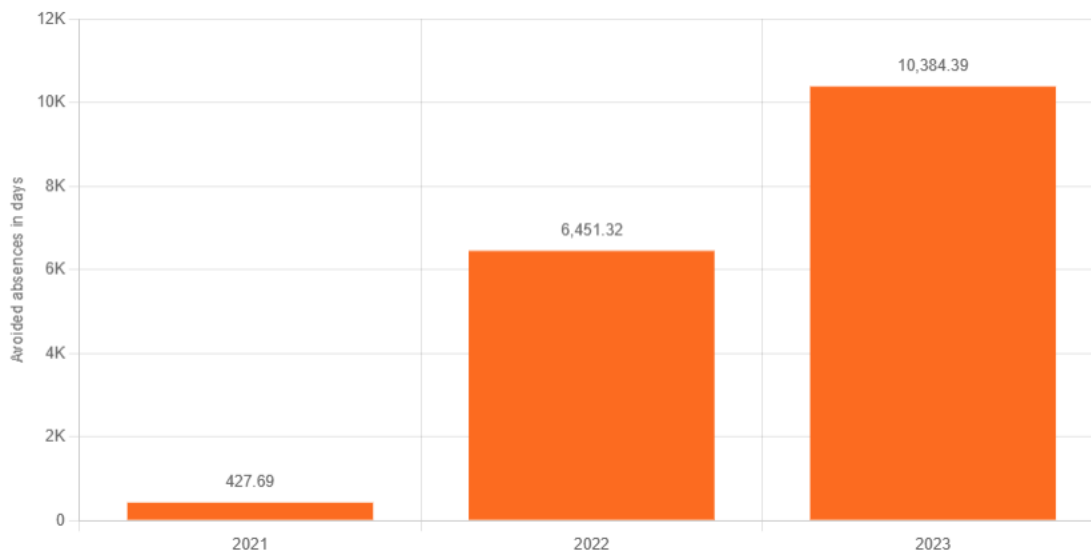


Figure 13: Avoided working days due to air pollution (BEG)

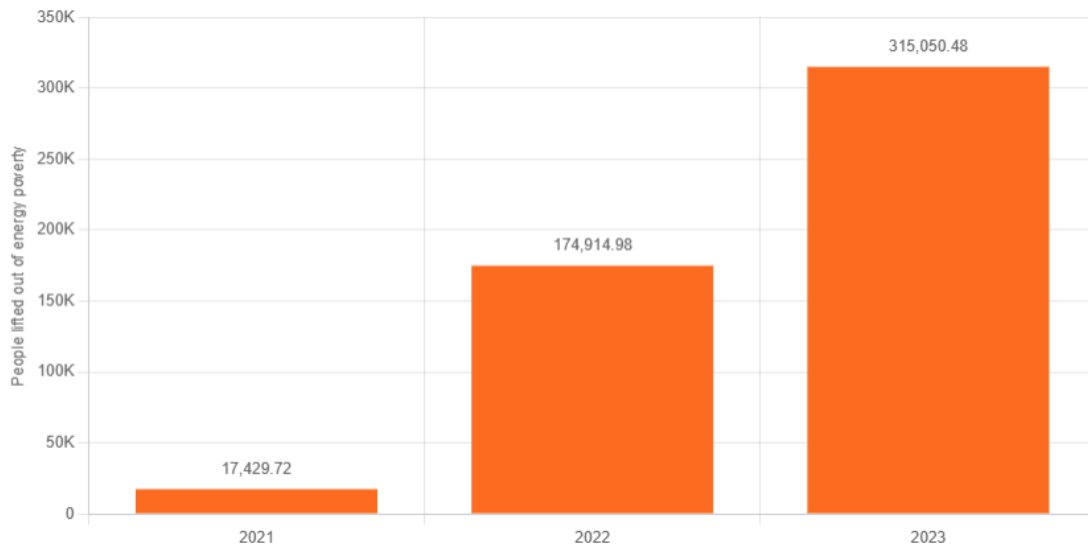


Figure 14: Alleviation of energy poverty (M/2) (BEG)

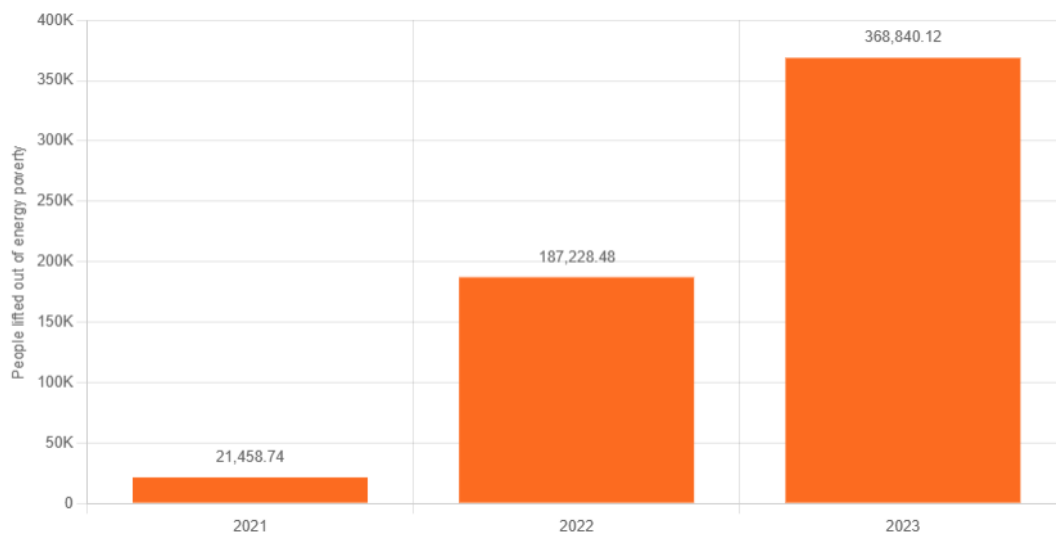


Figure 15: Alleviation of energy poverty (2M) (BEG)

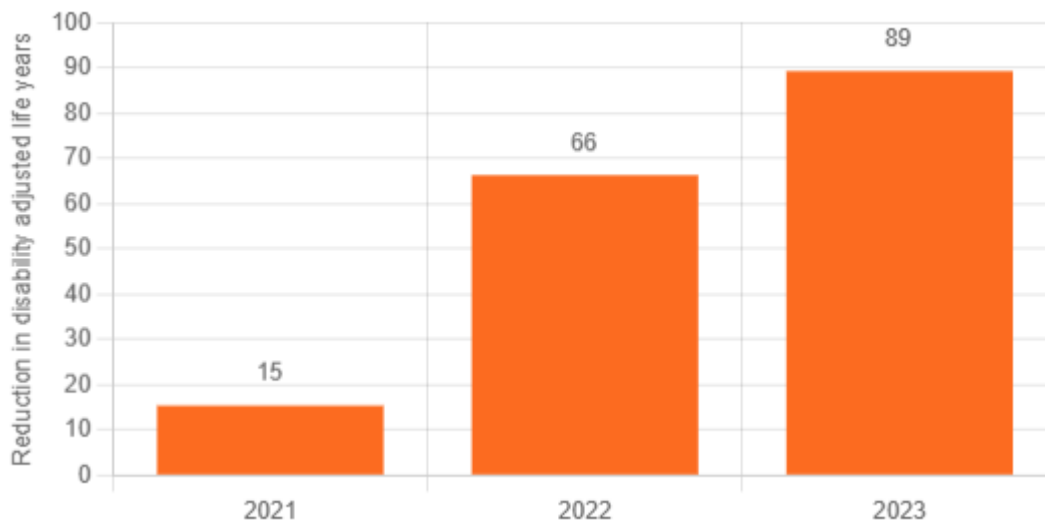


Figure 16: Avoided asthma cases (BEG)

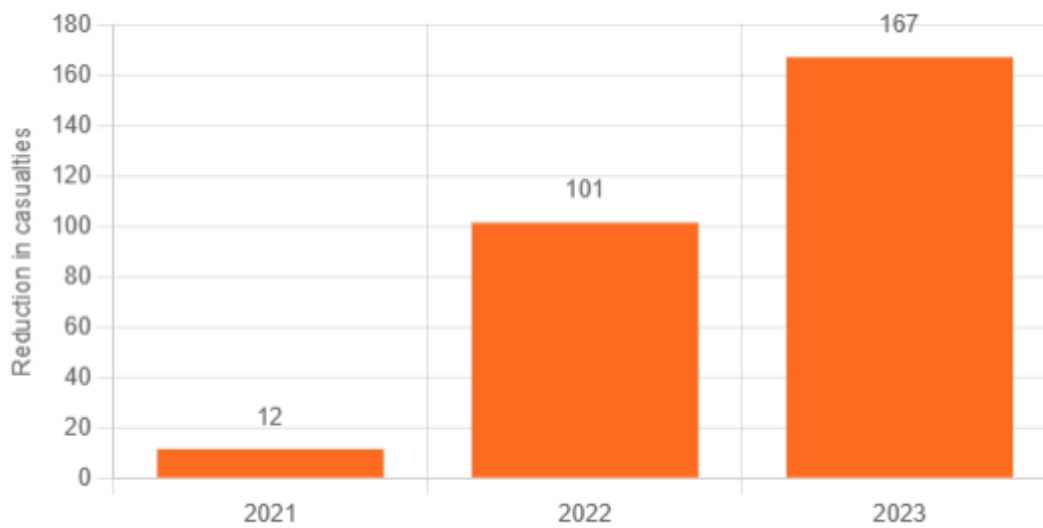


Figure 17: Reduction in excess cold weather mortality (BEG)

A.1.2. Economic impacts

Table 14: Quantification of the economic impacts for the BEG in Germany (2021-2023) in the MICATool

		2021	2022	2023
Energy impacts				
Energy intensity	<i>Change in ktOE/ Mio. €</i>	-0.31	-1.47	-0.75
Import dependency	%	0.000	-0.001	-0.002
Reduction of additional generation capacity	<i>MW</i>	31.6	186.6	309.4
Onshore wind	<i>MW</i>	9.9	55.3	86.7
Offshore wind	<i>MW</i>	0.7	4.0	6.3
Solar	<i>MW</i>	21.0	127.4	216.5
Economics and employment				
Gross Domestic Product	<i>Added value (Mio. €)</i>	8,334	43,219	15,778
Additional employment	<i>Full-time employment years</i>	139,576	716,528	265,914

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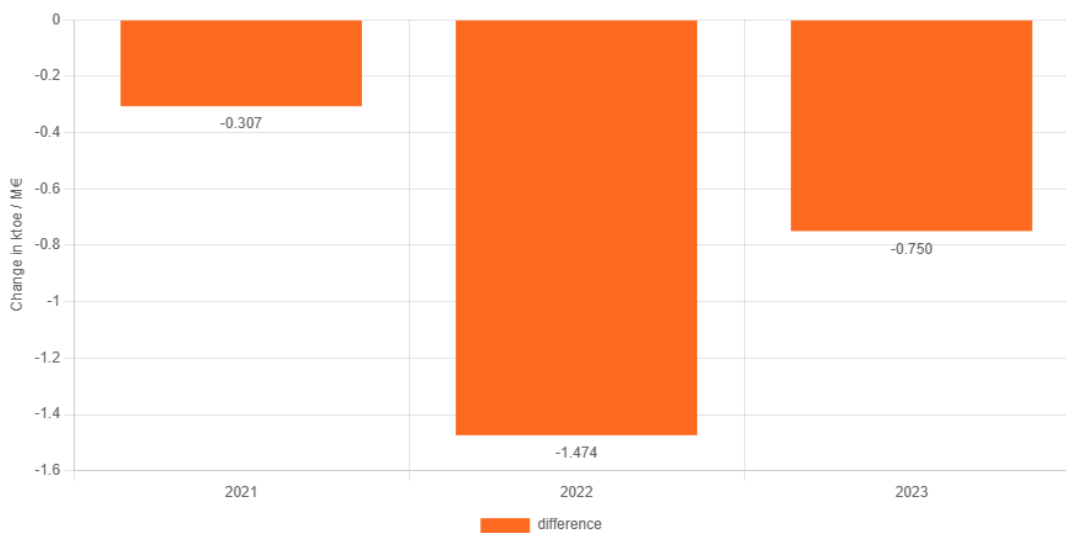


Figure 18: Impact on energy intensity (BEG)

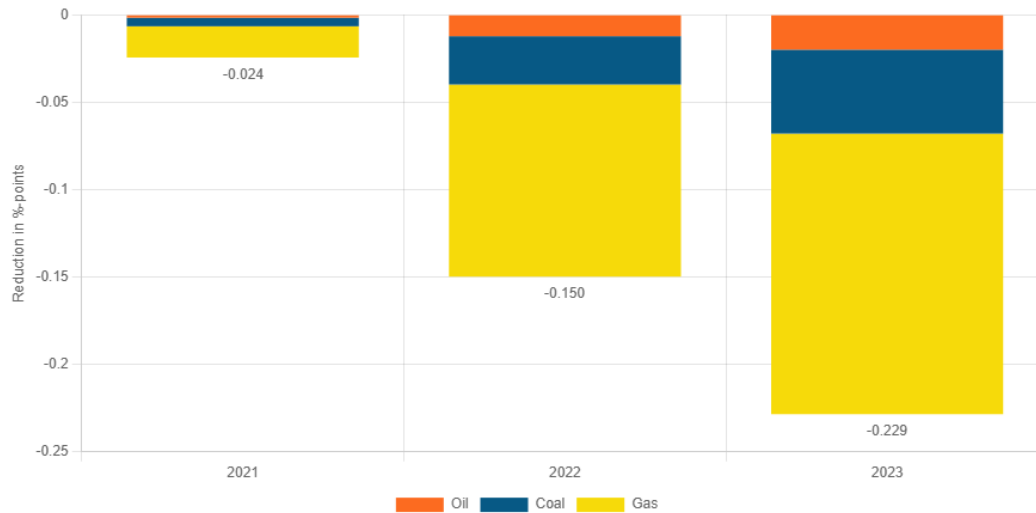


Figure 19: Impact on import dependence (BEG)

A.1.3. Environmental impacts

Table 15: Quantification of the environmental impacts for the BEG in Germany (2021-2023) in the MICATool

		2021	2022	2023
Energy impacts				
Primary savings	<i>Total ktoe</i>	181.7	1,020.8	1,420.4
	Oil <i>ktoe</i>	32.5	253.4	357.5
	Coal <i>ktoe</i>	5.2	30.0	38.6
	Gas <i>ktoe</i>	107.9	523.7	750.2
	Biomass and renewable waste <i>ktoe</i>	31.6	190.1	237.4
	Renewables <i>ktoe</i>	1.4	9.9	18.6
	Other <i>ktoe</i>	3.1	13.7	18.2
	Electricity <i>ktoe</i>	0.000	0.000	0.000
Change in RES targets	%	181.7	1,020.8	1,420.4
Emissions				
Reduction in air pollution	<i>kt</i>	0.5	2.7	3.5
	SO ₂ <i>kt</i>	0.1	0.5	0.7
	NOX <i>kt</i>	0.3	1.7	2.3
	PM _{2_5} <i>kt</i>	0.1	0.4	0.5
Reduction in greenhouse gas emissions (CO₂)	<i>kt</i>	438.3	2,524.1	3,492.1

Status of data and SEED MICATool 03.03.2026

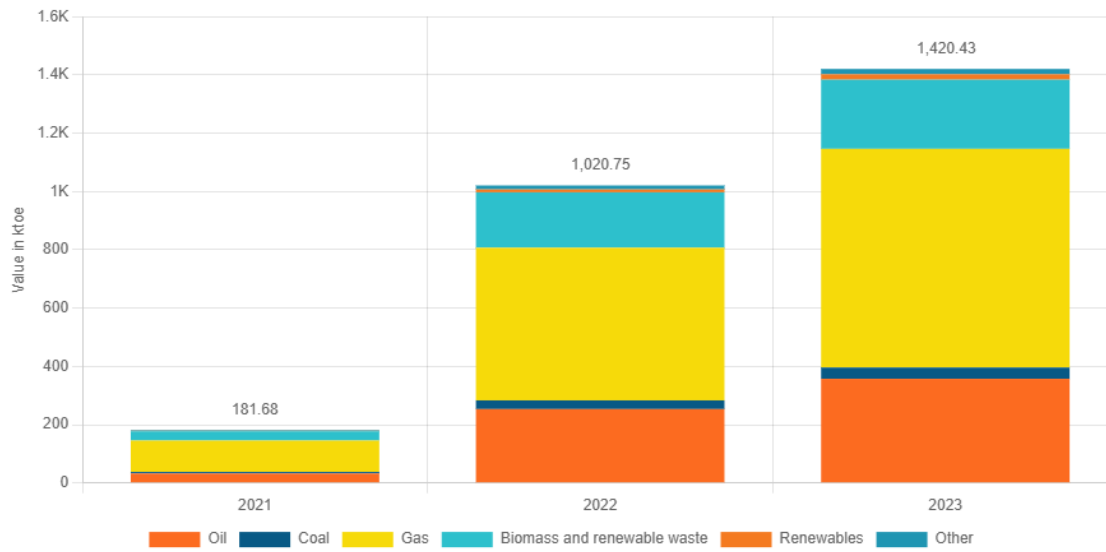


Figure 20: Primary savings by energy carriers (BEG)

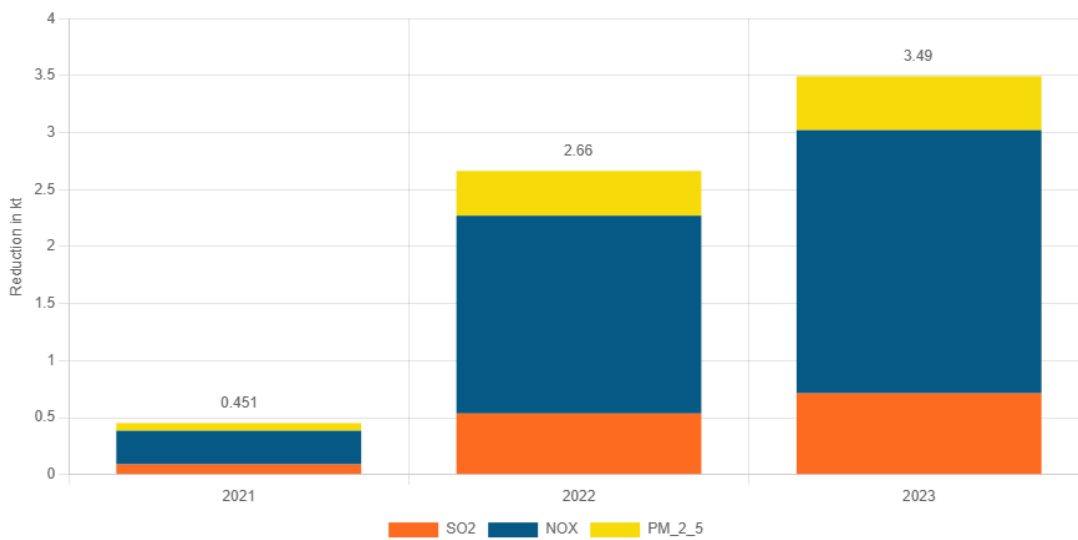


Figure 21: Reduction in air pollution (BEG)

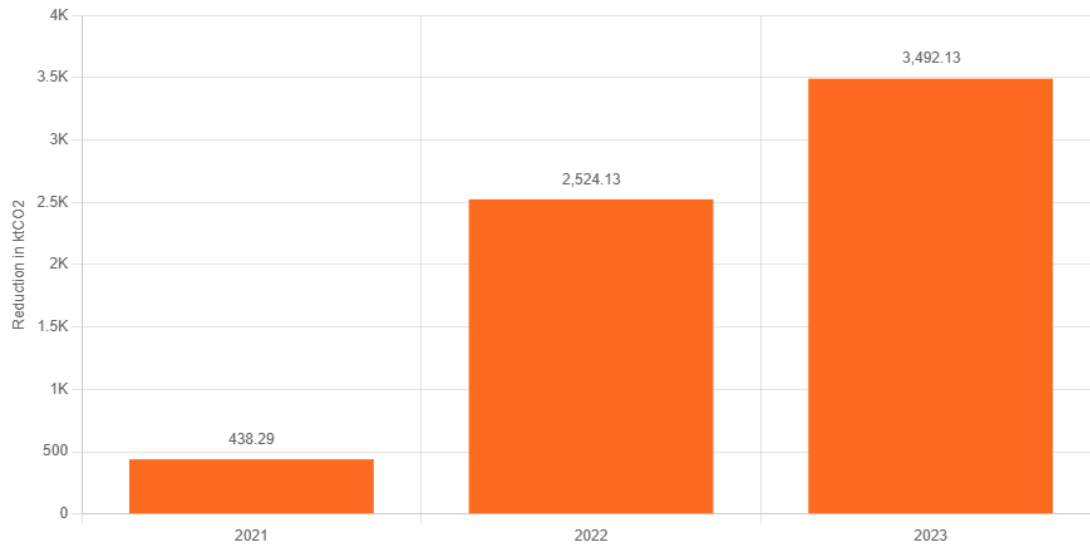


Figure 22: Reduction in greenhouse gas emissions (BEG)

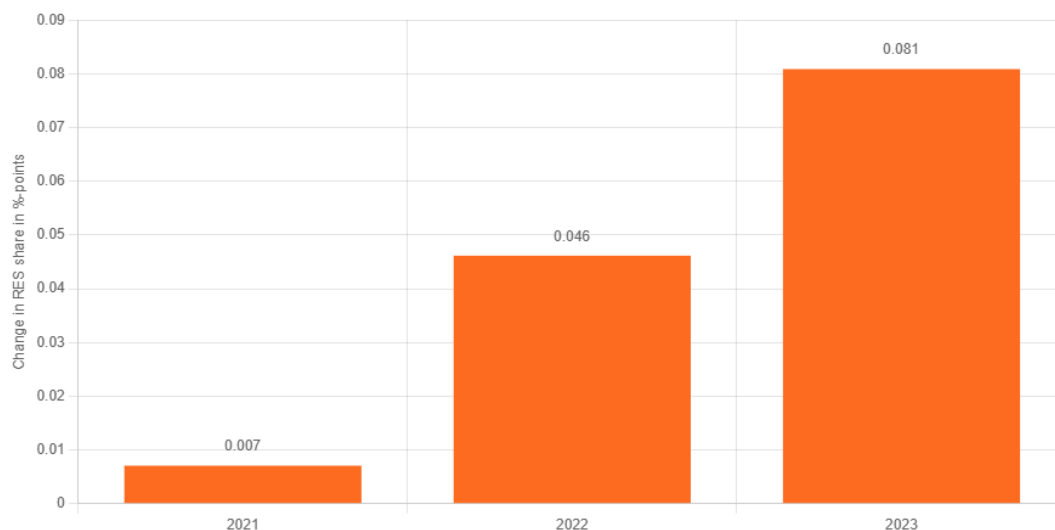


Figure 23: Impact on RES targets (BEG)

A.1.4. Monetisation

Table 16: Monetisation of the multiple impacts for the BEG in Germany (2021-2023) in the MICATool

		2021	2022	2023
Reduction of energy costs	<i>Total savings in Mio. €</i>	173.5	1,048.0	1,544.7
	Electricity <i>Savings in Mio. €</i>	13.7	80.7	133.5
	Oil <i>Savings in Mio. €</i>	26.9	234.8	370.1
	Coal <i>Savings in Mio. €</i>	1.3	7.6	12.2
	Gas <i>Savings in Mio. €</i>	77.6	408.4	622.3
	Biomass and Waste <i>Savings in Mio. €</i>	38.3	236.4	287.6

		2021	2022	2023
Heat	<i>Savings in Mio. €</i>	15.7	80.1	118.9
H2 and e-fuels	<i>Savings in Mio. €</i>	-	-	-
Reduction of greenhouse gas emissions	<i>Value in Mio. €</i>	32.9	378.6	785.7
Health effects linked to reduced air pollution	<i>Value in Mio. €</i>	5.8	68.7	130.9
Avoided asthma cases	<i>Value in Mio. €</i>	0.6	4.7	5.4
Avoided excess cold winter mortality	<i>Value in Mio. €</i>	12.4	188.8	269.2
Avoided lost working days due to air pollution	<i>Value in Mio. €</i>	0.1	1.1	2.1
Impact on RES targets	<i>Value in Mio. €</i>	3.4	21.3	33.5
Impact on Gross Domestic Product	<i>Value in Mio. €</i>	8,333.8	43,267.7	15,729.6
Added asset value of buildings	<i>Value in Mio. €</i>	5,350.3	32,316.2	47,630.0

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ANNEX B: THE DIRECTIVE TO PROMOTE THE SALE OF ELECTRIC-POWERED VEHICLES (ENVIRONMENTAL BONUS)

Further information on this EE programme can be found in 2.1.1.2 EE program 2: The directive to promote the sale of electric-powered vehicles (Environmental bonus).

B.1. Quantification of multiple impacts for the Directive to promote the sale of electric-powered vehicles (Environmental bonus)

B.1.1. Social impacts

There are no values for the indicators for avoided asthma cases, the energy poverty indicators or the reduction in excess cold weather mortality as the measures have no direct impact.

