
KfW Research

# KfW Energy Transition Barometer 2024

## Energy transition in private households moving ahead despite uncertain environment

**Imprint**

Published by
KfW
KfW Research
Palmengartenstrasse 5-9
60325 Frankfurt / Main
Phone +49 69 7431-0, Fax +49 69 7431-2944
www.kfw.de

Authors
Dr Daniel Römer
Phone +49 69 7431-6326
Dr Johannes Salzgeber
Phone +49 69 7431-2306



Frankfurt / Main, September 2024

# Contents

# Illustrations

# Executive summary

The energy transition is an issue that has accompanied people in Germany for years. And they have supported it for just as long. More than four in five households support the energy transition. That means there is a broad backing for this large-scale social project.

In the past year, however, households expressed a slightly lower rate of approval and slightly less willingness to adopt own measures in a political environment marked by uncertainty. An analysis of the influence of these sentiment indicators on public participation in the energy transition suggests that strong trust in policymakers increases people's willingness to contribute to it. Ultimately, however, it is the financial incentives and conditions that will drive their actual investment decisions.

Despite the downturn in confidence, last year a further 3% of households – approx. 1.2 million – adopted at least one of the energy transition technologies under review (heat pumps, photovoltaic (PV) systems, solar thermal systems, battery storage systems, combined heat and power, wood pellet heating, electric cars). Another 6% plan to do so in the next 12 months.

The highest increase was recorded for photovoltaic systems and home batteries. Heat pumps and electric vehicles also saw strong growth. The use of wood pellet heating rose only moderately, while solar thermal systems remained on a nearly constant usage level.

Increases were recorded in nearly all groups of households. Previous disparities in usage continued. Owner-occupied single-family houses were three times more likely to have an energy transition technology than a rental unit. The influence of income has even increased again slightly. Households in the top income quartile are now two and a half times more likely than those in the bottom income quartile to use energy transition technologies. One year ago, this was only twice the rate.

The sunny south was the dominant region. But other regions were able to narrow the gap slightly last year. With respect to settlement density, rural regions have the largest share of households embracing the energy transition, with small and mid-sized towns recording slightly higher rates of increase last year. Only the gap to large cities has actually widened once again.

The key barriers to investment are economic aspects. In particular, heat pumps, a key technology for the heating sector, are suspected of being insufficiently cost-effective. However, relevant research studies have come to a much more positive verdict and shown that technological progress has widened the range of applications for heat pumps, including in existing dwellings, for example. According to the industry association, four in five heat pumps are already being retrofitted to existing buildings. A look at how it is being done abroad confirms the potential. For years, heat pumps have had a market share of more than 90% in the cool north of Europe, where heating requirements are high.

Germany still has limited practical experience with heat pumps, which may explain why only 20% of current users are motivated by advice from an installer or energy consultant. Efficient operation is largely dependent on proper installation and a relevant technical understanding. Therefore, they can be expected to become more cost-effective and widespread as practical experience increases.

The energy transition as a key building block of decarbonisation is essentially not an ideological or moral project but the answer to changing climate and geopolitical conditions. A reliable and economic political framework is therefore the most important foundation for the broad use of the technologies and a successful transition. Clear economic aspects such as a rising and predictable carbon price coupled with accompanying support and a targeted equalisation of burdens for vulnerable groups of society thus constitute key elements for the further success of the transformation.

Assuming that policymakers succeed in creating attractive and reliable conditions, the energy transition is likely to continue gathering pace among households in the years ahead.

