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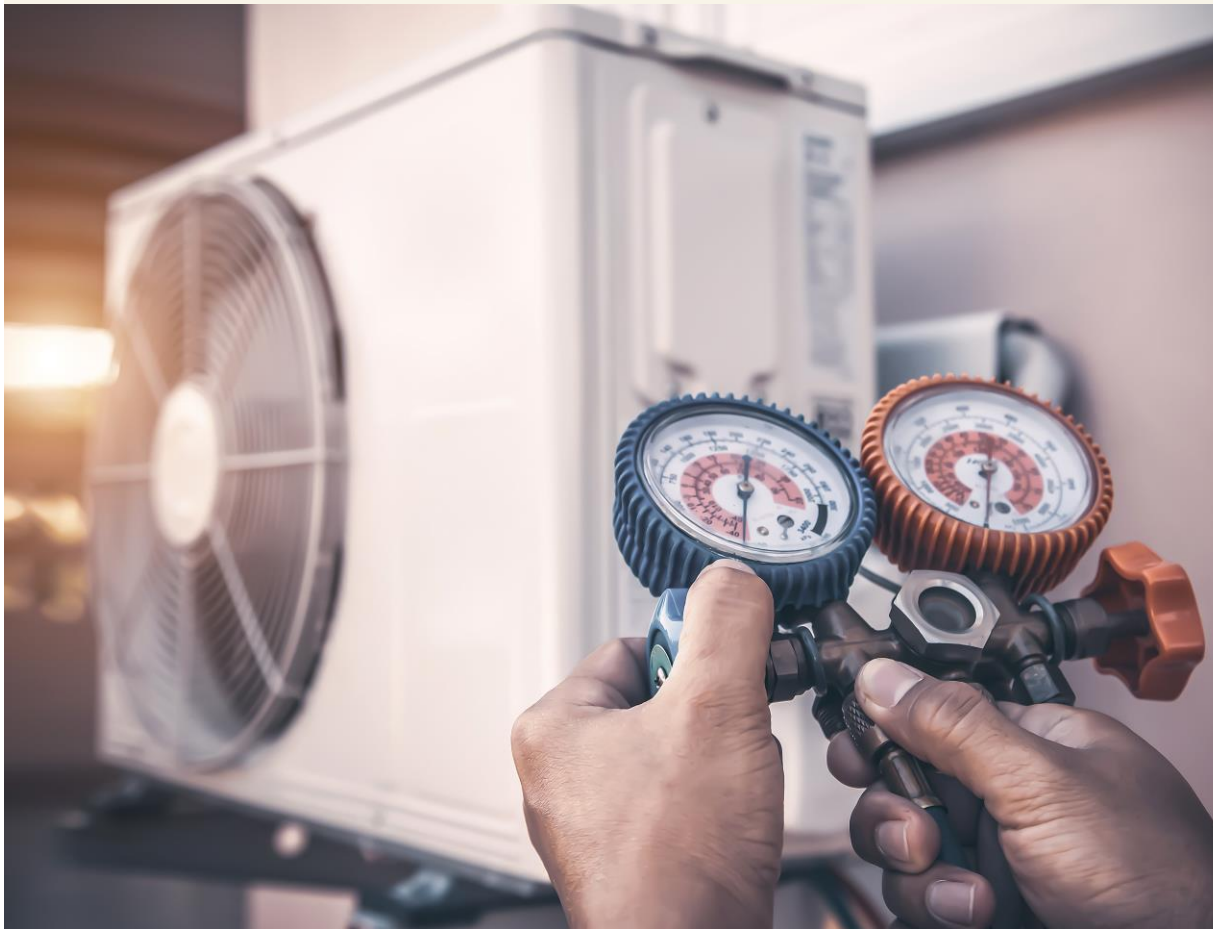
REPORT October 2022

AFFORDABLE HEAT WITHOUT LNG

HOW RENEWABLE HEAT CAN SAVE BILLIONS WHILE PROTECTING THE CLIMATE

MATHIAS KOCH, KAMILA GODZINSKA, BRICK MEDAK, LISA FISCHER, RONAN PALMER, RAPHAEL HANOTEAUX



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Neon Neue Energieökonomik is an energy consulting company with headquarters in Berlin. As a boutique company, we have specialised in challenging quantitative and theoretical economical analyses in the field of the energy markets since 2014. As part of this study, Neon helped estimate the costs of gas and electricity use. **www.neon.energy**

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SUMMARY AND RECOMMENDATIONS

Even beyond the current crisis, fossil gas will be significantly more expensive in Germany than in previous years. Germany will face additional costs of €120–200 billion by the end of the decade. To avoid paying these high costs, a step-change in reducing gas use is needed. Germany should fully exploit the savings potential in its building sector. Around 40% more gas can be saved until 2030 than under current plans. The high savings potential calls into question whether Germany needs new gas import infrastructure.

This study forecasts future fossil gas costs for Germany and shows how large amounts of fossil gas can be saved in coming years to avoid high gas costs. Germany will have to pay significantly more for its fossil gas imports as Russian supplies cease. The world market for fossil gas will remain tight until 2030. As a result, the European wholesale market price (TTF) will remain high, leading to high import costs for German imports of both Norwegian gas and liquefied natural gas (LNG).

Table I: Historical and expected import costs for fossil gas in Germany

	Historical 2010–2019	Base scenario 2023–2030	Risk scenario 2023–2030
Annual total import costs	€18.5 bn	€33.7 bn	€43.4 bn
Increase	—	82%	135%

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The cumulative additional costs amount to €120–200 billion by 2030. These high import costs will be passed on by the gas importers to households and businesses. For German consumers, gas prices are expected to almost double for the rest of the decade.

Table II: Annual gas costs for a four-person household (20,000 kWh)

	2010–2019	2023–2030
Yearly gas bill for families	€1370	€2620
Increase	—	91%

Permanently subsidising these high fossil gas prices would be disastrous in both ecological and economic terms. The sustainable solution is to reduce gas use. Without rapidly cutting its gas use, Germany will not only pay astronomical gas bills, but also the horrendous costs of the worsening climate crisis.

Germany needs a “renewable heat program” to make full use of the huge savings potential in its building sector. It should aim to install 1 million heat pumps and renovate 4% of building stock per year from 2025 onwards. Stimulating the necessary investments and making them economically viable will require government funding of €20 billion per year.