Table 17: Quantification of the social impacts for the directive to promote the sale of electric-powered vehicles (Environmental bonus) in the MICATool

		2016	2017	2018	2019	2020	2021	2022	2023
Avoided health effects linked to reduced air pollution									
Mortality	<i>Reduction in casualties</i>	0.3	1.5	3.2	5.9	12.8	28.3	47.4	58.7
Hospital admissions	<i>(#)</i>	0.2	1.2	2.5	4.5	9.6	21.1	35.2	43.3
Avoided lost working days due to air pollution									
Avoided absences	<i>days</i>	110.3	574.1	1,202.2	2,179.8	4,629.6	10,077.6	16,703.8	20,332.4
Reduction in disability-adjusted life-years									
Avoided asthma cases	<i>years</i>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Estimated number of people lifted out of energy poverty									
M/2	<i>people</i>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2M	<i>people</i>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Reduction in excess cold weather mortality									
Reduction in casualties	<i>Reduction in casualties (#)</i>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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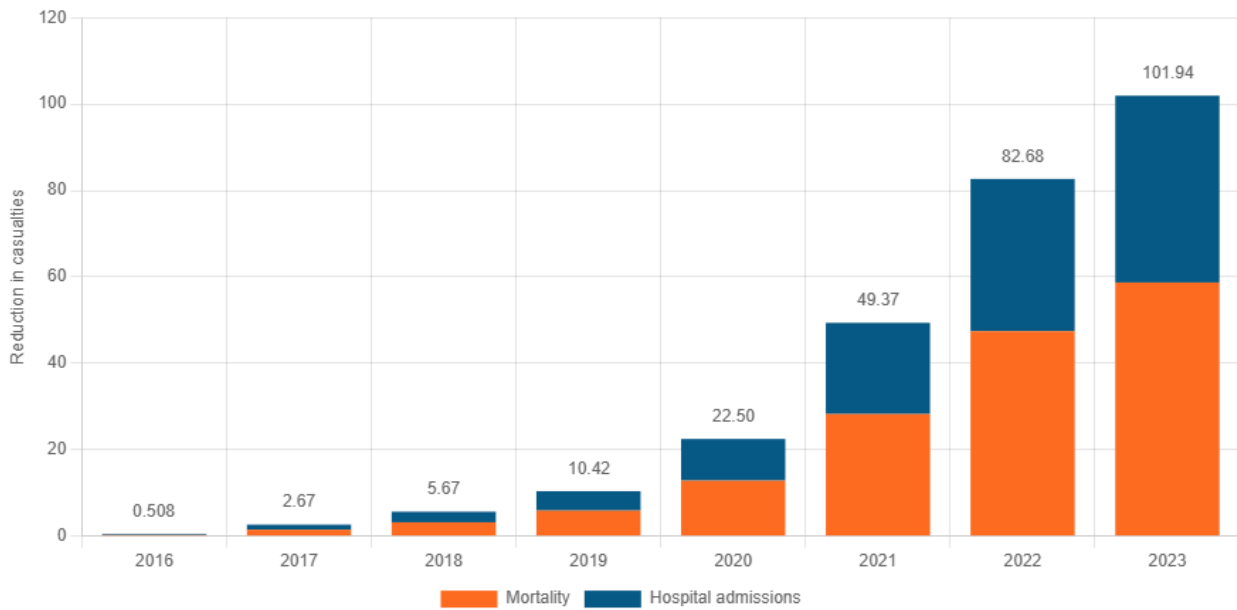


Figure 24: Health effects linked to reduced air pollution (Environmental bonus)

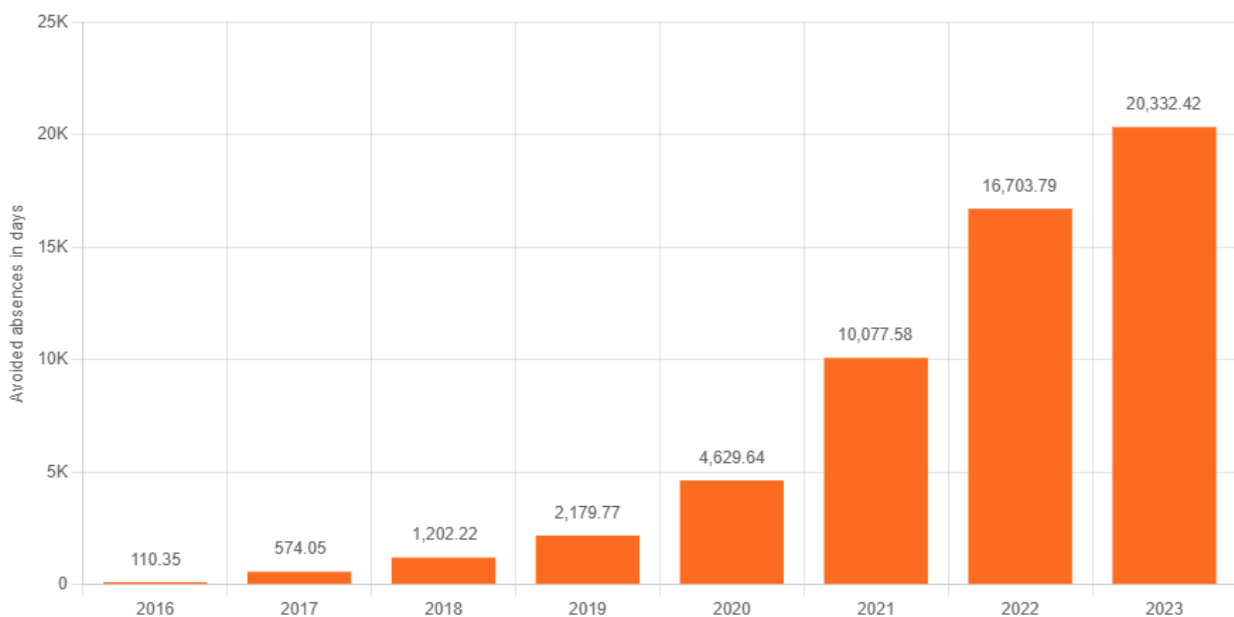


Figure 25: Avoided working days due to air pollution (Environmental bonus)

B.1.2. Economic impacts

Table 18: Quantification of the economic impacts for the directive to promote the sale of electric-powered vehicles (Environmental bonus) in the MICATool

		2016	2017	2018	2019	2020	2021	2022	2023
Energy impacts									
Energy intensity	Change in ktoe/ Mio. €	0.0	0.0	0.0	-0.1	-0.2	-0.5	-0.8	-0.9
Import dependency	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

		2016	2017	2018	2019	2020	2021	2022	2023
Reduction of additional generation capacity	<i>MW</i>	-21.2	-115.8	-259.5	-509.1	-1185.2	-2908.2	-5485.9	-7713.5
Onshore wind	<i>MW</i>	-7.5	-42.5	-93.6	-175.9	-391.4	-908.9	-1624.5	-2161.1
Offshore wind	<i>MW</i>	-0.4	-2.3	-5.9	-12.8	-28.7	-65.0	-116.8	-156.3
Solar	<i>MW</i>	-13.4	-71.0	-160.1	-320.5	-765.1	-1934.4	-3744.7	-5396.1
Economics and employment									
Gross domestic product	<i>Added value (Mio. €)</i>	66.7	277.1	448.7	811.6	2,278.1	5,970.7	9,564.7	8,057.5
Additional employment	<i>Full-time employment years</i>	996.4	4,141.7	6,706.4	12,130.5	34,052.0	89,245.7	142,966.5	120,438.4

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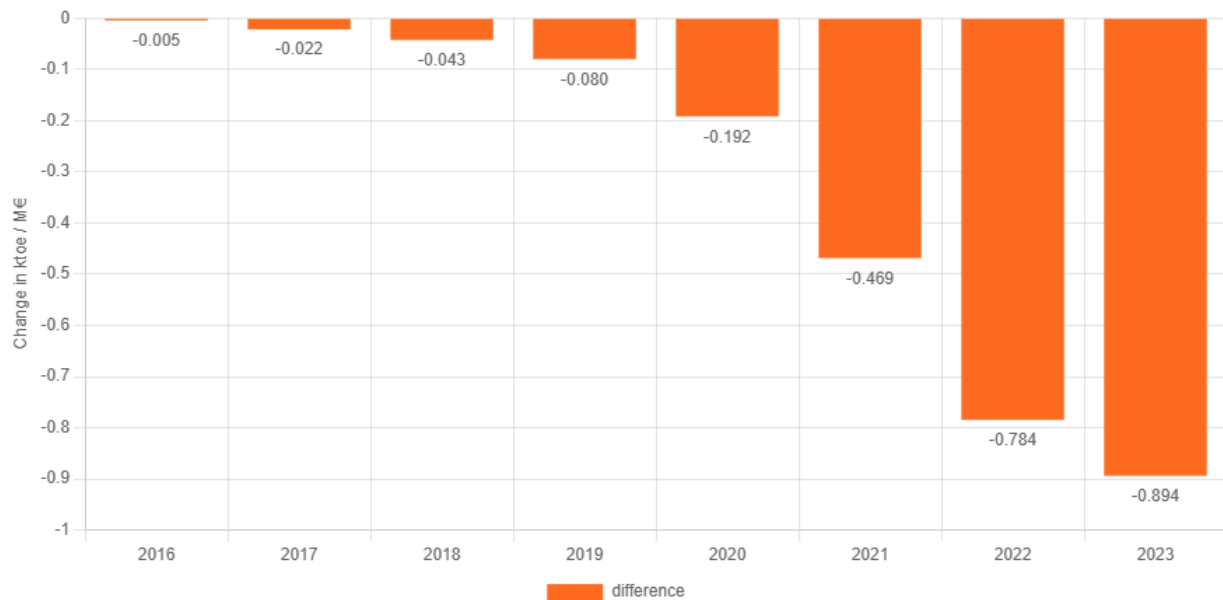


Figure 26: Impact on energy intensity (Environmental bonus)

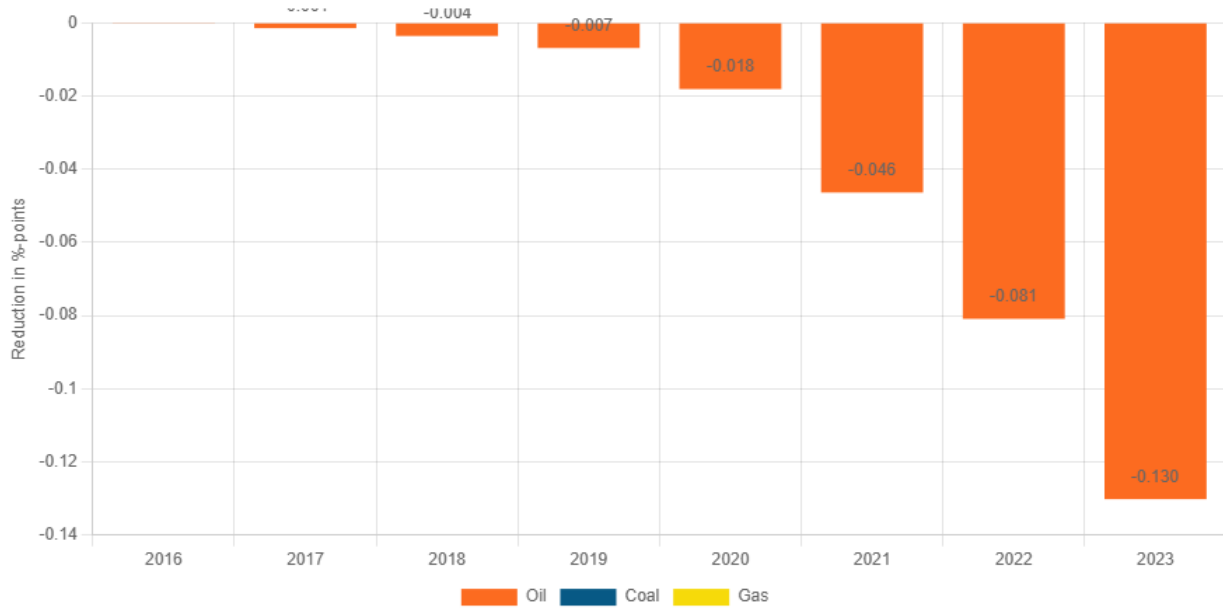


Figure 27: Impact on import dependence (Environmental bonus)

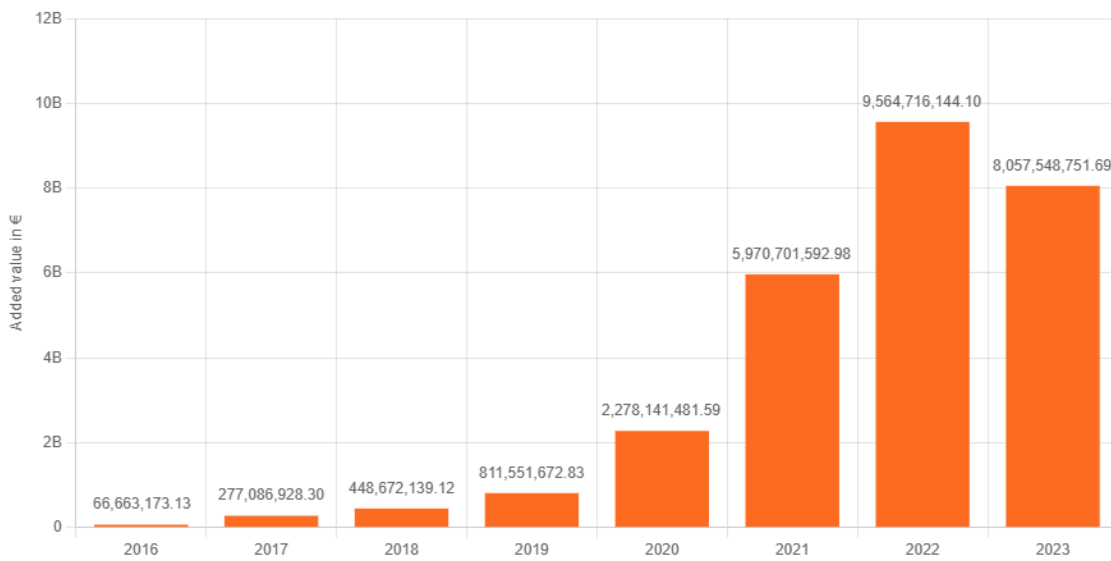


Figure 28: Impact on Gross Domestic Product (Environmental bonus)

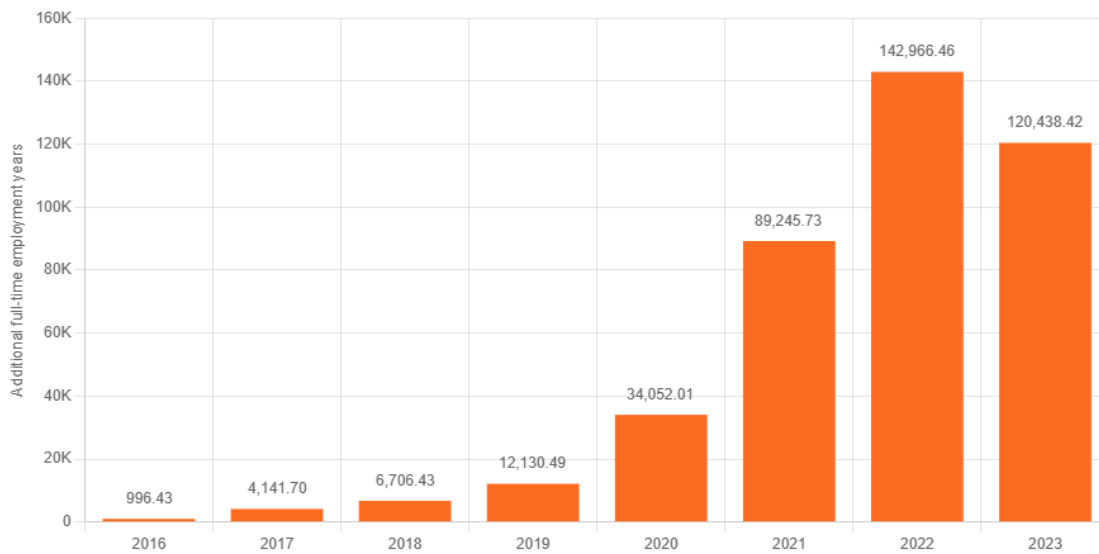


Figure 29: Additional employment (Environmental bonus)

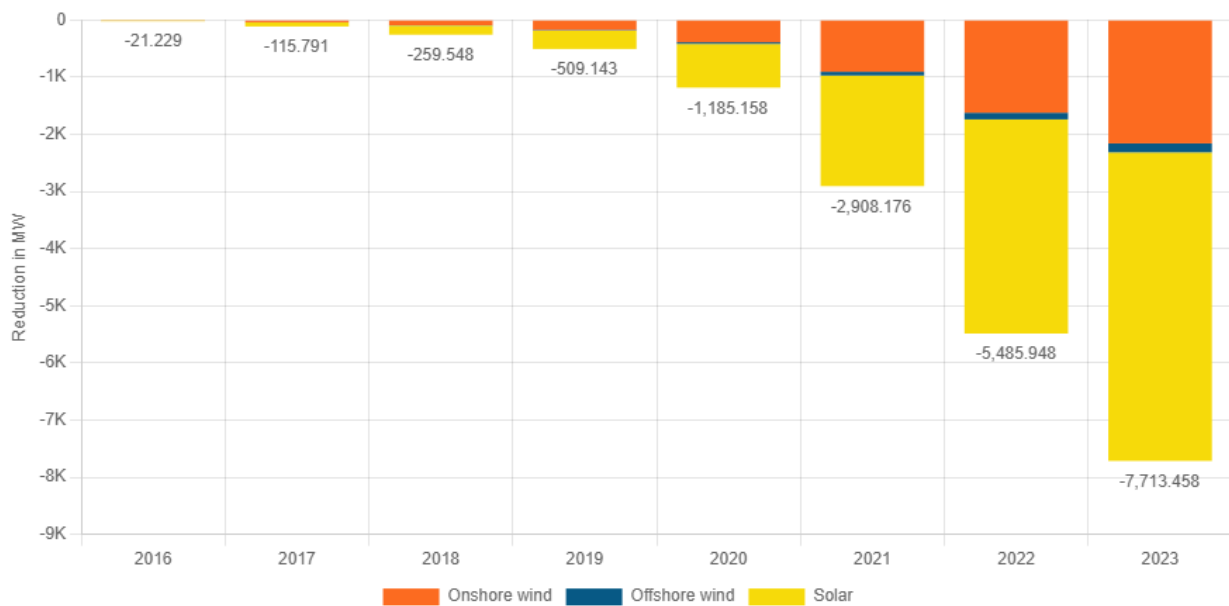


Figure 30: Reduction of additional needed generation capacity (Environmental bonus)

B.1.3. Environmental impacts

Table 19: Quantification of the environmental impacts of the directive to promote the sale of electric-powered vehicles (Environmental bonus) in the MICATool

		2016	2017	2018	2019	2020	2021	2022	2023
Energy impacts									
Primary savings	Total ktoe	4.1	22.8	51.2	99.9	229.7	554.5	1,031.4	1,430.3
	Oil ktoe	6.6	36.4	81.7	159.5	366.6	884.9	1,645.9	2,282.4

		2016	2017	2018	2019	2020	2021	2022	2023
Coal	ktoe	-	-	-	-	-	-	-	-
Gas	ktoe	-	-	-	-	-	-	-	-
Biomass and renewable waste	ktoe	-	-	-	-	-	-	-	-
Renewables	ktoe	-2.5	-13.6	-30.5	-59.5	-136.9	-330.3	-614.5	-852.1
Other	ktoe	-	-	-	-	-	-	-	-
Change in RES targets	%	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
Emissions									
Reduction in air pollution	kt	0.1	0.3	0.7	1.3	2.9	6.4	10.7	13.2
SO2	kt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
NOX	kt	0.1	0.3	0.7	1.3	2.9	6.3	10.5	12.9
PM_2_5	kt	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2
Reduction in greenhouse gas emissions (CO₂)	kt	19.5	108.6	244.1	477.6	1,100.9	2,658.6	4,947.7	6,864.4

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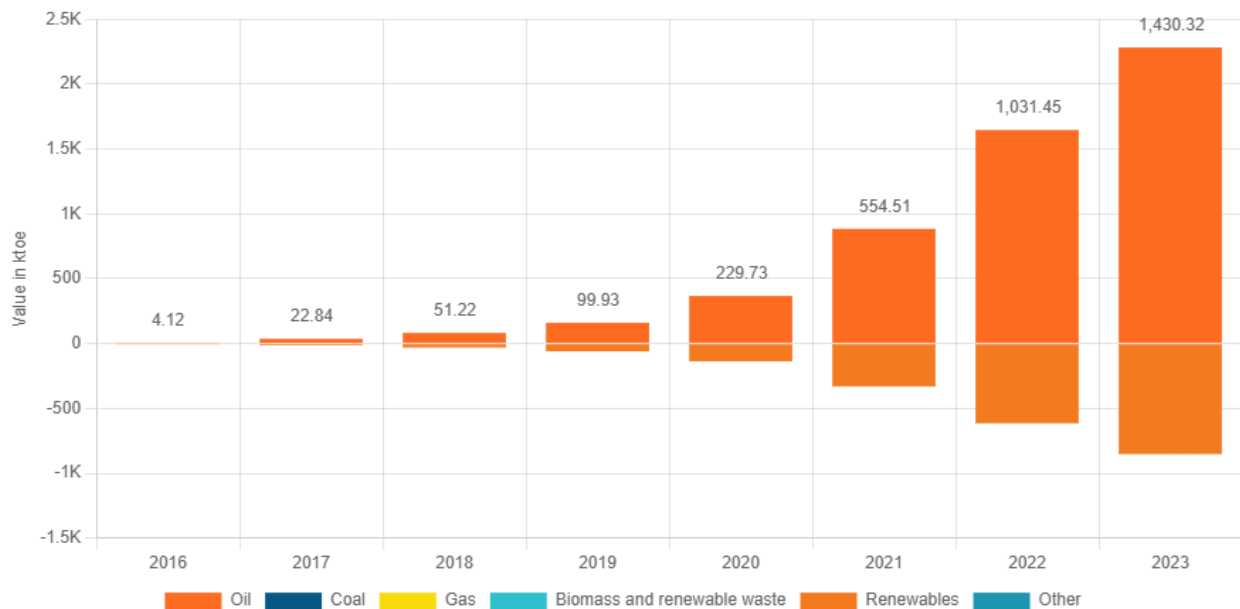


Figure 31: Primary savings by energy carriers (Environmental bonus)

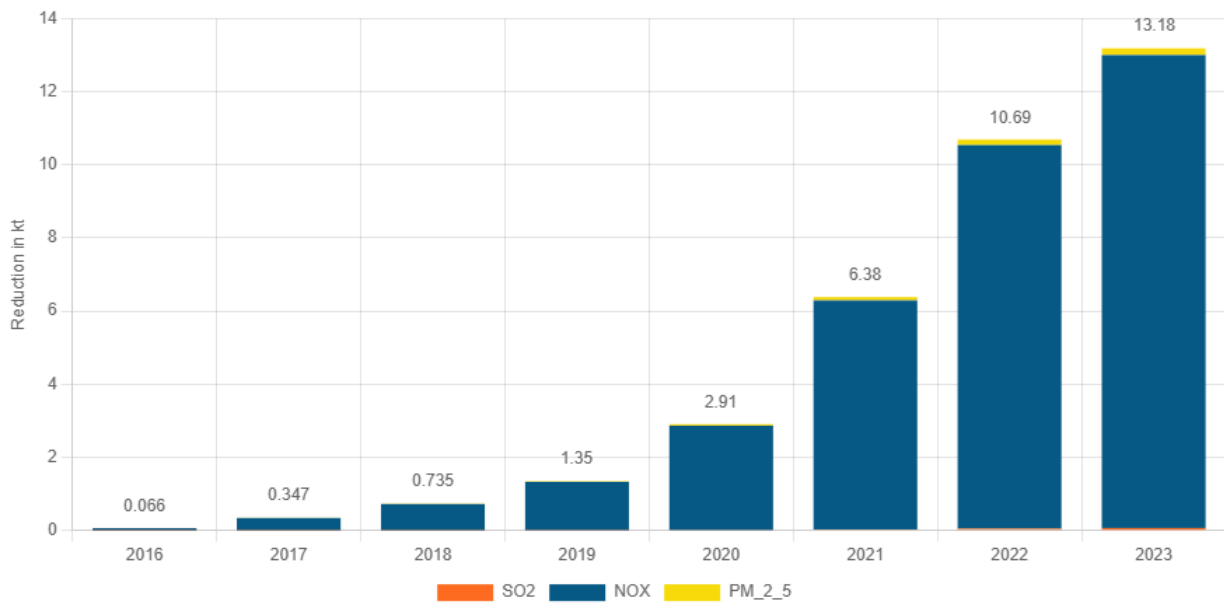


Figure 32: Reduction in air pollution (Environmental bonus)

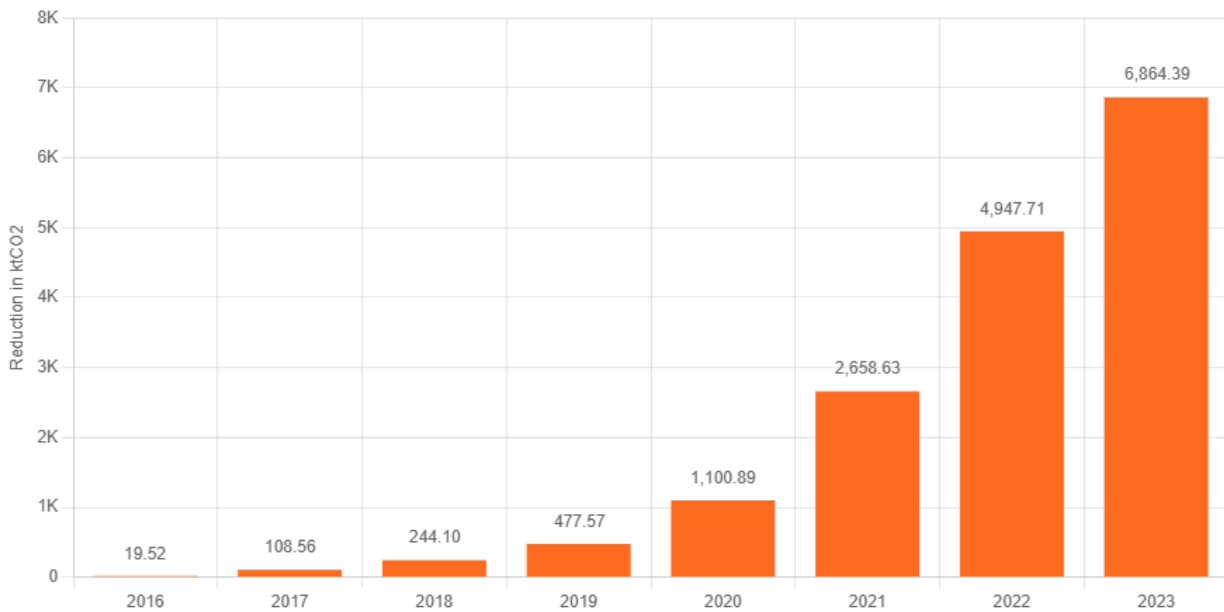


Figure 33: Reduction in greenhouse gas emissions (Environmental bonus)

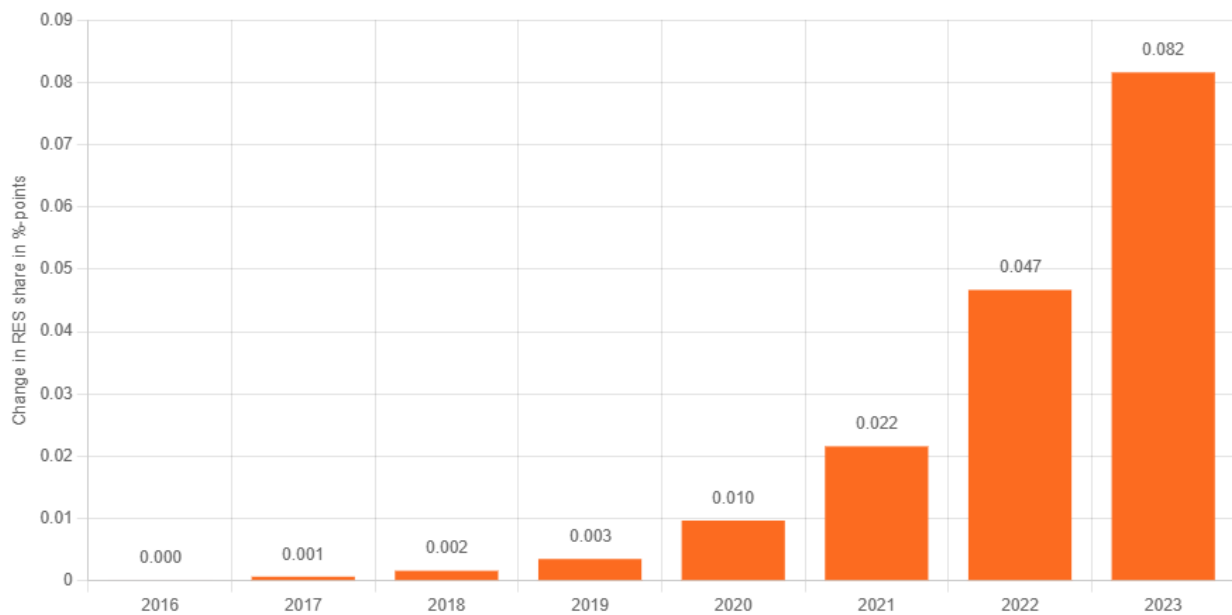


Figure 34: Impact on RES targets (Environmental bonus)

B.1.4. Monetisation

Table 20: Monetisation of the multiple impacts for the directive to promote the sale of electric-powered vehicles (Environmental bonus) in the MICATool

		2016	2017	2018	2019	2020	2021	2022	2023
Reduction of energy costs	<i>Total savings in Mio. €</i>	3.4	21.9	61.5	112.6	168.5	455.7	938.9	1,428.4
Electricity	<i>Savings in Mio. €</i>	-6.6	-37.3	-84.5	-170.7	-404.1	-982.0	-1,838.7	-2,566.6
Oil	<i>Savings in Mio. €</i>	10.0	59.2	146.0	283.2	572.6	1,437.8	2,777.6	3,994.9
Other fuels	<i>Savings in Mio. €</i>	-	-	-	-	-	-	-	-
Reduction of greenhouse gas emissions	<i>Value in Mio. €</i>	0.7	7.2	24.4	63.7	183.5	531.7	1,154.5	1,830.5
Health effects linked to reduced air pollution	<i>Value in Mio. €</i>	0.2	2.4	7.5	18.6	50.4	113.4	194.7	246.3
Avoided asthma cases	<i>Value in Mio. €</i>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Avoided excess cold winter mortality	<i>Value in Mio. €</i>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Avoided lost working days due to air pollution	<i>Value in Mio. €</i>	0.0	0.0	0.1	0.3	0.9	2.0	3.3	4.1
Impact on RES targets	<i>Value in Mio. €</i>	0.1	0.4	0.8	1.8	4.5	10.5	21.6	33.7
Impact on gross domestic product	<i>Value in Mio. €</i>	66.7	277.1	448.7	811.6	2,278.1	5,970.7	9,564.7	8,057.5
Added asset value of buildings	<i>Value in Mio. €</i>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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ANNEX C: FEDERAL FUNDING FOR ENERGY AND RESOURCE EFFICIENCY IN INDUSTRY (EEW)

Further information on this EE programme can be found in 2.1.1.3 EE program 3: Federal Funding for Energy and Resource Efficiency in Industry (EEW).