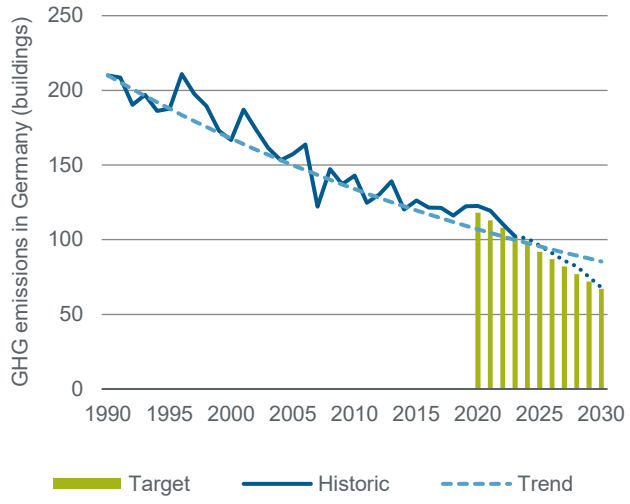
# 1. Introduction: Staying the course

In 2023, around 674 million tonnes of greenhouse gases were released into the atmosphere in Germany. That was significant progress on the 1,251 million tonnes in 1990. Emissions were nearly halved in 33 years (-46% on 1990). What is also clear is that the pace is not quick enough to reach climate neutrality by 2045. But there are aspects that give hope.

Emissions decreased by 76 million tonnes or 10.1% in 2023 on the previous year alone – the sharpest drop since 1990. This positive development is attributable to a growing share of renewable energy and decreased energy demand from businesses and consumers. The climate targets for 2030 (-65% compared with 1990) thus remain within reach.

Most of the sectors were even able to exceed their targets defined in Germany's Federal Climate Change Act – with two exceptions: In the building sector, emissions were slightly above the target, at 102 million tonnes of $CO_2$ equivalent. Even if this is not a significant deviation, the annual reduction since 1990 – which at -51% from 1990 is definitely respectable – is insufficient to achieve the targets set for 2030 (Figure 1.1).

**Figure 1.1: The building sector has achieved great successes but remains moderately above the target trajectory**




Guide: The graph shows the development of greenhouse gas emissions to date (Historic), in millions of tonnes of $CO_{2e}$, the updated linear trend from 1990 to 2023 (Trend) and the sector targets according to the Federal Climate Change Act (Target).

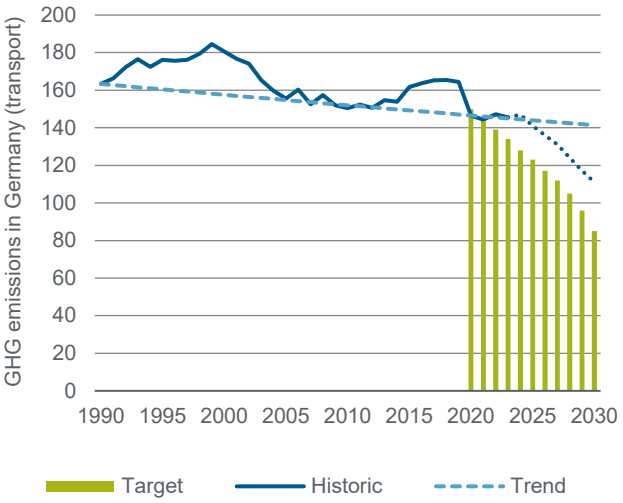
Source: Own calculations based on German Environment Agency (2024)

Each year, the German Environment Agency publishes a projection report that presents the predicted development on the basis of the adopted policy measures. The current 2024 Projection Report for the first time expects an emissions level of 68 million tonnes of $CO_{2e}$ for 2030, which would almost meet the targets.[1] However, the projection did not yet take into account the fact that the support measures had to be scaled back as a result of budget cuts last December. The next projection is therefore likely to be closer to the historic trend again.

The sector with the lowest reduction rates so far is transport. Here, the conservative approach of the historical trend extrapolation reveals significant gaps (Figure 1.2).

And even the more optimistic 2024 Projection Report predicts that the targets for 2030 will be missed by a wide margin. Again, without taking into account the budget cuts, it expects emissions of 111 million tonnes of $CO_{2e}$ for the year 2030, which is almost exactly halfway between the trend extrapolation (141 million t $CO_{2e}$) and the target (85 million t $CO_{2e}$).

**Figure 2.2: Transport expected to clearly miss targets by 2030**




Guide: The graph shows the development of greenhouse gas emissions to date (Historic), in millions of tonnes of $CO_{2e}$, the updated linear trend from 1990 to 2023 (Trend) and the sector targets according to the Federal Climate Change Act (Target).

Source: Own calculations based on German Environment Agency (2024)

[1] Cf. Wehnemann and Schultz (2024).