Table III: Gas savings in the building sector up to 2030 (each compared with previous government)

	Current GER government	Possible savings
Cumulative savings until 2030	470 TWh	810 TWh
Savings as a percentage	16%	28%

With political support from the German government, German energy importers are planning to build new gas import infrastructure and enter new long-term gas contracts. Both would tie Germany to the volatile and expensive world market for fossil gas for decades to come. However, new permanent LNG terminals will not come online before 2026 and will therefore do nothing to overcome the current shortages. Gas savings in the buildings sector could already exceed the terminals' planned import capacity by the earliest date at which they could become operational. Instead of promoting unneeded terminals, policy efforts should focus on bringing forward the necessary gas use reductions, thereby accelerating the energy transition and protecting German gas users from high prices.

Table IV: Annual savings potential (vs. 2021) and potential new import capacity

	Savings potential in the buildings sector	Import capacity of planned LNG terminals
2026	120 TWh	117 TWh
2030	258 TWh	195 TWh

INTRODUCTION: DARE TO ACHIEVE MORE ENERGY TRANSITION

For decades, importing cheap fossil fuels from Russia was a key driver of the German economy, mobility and heating in buildings. The escalated Russian attack on Ukraine ended this relationship within just a few months. Together with its EU partners, Germany has agreed an embargo on Russian coal and oil. **Russia**, meanwhile, had started gradually switching off the natural gas supply to Europe in early 2021. Russia has not just permanently discredited itself as a reliable energy supplier. The scope and brutality of the Russian war in Ukraine **rule out any renewal of collaboration in the foreseeable future**.

To date, political efforts in Germany have focused on securing the natural gas supply and the functioning of the gas market for the coming two winters, in light of the loss of supplies from Russia, and on protecting the general population from the enormous price rises. The federal government has provided more than €300 billion for this purpose. Increasing numbers of energy importers are becoming nationalised.

Significant political efforts are therefore needed to permanently reduce Germany's dependence on fossil fuels. Without determined action by the state to **accelerate the energy transition**, Germany will not only pay permanently higher prices but also the **horrendous costs of the worsening climate crisis**. The consequences of climate change, which are becoming more dramatic even for Germany, illustrate this.

To achieve the legally defined goal of greenhouse gas neutrality by no later than 2045, the **consumption of natural gas** in the fields of **buildings and industry needs to drop substantially by 2030**.

Table 1: Decrease in natural gas consumption to be achieved by 2030 according to current studies.

	Agora	DENA	BDI
Buildings	41%	30%	41%
Industry	14%	37%	36%

Source: Agora Energiewende (2021); DENA (2021a); BDI (2021)

In addition to the relief packages, the federal government has shown that it is able to mobilise large sums to react to specific challenges, such as in the case of the special fund for the armed forces. This political will is needed in the energy transition too. Germany is in the favourable position of being able to make **the future investments needed from its own economic and financial strength to reduce consumption**. Lower levels of consumption of natural gas are not simply a critical step on the way to climate neutrality. Lower gas bills also strengthen social cohesion and increase companies' competitiveness. The parties that formed a government under the mantra of progress now need to take the necessary steps to ensure a **real change in tempo in the reduction of consumption**.

The first part of this study aims to predict the costs of German natural gas imports beyond the current crisis. In the second part of the study, we sketch out a "future programme for sustainable heat", which will enable Germany to avoid significant amounts of its natural gas consumption this decade. This will result in a significant amount of the high import costs being saved. It also calls into question the benefit of new, permanent infrastructure for importing natural gas.

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NATURAL GAS IMPORTS: A PERMANENTLY EXPENSIVE BUSINESS

By the end of the decade, importing natural gas will cost Germany €120 billion to €200 billion more than it used to, an increase of 80 to 135%. The time of cheap German natural gas imports is over.

In this part of the study, we make predictions about the future of German natural gas imports. It is unlikely that Germany will end its dependence on natural gas within just a few years. The question of the conditions under which German energy importers will be procuring natural gas on the global market after the current crisis is therefore relevant. We predict the expected costs of German natural gas imports and the resulting costs for households.

German natural gas imports in the energy crisis

Germany imports 95% of the natural gas it uses. Between 2010 and 2019, the average annual natural gas imports for domestic use totalled 789 TWh of natural gas. Of this, 51% came from Russia, 25% from Norway and 21% from the Netherlands.[1]

The deliveries from Russia in particular were based on favourable long-term contracts, with Germany benefiting from stable, lower prices with a high geopolitical risk. In the **past decade**, the average annual costs for **German natural gas imports were €18.5 billion.**

Russia is no longer servicing the long-term contracts. This means German energy importers currently need to buy larger quantities on the spot market to replace the missed Russian deliveries and meet their own delivery obligations to gas distributors and industrial customers. This dynamic is driving the European wholesale price (Dutch TTF Front Month) to an average of €228 per MWh in August 2022, more than ten times higher than it had been eighteen months previously.

[1] BP (2020)

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Prediction for future import costs of natural gas

Predictions by the industry database IHS Markit show that even with the increasing availability of LNG, the **European wholesale price will remain significantly above the pre-crisis level for the rest of the decade**. Prices of three to five times pre-crisis levels will last until at least 2025. Even beyond 2025 the wholesale prices will remain 50–100% above the previous years.

In the medium term, the assumption should be made that German energy importers will be able to conclude new **long-term contracts** for some of the quantities needed, reducing their dependence on the wholesale prices. For the German energy transition, though, it is essential that **contractual commitments do not prevent the necessary reduction in consumption**. There is therefore a fundamental conflict of objectives between prices that are as cheap as possible and avoiding the long-term commitments that certain LNG exporters strive to achieve. The forthcoming nationalisation of Germany's central natural gas importers means that this conflict of objectives has become the direct subject of political decision-making.

Various price indices are conceivable for long-term contracts. Existing long-term contracts with Norway are already based on the TTF price. We assume that new contracts will be based on the TTF too, smoothing out extreme price hikes in the TTF and overall ensuring a reduction in price. However, since new long-term contracts for LNG will be agreed in a competitive global market in the context of very high prices, reductions in price are likely to be minimal. Overall, our calculations assume that, depending on the suppliers, German gas importers will cover 50–80% of their natural gas deliveries with long-term contracts.

Based on these assumptions, our calculations show that the Russian war in Ukraine has permanently ended the time of cheap German natural gas imports. Even in the **most favourable scenario**, Germany will have to pay **€15 billion more per year** in the years from 2023 to 2030 than the average in the past decade. In an **unfavourable scenario** for the German energy importers, natural gas supply will cost Germany **€25 billion more per year** than in the past.

Table 2: Historical and anticipated import costs for natural gas.