C.1. Quantification of multiple impacts for the Federal funding for energy and resource efficiency in industry (EEW) (2019-2023)

C.1.1. Improvement Action 1: Cross-cutting technologies

C.1.1.1. Social impacts

Note: There are no values for the indicators for avoided asthma cases, the energy poverty indicators or the reduction in excess cold weather mortality as the measures have no direct impact.

Table 21: Quantification of the social impacts for the Federal funding for energy and resource efficiency in industry (EEW) (2019-2023), Improvement Action 1: cross-cutting technologies in the MICATool

		2019	2020	2021	2022	2023
Avoided health effects linked to reduced air pollution						
Mortality	<i>Reduction in casualties (#)</i>	1.2	2.8	7.0	10.7	8.2
Hospital admissions		0.9	2.1	5.2	7.9	6.0
Avoided lost working days due to air pollution						
Avoided absences	<i>days</i>	425.6	1,018.3	2,469.8	3,735.4	2,801.9
Reduction in disability-adjusted life-years						
Avoided asthma cases	<i>years</i>	N/A	N/A	N/A	N/A	N/A
Estimated number of people lifted out of energy poverty						
M/2	<i>people</i>	N/A	N/A	N/A	N/A	N/A
2M	<i>people</i>	N/A	N/A	N/A	N/A	N/A
Reduction in excess cold weather mortality						
Reduction in casualties	<i>Reduction in casualties (#)</i>	N/A	N/A	N/A	N/A	N/A

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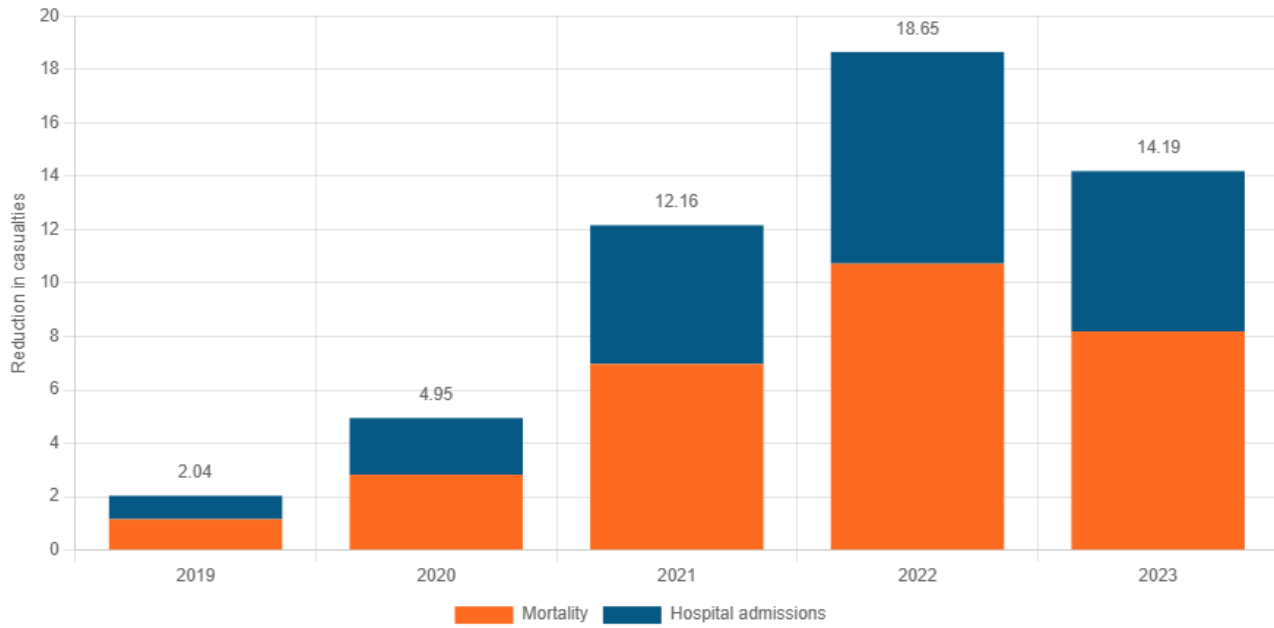


Figure 35: Health effects linked to reduced air pollution (EEW – IA1)

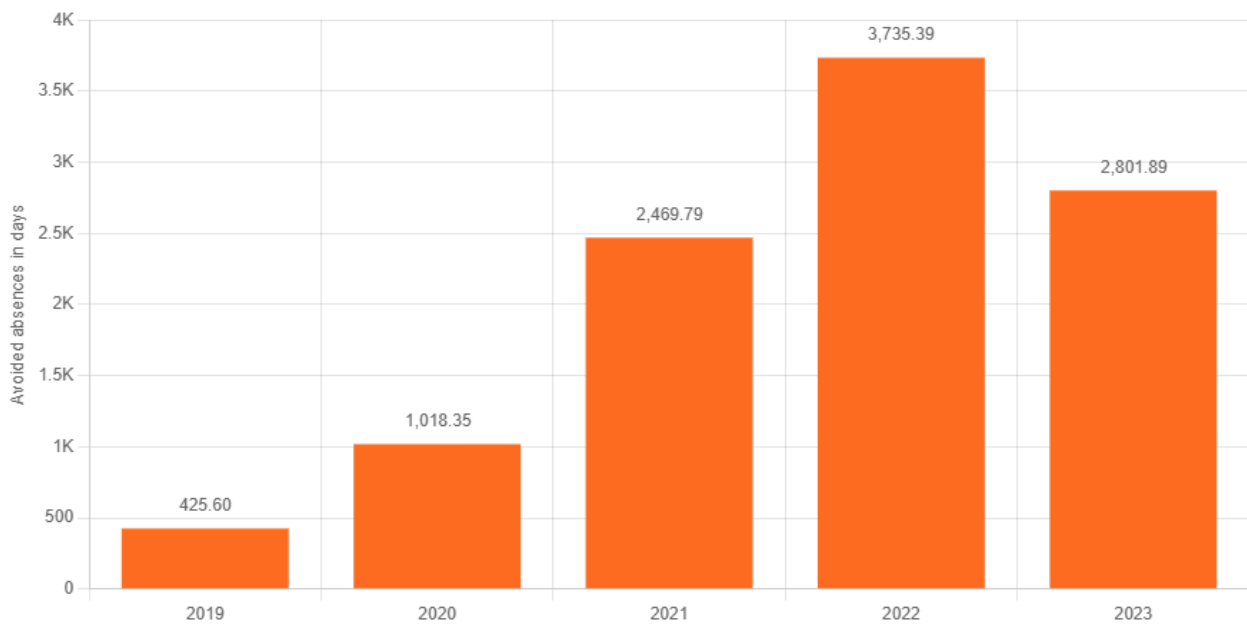


Figure 36: Avoided working days due to air pollution (EEW – IA1)

C.1.1.2. Economic impacts

Table 22: Quantification of the economic impacts for the Federal funding for energy and resource efficiency in industry (EEW) (2019-2023), Improvement Action 1: cross-cutting technologies in the MICATool

		2019	2020	2021	2022	2023
Energy impacts						
Energy intensity	<i>Change in ktoe/ Mio. €</i>	-0.01	-0.02	-0.02	-0.03	-0.04
Import dependency	%	-0.000	-0.000	-0.001	-0.001	-0.001
Reduction of additional generation capacity	<i>MW</i>	98.4	326.7	960.3	1,407.4	1,156.3
Onshore wind	<i>MW</i>	34.0	107.9	300.1	416.8	323.9
Offshore wind	<i>MW</i>	2.5	7.9	21.4	30.0	23.4
Solar	<i>MW</i>	61.9	210.9	638.7	960.7	808.9
Economics and employment						
Gross Domestic Product	<i>Added value (Mio. €)</i>	124.7	180.7	195.9	239.4	283.0
Additional employment	<i>Full-time employment years</i>	2,043.7	2,962.8	3,211.5	3,925.1	4,638.8

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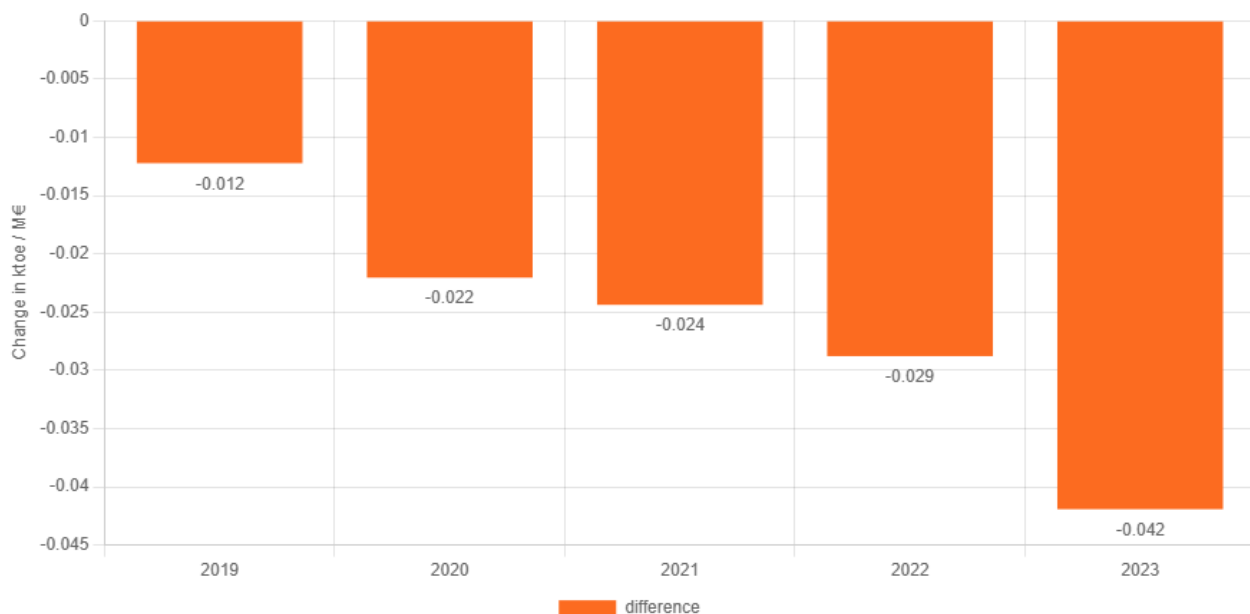


Figure 37: Impact on energy intensity (EEW – IA1)

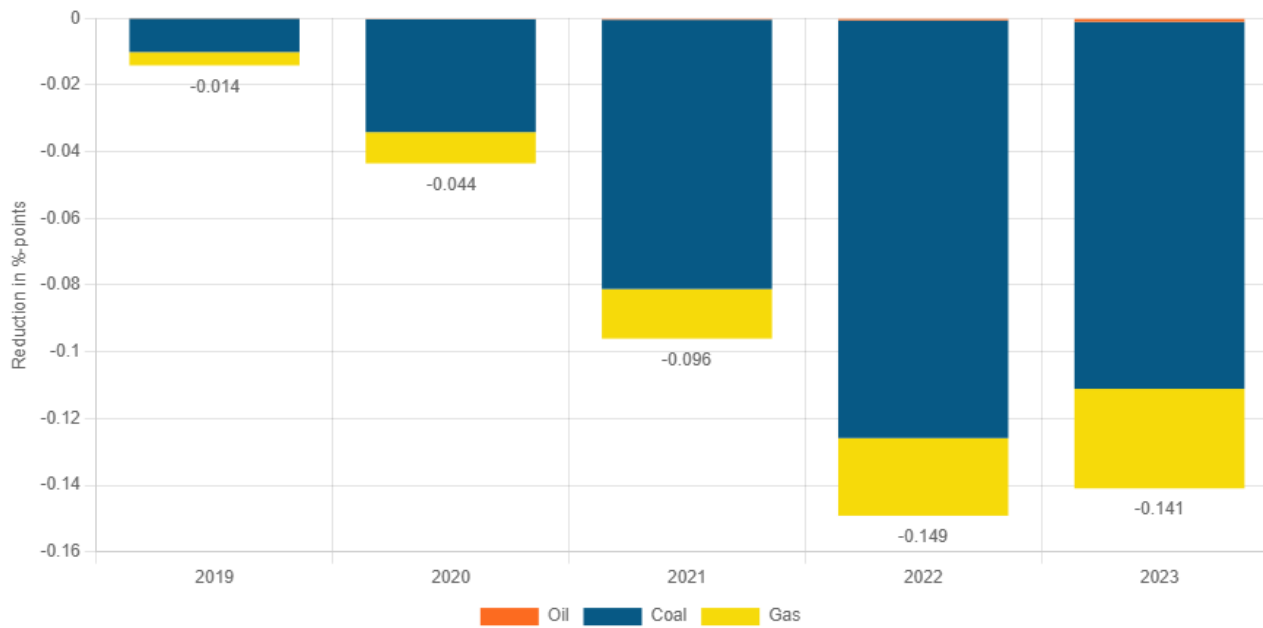


Figure 38: Impact on import dependence (EEW – IA1)

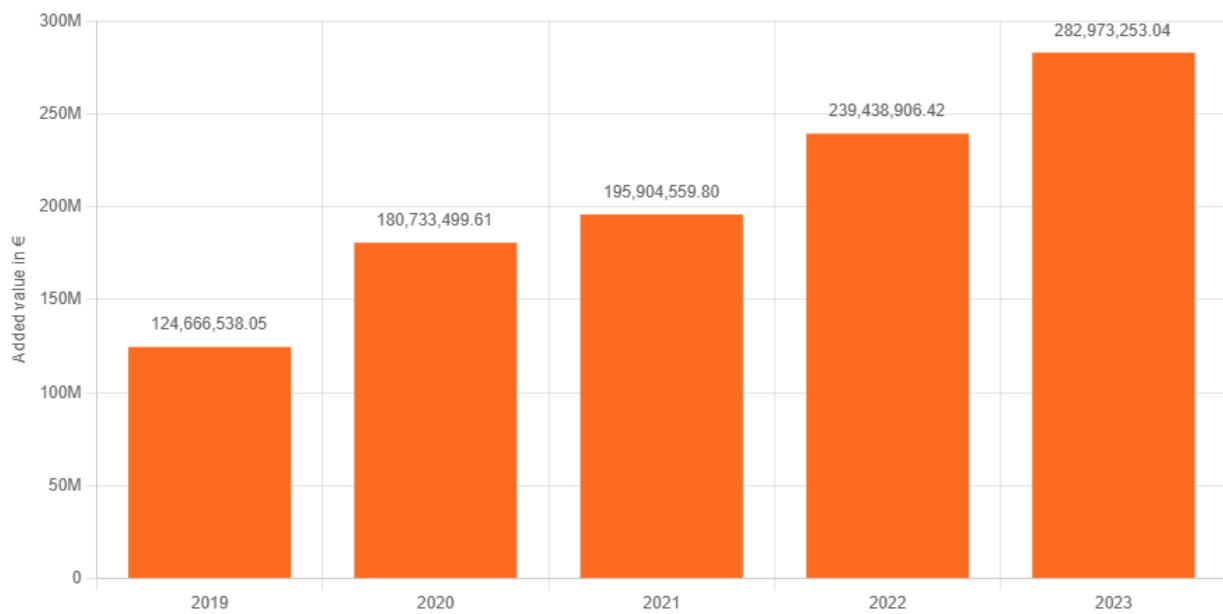


Figure 39: Impact on Gross Domestic Product (EEW – IA1)

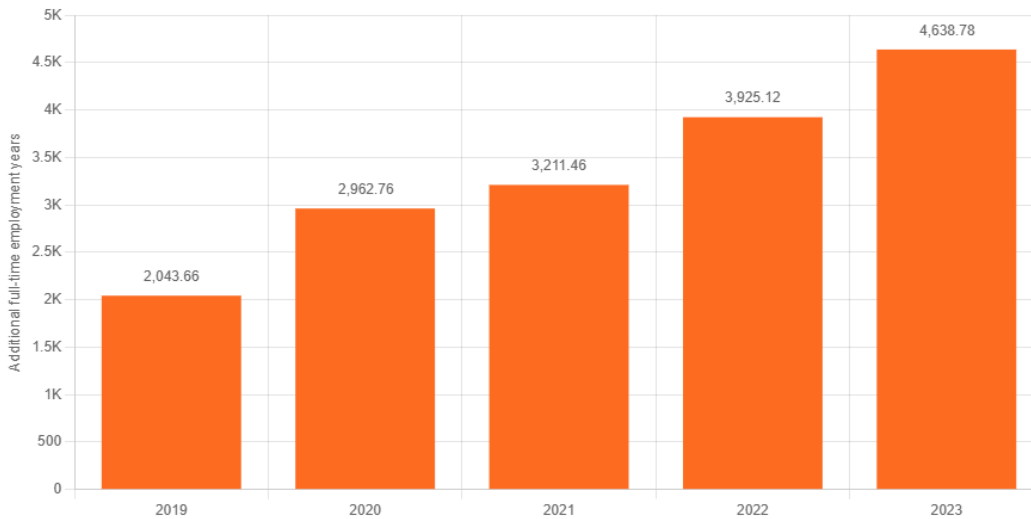


Figure 40: Additional employment (EEW – IA1)

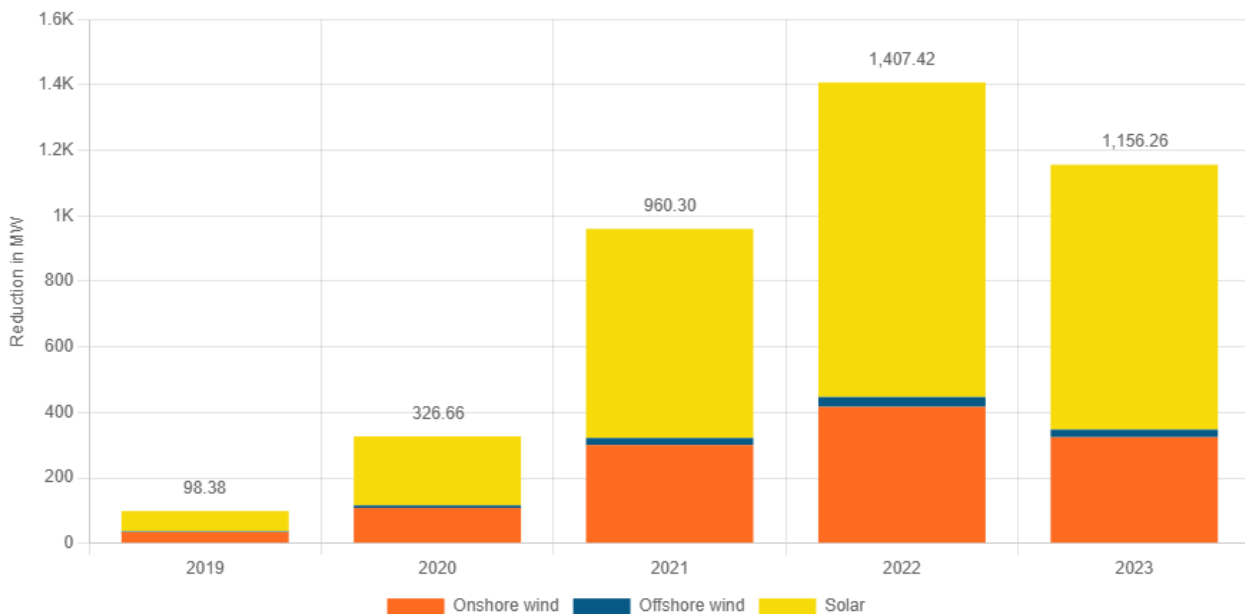


Figure 41: Reduction of additional needed generation capacity (EEW – IA1)

C.1.1.3. Environmental impacts

Table 23: Quantification of the environmental impacts for the Federal funding for energy and resource efficiency in industry (EEW) (2019-2023), Improvement Action 1: cross-cutting technologies in the MICATool

		2019	2020	2021	2022	2023
Energy impacts						
Primary savings	<i>Total ktoe</i>	50.0	126.3	272.7	370.2	343.7
	Oil <i>ktoe</i>	2.9	6.5	8.4	12.8	18.9
	Coal <i>ktoe</i>	11.2	28.8	85.1	135.7	88.4

		2019	2020	2021	2022	2023
Gas	ktoe	23.1	53.8	89.7	111.3	140.2
Biomass and renewable waste	ktoe	4.5	10.4	17.1	23.2	28.9
Renewables	ktoe	3.7	13.5	34.5	56.4	56.7
Other	ktoe	4.5	13.2	37.9	30.8	10.6
Change in RES targets	%	0.0	0.0	0.0	0.0	0.0
Emissions						
Reduction in air pollution	kt	0.14	0.32	0.70	1.03	0.89
SO2	kt	0.04	0.11	0.25	0.39	0.29
NOX	kt	0.09	0.21	0.43	0.62	0.59
PM_2_5	kt	0.00	0.01	0.01	0.02	0.02
Reduction in greenhouse gas emissions (CO2)	kt	108.7	263.0	582.7	852.8	745.0

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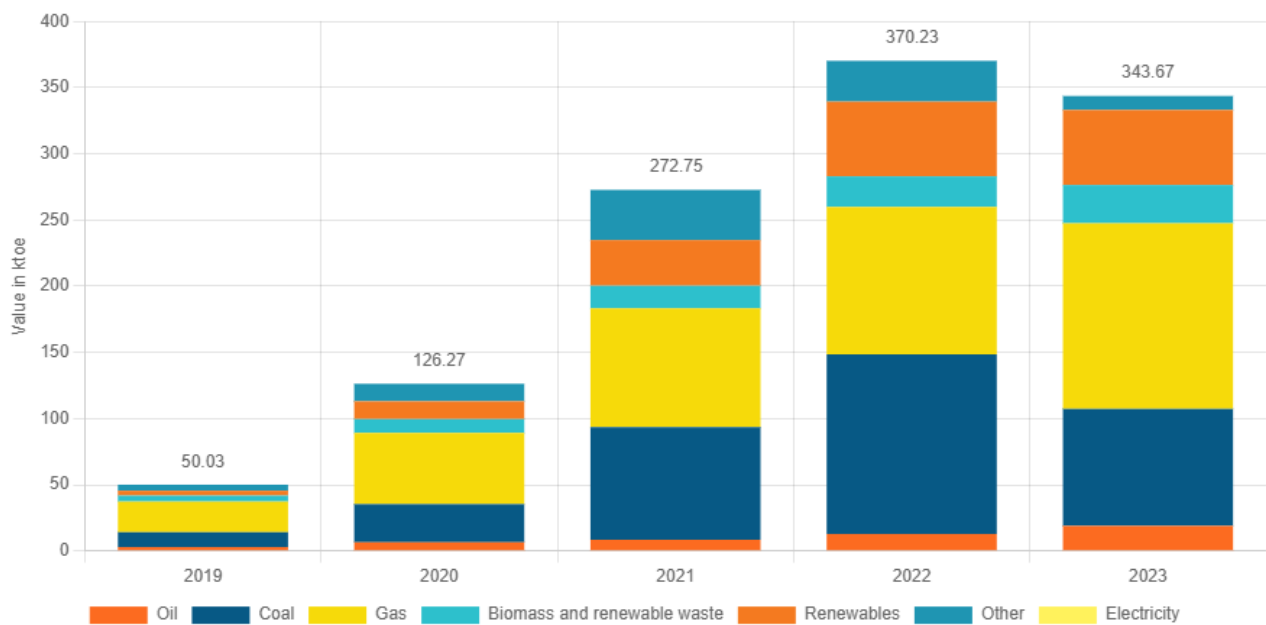


Figure 42: Primary savings by energy carriers (EEW – IA1)

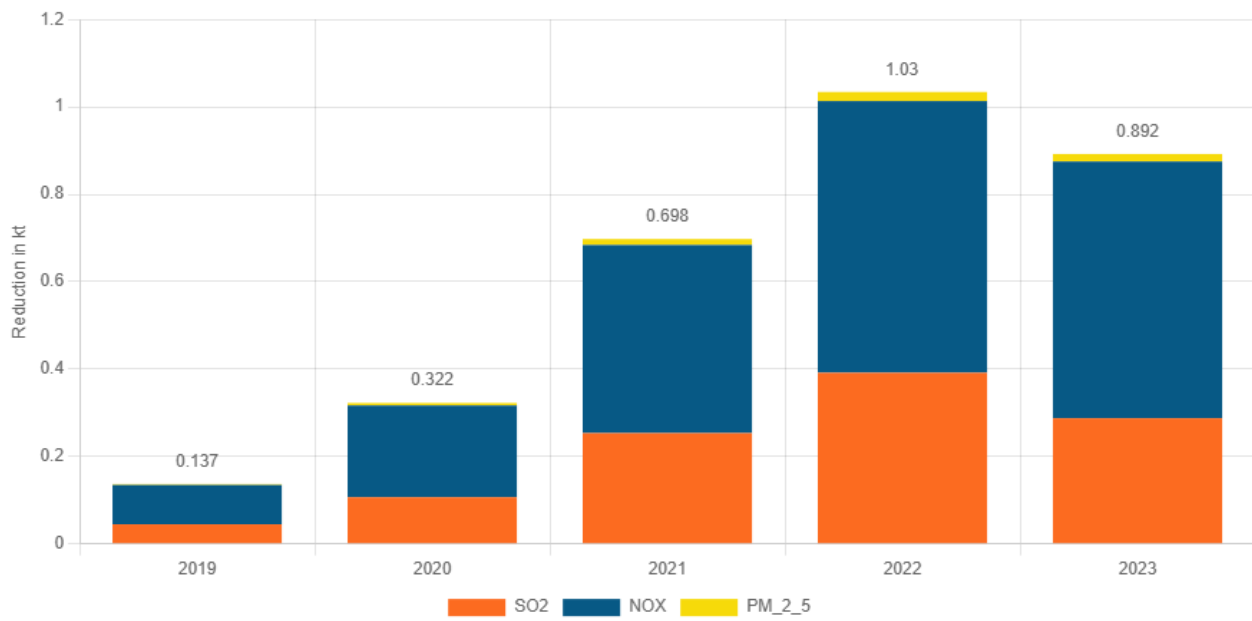


Figure 43: Reduction in air pollution (EEW – IA1)