Germany's Federal Climate Change Act, however, is not the only regulation that needs to be considered with respect to excess emissions. Both buildings and transport are among the sectors not covered by the EU ETS, which are regulated by the Effort Sharing Regulation (ESR) at European level. Even if the reductions were to materialise according to the current Projection Report, Germany would exceed the maximum by 126 million tonnes of greenhouse gas emissions between 2021 and 2030. In this case, there is a risk of penalties in the billions of euros. A recent estimate by Transport & Environment put the costs at around EUR 16 billion on the basis of the projections but points out that higher amounts are also possible.[2]

Households can play a crucial role in both sectors. They cause more than 70% of greenhouse gas emissions in the building sector.[3] In the transport sector their share is nearly as high, at two thirds.

The KfW Energy Transition Barometer examines the activities of households regarding technologies that enable the transition to climate neutrality. It also records investment plans and attitudes in order to assess what future developments are to be expected.

[2] Cf. Transport & Environment (2024).

[3] Cf. German Federal Environment Agency (2024).

# 2. Attitudes towards the energy transition

A vast majority of households still considers the energy transition to be important or extremely important.

A minor drop in households' endorsement and willingness to act was identified.

Financial aspects are more important for energy transition activities than personal support or perceptions of fairness.

## 2.1 Even in a difficult environment, there is strong support for the energy transition

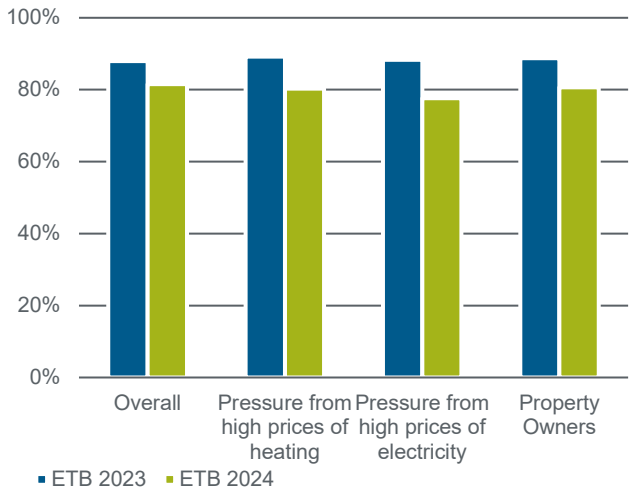
A look at the attitudes of households shows a continuing high level of support for the energy transition. Around 82% of the households surveyed in the KfW Energy Transition Barometer 2024 stated that they considered the energy transition to be important or very important (Figure 1.1). Although this figure is lower than in the previous year (88%), it illustrates that there is still a very high level of support for the targets of the energy transition among the population.

Minor differences in the level of support exist between different groups of the population. In eastern Germany, support is rather below the average at 78%, as has been the case in previous years, while in northern Germany it is well above the average, at 88%.[4] On the other hand, no systematic disparities can be seen between age groups (values fluctuate between 79 and 85%) or by household income (values fluctuate between 79 and 85%). These figures illustrate that despite the disparities, there are consistently high approval rates above 75% in all of the surveyed groups.

Another finding was that both property owners (81%) and tenants (82%) have a positive attitude towards the energy transition. Support is high even among households that are under pressure from high prices of electricity or heating (Figure 2.1). This confirms that the energy transition is backed even by groups that are particularly affected by the difficult environment and prevailing uncertainties, whether from high energy prices or the uncertainties around legal requirements for building upgrades.

### Figure 2.1: High support for the energy transition

Share of households that regard the energy transition as important or very important.




Source: KfW Energy Transition Barometer 2023 and 2024

## 2.2 Households' willingness to act varies with their fairness perception

In order for the energy transition to succeed, it is not only important that the population broadly supports the abstract targets. Rather, what is crucial is that households make a tangible contribution to its success.

It turns out that the levels of willingness to actually contribute are lower than the levels of support for the energy transition. Around 60% of the surveyed households reported a high willingness to play a role in the energy transition (Figure 2.2).[5] This share is lower than in the previous year (68%) and even slightly below the level of the year 2022 (63%), while the share in 2021 was similar.