	Historical 2010–2019	Baseline scenario 2023–2030	High-risk scenario 2023–2030
Annual import costs (€)	18.5 billion	33.7 billion	43.4 billion
Increase	—	82%	135%

In the **baseline scenario**, we assume that Germany can reduce its natural gas consumption by 30% by 2030. In this scenario, a higher percentage of the gas needs will be covered by long-term contracts, although it is important to ensure that contractual lock-in effects are avoided. A higher price discount compared to the TTF predictions is also assumed in the favourable scenario.

In a **high-risk scenario** for German gas importers, the costs will be significantly higher. Exporters such as Qatar have not, as yet, given any indication that they will deviate from their demand for very long-term, inflexible contracts. Contracts of this type are difficult to reconcile with the German goal of climate neutrality by 2045. Accordingly, small numbers of these contracts should be concluded, so the relevant price discounts would also be minimal. In this scenario, we assume that decarbonisation in Germany moves more slowly, and the consumption of natural gas can only be reduced by 25% by 2030.

By **2030**, the **cumulative additional costs** for German gas importers will be **€120 billion to €200 billion** more than the historical import costs from the previous decade.

Chart 1: Historical and expected import costs for fossil gas to Germany (baseline scenario).

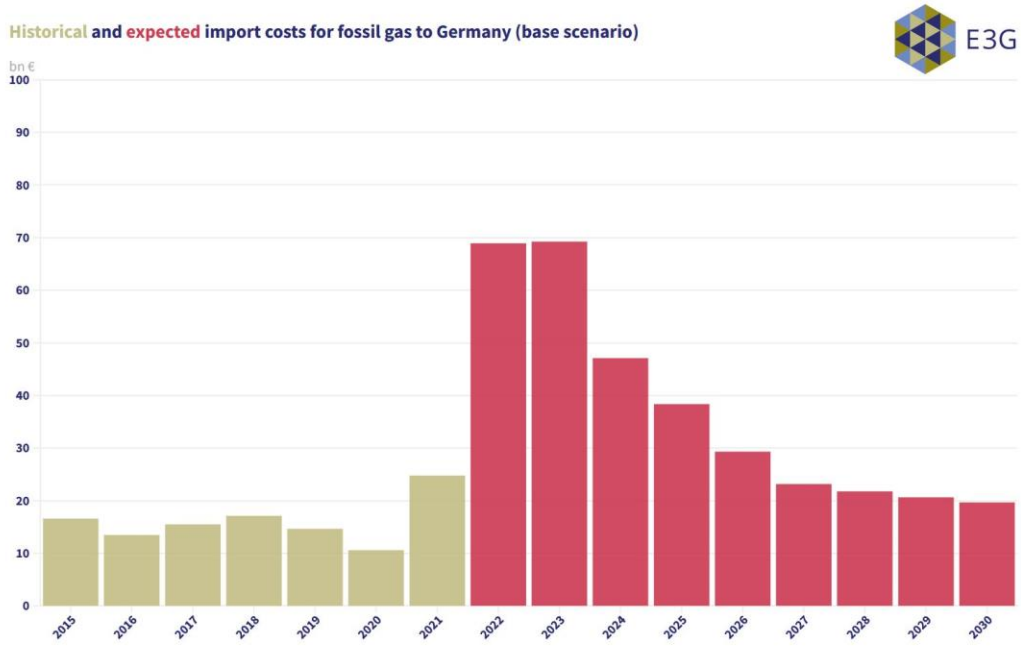
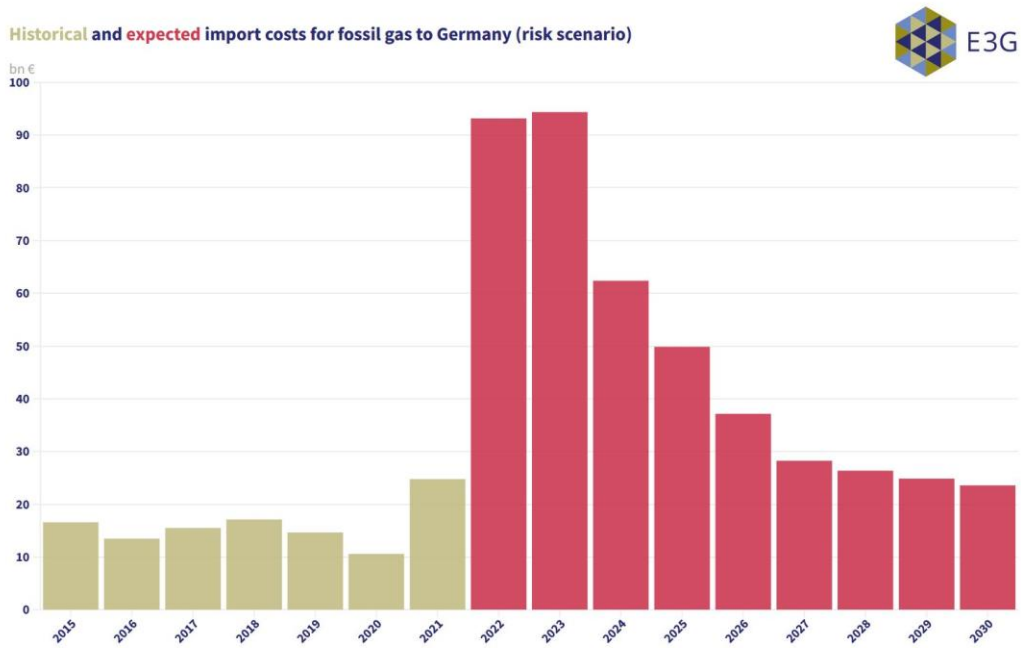


Chart 2: Historical and expected import costs for fossil gas to Germany (high-risk scenario).



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Method

Countries of origin: In terms of imports, the assumption is made that no further Russian gas will be imported from 2023. Germany will have gas imports from Norway and will import liquefied natural gas either via the terminals in its neighbouring western countries, predominantly Belgium, or its own terminals.

Gas consumption: The expected gas consumption is based on IHS (2022c) and on modelling results from Agora Energiewende (2021). Both scenarios assume a substantial reduction in consumption by 2030. The reduction in consumption is higher in the baseline scenario.

Price projection: The basis for the price calculation is the projection of the TTF by IHS Markit (IHS 2022a). We are using BAFA cross-border prices (IHS 2022b) to price the historical imports. Historical prices for household customers are from Destatis (2022a).

Contracts and conditions: We assume that long-term contracts will be concluded for some of the import quantities in each case. The remaining quantities will be obtained from the spot market. The percentage of long-term contracts and the price structure differs between deliveries from Norway and LNG deliveries. Long-term contracts are based on TTF but have a smoother price structure compared to the spot prices. Depending on the supplier, a different level of price discount is also granted for long-term contracts.