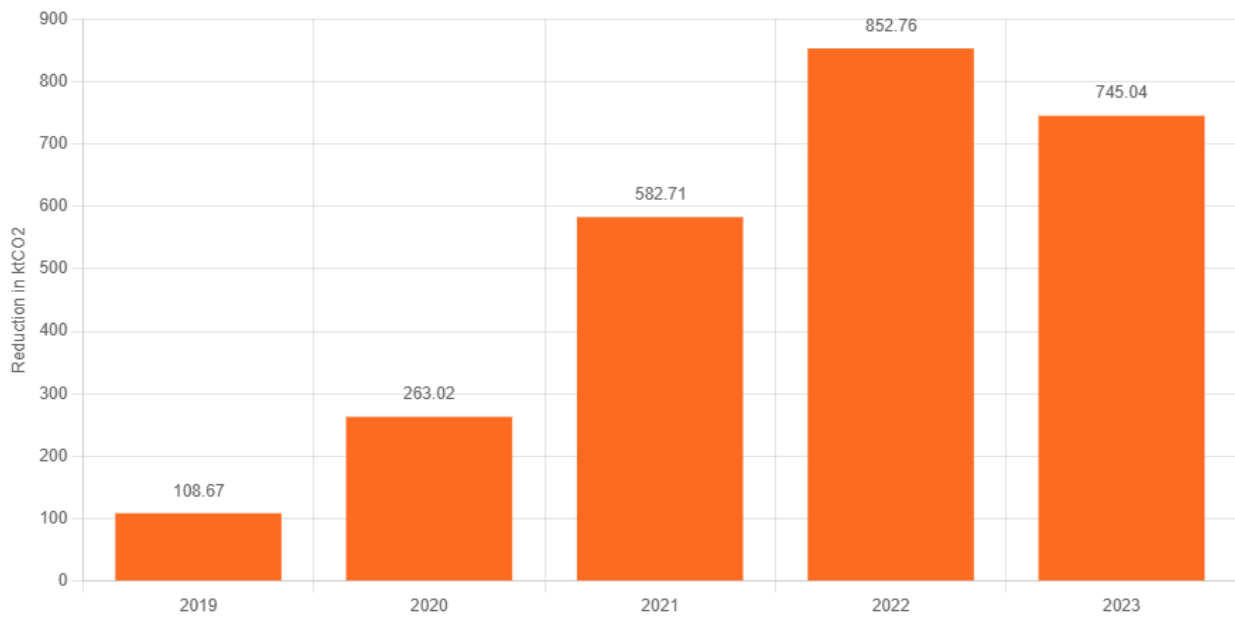


Figure 44: Reduction in greenhouse gas emissions (EEW – IA1)

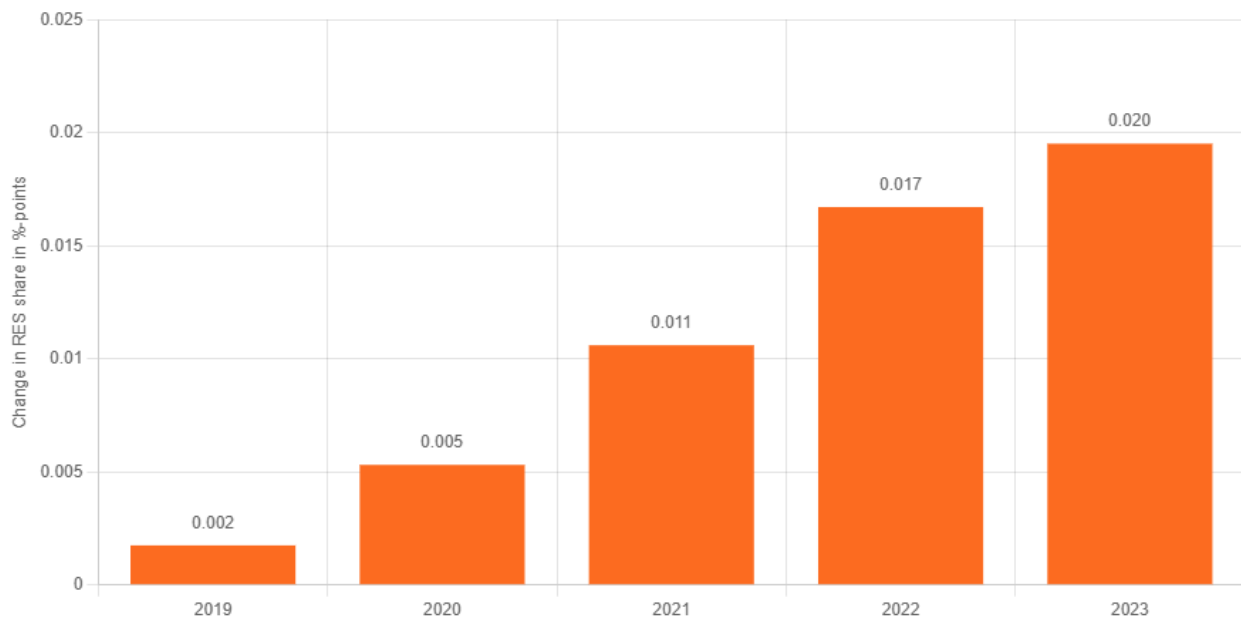


Figure 45: Impact on RES targets (EEW – IA1)

C.1.1.4. Monetisation

Table 24: Monetisation of the Multiple Impacts for the Federal funding for energy and resource efficiency in industry (EEW) (2019-2023), Improvement Action 1: cross-cutting technologies in the MICATool

		2019	2020	2021	2022	2023
Reduction of energy costs	<i>Total savings in Mio. €</i>	26.2	73.6	178.6	256.2	239.9
Electricity	<i>Savings in Mio. €</i>	15.5	52.2	152.6	223.0	182.6
Oil	<i>Savings in Mio. €</i>	1.4	2.4	2.8	4.3	8.1
Coal	<i>Savings in Mio. €</i>	0.5	1.0	1.0	1.6	2.1
Gas	<i>Savings in Mio. €</i>	6.4	13.2	16.3	19.7	34.6
Biomass and Waste	<i>Savings in Mio. €</i>	1.0	2.0	2.4	3.1	5.1
Heat	<i>Savings in Mio. €</i>	1.5	2.7	3.4	4.4	7.5
H2 and e-fuels	<i>Savings in Mio. €</i>	-	-	-	-	-
Reduction of greenhouse gas emissions	<i>Value in Mio. €</i>	5.4	26.3	87.4	170.6	186.3
Health effects linked to reduced air pollution	<i>Value in Mio. €</i>	2.3	11.1	28.0	44.0	34.4
Avoided asthma cases	<i>Value in Mio. €</i>	N/A	N/A	N/A	N/A	N/A
Avoided excess cold winter mortality	<i>Value in Mio. €</i>	N/A	N/A	N/A	N/A	N/A
Avoided lost working days due to air pollution	<i>Value in Mio. €</i>	0.0	0.2	0.5	0.7	0.6
Impact on RES targets	<i>Value in Mio. €</i>	0.9	2.5	5.1	7.7	8.1
Impact on Gross Domestic Product	<i>Value in Mio. €</i>	124.7	180.7	195.9	239.4	283.0
Added asset value of buildings	<i>Value in Mio. €</i>	N/A	N/A	N/A	N/A	N/A

Status of data and SEED MICATool 03.03.2026

C.1.2. Improvement Action 2a: Fuel switch

C.1.2.1. Social impacts

Note: There are no values for the indicators for avoided asthma cases, the energy poverty indicators or the reduction in excess cold weather mortality as the measures have no direct impact.

Table 25: Quantification of the social impacts for the Federal funding for energy and resource efficiency in industry (EEW) (2019-2023), Improvement Action 2a: Fuel Switch in the MICATool

		2019	2020	2021	2022	2023
Avoided health effects linked to reduced air pollution						
Mortality	<i>Reduction in casualties (#)</i>	0.00	0.00	-0.01	-0.08	-0.04
Hospital admissions		0.00	0.00	0.00	-0.06	-0.03
Avoided lost working days due to air pollution						
Avoided absences	<i>days</i>	-1.1	-1.4	-2.3	-28.8	-15.1
Reduction in disability-adjusted life-years						
Avoided asthma cases	<i>years</i>	N/A	N/A	N/A	N/A	N/A
Estimated number of people lifted out of energy poverty						
M/2	<i>people</i>	N/A	N/A	N/A	N/A	N/A
2M	<i>people</i>	N/A	N/A	N/A	N/A	N/A
Reduction in excess cold weather mortality						
Reduction in casualties	<i>Reduction in casualties (#)</i>	N/A	N/A	N/A	N/A	N/A

Status of data and SEED MICATool 03.03.2026

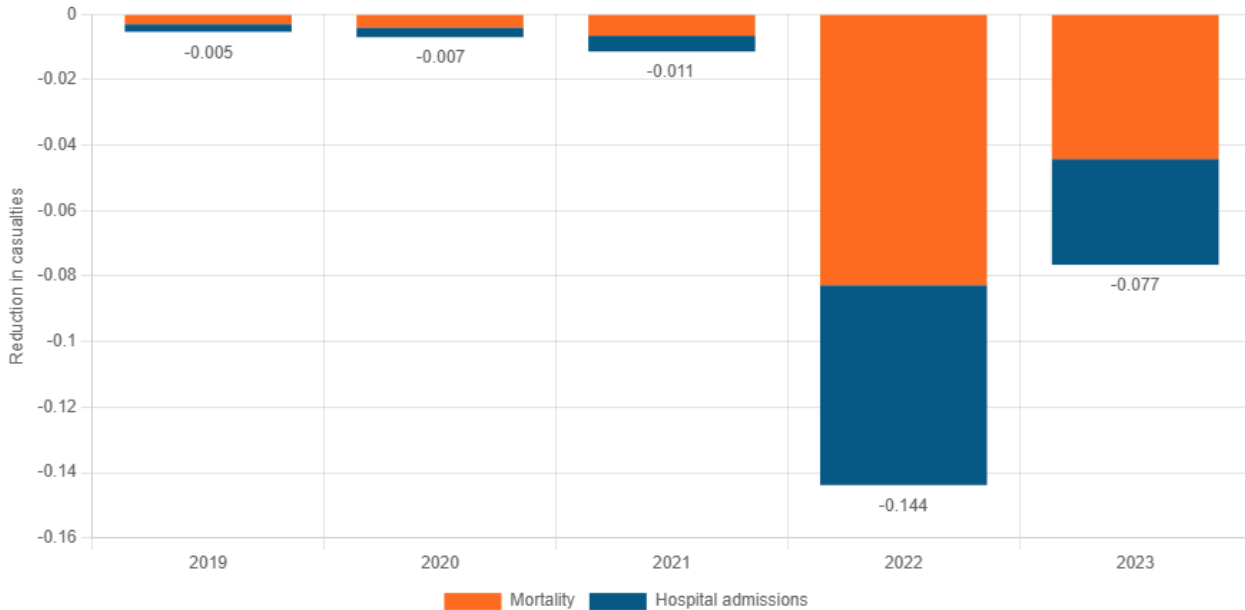


Figure 46: Health effects linked to reduced air pollution (EEW – IA2a)

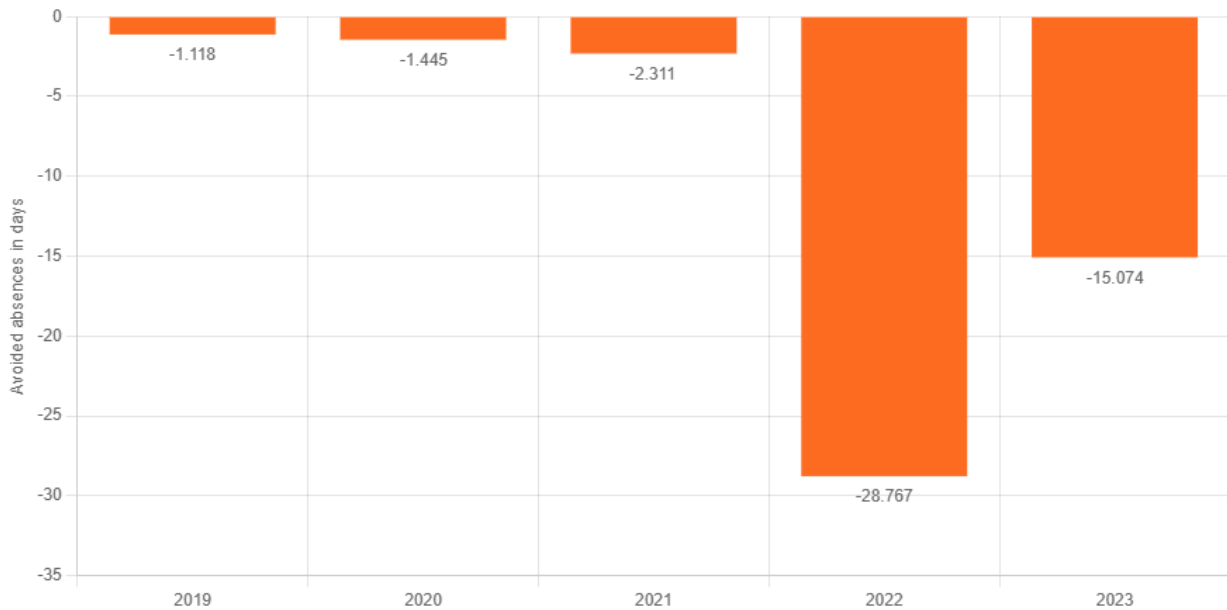


Figure 47: Avoided working days due to air pollution (EEW – IA2a)

C.1.2.2. Economic impacts

Table 26: Quantification of the economic impacts for Federal funding for energy and resource efficiency in industry (EEW) (2019-2023), Improvement Action 2a: Fuel Switch in the MICATool

		2019	2020	2021	2022	2023
Energy impacts						
Energy intensity	<i>Change in ktoe/ Mio. €</i>	-0.001	-0.003	-0.005	-0.007	-0.015
Import dependency	%	0.000001	0.000001	0.000001	0.000014	0.000013
Reduction of additional generation capacity	<i>MW</i>	-1.2	-2.4	-2.5	-28.0	-27.4
Onshore wind	<i>MW</i>	-0.4	-0.8	-0.8	-8.3	-7.7
Offshore wind	<i>MW</i>	0.0	-0.1	-0.1	-0.6	-0.6
Solar	<i>MW</i>	-0.8	-1.5	-1.7	-19.1	-19.2
Economics and employment						
Gross Domestic Product	<i>Added value (Mio. €)</i>	13.2	79.8	153.1	197.3	558.9
Additional employment	<i>Full-time employment years</i>	214.2	1296.1	2485.0	3202.7	9072.4

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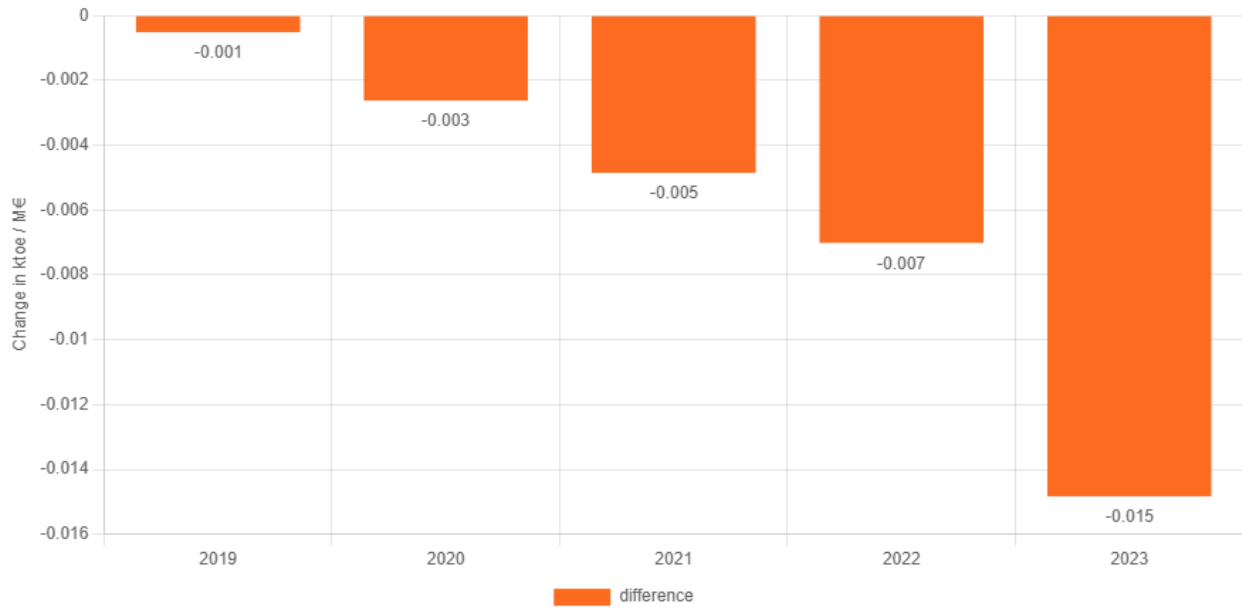


Figure 48: Impact on energy intensity (EEW – IA2a)

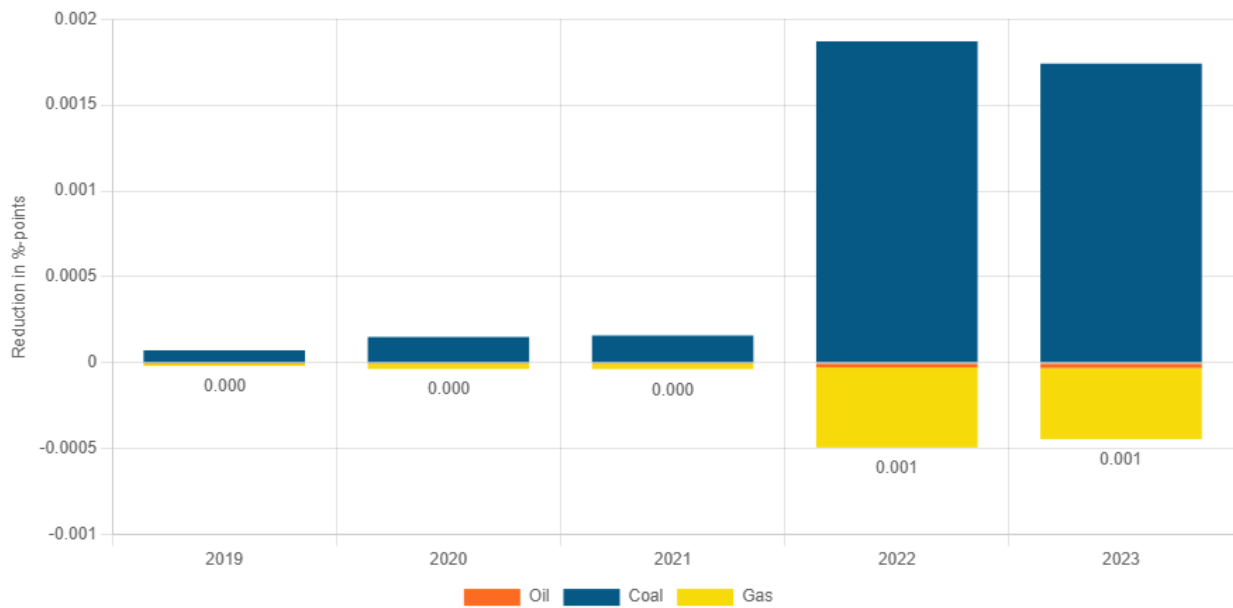


Figure 49: Impact on import dependence (EEW – IA2a)

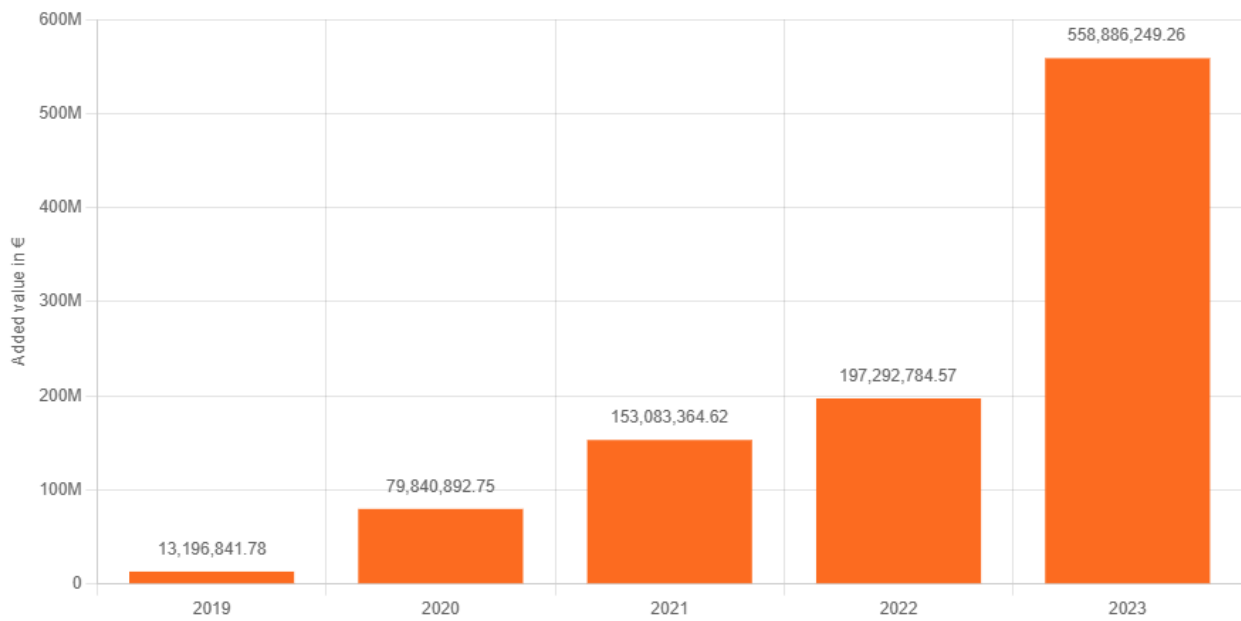


Figure 50: Impact on Gross Domestic Product (EEW – IA2a)

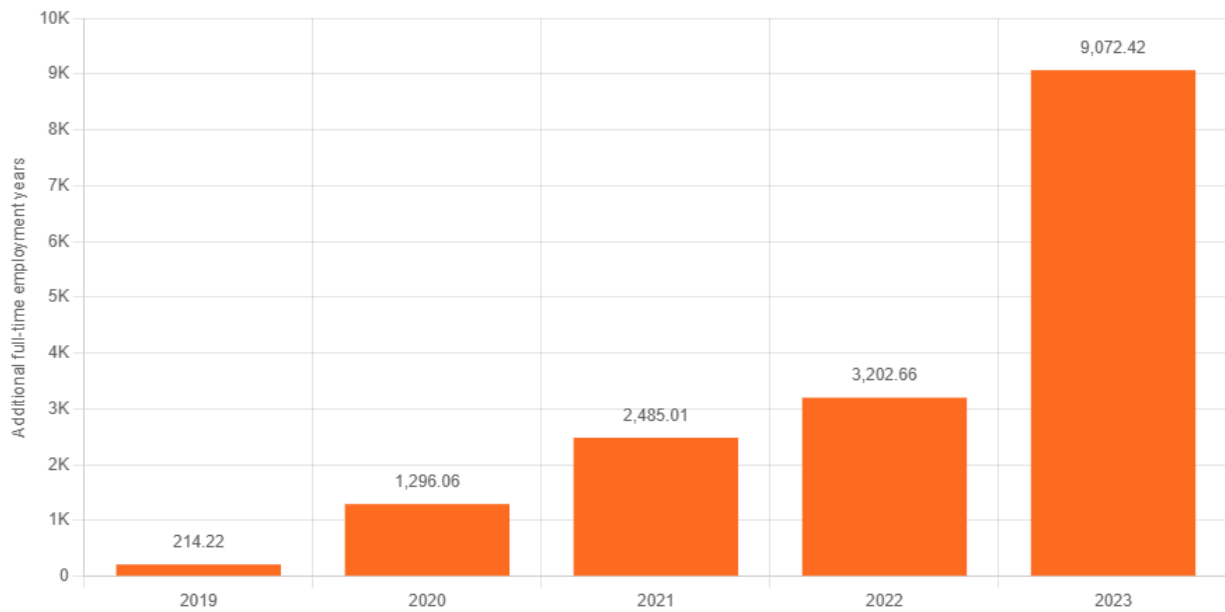


Figure 51: Additional employment (EEW – IA2a)

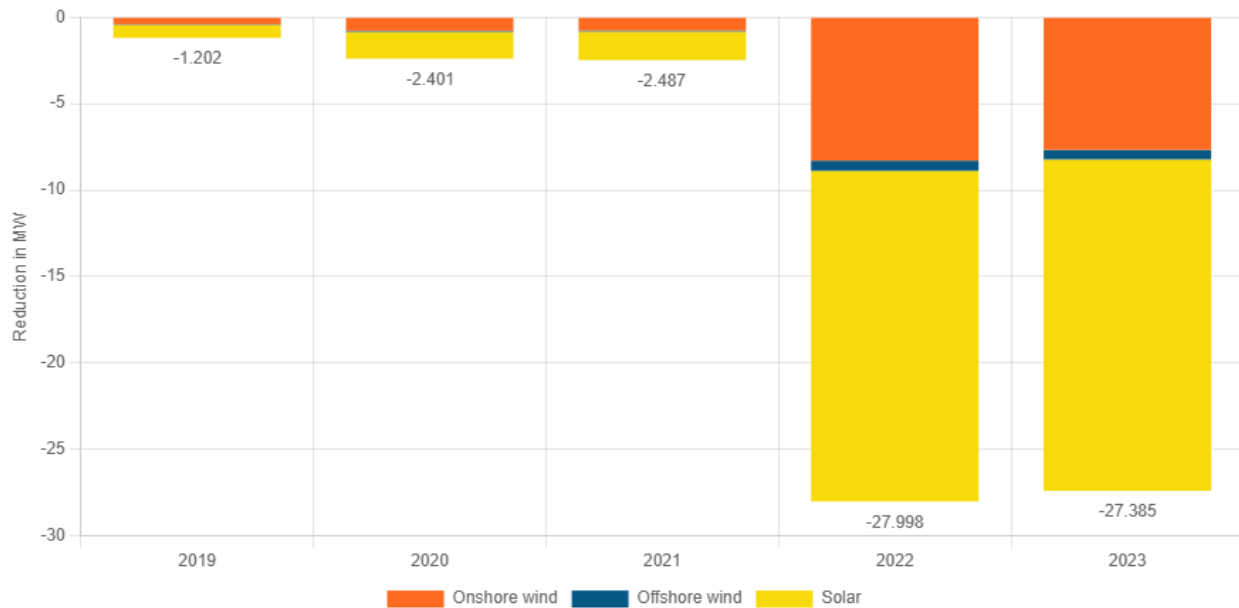


Figure 52: Reduction of additional needed generation capacity (EEW – IA2a)