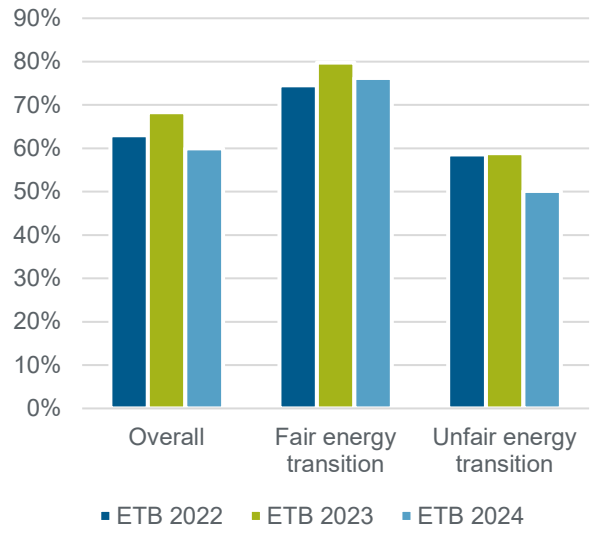
It is worth noting that households that believe the energy transition is fair are more willing to act (76%) than those who have doubts about its fairness (50%). These disparities have even widened over the past three years. In 2022 the difference was 16 percentage points (PP), last year it was 21 PP, and now it sits at 26 PP.

[4] These disparities may be explained by differences in age or financial status and by differences in attitudes towards climate change. Thus, concerns about climate change rank ninth among the greatest fears of people in western Germany, where 49% of the survey respondents fear the consequences. In eastern Germany, however, climate change is not among the top ten concerns, and the share of respondents who reported anxiety has actually fallen in recent years (currently 40%, rank 17). Cf. R+V Versicherungen (2024).

[5] A 'high' willingness to act is expressed here by a score of 6 or more on a scale of 0 to 10.

### Figure 2.2: Willingness to take action

Share of households with a high willingness to take action




Note: The question was: 'How high is the willingness of your household to accept sacrifices in order to advance the energy transition? Please answer on a scale of 0 to 10, where 0 means 'no willingness' and 10 means 'very high willingness'; showing households that answered at least 6.

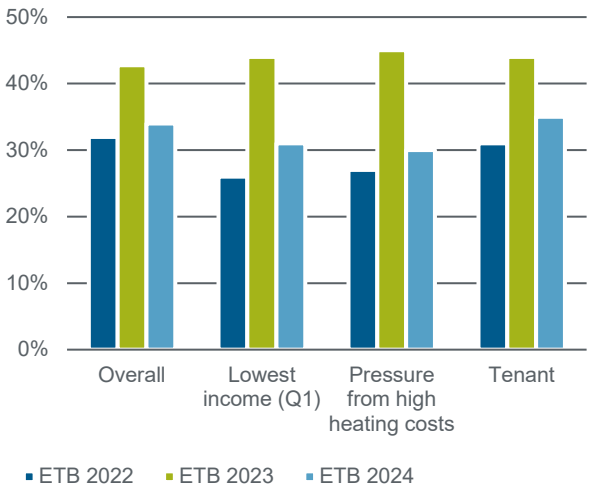
Source: KfW Energy Transition Barometer 2022, 2023 and 2024

The overall decrease was also driven by the fact that the fairness perception was more negative overall than the year before (Figure 2.3). In the current KfW Energy Transition Barometer, 34% of households believe that policymakers are intent on finding a fair balance between all groups of society in the energy transition. That rate still stood at 43% in the previous year, but in 2022 it was lower than the current level, at 32%.

It appears that the perception of fairness improved in 2023 thanks to the bold intervention of the Federal Government against the sharp increases in electricity and gas prices, while the uncertainties resulting from the debates around internal combustion engines, heating systems and building modernisation had the opposite effect in the current survey, so that the perception of fairness has decreased again overall. The declines are particularly pronounced in households with low incomes (44 to 31%) and those experiencing high cost pressures (45 to 30%). These groups are already affected by high economic uncertainty and are likely to also feel unsettled from the ongoing debates. What is positive is that the share of households experiencing high cost pressures dropped slightly in the past year (from 60 to 56%).