Gas household customer prices: The spot prices (TTF) are relevant when calculating gas prices for household customers. This is the marginal price in the plausible case of the imports not entirely being covered by long-term contracts.

Expected inflation: All prices and costs are given in euros (real 2021 levels). Where necessary, we convert nominal to real price data.

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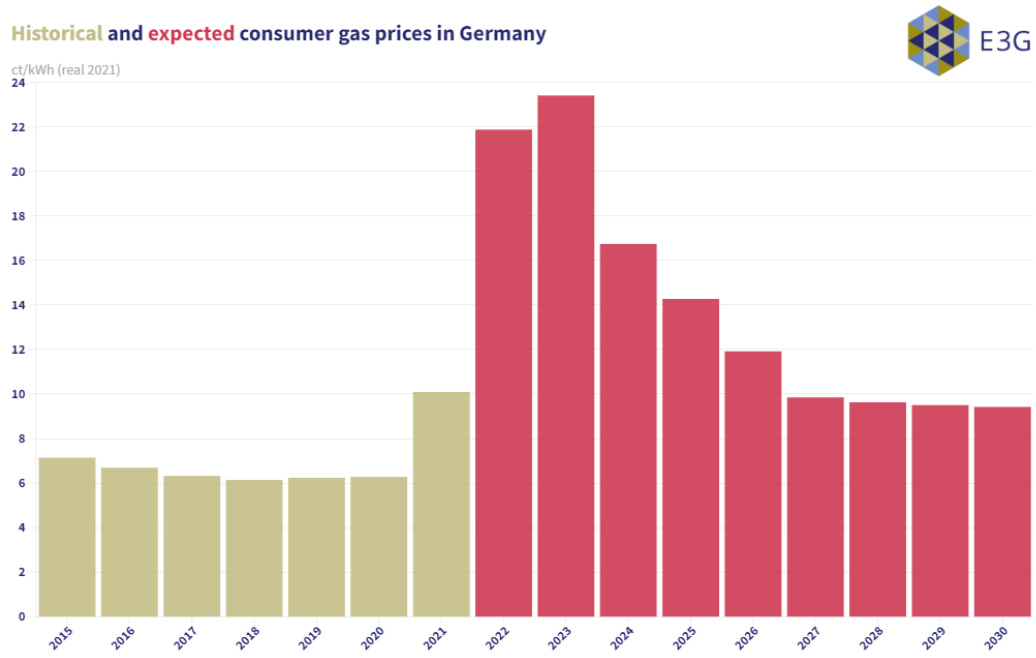
Predictions for costs for households

The high import costs reflect a persistent, real shortage of natural gas in the North-West European gas network. German society has to cope with it in one way or another. Without state intervention in the market, those who use the natural gas will have to pay for the high import costs. Gas importers such as Uniper and VNG will pass the global market prices onto their customers, including gas distributors such as local municipal utilities and industrial customers. Ultimately the high prices reach households via the gas distributors.

Chart 3: Historical and expected consumer gas prices in Germany.



Our calculations show the expected gas prices for household customers based on the import costs for natural gas. This clearly shows that there will be no return to household prices like those before the crisis. While the gas price for households was an average of 6.8 ct/kWh between 2010 and 2019, **gas customers** will have to pay an average of **13.1 ct/kWh** in the years from **2023 to 2030**. This means gas bills for household customers will **almost double** in the rest of the decade. For a family with an annual gas consumption of 20,000 kWh, this means additional costs of around €1250 per year this decade.

Table 3: Annual gas costs for a four-person household (20,000 kWh).

	2010 - 2019	2023 - 2030
Gas costs	€1370	€2620
Increase	—	91%

The “gas price break” and sustainable alternatives

Considering this enormous added burden, it is right to protect households and companies from the worst effects of the price increase. In the current crisis, the federal government decided to do this directly in the form of a gas price cap and a reduction in the VAT on gas.

The predictions for the average gas prices for households show that this cannot be a permanent solution. Subsidising gas prices in the long term would be diametrically opposed to the federal government’s efforts to put Germany on a path towards climate neutrality. To support the decrease in gas consumption that is needed by 2030, politicians need to develop **instruments** that allow for **end consumers to shoulder permanently increased prices**, without **leaving the economically weakest households and companies on their own**.[2]

Instead of using state funds totalling billions to lower the gas price, the **core of a sustainable solution for gas prices** needs to be a **structural reduction in consumption**. Only through a sustainable decrease in consumption can **gas consumers** and **taxpayers be permanently protected from the high costs**.

In the next chapter, we set out a programme that Germany can use to save substantial quantities of natural gas in the building sector this decade. By doing this, the federal government would not only protect households and companies from the high import costs, it would also be taking a major step towards a climate-neutral building sector.

[2] For more criteria for the ecologically and socially sustainable design of relief measures, see E3G (2022).

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International natural gas markets – 2022 and beyond

In this paper, we show what high global market prices for natural gas mean for Germany. The price assumptions are based on data from the leading market research institute, IHS Markit. What explains the persistently high prices even beyond the current crisis?

Following the Russian attack on Ukraine, Russian gas supplies to many European countries came to a standstill. Over the next few years, all or at least most European countries are expected to stop using Russian gas. The excess quantities of gas that Russia now has cannot easily be imported into other countries. Both the pipeline connections to East Asia and the options to export liquefied natural gas from Russia are limited. This means larger quantities of gas will be removed from the global market as a result of these events.

European countries, including Germany, are trying to procure the necessary quantities of gas from the LNG market. Because of the pipeline connections with Russia, LNG only made up one-fifth of European gas imports to date. In addition to the Europeans, Asian countries are contributing to a significant increase in demand. The IEA expects an increase in demand of 140 billion cubic metres of natural gas by 2025 – almost one and a half times the annual natural gas consumption in Germany.[3]

The increasing demand, however, does not lead to a higher supply to the same extent. New export capacity is generally only available on the market three to five years after a decision is made to invest. Excess capacities in 2015 to 2019 led to lower levels of investment. During the COVID pandemic in particular almost no decisions were made to invest in new projects. This period of low investment means that the supply is currently only increasing slowly.

There is a lot of evidence that investors will only cautiously invest in increasing capacity in the future, too. Due to the competitive global market, new export projects have an amortisation period of up to 20 years. However, the EU has mandated a significant reduction in gas consumption within this decade as part of its REPowerEU programme. As renewable energy sources become increasingly affordable, the long-term demand

[3] IEA (2022)

projections are uncertain even in other regions of the world. China, until now the fastest-growing import market, has set extensive goals to expand renewable energy sources in its new five-year plan. In countries such as the Philippines and Bangladesh, the current price rise means imports are no longer occurring as planned.