C.1.2.3. Environmental impacts

Table 27: Quantification of the environmental impacts for the Federal funding for energy and resource efficiency in industry (EEW) (2019-2023), Improvement Action 2a: Fuel Switch in the MICATool

		2019	2020	2021	2022	2023
Energy impacts						
Primary savings	<i>Total ktoe</i>	0.0	0.0	-0.1	-0.5	0.1
	Oil <i>ktoe</i>	0.0	0.0	0.0	0.5	0.5
	Coal <i>ktoe</i>	-0.1	-0.1	-0.2	-2.0	-1.4
	Gas <i>ktoe</i>	0.1	0.2	0.2	2.2	1.9
	Biomass and renewable waste <i>ktoe</i>	0.0	0.0	0.0	0.4	0.4
	Renewables <i>ktoe</i>	0.0	-0.1	-0.1	-1.1	-1.3
	Other <i>ktoe</i>	0.0	-0.1	-0.1	-0.5	-0.1
Change in RES targets	%	0.0	0.0	0.0	0.0	0.0
Emissions						
Reduction in air pollution	<i>kt</i>	0.000	0.000	0.000	-0.001	0.002
	SO2 <i>kt</i>	0.000	0.000	0.000	-0.003	-0.001
	NOX <i>kt</i>	0.000	0.000	0.000	0.002	0.003
	PM_2_5 <i>kt</i>	0.000	0.000	0.000	0.000	0.000
Reduction in greenhouse gas emissions (CO₂)	<i>kt</i>	0.0	0.0	-0.1	-1.5	0.4

Status of data and SEED MICATool 03.03.2026

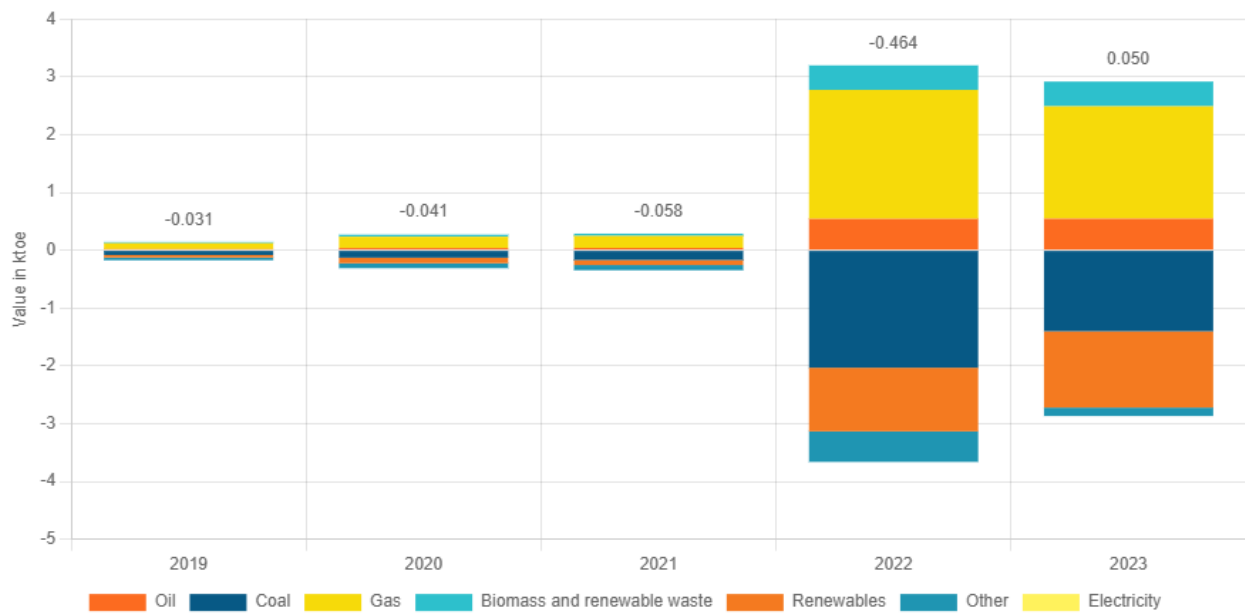


Figure 53: Primary savings by energy carriers (EEW – IA2a)

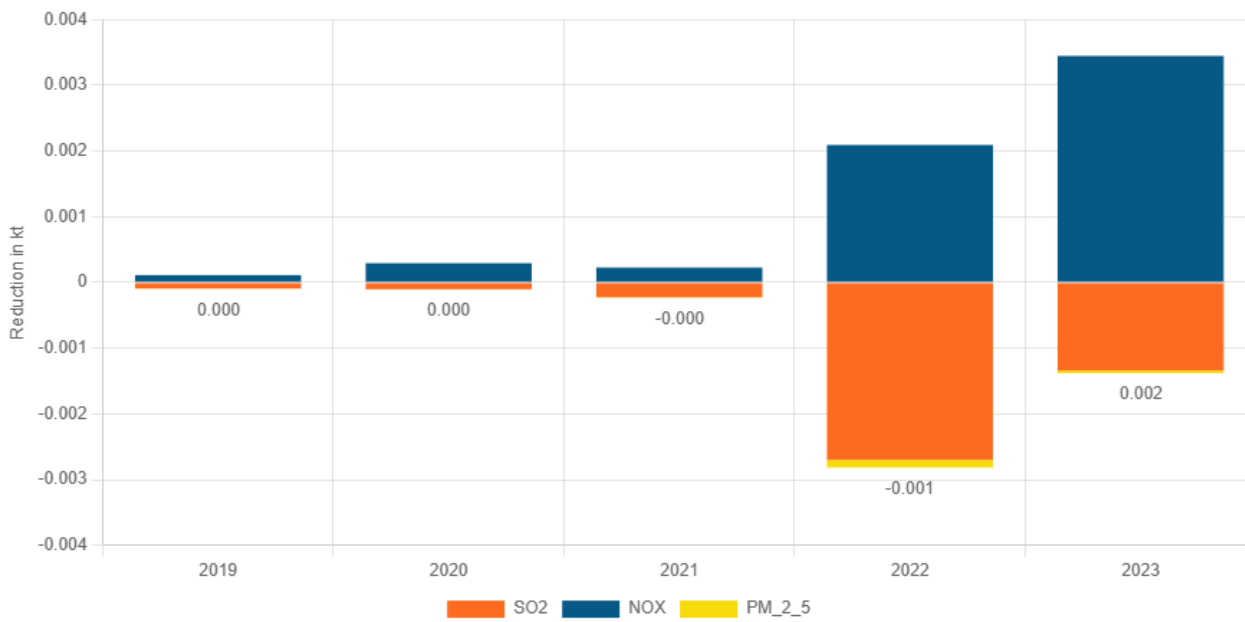


Figure 54: Reduction in air pollution (EEW – IA2a)

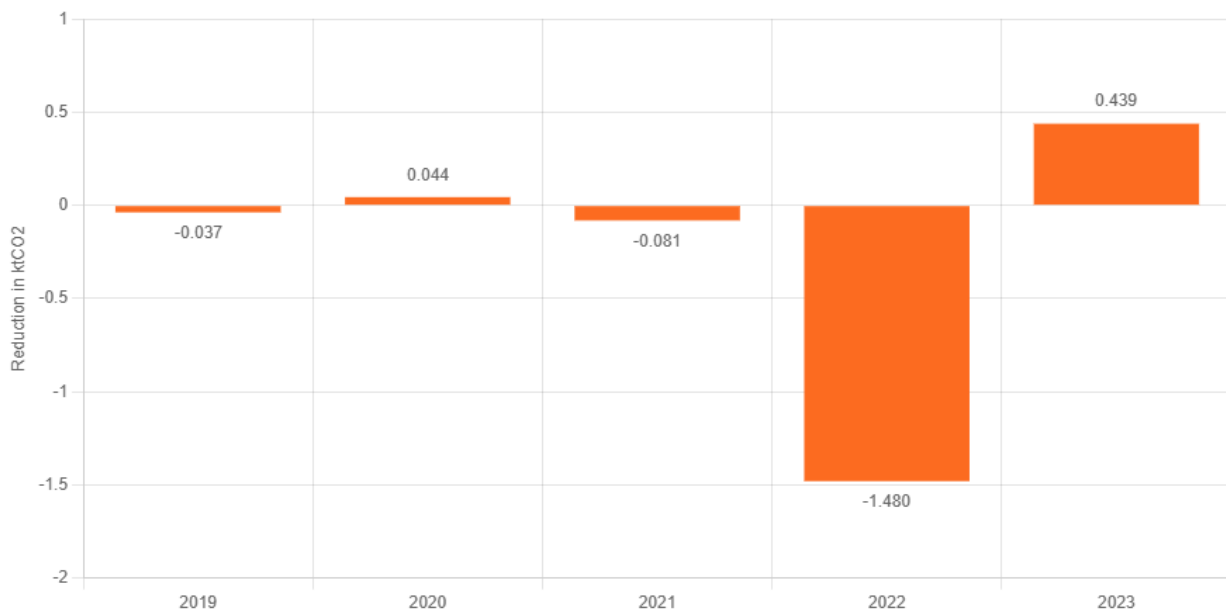


Figure 55: Reduction in greenhouse gas emissions (EEW – IA2a)

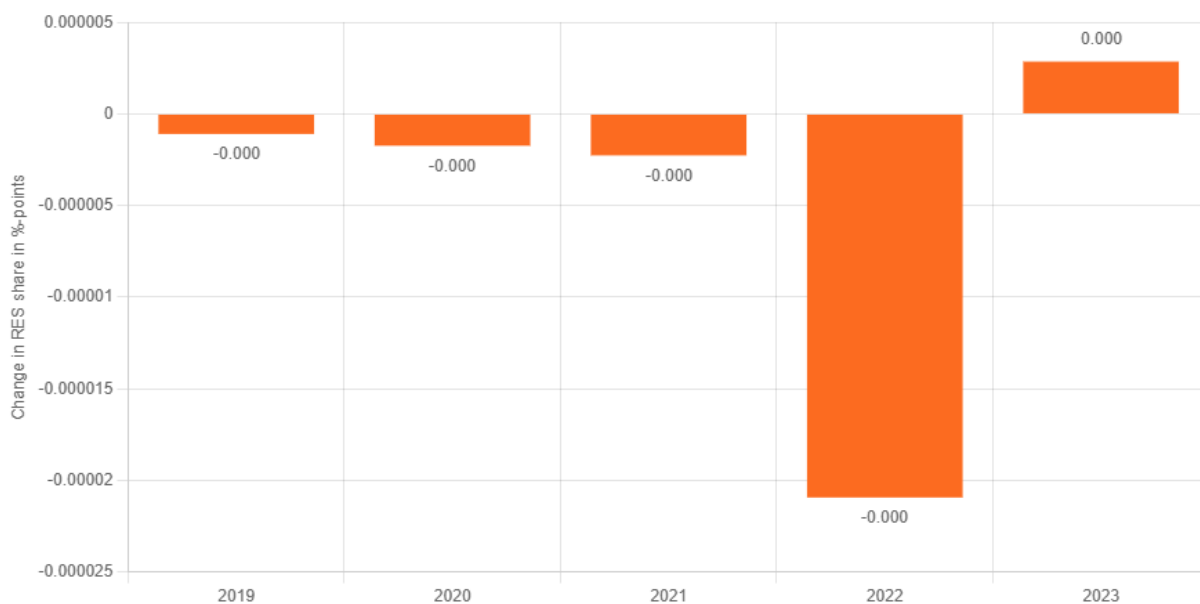


Figure 56: Impact on RES targets (EEW – IA2a)

C.1.2.4. Monetisation

Table 28: Monetisation of the multiple impacts for the Federal funding for energy and resource efficiency in industry (EEW) (2019-2023), Improvement Action 2a: Fuel Switch in the MICATool

		2019	2020	2021	2022	2023
Reduction of energy costs	Total savings in Mio. €	-0.097	-0.207	-0.204	-2.2	-2.1
	Electricity Savings in Mio. €	-0.189	-0.384	-0.395	-4.4	-4.3
	Oil Savings in Mio. €	0.012	0.018	0.020	0.288	0.325
	Coal Savings in Mio. €	0.004	0.009	0.008	0.108	0.104

		2019	2020	2021	2022	2023
Gas	Savings in Mio. €	0.054	0.111	0.119	1.3	1.3
Biomass and Waste	Savings in Mio. €	0.009	0.017	0.017	0.195	0.207
Heat	Savings in Mio. €	0.013	0.022	0.027	0.285	0.277
H2 and e-fuels	Savings in Mio. €	0.000	0.000	0.000	0.000	0.000
Reduction of greenhouse gas emissions	<i>Value in Mio. €</i>	-0.002	0.004	-0.012	-0.296	0.110
Health effects linked to reduced air pollution	<i>Value in Mio. €</i>	-0.006	-0.016	-0.026	-0.340	-0.186
Avoided asthma cases	<i>Value in Mio. €</i>	0.000	0.000	0.000	0.000	0.000
Avoided excess cold winter mortality	<i>Value in Mio. €</i>	0.000	0.000	0.000	0.000	0.000
Avoided lost working days due to air pollution	<i>Value in Mio. €</i>	0.000	0.000	0.000	-0.006	-0.003
Impact on RES targets	<i>Value in Mio. €</i>	-0.001	-0.001	-0.001	-0.010	0.001
Impact on gross domestic product	<i>Value in Mio. €</i>	13.2	79.8	153.1	197.3	558.9
Added asset value of buildings	<i>Value in Mio. €</i>	0.000	0.000	0.000	0.000	0.000

Status of data and SEED MICATool 03.03.2026

C.1.3. Improvement Action 3a: Process-specific savings

C.1.3.1. Social impacts

Note: There are no values for the indicators for avoided asthma cases, the energy poverty indicators or the reduction in excess cold weather mortality as the measures have no direct impact.

Table 29: Quantification of the social impacts for the Federal funding for energy and resource efficiency in industry (EEW) (2019-2023), Improvement Action 3a: Process-specific savings in the MICATool

		2019	2020	2021	2022	2023
Avoided health effects linked to reduced air pollution						
Mortality	<i>Reduction in casualties (#)</i>	8.8	9.2	15.6	24.3	31.2
Hospital admissions		6.6	6.9	11.6	18.0	22.9
Avoided lost working days due to air pollution						
Avoided absences	<i>days</i>	3,212.8	3,320.8	5,536.9	8,467.5	10,681.3
Reduction in disability-adjusted life-years						
Avoided asthma cases	<i>years</i>	0.0	0.0	0.0	0.0	0.0
Estimated number of people lifted out of energy poverty						
M/2	<i>people</i>	0.0	0.0	0.0	0.0	0.0
2M	<i>people</i>	0.0	0.0	0.0	0.0	0.0
Reduction in excess cold weather mortality						
Reduction in casualties	<i>Reduction in casualties (#)</i>	0.0	0.0	0.0	0.0	0.0

Status of data and SEED MICATool 03.03.2026

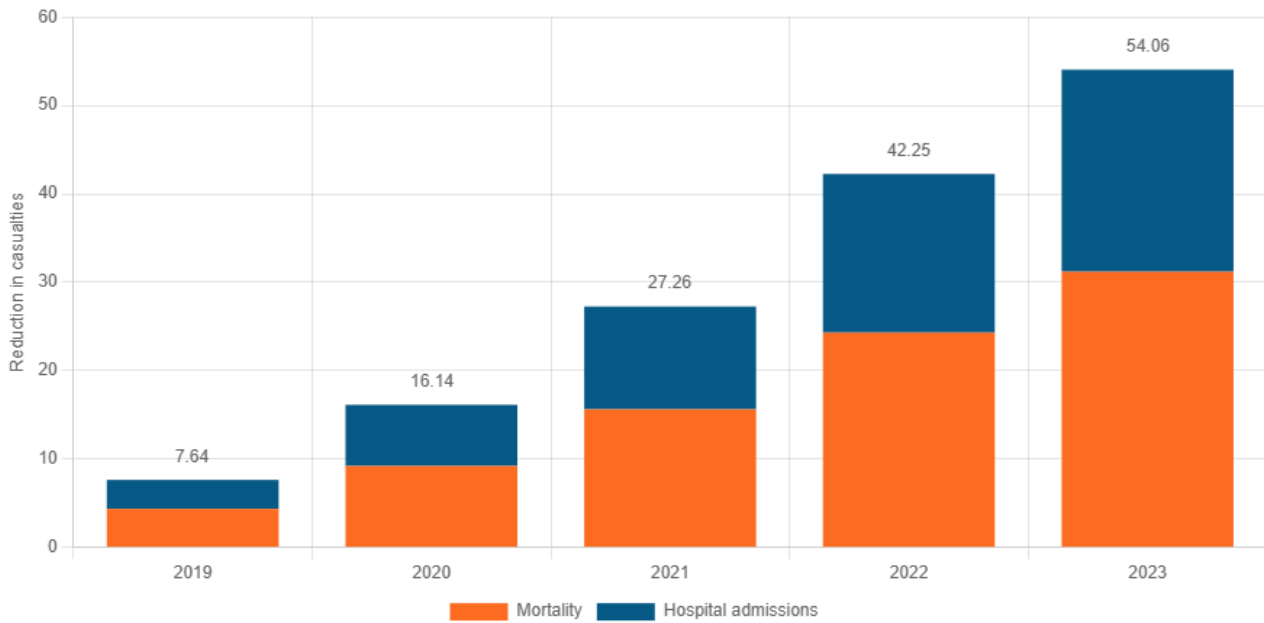


Figure 57: Health effects linked to reduced air pollution (EEW – IA3a)

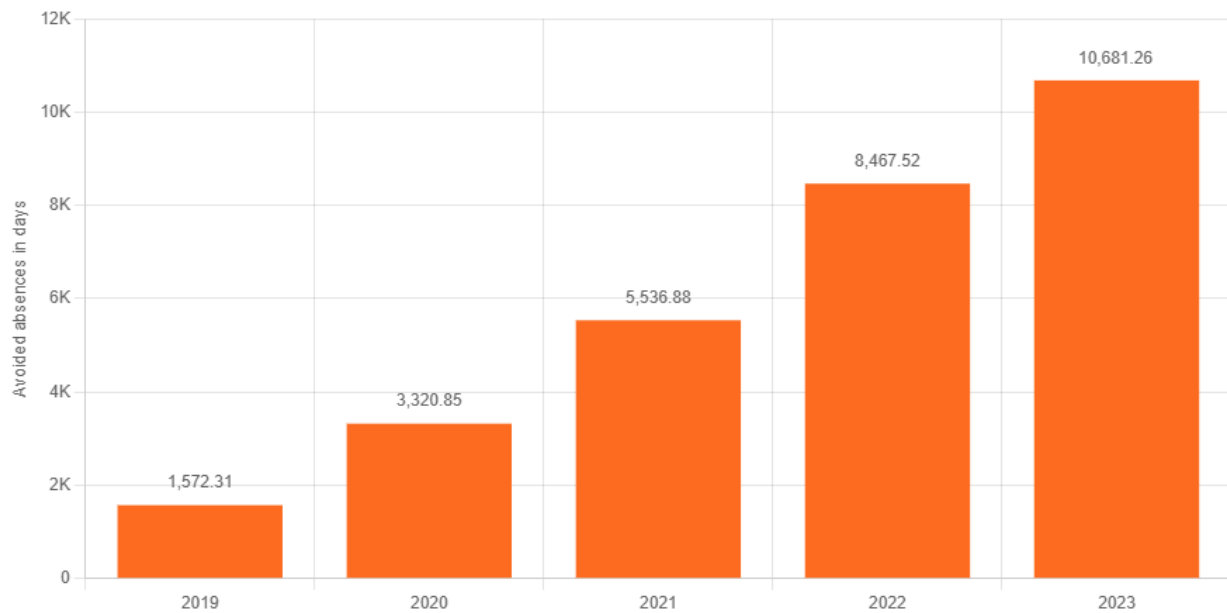


Figure 58: Avoided working days due to air pollution (EEW – IA3a)

C.1.3.2. Economic impacts

Table 30: Quantification of the economic impacts for the Federal funding for energy and resource efficiency in industry (EEW) (2019-2023), Improvement Action 3a: Process-specific savings in the MICATool

		2019	2020	2021	2022	2023
Energy impacts						
Energy intensity	Change in ktoe/ Mio. €	-0.02	-0.10	-0.22	-0.26	-0.38

		2019	2020	2021	2022	2023
Import dependency	%	-0.001	-0.001	-0.002	-0.003	-0.005
Reduction of additional generation capacity	MW	1,301.9	897.7	904.5	1,636.9	2,048.6
Onshore wind	MW	449.7	296.5	282.7	484.7	574.0
Offshore wind	MW	32.7	21.7	20.2	34.8	41.5
Solar	MW	819.6	579.5	601.6	1,117.3	1,433.1
Economics and employment						
Gross Domestic Product	Added value (Mio. €)	259.8	866.8	1,307.8	1,293.3	2,060.0
Additional employment	Full-time employment years	4,216.9	14,070.1	21,228.6	20,992.1	33,437.2

Status of data and SEED MICATool 03.03.2026



Figure 59: Impact on energy intensity (EEW – IA3a)

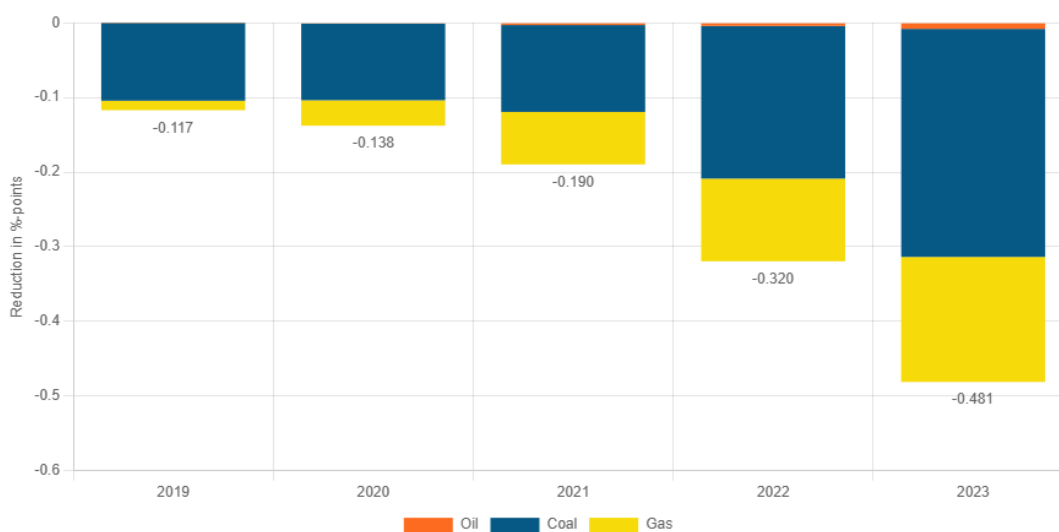


Figure 60: Impact on import dependence (EEW – IA3a)

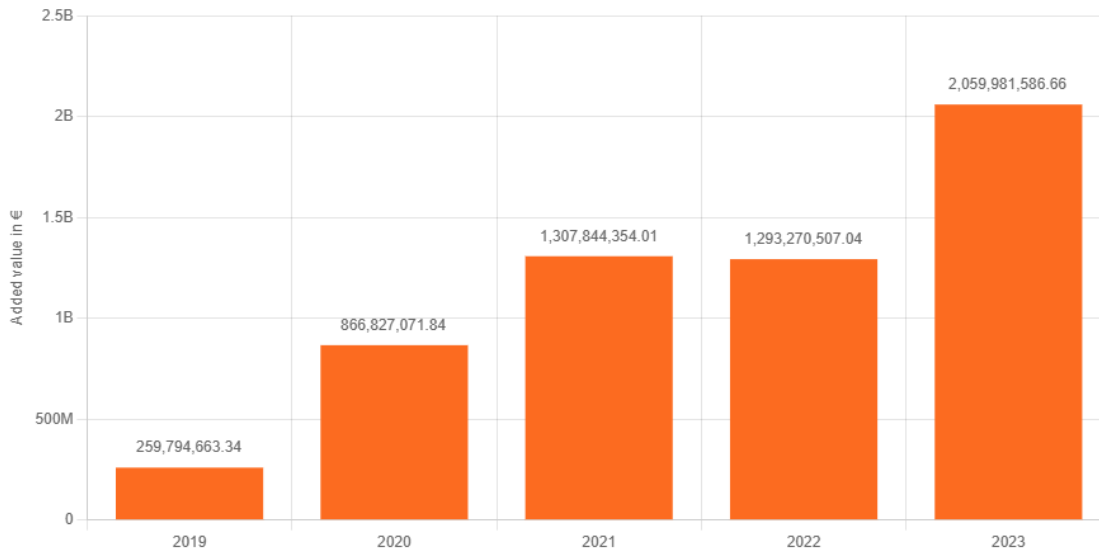


Figure 61: Impact on Gross Domestic Product (EEW – IA3a)

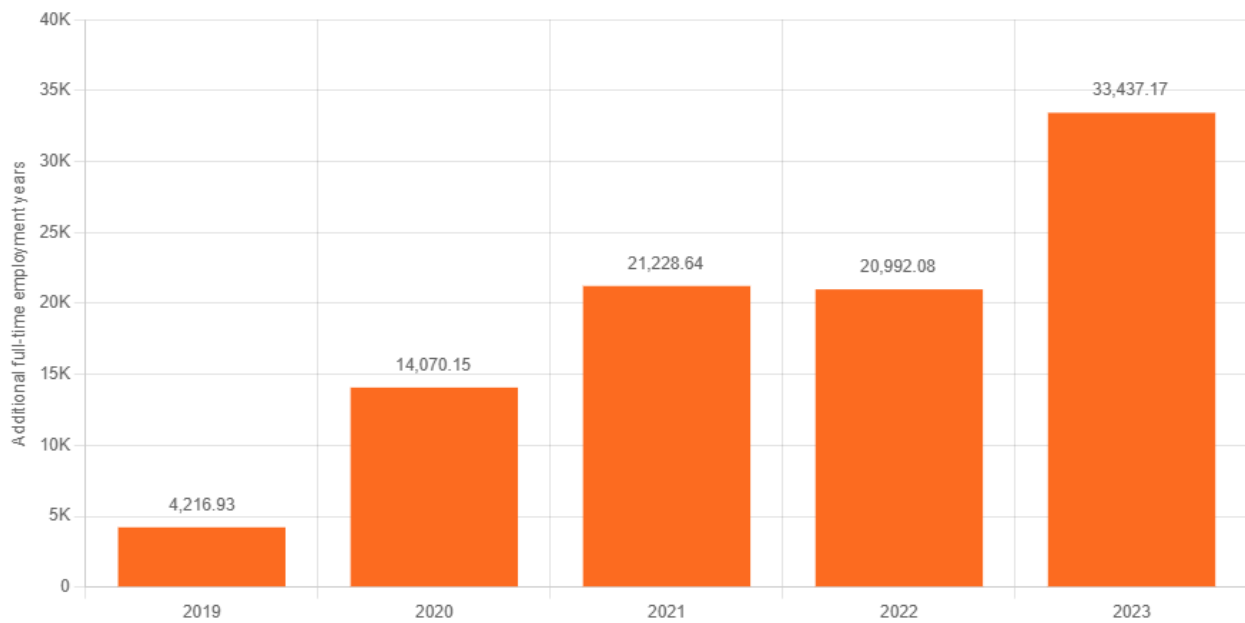


Figure 62: Additional employment (EEW – IA3a)