This tension between a rapid rise in demand in the short term with a reduction in demand in the long term means that the high prices will not result in a significant increase in supply. As a result, it's probable that the global natural gas prices will remain high for the rest of the decade until the expected reduction in demand increasingly results in prices dropping. For Germany, this means that the higher import costs will continue – this is why there is an increased need to save natural gas.

In the current crisis, this dynamic is playing out in the fact that German energy importers are more cautious about committing to take on larger quantities of gas in the long term. More than half of the global guaranteed purchases are currently concluded by portfolio holders who buy gas through long-term contracts and sell it at the spot price, or through other more flexible price structures.[4] This offers buyers more flexibility, but conversely also results in higher prices.

[4] Rystad (2022)

A FUTURE PROGRAMME FOR SUSTAINABLE HEAT

By 2030, the building sector alone could save 40% more natural gas than the federal government is planning. To stimulate the necessary investment, a "future programme for sustainable heat" is needed, which includes both extensive financial support and a framework programme for technical implementation. The savings that are possible in the building sector by 2030 are higher than the import capacity of the planned onshore LNG terminals, calling into question the need for them.

In this part of the study, we describe a programme that could save large quantities of natural gas in the building sector this decade. We calculate the state funding that is needed to encourage the necessary investments. A comparison with the planned new import capacities for natural gas shows that more gas can be saved in the building sector this decade than is planned as permanent import capacity in the form of LNG terminals.

Decarbonisation in the building sector

With around a third of the final energy consumption, the building sector plays a critical role on the road to climate neutrality in Germany.[5] The Climate Protection Act sets out a decrease in greenhouse gas emissions in the building sector of 43% by 2030, relative to 2020. Germany's Expert Panel on Climate Issues thinks that the measures planned by the federal government are fundamentally suitable to achieve this goal, although there is some doubt regarding the extent to which they can be implemented.[6]

The **current sector goal**, however, is **nowhere near** to exhausting the **possibilities for decarbonisation**. A greenhouse gas-neutral building sector by 2035 is possible.[7] On this trajectory, more than 60% of the greenhouse gas

[5] BMWK [Federal Ministry for Economic Affairs and Climate Action of Germany] (2022a)

[6] Expert Panel on Climate Issues (2022)

[7] Greenpeace (2022)

emissions would be avoided by 2030. The measures presented here are based on this goal.

Around half of the heating of buildings and hot water in Germany is based on natural gas.[8] Germany needs a "future programme for sustainable heat" to exploit the **significant potential for savings in natural gas in the building sector** considerably more quickly than the federal government is currently planning. This is the only way that consumers and taxpayers in Germany can be protected against the exorbitant costs of continuing to use fossil fuels for heating.

Making the building sector climate neutral would not merely be a central component of the German energy transition. It would also be **an effective long-term socio-political measure**, particularly if lower-income households are prioritised for support. An extensive programme in the building sector **would also help the economy**: small and medium-sized companies will suffer as a result of high heating costs in the coming years and would benefit directly from measures in the building sector. Lastly, this would also comply with the **requirement in the coalition agreement** to make half of the heat in the building sector climate neutral by 2030.

Elements of the "future programme for sustainable heat"

By 2030, the "future programme for sustainable heat" should achieve the following objectives:

> the **renovation of a third of existing buildings** to a low-energy standard[9]

> the installation of an additional **7.7 million heat pumps**

> **1.5 million** additional **district heat connections**

> the additional construction of just under **30 million square metres of solar thermal energy**.

These figures are based on the goal of a greenhouse gas-neutral building sector by 2035. To achieve the figures mentioned, annual funding totalling around €20 billion from federal funds is needed until 2030.

[8] BMWK [Federal Ministry for Economic Affairs and Climate Action of Germany] (2022a)

[9] Corresponding to a useful heat demand like the "KfW Effizienzhaus" 55 or 70 standard

Renovation

Heat that does not leave a building does not need to be generated. Federal funding for efficient buildings should be enhanced so that, together with other instruments, the **rate of energy-efficient renovation increases to at least 4% per year**, resulting in around a third of existing buildings being renovated in the coming years. In addition to sufficient funding, stricter standards and renovation requirements, and practical support to overcome the non-financial obstacles to implementing these goals, are also needed. The principle of "worst first" should be used for the renovations.

Heat pumps

Heat pumps are central to the energy transition in the building sector. In a climate-neutral building sector, they would make up 60–80% of the heating systems, corresponding to at least 12 million devices. The federal government is currently aiming to install 0.5 million heat pumps per year from 2024. This goal should be increased significantly, so that **1 million heat pumps are installed per year** from 2025.

Climate-neutral local heat and district heat

Climate-neutral local heat and district heat is the second part of the decarbonisation of the heating sector. By 2030 there should be **1.5 million new district heat connections**, with district heat then being 65% climate-neutral; in other words, using geothermal energy, ambient heat, large solar thermal plants, large heat pumps, the use of unavoidable waste heat and both short-term and seasonal heat accumulators. The ramping up of heat networks needs to be combined with an appropriate legal framework.

Solar thermal energy

When it comes to solar thermal energy, there is a competition for space with the use of PV systems, which needs to be taken into account when setting objectives. We assume a total of 10% based on the entire roof surface potential in Germany.[10] This means a target of **29 million square metres of additional solar collector surface** by 2030.

[10] BCG & Prognos comparisons (2018)

Table 4: Measure-related annual operative objectives up to 2030.

Measure	2022	2023	2024	2025	2026	2027	2028	2029	2030	2030 total
Heat pumps (million)	0.35	0.55	0.8	1	1	1	1	1	1	**7.7 million**
Solar thermal energy (million m²)	1	1.7	2.5	3.5	4	4	4	4	4	**29 million**
Renovation rate	2%	2.7%	3.5%	4%	4%	4%	4%	4%	4%	**32%**
DH connections (million)	0.03	0.06	0.1	0.15	0.2	0.25	0.25	0.25	0.25	**1.54 million**

Source: E3G calculations based on Greenpeace (2022).

Funding costs

Table 5: Funds needed to achieve the objectives by 2030.

Measure	Funding and Renewable Energy Sources Act levy – *all buildings* (billion €/year)	Funding and Renewable Energy Sources Act levy – *gas-heated buildings* (billion €/year)
Heat pumps	4.5	3.0
Solar thermal energy	0.9	0.4
Building renovation	12.3	5.8
Local heat and district heat	2.9	1.3
Total	**20.6**	**10.5**

Source: E3G calculations.

Sufficient state funding is needed to achieve these goals as part of the "future programme for heat". By 2030, the federal government should invest around €20 billion to set the German building sector on a path to climate neutrality in 2035. This amount will enable the above-mentioned targets to be achieved by 2030.

Method

The targets set out in Table 4 are based on the goal of a greenhouse gas-neutral building sector by 2035. By 2025, the annual targets for renovation and heat pumps increase from the historical levels[11] to the figures that are needed subsequently until 2035 (renovation: 4%, up from 2%; heat pumps: 1 million, up from 160,000). For solar thermal energy and district heat – where numbers are currently low – the necessary targets of 3.5 million square metres and 150,000 connections will not yet be reached in 2025.

The **funding costs** (Table 5) are derived from a comparison between a "frozen efficiency" reference scenario (1:1 replacement of existing heating systems and building shells) with the additional costs of the green investments. The profitability over the service life of the systems is calculated by annualising the additional investment costs and comparing them with the energy cost savings achieved by using heat pumps, solar systems and renovation. The energy prices are based on the cost projections set out in the first part of the study. To calculate the level of funding needed for building renovation, the assumption is made that the energy cost savings need to be at least 50% above the additional investment, including funding to overcome the many obstacles to implementation and the bias towards the status quo. Given the increase in energy prices, an average of 15% funding is sufficient. For heat pumps, the level of funding is determined with the aim of ensuring that they are economical for various use cases in detached/semi-detached houses and apartment buildings. This leads to funding levels for investment and operating costs of 25% in detached/semi-detached houses and 35% in apartment buildings.

A technically possible and politically necessary programme

The programme set out is **ambitious but realistic in its goals**. The enormous rise in the price of German energy imports, the exceptional geopolitical situation and

[11] Dena Building Report 2021

the worsening climate crisis even in Germany require determined actions in the building sector.
All of the technologies needed to decarbonise buildings are available. The drastic, persistent increase in the price of possible fuels makes **many measures economical even over shorter periods of time**. There is a risk that incorrect price assumptions, a bias towards the status quo and a lack of funding options will delay the more economically favourable decarbonisation, with fatal consequences for both heating costs and the climate. Determined, **proactive state action** can overcome these hurdles and result in a **real change in pace in the building sector**.

In addition to financial support, an extensive **programme** to ensure the **technical feasibility is also needed**. The federal government should continue their discussions with the manufacturers of heat pumps and guarantee planning security, among other things by requiring new heating systems to operate on 65% renewable energy in the future. The planned further training offensive must also be given shape and quickly driven forward to create the necessary number of tradespeople to install the devices. It must be viewed as a **top priority national task**, which can only be achieved by the government, tradespeople and manufacturing companies working together.

If Germany manages to become the leading country in the production and installation of heat pumps, it will not only protect against high energy costs and climate consequences. It will also strengthen the companies that are involved, create jobs, and open up new export opportunities in the medium term.

In addition to **funding** and stricter **standards**, an extensive **framework programme** is also needed in **renovation**, to create the technical and practical conditions for a rapid increase in the renovation rate. This includes setting up what are known as **one-stop shops**. These facilities offer advice and practical support through the entire process, including advice and the selection of companies as well quality control. In this way, the desired renovation rate can be increased even with lower levels of funding. The potential of prefabrication (**industrial renovation**) also needs to be used to a greater extent to reduce the renovation costs.

Possible gas savings

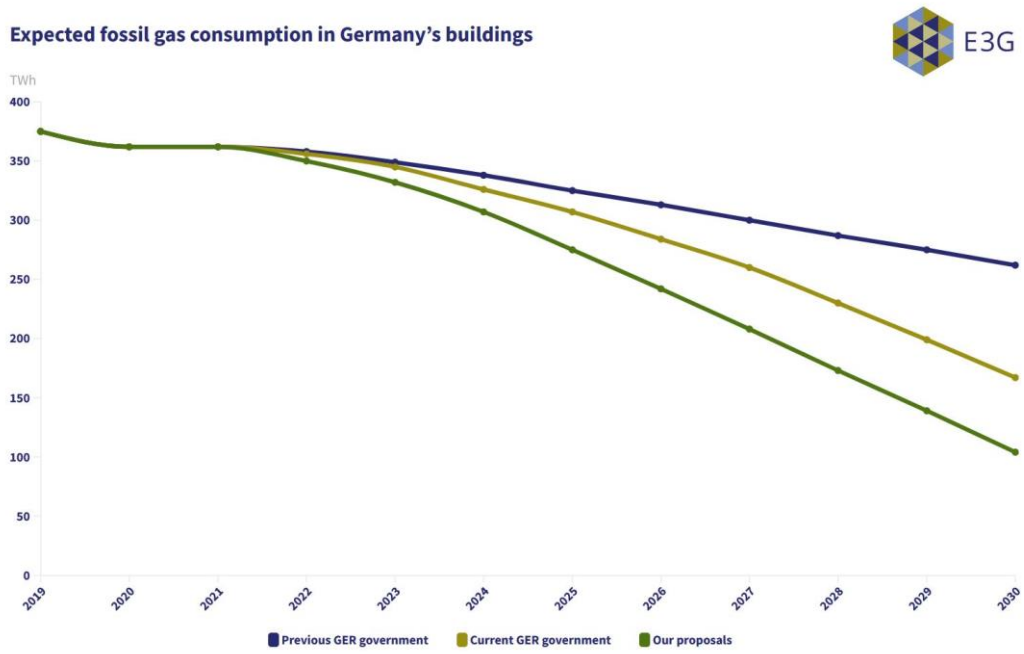
The measures described can save substantial quantities of natural gas this decade, in addition to the measures the federal government are already implementing in the building sector. By 2030, the building sector will have saved

a cumulative 810 TWh of natural gas compared to the plans of the previous government. The current government's plans mean savings of just 470 TWh by 2030.[12] Although the new federal government is significantly more ambitious than its predecessor, there is **still considerable unused potential**.

Table 6: Gas savings in the building sector by 2030 (in each case compared to the previous government).

	Federal government	Future programme for heat
Cumulative savings	470 TWh	810 TWh
Percentage savings	16%	28%

Chart 4: Expected fossil gas consumption in Germany's buildings.



[12] Calculated on the basis of BMWK & BMWSB [Federal Ministry for Housing, Urban Development and Building] (2022). Since there is no information about gas consumption there, the trend for this was calculated as proportional to the decrease in CO_2 emissions achieved by the target programme presented here and the savings as a result of this in gas consumption.

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Effects on the need for LNG terminals

The implementation of the "future programme for sustainable heat" will result in gas savings that call into question the need for new infrastructure to import gas. **It is possible to save more gas in the building sector than the new terminals will be able to import**, by the time the terminals are put into operation. This potential to reduce consumption – sensible from both an economical and a climate policy perspective – needs to be taken into account when planning new gas infrastructure.