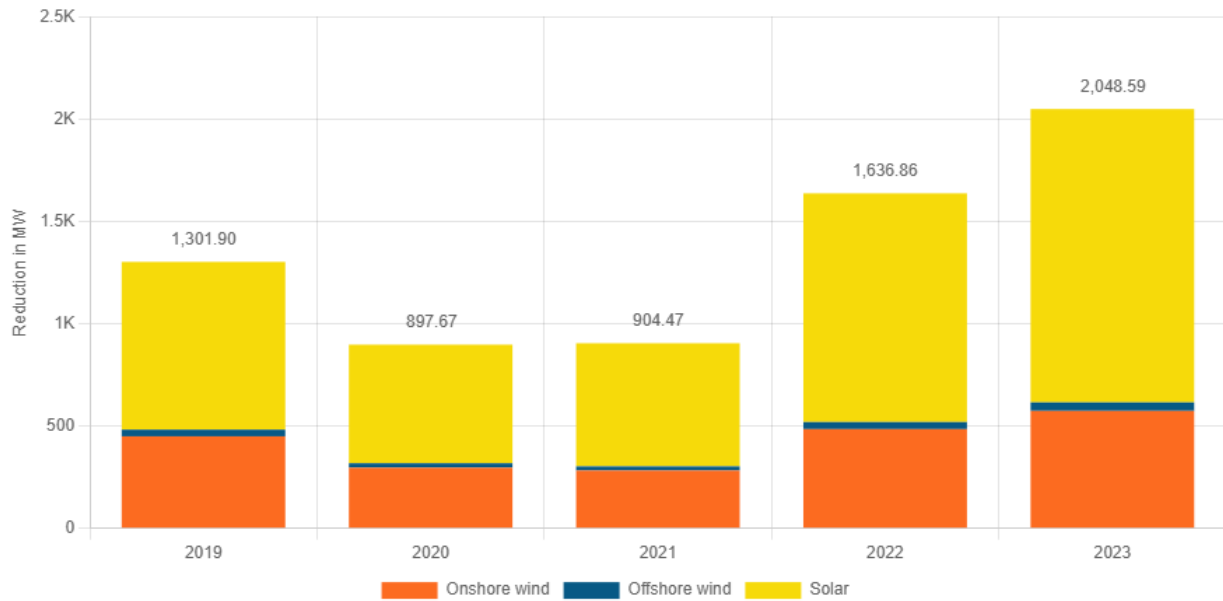


Figure 63: Reduction of additional needed generation capacity (EEW – IA3a)

C.1.3.3. Environmental impacts

Table 31: Quantification of the environmental impacts for the Federal funding for energy and resource efficiency in industry (EEW) (2019-2023), Improvement Action 3a: Process-specific savings in the MICATool

		2019	2020	2021	2022	2023
Energy impacts						
Primary savings	<i>Total ktoe</i>	313.0	413.7	745.8	1,034.5	1,445.6
	Oil <i>ktoe</i>	5.3	24.8	58.9	88.1	146.0
	Coal <i>ktoe</i>	116.7	87.3	122.6	221.1	244.3
	Gas <i>ktoe</i>	73.4	195.4	422.5	526.7	779.4
	Biomass and renewable waste <i>ktoe</i>	14.7	35.4	74.5	98.5	160.4
	Renewables <i>ktoe</i>	48.3	36.6	32.4	65.3	99.8
	Other <i>ktoe</i>	54.7	34.2	35.0	34.7	15.7
Change in RES targets	%	0.0001	0.0002	0.0003	0.0005	0.0008
Emissions						
Reduction in air pollution	<i>kt</i>	0.40	1.11	2.09	3.03	4.15
	SO2 <i>kt</i>	0.16	0.36	0.59	0.93	1.16
	NOX <i>kt</i>	0.23	0.74	1.47	2.05	2.92
	PM _{2_5} <i>kt</i>	0.01	0.02	0.03	0.05	0.07
Reduction in greenhouse gas emissions (CO₂)	<i>kt</i>	332.4	887.1	1,662.7	2,395.3	3,252.6

Status of data and SEED MICATool 03.03.2026

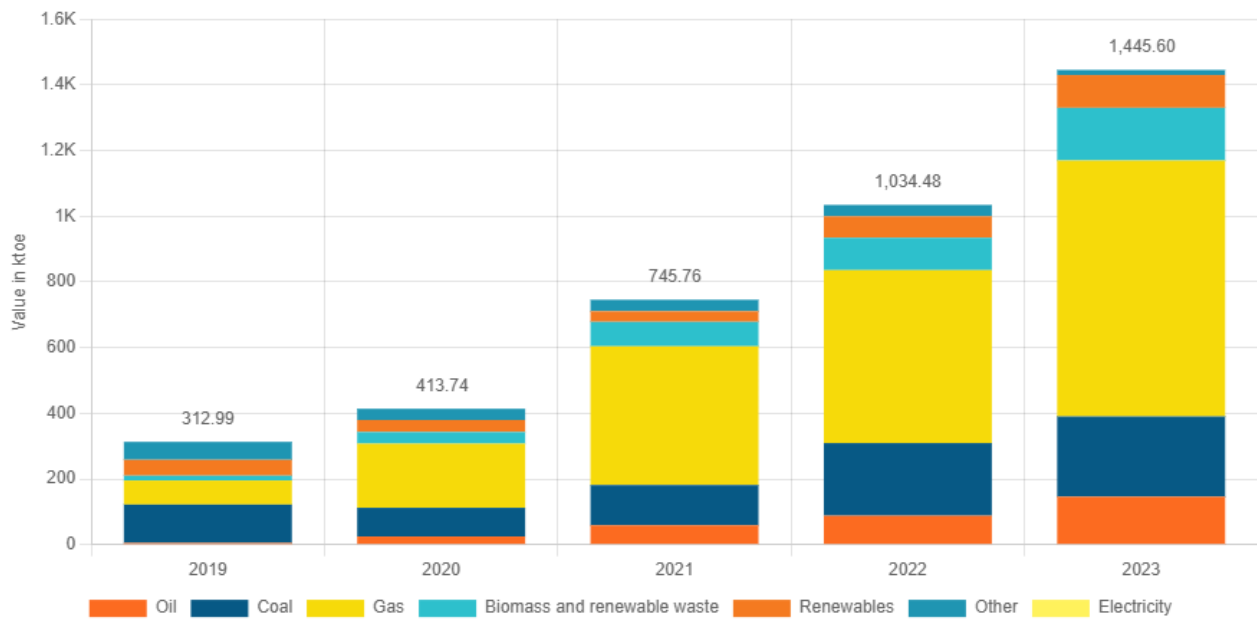


Figure 64: Primary savings by energy carriers (EEW – IA3a)

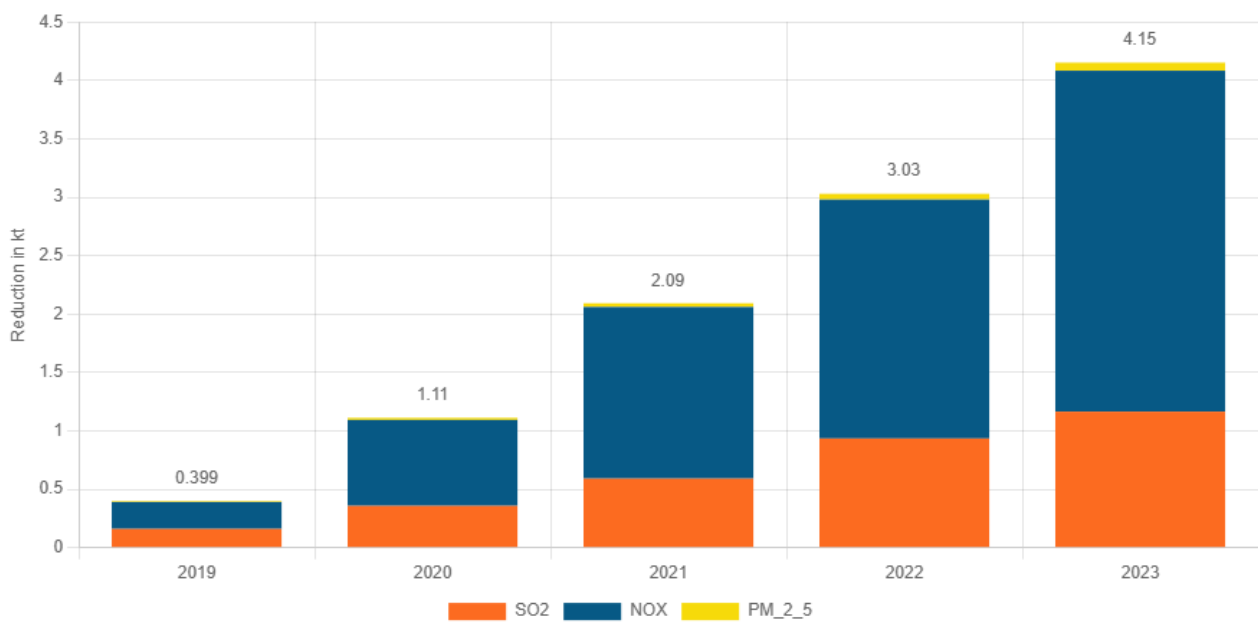


Figure 65: Reduction in air pollution (EEW – IA3a)

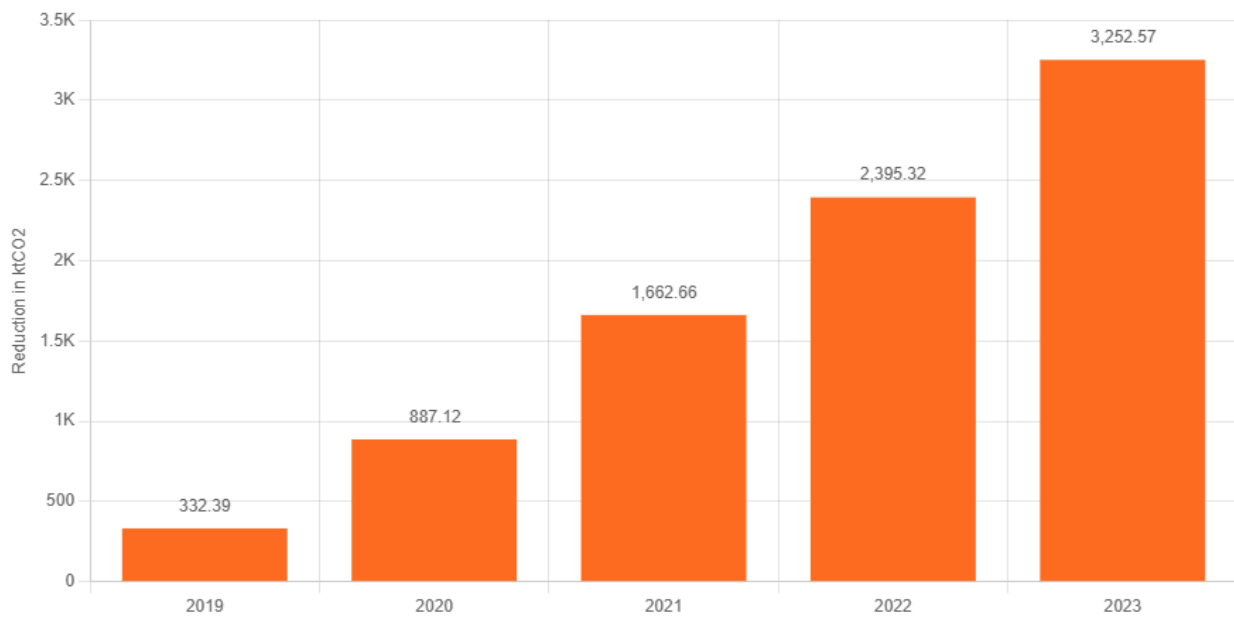


Figure 66: Reduction in greenhouse gas emissions (EEW – IA3a)

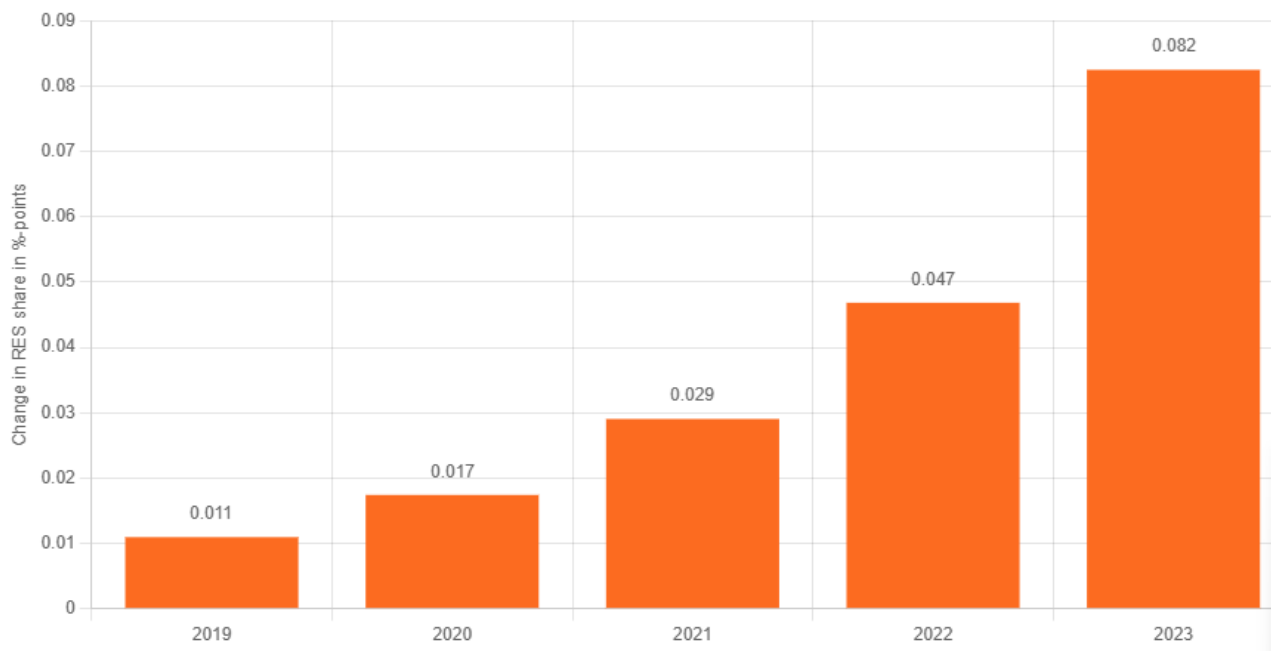


Figure 67: Impact on RES targets (EEW – IA3a)

C.1.3.4. Monetisation

Table 32: Monetisation of the multiple impacts for the Federal funding for energy and resource efficiency in industry (EEW) (2019-2023), Improvement Action 3a: Process-specific savings in the MICATool

		2019	2020	2021	2022	2023
Reduction of energy costs	Total savings in Mio. €	212.3	226.7	361.4	546.3	784.0

		2019	2020	2021	2022	2023
Electricity	<i>Savings in Mio. €</i>	204.5	143.5	143.8	259.3	323.6
Oil	<i>Savings in Mio. €</i>	1.1	9.9	26.9	42.7	76.3
Coal	<i>Savings in Mio. €</i>	0.4	4.6	10.2	16.2	24.4
Gas	<i>Savings in Mio. €</i>	5.3	59.8	158.0	199.1	311.0
Biomass and Waste	<i>Savings in Mio. €</i>	0.9	9.0	22.7	28.9	48.7
Heat	<i>Savings in Mio. €</i>	0.0	0.0	0.0	0.0	0.0
H2 and e-fuels	<i>Savings in Mio. €</i>	0.0	0.0	0.0	0.0	0.0
Reduction of greenhouse gas emissions	<i>Value in Mio. €</i>	16.6	88.7	249.4	479.1	813.1
Health effects linked to reduced air pollution	<i>Value in Mio. €</i>	8.6	36.1	62.7	99.7	130.9
Avoided asthma cases	<i>Value in Mio. €</i>	0.0	0.0	0.0	0.0	0.0
Avoided excess cold winter mortality	<i>Value in Mio. €</i>	0.0	0.0	0.0	0.0	0.0
Avoided lost working days due to air pollution	<i>Value in Mio. €</i>	0.2	0.6	1.1	1.7	2.2
Impact on RES targets	<i>Value in Mio. €</i>	5.5	8.1	14.1	21.6	34.1
Impact on gross domestic product	<i>Value in Mio. €</i>	259.8	866.8	1,307.8	1,293.3	2,060.0
Added asset value of buildings	<i>Value in Mio. €</i>	0.0	0.0	0.0	0.0	0.0

Status of data and SEED MICATool 03.03.2026

C.1.4. Improvement Action 2b: Fuel switch

Note: This improvement action (module 6 of the EE programme) only took place from May 2023.

C.1.4.1. Social impacts

Note: There are no values for the indicators for avoided asthma cases, the energy poverty indicators or the reduction in excess cold weather mortality as the measures have no direct impact.

Table 33: Quantification of the social impacts for the Federal funding for energy and resource efficiency in industry (EEW) (2019-2023), Improvement Action 2b: Fuel Switch

		2019	2020	2021	2022	2023
Avoided health effects linked to reduced air pollution						
Mortality	<i>Reduction in casualties (#)</i>	-	-	-	-	-33
Hospital admissions		-	-	-	-	-24
Avoided lost working days due to air pollution						
Avoided absences	<i>days</i>	-	-	-	-	-11.1
Reduction in disability-adjusted life-years						
Avoided asthma cases	<i>years</i>	-	-	-	-	N/A
Estimated number of people lifted out of energy poverty						
M/2	<i>people</i>	-	-	-	-	N/A
2M	<i>people</i>	-	-	-	-	N/A
Reduction in excess cold weather mortality						
Reduction in casualties	<i>Reduction in casualties (#)</i>	-	-	-	-	N/A

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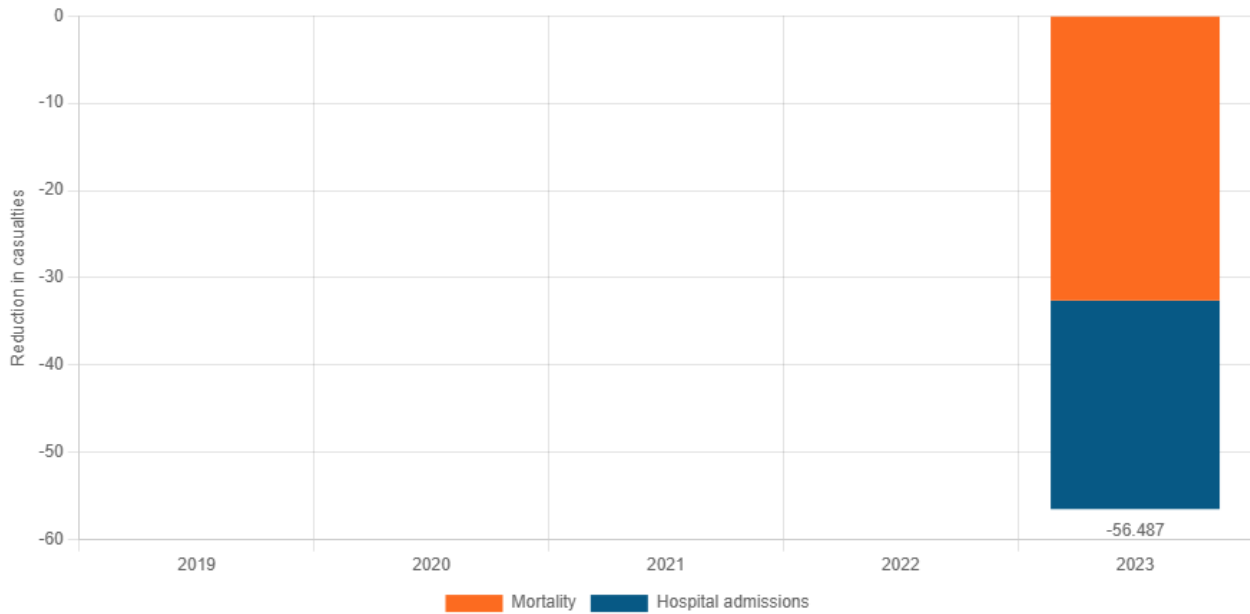


Figure 68: Health effects linked to reduced air pollution (EEW – IA2b)

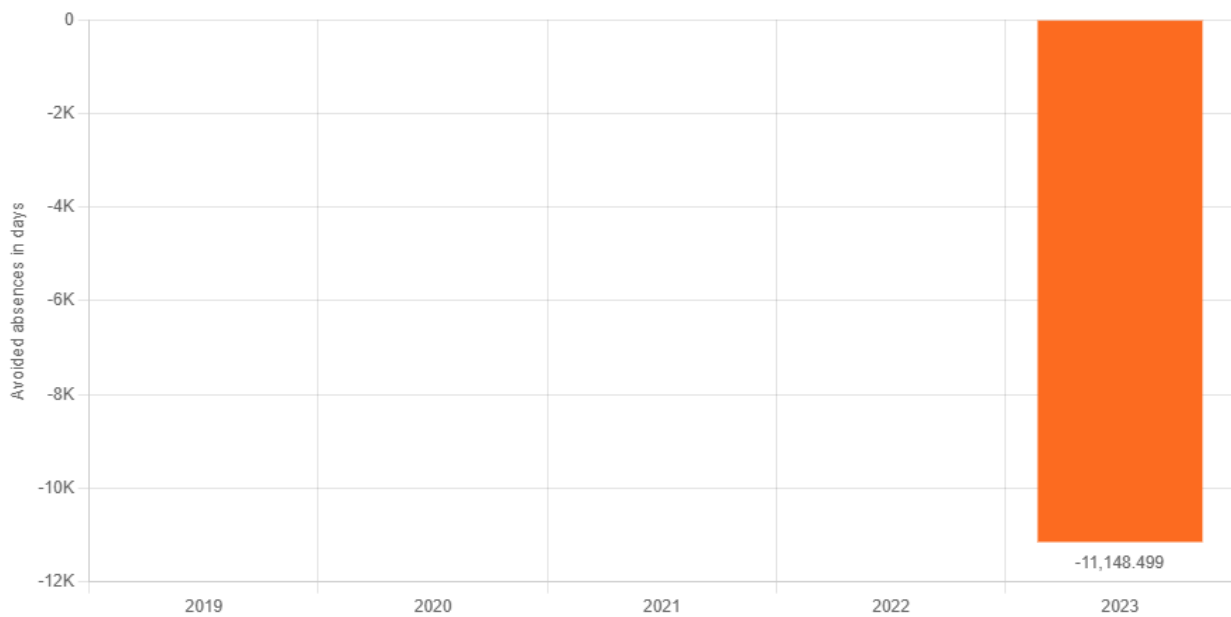


Figure 69: Avoided working days due to air pollution (EEW – IA2b)

C.1.4.2. Economic impacts

Table 34: Quantification of the economic impacts for the Federal funding for energy and resource efficiency in industry (EEW) (2019-2023), Improvement Action 2b: Fuel Switch in the MICATool

		2019	2020	2021	2022	2023
Energy impacts						
Energy intensity	<i>Change in ktoe/ Mio. €</i>	-	-	-	-	-0.47
Import dependency	%	-	-	-	-	0.004

		2019	2020	2021	2022	2023
Reduction of additional generation capacity	<i>MW</i>	-	-	-	-	-8,259.1
Onshore wind	<i>MW</i>	-	-	-	-	-2,314.0
Offshore wind	<i>MW</i>	-	-	-	-	-167.4
Solar	<i>MW</i>	-	-	-	-	-5,777.8
Economics and employment						
Gross domestic product	<i>Added value (Mio. €)</i>	-	-	-	-	10.6
Additional employment	<i>Full-time employment years</i>	-	-	-	-	171

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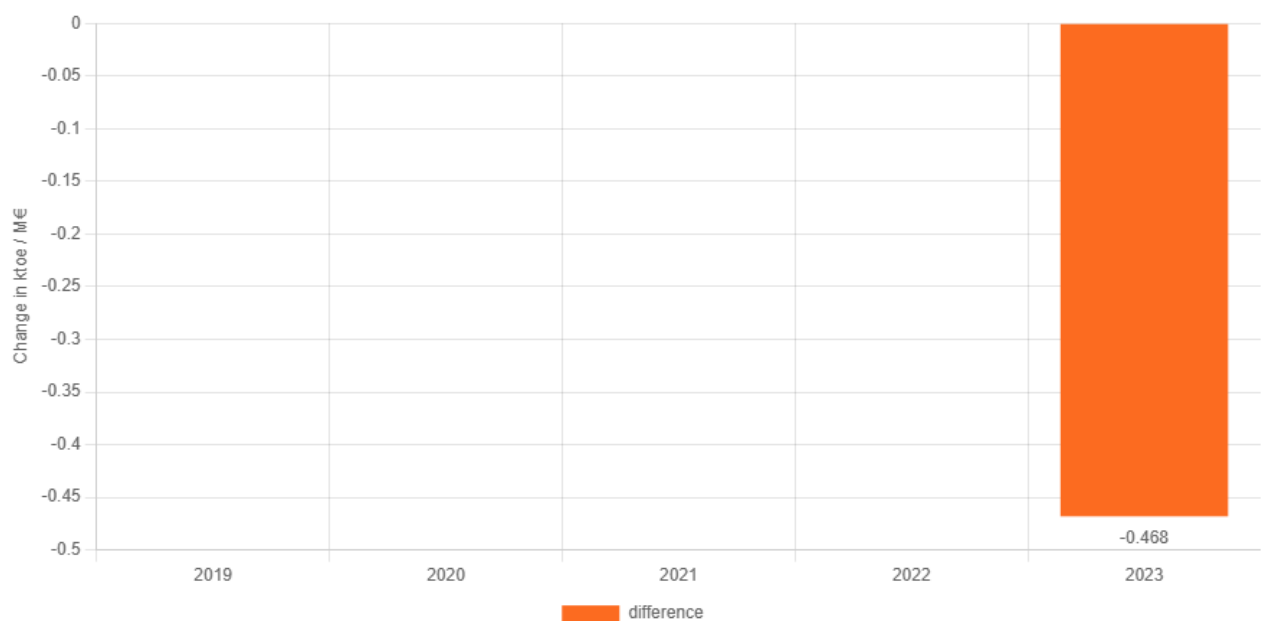


Figure 70: Impact on energy intensity (E_{EW} – IA_{2b})

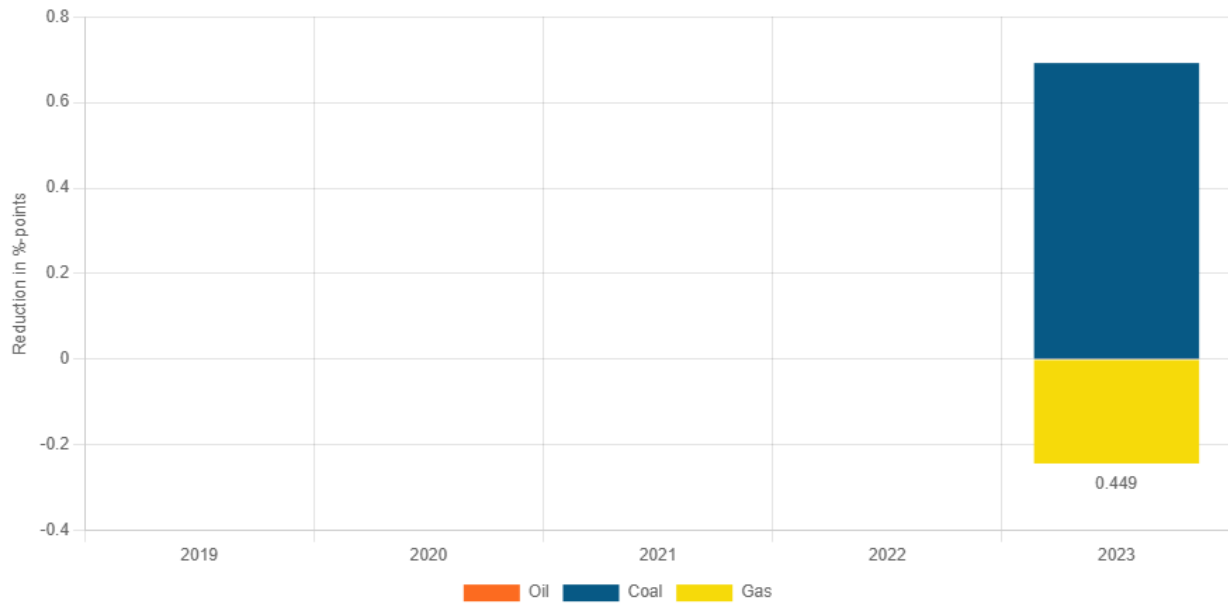


Figure 71: Impact on import dependence (EEW – IA2b)

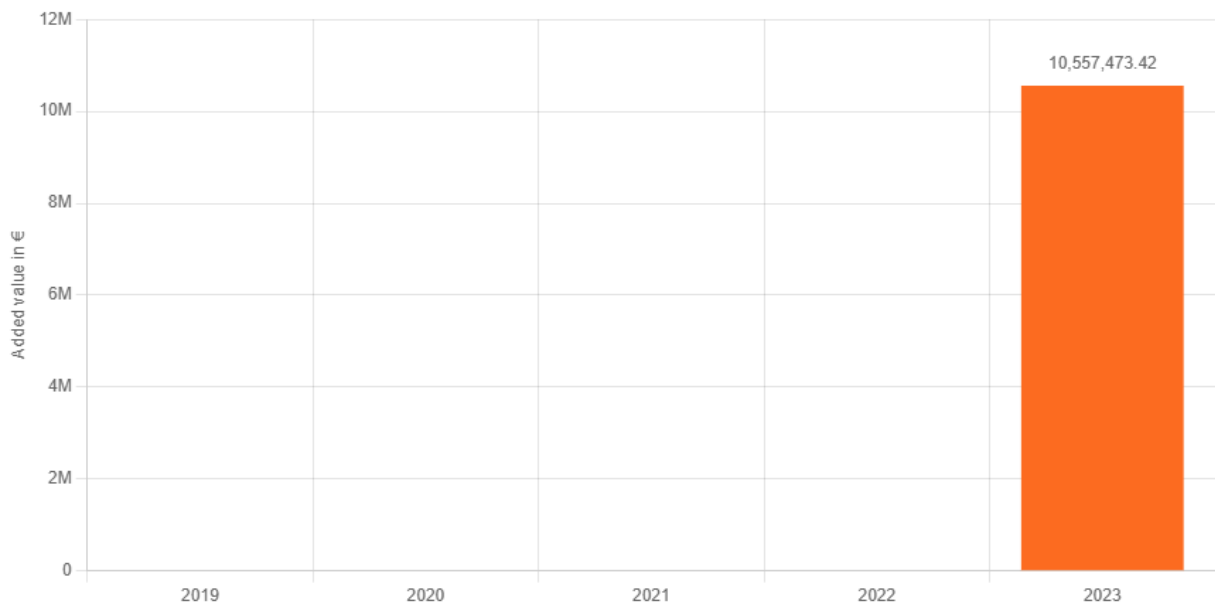


Figure 72: Impact on Gross Domestic Product (EEW – IA2b)

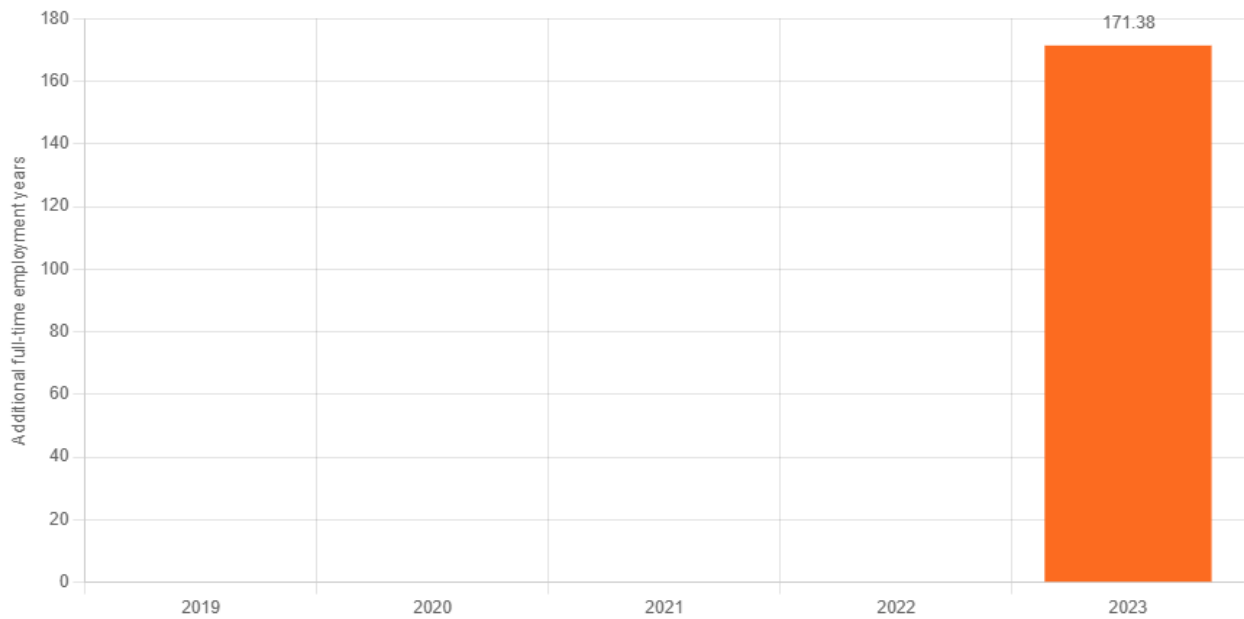


Figure 73: Additional employment (EEW – IA2b)

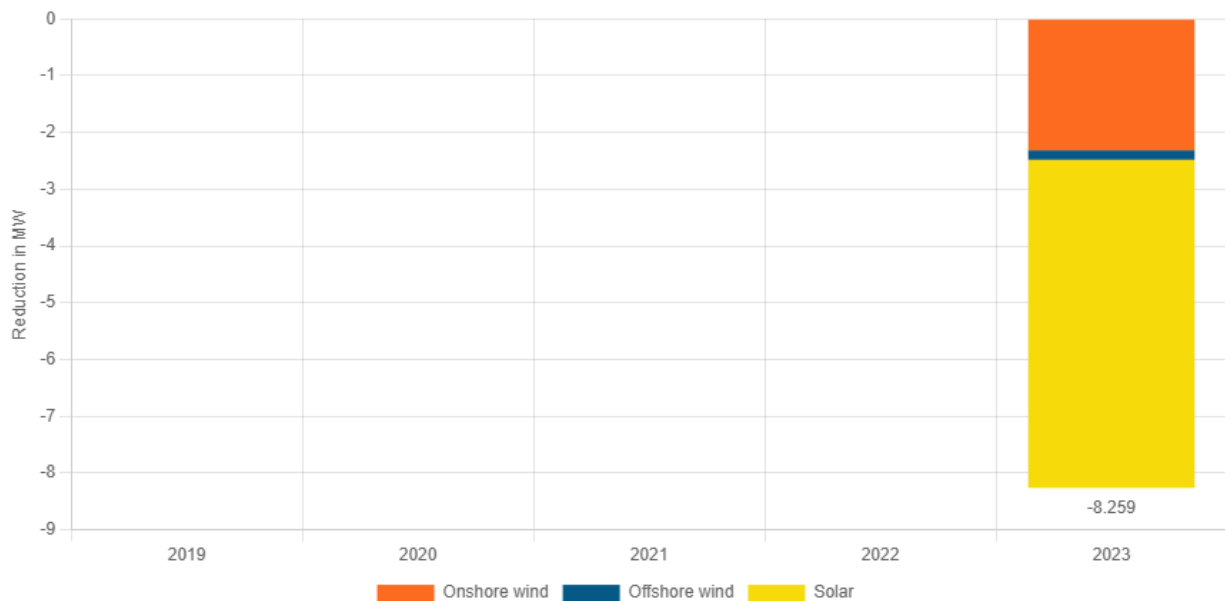


Figure 74: Reduction of additional needed generation capacity (EEW – IA2b)

C.1.4.3. Environmental impacts

Table 35: Quantification of the environmental impacts for the Federal funding for energy and resource efficiency in industry (EEW) (2019-2023), Improvement Action 2b: Fuel Switch in the MICATool

		2019	2020	2021	2022	2023
Energy impacts						
Primary savings	<i>Total ktoe</i>	-	-	-	-	-7.9
	Oil <i>ktoe</i>	-	-	-	-	-23.9

		2019	2020	2021	2022	2023
Coal	ktoe	-	-	-	-	-563.0
Gas	ktoe	-	-	-	-	1126.8
Biomass and renewable waste	ktoe	-	-	-	-	-82.2
Renewables	ktoe	-	-	-	-	-402.4
Other	ktoe	-	-	-	-	-63.2
Change in RES targets	%	-	-	-	-	0.000
Emissions						
Reduction in air pollution	kt	-	-	-	-	-1.05
SO2	kt	-	-	-	-	-1.46
NOX	kt	-	-	-	-	0.49
PM_2_5	kt	-	-	-	-	-0.08
Reduction in greenhouse gas emissions (CO₂)	kt	-	-	-	-	260.5

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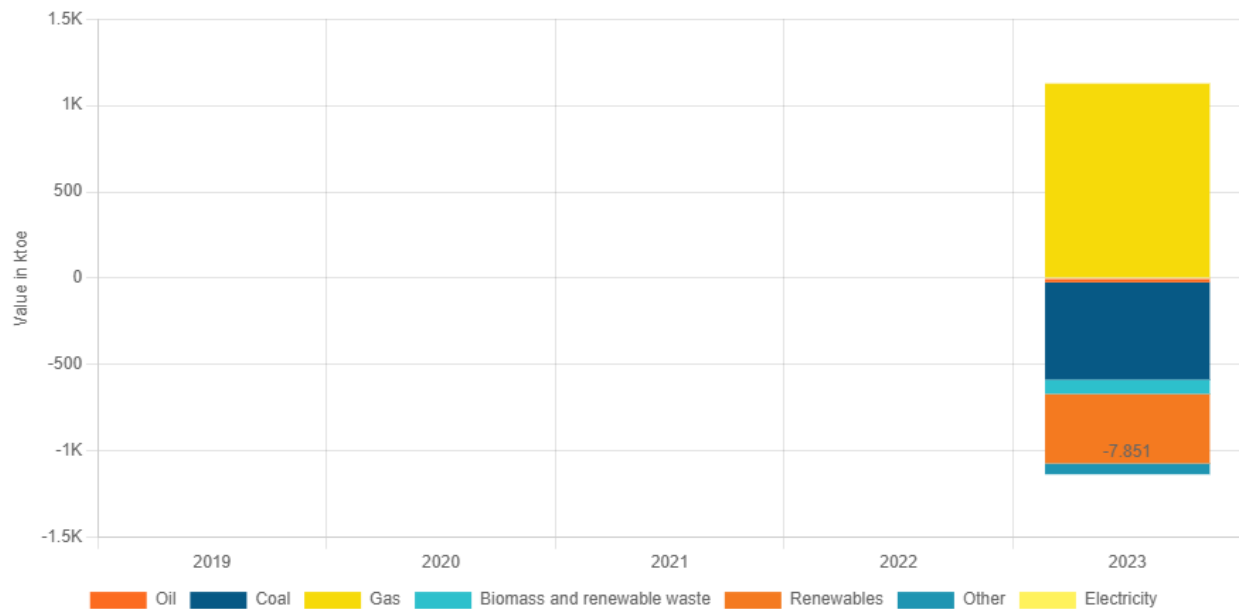


Figure 75: Primary savings by energy carriers (EEW – IA2b)

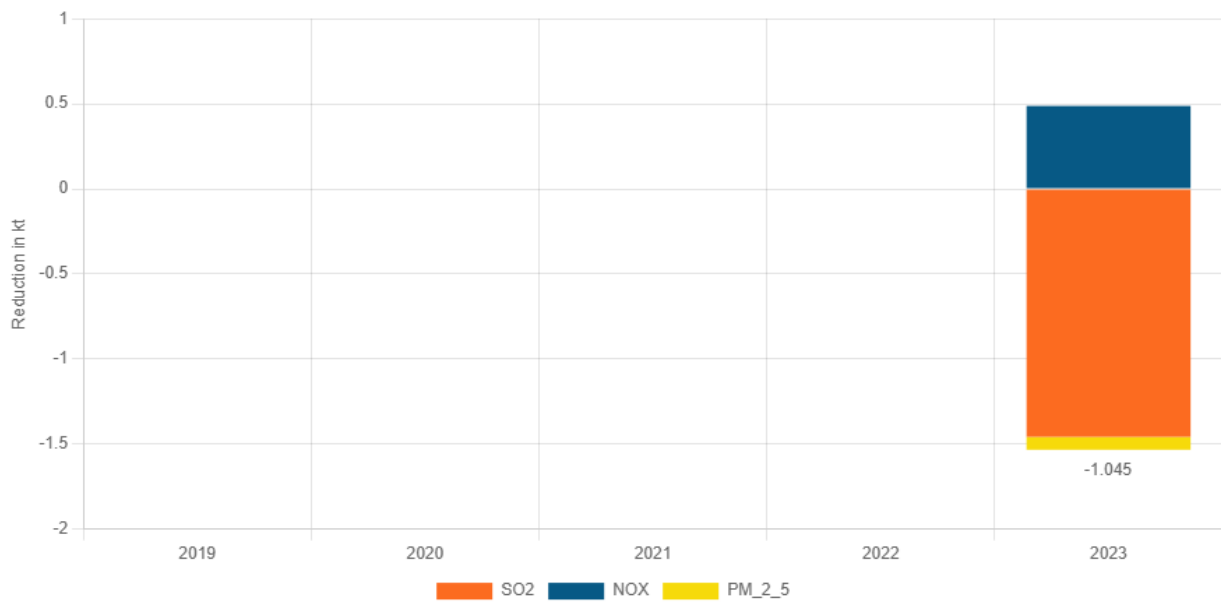


Figure 76: Reduction in air pollution (EEW – IA2b)

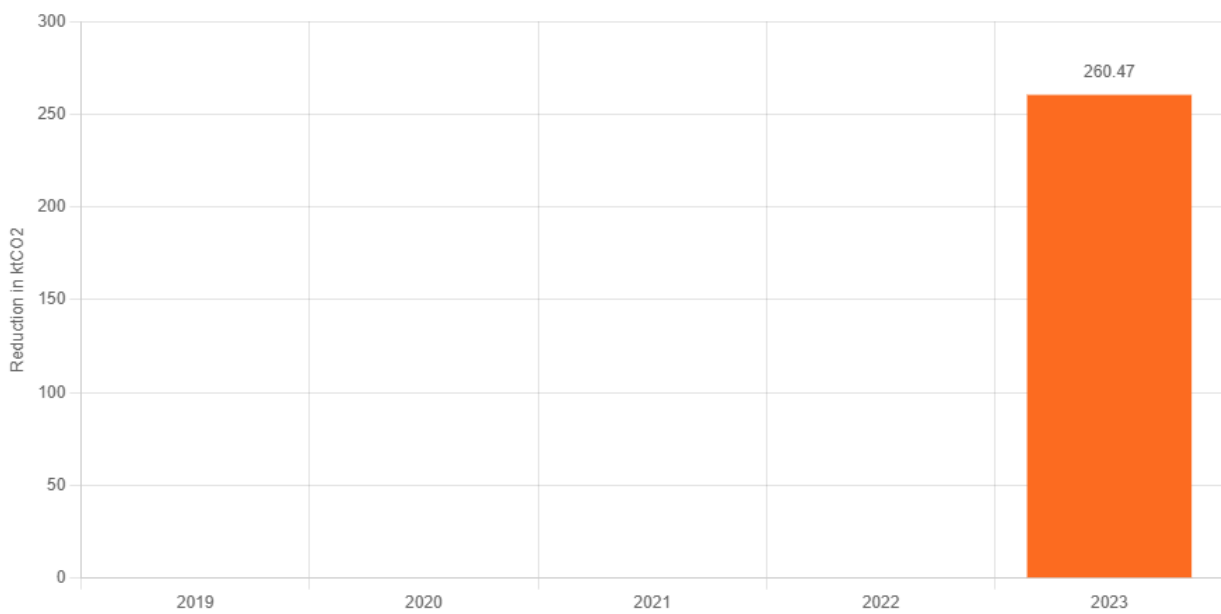


Figure 77: Reduction in greenhouse gas emissions (EEW – IA2b)

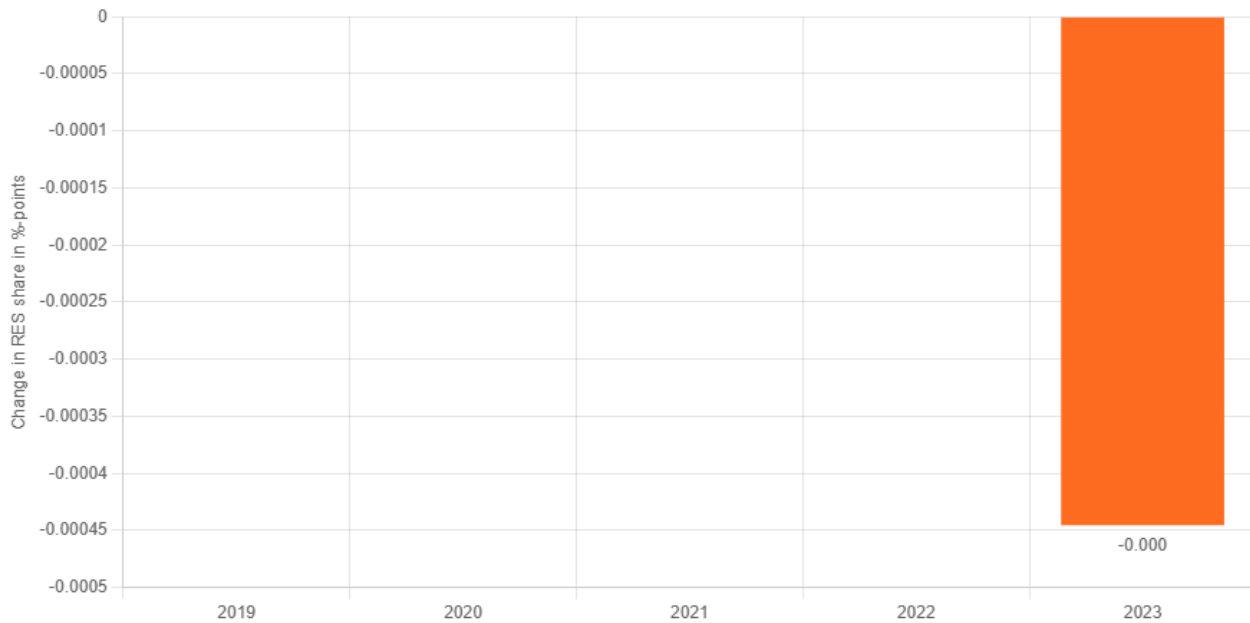


Figure 78: Impact on RES targets (EEW – IA2b)

C.1.4.4. Monetisation

Table 36: Monetisation of the multiple impacts for the Federal funding for energy and resource efficiency in industry (EEW) (2019-2023), Improvement Action 2b: Fuel Switch in the MICATool

		2019	2020	2021	2022	2023
Reduction of energy costs	<i>Total savings in Mio. €</i>	-	-	-	-	- 610.7
	Electricity <i>Savings in Mio. €</i>	-	-	-	-	- 1,304.4
	Oil <i>Savings in Mio. €</i>	-	-	-	-	-
	Coal <i>Savings in Mio. €</i>	-	-	-	-	-
	Gas <i>Savings in Mio. €</i>	-	-	-	-	693.7
	Biomass and Waste <i>Savings in Mio. €</i>	-	-	-	-	-
	Heat <i>Savings in Mio. €</i>	-	-	-	-	-
	H2 and e-fuels <i>Savings in Mio. €</i>	-	-	-	-	-
Reduction of greenhouse gas emissions	<i>Value in Mio. €</i>	-	-	-	-	65.1
Health effects linked to reduced air pollution	<i>Value in Mio. €</i>	-	-	-	-	- 136.8
Avoided asthma cases	<i>Value in Mio. €</i>	-	-	-	-	-
Avoided excess cold winter mortality	<i>Value in Mio. €</i>	-	-	-	-	-
Avoided lost working days due to air pollution	<i>Value in Mio. €</i>	-	-	-	-	- 2.3
Impact on RES targets	<i>Value in Mio. €</i>	-	-	-	-	- 0.2
Impact on gross domestic product	<i>Value in Mio. €</i>	-	-	-	-	10.6
Added asset value of buildings	<i>Value in Mio. €</i>	-	-	-	-	-

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C.1.5. Improvement Action 3b: Process-specific savings

C.1.5.1. Social impacts

Note: There are no values for the indicators for avoided asthma cases, the energy poverty indicators or the reduction in excess cold weather mortality as the measures have no direct impact.

Table 37: Quantification of the social impacts for the Federal funding for energy and resource efficiency in industry (EEW) (2019-2023), Improvement Action 3b: Process-specific savings in the MICATool

		2019	2020	2021	2022	2023
Avoided health effects linked to reduced air pollution						
Mortality	<i>Reduction in casualties (#)</i>	0.5	1.3	2.8	3.6	5.0
Hospital admissions		0.2	1.0	2.1	2.7	3.7
Avoided lost working days due to air pollution						
Avoided absences	<i>days</i>	168	456	985	1,257	1,709
Reduction in disability-adjusted life-years						
Avoided asthma cases	<i>years</i>	N/A	N/A	N/A	N/A	N/A
Estimated number of people lifted out of energy poverty						
M/2	<i>people</i>	N/A	N/A	N/A	N/A	N/A
2M	<i>people</i>	N/A	N/A	N/A	N/A	N/A
Reduction in excess cold weather mortality						
Reduction in casualties	<i>Reduction in casualties (#)</i>	N/A	N/A	N/A	N/A	N/A

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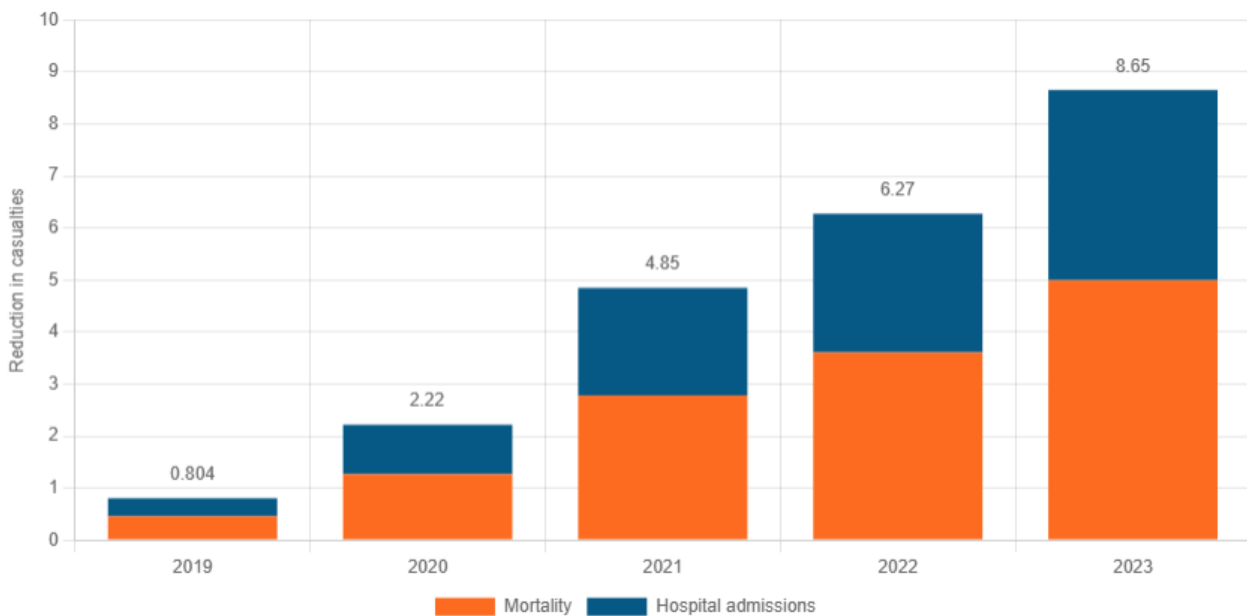


Figure 79: Health effects linked to reduced air pollution (EEW – IA3b)

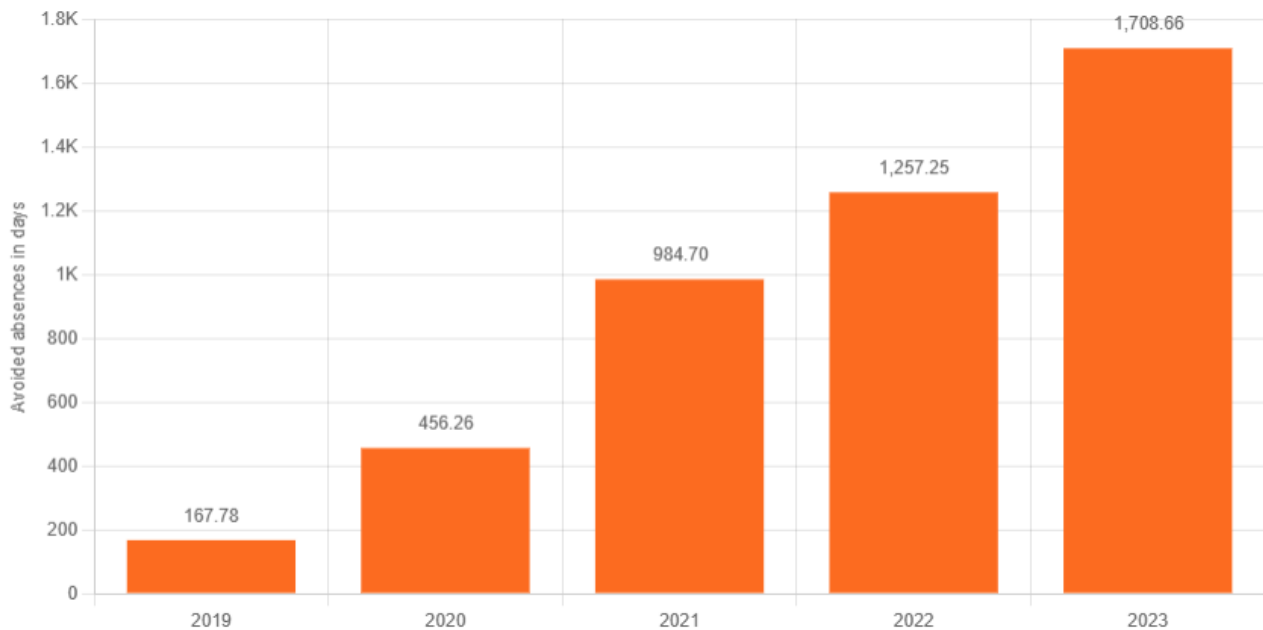


Figure 80: Avoided working days due to air pollution (EEW – IA3b)