To replace the previous imports from Russia, the federal government is currently paying €3 billion out of the federal budget to rent floating terminals to import LNG. In addition, energy importers are planning to build two permanent LNG terminals in Stade and Brunsbüttel, with the political support of the federal government.[13] The terminal in Stade, with an expected annual capacity of 117 TWh, will be available in 2026 at the earliest; the terminal in Brunsbüttel, expected annual capacity 78 TWh, will be available in 2027 at the earliest.

Building **new, permanent infrastructure to import natural gas** and the **natural gas-based energy diplomacy** of the federal government are **not consistent** with the decarbonisation measures needed to achieve the **greenhouse gas neutrality by 2045** that is set out in law. As this study shows, the new infrastructure also binds German energy supply to an international market that will be determined by high and volatile prices for the foreseeable future.

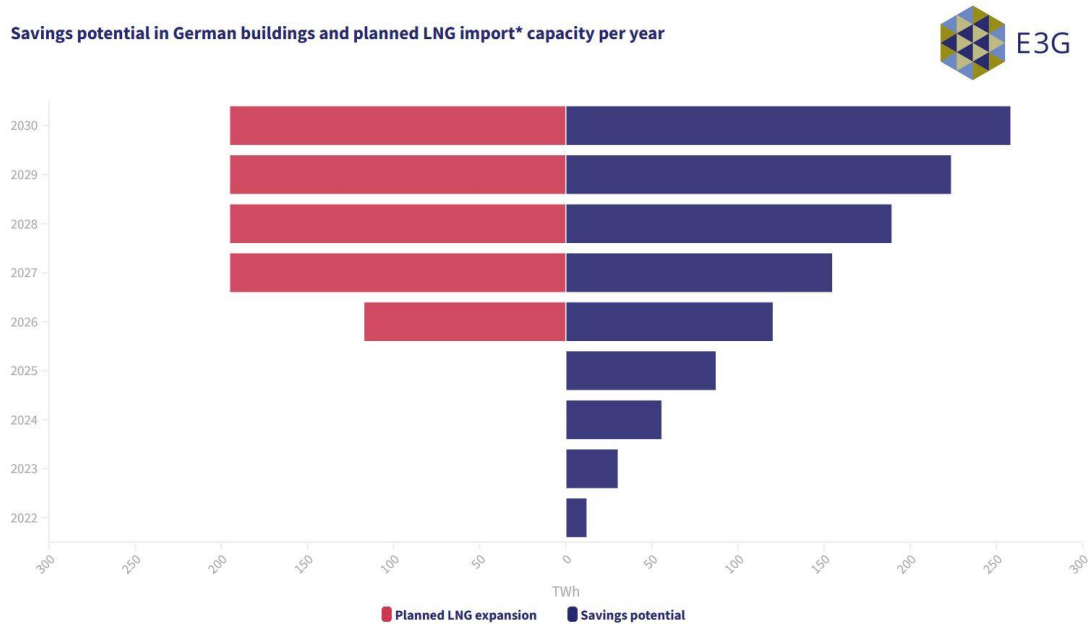
A comparison with the previous results shows that, by the end of the decade, **the building sector alone can save more in annual consumption** than would be **imported via the two onshore terminals**.

Table 7: Annual potential savings (compared to 2021) and potential new import capacity

	Potential savings in the building sector	Import capacity of the planned LNG terminals
2026	120 TWh	117 TWh
2030	258 TWh	195 TWh

[13] BMWK (2022b)

Chart 4: Savings potential in German buildings and planned LNG import capacity per year. By 2026 the yearly fossil gas consumption in the German buildings sector can be reduced by 120 TWh. These savings exceed the LNG import capacity planned to be ready by 2026.*



**Land-based LNG terminals*

Given the available alternatives, funding the building of new infrastructure for importing gas is not politically or even financially advisable. Instead, the **federal government** should **publish their own natural gas consumption goals and the price assumptions on which these are based** to give both national and international investors a realistic idea about the evolution of the German natural gas market.

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Industry

In addition to the building sector, industry plays a key role in reducing the consumption of natural gas in Germany. Natural gas is the most significant energy source in industry, considerably above electricity.[14] Natural gas is very important in the chemical industry, food and feed manufacturing, and metal production and processing.

Substantial savings are possible in industry in the short term, too: Agora Energiewende[15] and Wuppertal Institut assume that natural gas consumption in industry can be reduced by around half by 2030 (corresponding to 120 to 140 TWh per year). A significant proportion of the reduction in consumption comes from electrifying process heat up to 500 °C (electrode boilers and heat pumps). Further savings are possible through electrification in the field above 500 °C, through improvements in efficiency, and the material use of renewable hydrogen. Building insulation plays an important role in industry too.

Economic savings

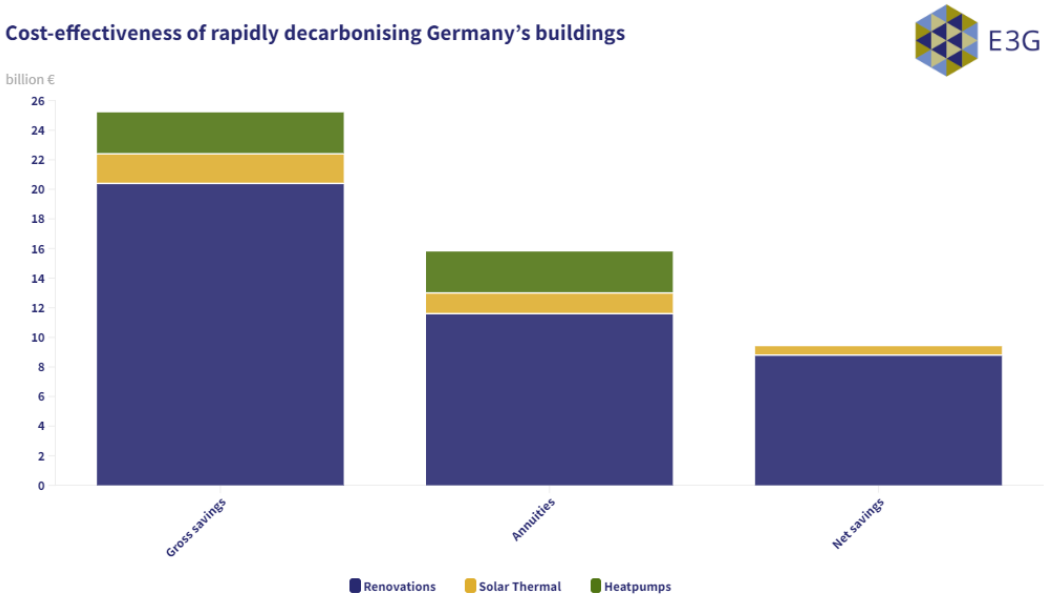
As shown in the first part of the study, importing natural gas will become significantly more expensive over the coming years than it has been in the past. There will be high levels of additional cost for gas-heated households and companies in the long term. Instead of trying to compensate for the economic and social consequences of these high prices retrospectively, targeted countermeasures are needed against unnecessarily high gas consumption. The funds and investment costs used for this benefit the German energy transition instead of the state funds of international gas exporters.