C.1.5.2. Economic impacts

Table 38: Quantification of the economic impacts for the Federal funding for energy and resource efficiency in industry (EEW) (2019-2023), Improvement Action 3b: Process-specific savings in the MICATool

		2019	2020	2021	2022	2023
Energy impacts						
Energy intensity	<i>Change in ktoe/ Mio. €</i>	-0.007	-0.018	-0.030	-0.044	-0.026
Import dependency	%	-0.0001	-0.0002	-0.0003	-0.0005	-0.0009
Reduction of additional generation capacity	<i>MW</i>	14.0	57.0	189.7	160.6	684.8
Onshore wind	<i>MW</i>	4.8	18.8	59.3	47.6	191.9
Offshore wind	<i>MW</i>	0.4	1.4	4.2	3.4	13.9
Solar	<i>MW</i>	8.8	36.8	126.2	109.6	479.1
Economics and employment						
Gross domestic product	<i>Added value (Mio. €)</i>	20.3	58.9	33.6	93.8	114.1
Additional employment	<i>Full-time employment years</i>	329	957	545	1,522	1,851

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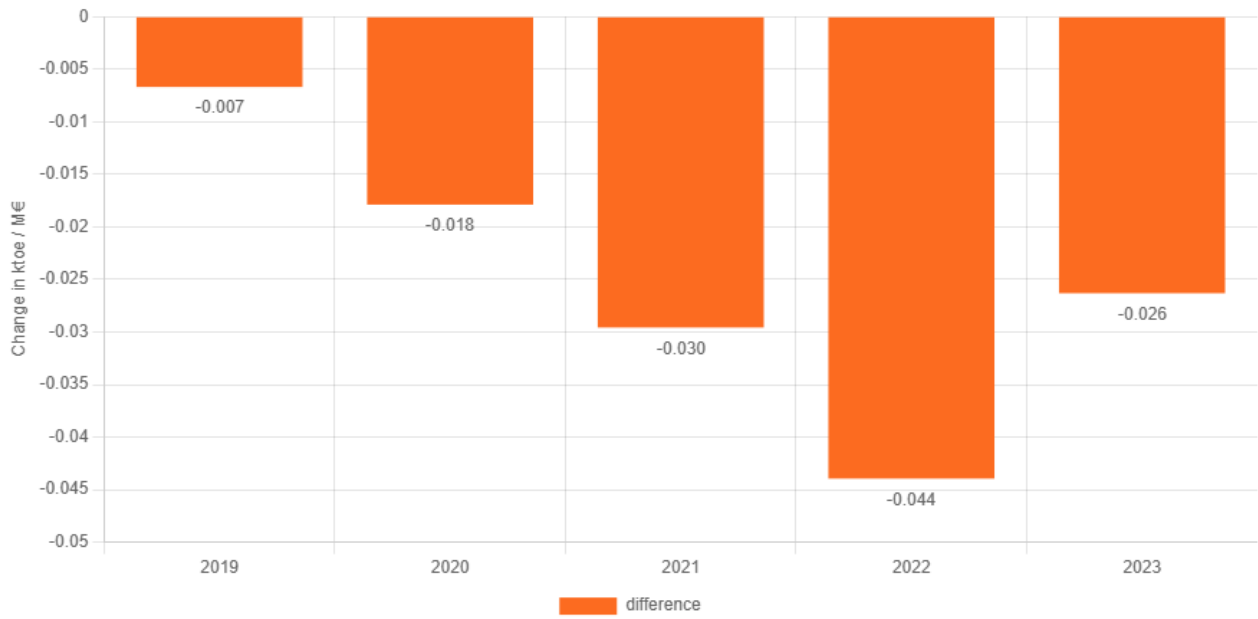


Figure 81: Impact on energy intensity (EEW – IA3b)

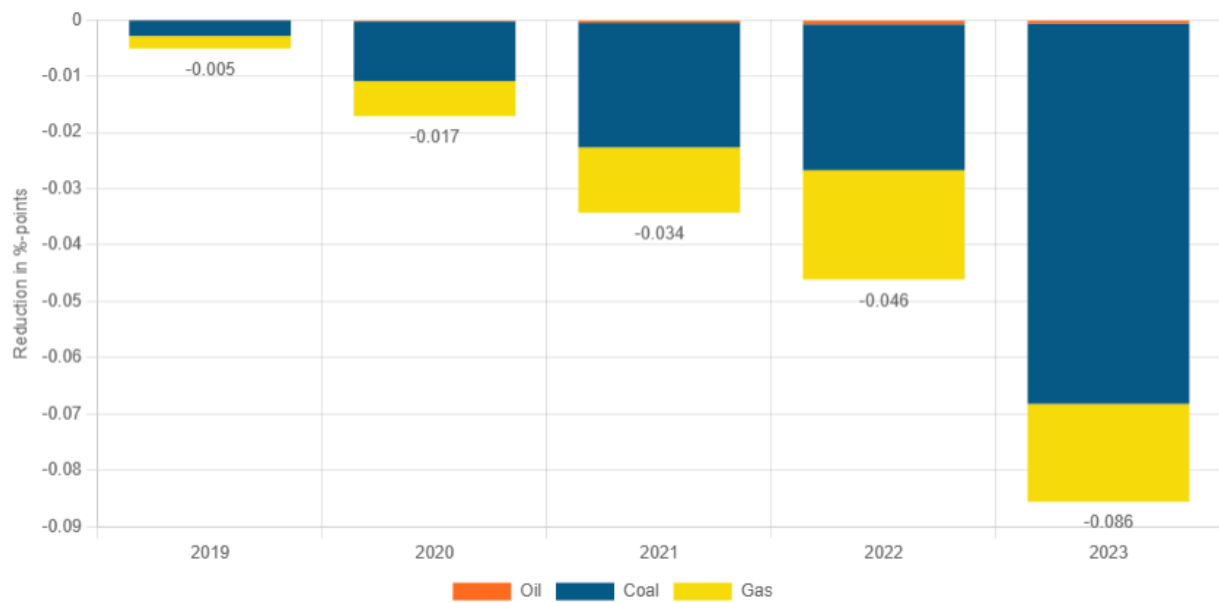


Figure 82: Impact on import dependence (EEW – IA3b)

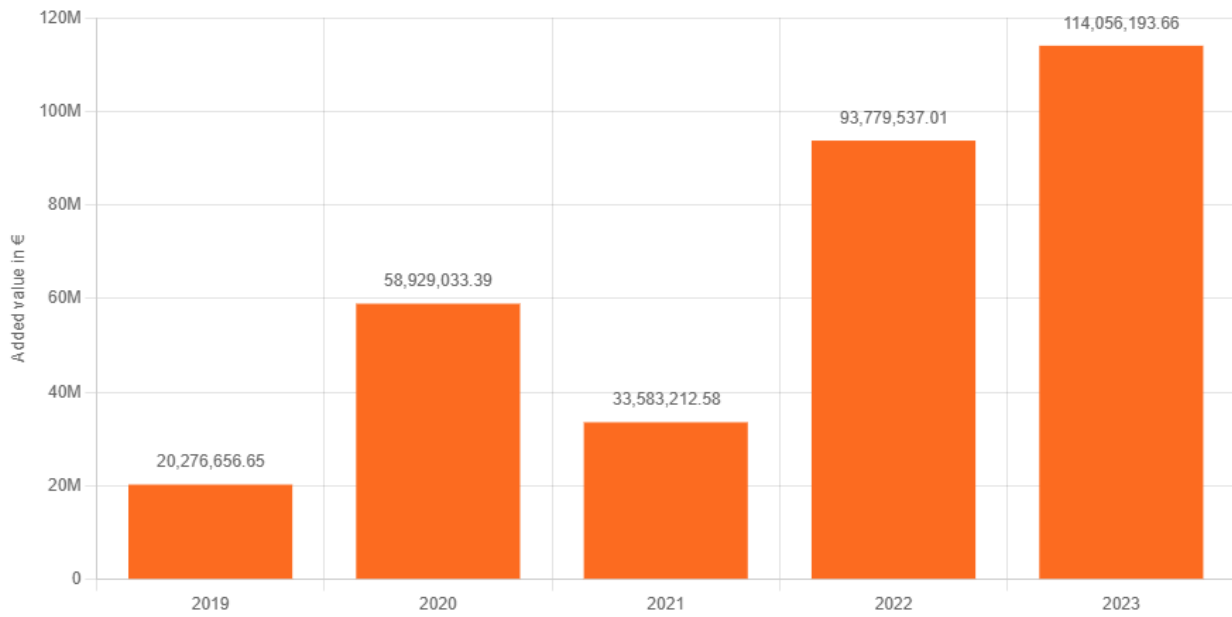


Figure 83: Impact on Gross Domestic Product (EEW – IA3b)

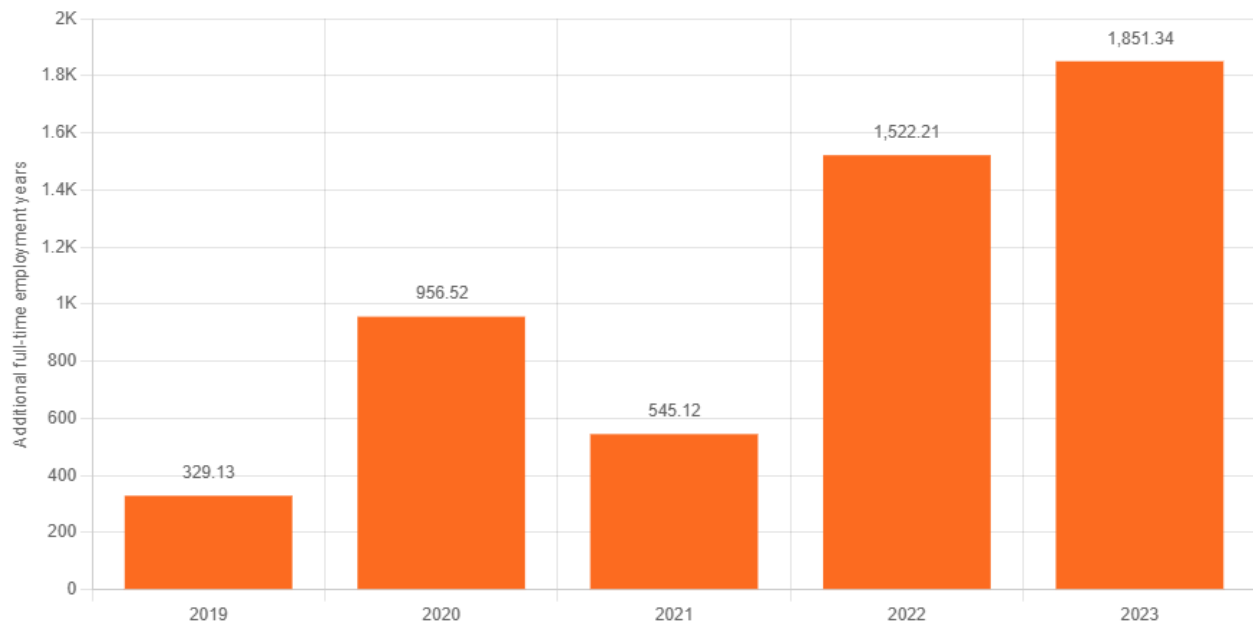


Figure 84: Additional employment (EEW – IA3b)

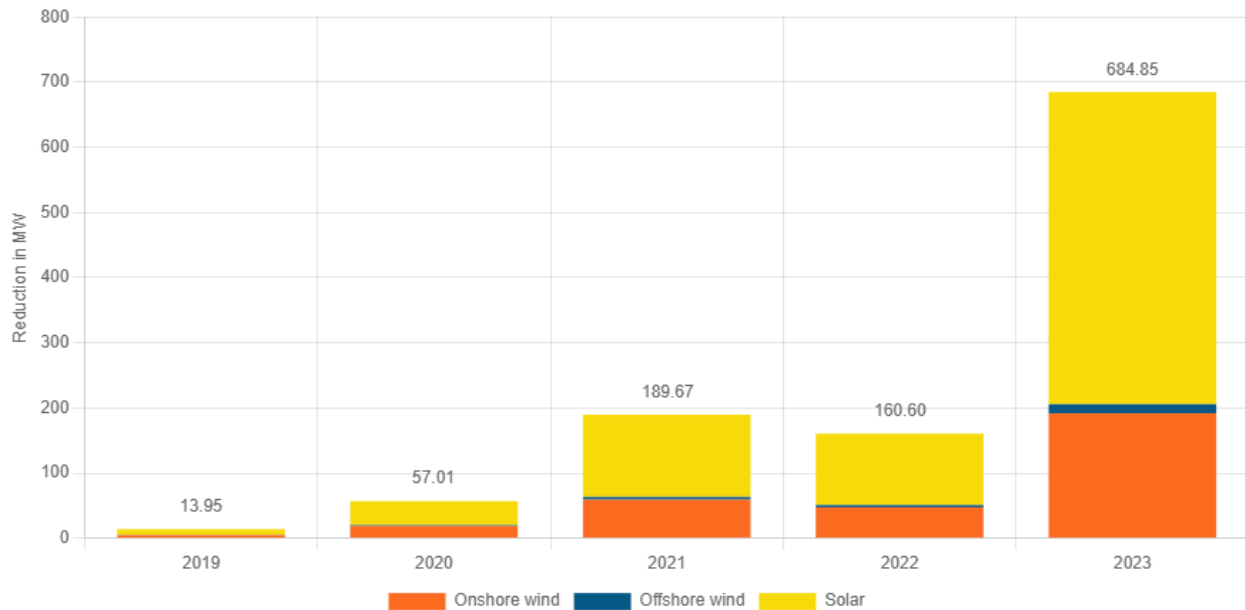


Figure 85: Reduction of additional needed generation capacity (Eew – IA3b)

C.1.5.3. Environmental impacts

Table 39: Quantification of the environmental impacts for the Federal funding for energy and resource efficiency in industry (Eew) (2019-2023), Improvement Action 3b: Process-specific savings in the MICATool

		2019	2020	2021	2022	2023
Energy impacts						
Primary savings	<i>Total ktoe</i>	21.3	60.7	129.5	164.3	203.4
	Oil <i>ktoe</i>	1.9	5.1	9.6	16.3	12.0
	Coal <i>ktoe</i>	3.1	9.0	23.4	28.1	54.3
	Gas <i>ktoe</i>	12.9	35.7	70.1	92.9	81.7
	Biomass and renewable waste <i>ktoe</i>	2.3	6.4	12.4	17.3	16.8
	Renewables <i>ktoe</i>	0.5	2.3	6.8	6.4	33.4
	Other <i>ktoe</i>	0.6	2.2	7.3	3.4	5.2
Change in RES targets	%	0.0000	0.0000	0.0001	0.0001	0.0001
Emissions						
Reduction in air pollution	<i>kt</i>	0.0643	0.1750	0.3602	0.4860	0.5463
	SO2 <i>kt</i>	0.0192	0.0513	0.1047	0.1408	0.1804
	NOX <i>kt</i>	0.0442	0.1212	0.2499	0.3376	0.3556
	PM _{2.5} <i>kt</i>	0.0009	0.0025	0.0057	0.0076	0.0103
Reduction in greenhouse gas emissions (CO₂)	<i>kt</i>	48.5	135.5	287.7	380.1	448.2

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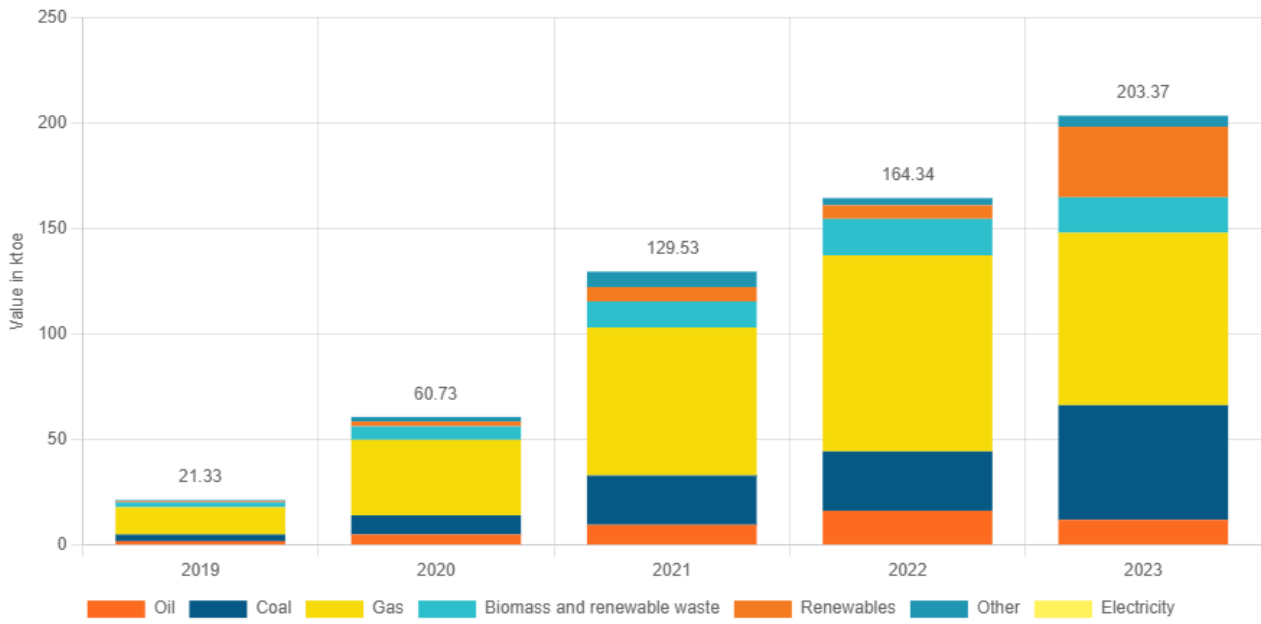


Figure 86: Primary savings by energy carriers (EEW – IA3b)

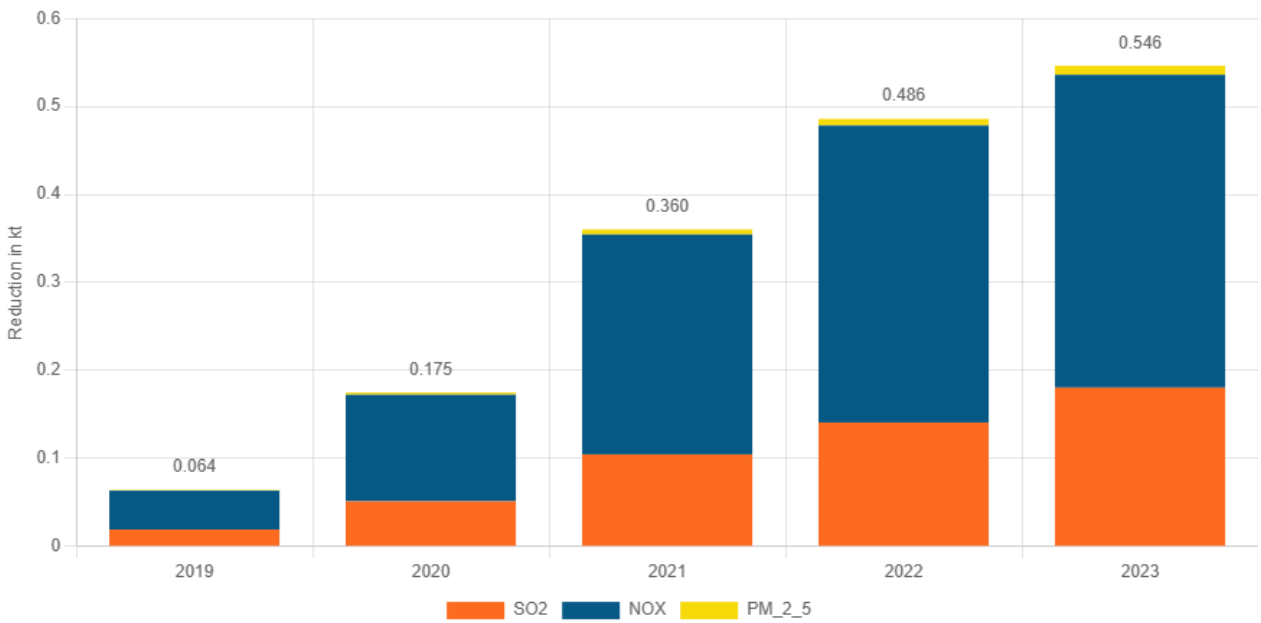


Figure 87: Reduction in air pollution (EEW – IA3b)

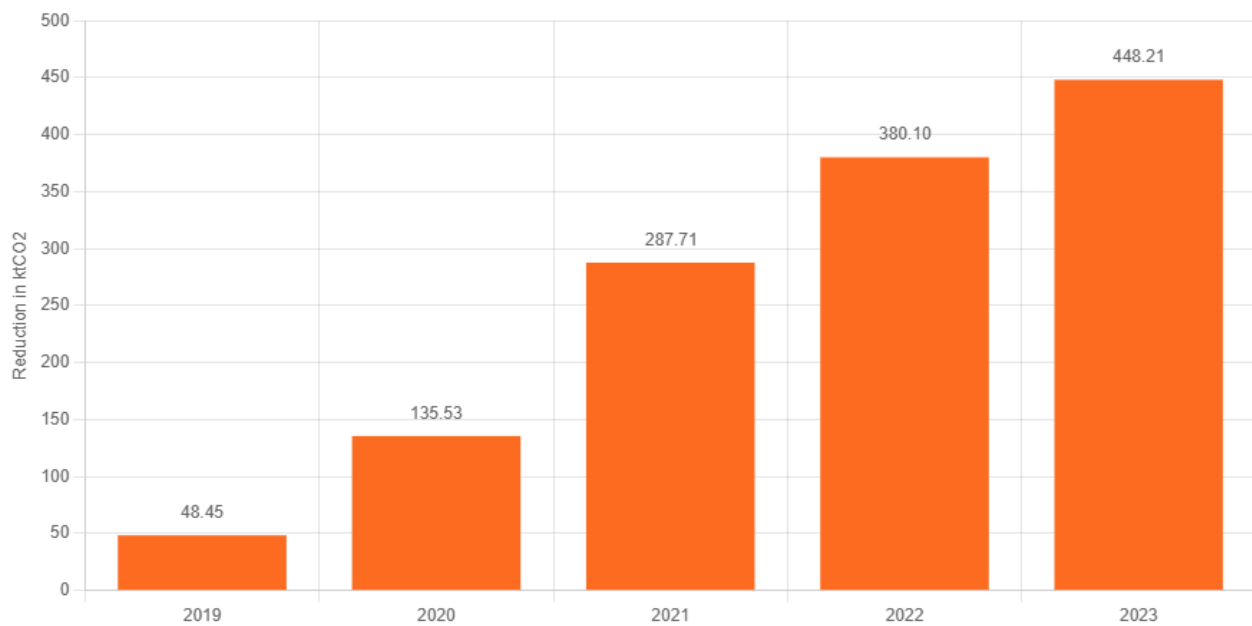


Figure 88: Reduction in greenhouse gas emissions (EEW – IA3b)

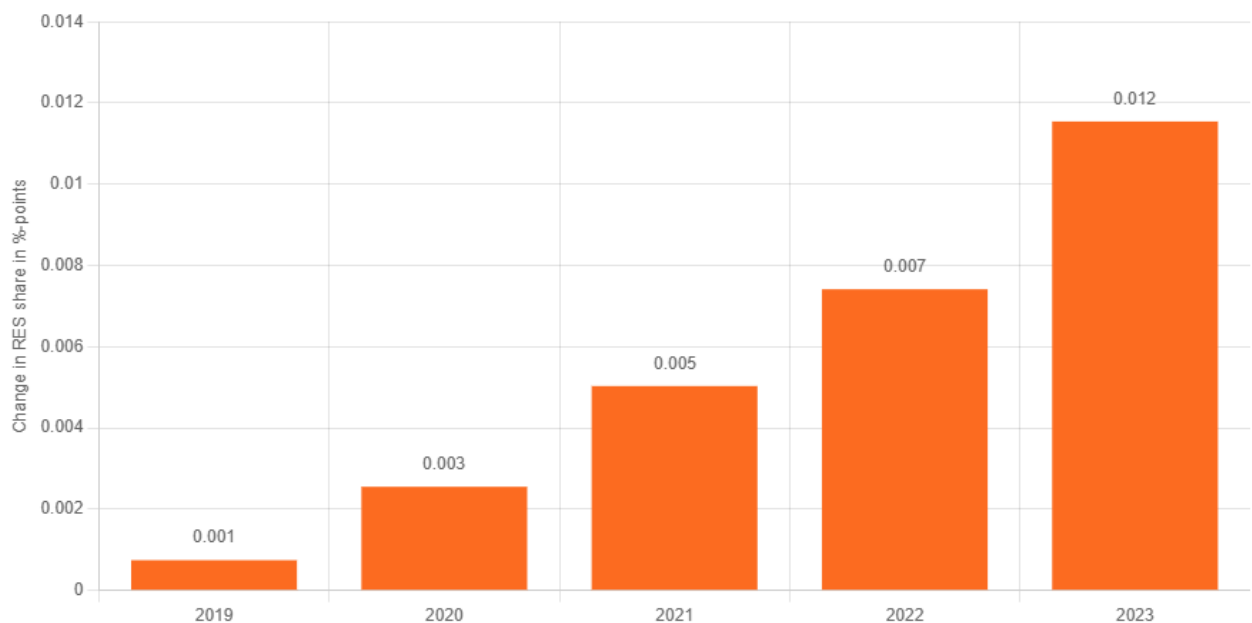


Figure 89: Impact on RES targets (EEW – IA3b)

C.1.5.4. Monetisation

Table 40: Monetisation of the multiple impacts for the Federal funding for energy and resource efficiency in industry (EEW) (2019-2023), Improvement Action 3b: Process-specific savings in the MICATool

		2019	2020	2021	2022	2023
Reduction of energy costs	<i>Total savings in Mio. €</i>	9.1	27.3	65.2	79.5	141.2
Electricity	<i>Savings in Mio. €</i>	2.2	9.1	30.1	25.4	108.2

		2019	2020	2021	2022	2023
Oil	<i>Savings in Mio. €</i>	1.0	2.2	4.3	8.1	5.4
Coal	<i>Savings in Mio. €</i>	0.4	1.0	1.6	3.0	1.8
Gas	<i>Savings in Mio. €</i>	4.8	13.0	25.4	37.5	22.4
Biomass and Waste	<i>Savings in Mio. €</i>	0.8	2.0	3.6	5.5	3.5
Heat	<i>Savings in Mio. €</i>	0.0	0.0	0.0	0.0	0.0
H2 and e-fuels	<i>Savings in Mio. €</i>	0.0	0.0	0.0	0.0	0.0
Reduction of greenhouse gas emissions	<i>Value in Mio. €</i>	2.4	13.6	43.2	76.0	112.1
Health effects linked to reduced air pollution	<i>Value in Mio. €</i>	0.9	5.0	11.1	14.8	21.0
Avoided asthma cases	<i>Value in Mio. €</i>	-	-	-	-	-
Avoided excess cold winter mortality	<i>Value in Mio. €</i>	-	-	-	-	-
Avoided lost working days due to air pollution	<i>Value in Mio. €</i>	0.0	0.1	0.2	0.3	0.3
Impact on RES targets	<i>Value in Mio. €</i>	0.4	1.2	2.4	3.4	4.8
Impact on gross domestic product	<i>Value in Mio. €</i>	20.3	58.9	33.6	93.8	114.1
Added asset value of buildings	<i>Value in Mio. €</i>	-	-	-	-	-

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