The **proposals for the building sector** set out here mean **annual net savings of around €9.5 billion from 2030** for households, companies and public institutions.

[14] Destatis (2022b)

[15] Agora Energiewende (2022)

Chart 6: Cost-effectiveness of rapidly decarbonising Germany's buildings. From 2030, German gas users will make yearly savings of €9.4 billion through more rapid decarbonisation of Germany's buildings. This equals the gross savings in energy expenditure minus the annualised investment costs.



The net savings are calculated from the gross savings, that is, the total energy cost savings for those using the buildings (households, companies, public institutions) minus the annuities (the investment costs spread over the years).[16] Based on the underlying energy prices, the gross savings amount to around €25 billion per year. The additional electricity costs for the heat pumps are included in this calculation. The annuities on the additional costs for the heating transition are just under €16 billion per year. In the calculation, the funding was initially subtracted from the investments, and then the annuities were determined at an interest rate of 2% using the technical service lives of the systems or renovation. The remaining net savings of a total of €9.5 billion per year from 2030 to the end of the useful life of the respective systems or building parts illustrates that **all types of investment** made through the **future programme for heat** are, on average, **economically positive or neutral for energy consumers**.

However, there is a **landlord–tenant dilemma**. For landlords, the funding alone will mostly not cover the additional costs. Even if the value of the building

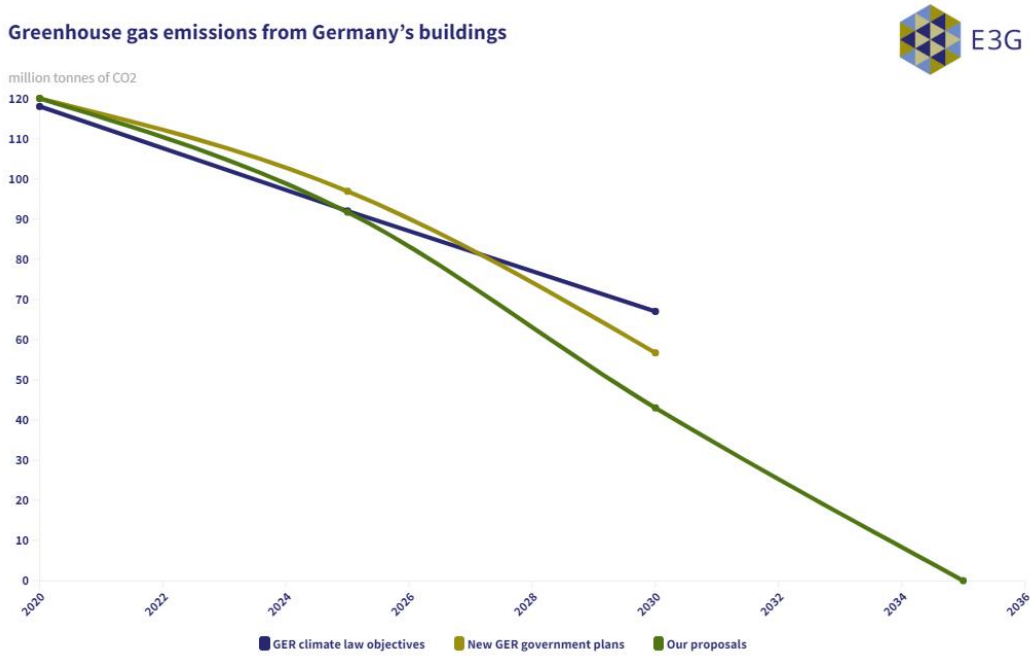
[16] For simplification purposes, for district heating the assumption is made that the investments are economical for the local and district heat companies and no additional costs arise for consumers as a result of the switch to green local and district heat, but that no cost savings are made either.

increases and the modernisation levy (“Modernisierungsumlage”) can be used, there will be buildings for which the incentives to carry out the renovation or convert the heating will be too low from the landlords’ perspective to take the necessary actions. This is why **replacement and renovation obligations need to be introduced as well as funding being provided**.[17] A switch from the modernisation allocation to a model of rent partially including heating – as the federal government has announced –should be investigated to increase the incentives for landlords. Another factor is that the new federal government has mandated that **only tenants in buildings with good energy ratings will primarily pay the CO_2 price.** Otherwise it is entirely or partially paid by the landlords.

Greenhouse gas savings

Investments in sustainable heating are not merely economical and beneficial to Germany’s geopolitical independence. They are also a critical step on the road to climate neutrality. By 2030, the CO_2 emissions in the building sector would be reduced by 64%. This is significantly more than according to the Climate Protection Act, which only provides for a 43% reduction.

Chart 7: Greenhouse gas emissions from Germany’s buildings.



[17] See Thomas, S., Schüwer, D., Vondung, F., Wagner, O. (2022). Heating without oil and gas by 2035 – an emergency programme for renewable heat and efficient buildings. On behalf of Greenpeace e.V.

CONCLUSION

A key pillar of the German energy system, built up and expanded over decades, collapsed within just a few weeks following the escalated Russian attack on Ukraine. In the months after the start of the war, an intensive debate raged about the effects that an embargo on Russian natural gas supplies would have. These discussions turned out to be moot, however, once Russia unilaterally turned the taps off. All of the efforts subsequently turned to filling the gas storage tanks to get through the coming winters.

Germany now needs to look beyond the next two years. With this study, we have shown the additional costs that Germany faces by 2030 if it does not reduce its dependence on gas. These figures need to be part of the debate about getting out of the current crisis.

There are alternatives: this crisis is also an opportunity to use determined actions to choose the many advantages of a decarbonised society and to make this a reality within this decade. **Germany's dependence on natural gas is not irreversible, and the high prices are not unavoidable**. In the building sector in particular, Germany can save a large amount of its natural gas consumption in the coming years.

Germany has the economic, financial and political strength to make the necessary investment decisions to follow this path today. It would be negligent not to use these strengths to make Germany the envy of many other countries.

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