### Figure 2.3 Perceptions of fairness of the energy transition

Shares of households that believe in a fair energy transition




Note: The question was: 'Do you believe that policymakers are working to ensure a fair solution for all groups of society in the energy transition?'; showing households that answered 'yes'.

Source: KfW Energy Transition Barometer 2022, 2023 and 2024

## 2.3 Importance of trust and fairness perception for energy transition activity

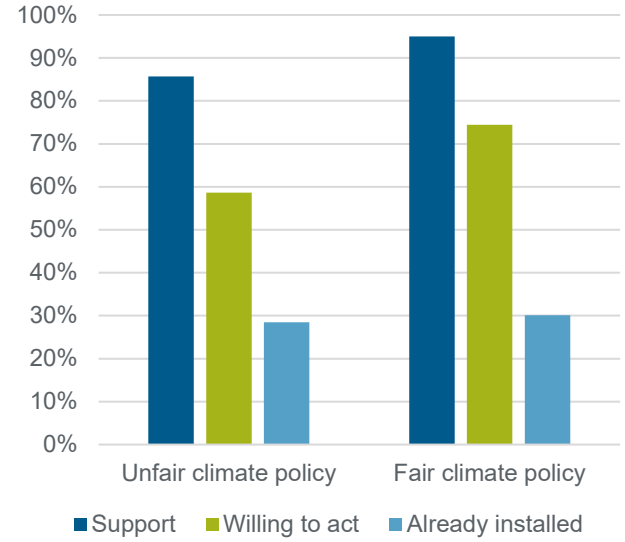
A decreasing perception of fairness can definitely become a challenge for large-scale social projects such as the energy transition if it is an expression of a crisis of confidence in political decisions. It is therefore of interest to examine whether the perceived fairness also affects the support of households for the energy transition, their willingness to take action or their actual activity.

The KfW Energy Transition Barometer allows this question to be examined because it surveyed aspects of fairness and trust as well as various levels of support for the energy transition in the survey year 2022. It also provides information as to whether households are actually using an energy transition technology ('installed'). These findings can provide revealing insights to this question.

With a view to the three levels of participation in the energy transition, it was found that the level of fairness perceived has varying degrees of influence (Figure 2.4). Households that believe in a fair equalisation of burdens show greater support for the energy transition (95 vs. 86%). This perception also has a noticeable effect on their willingness to act (74 vs. 59%). Actual installation, on the other hand, remains less affected, and the corresponding values are nearly identical (30 vs. 28%).

### Figure 2.4: Households that believe in a fair energy transition are more supportive and willing to act

Shares of households, by fairness perception




Note: 'Support' describes households that regard the energy transition as important or very important; 'willing to act' describes households whose willingness to act is at least 6 on a scale of 0 to 10; 'already installed' describes households that use at least one energy transition technology.

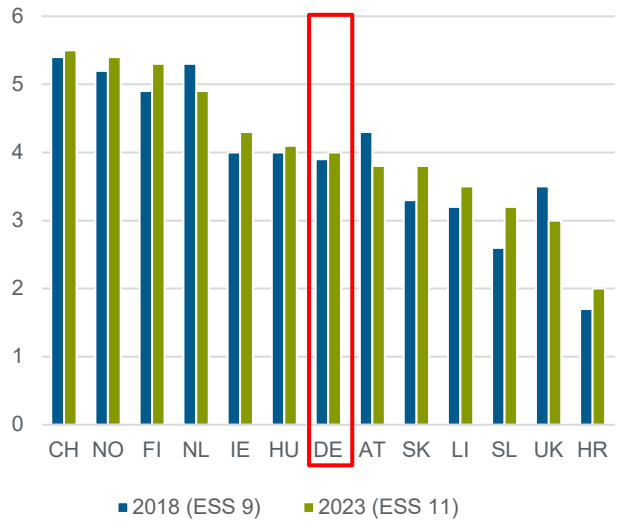
Source: KfW Energy Transition Barometer 2022

Another relevant aspect is overall trust. Trust is particularly relevant for whole-of-society projects and processes where individual and social benefit do not coincide, creating what is referred to as a social dilemma.[6] The implementation of suitable and necessary climate action measures is such a dilemma because a society in which all take action for the climate is better off than a society in which no one takes action. From an individual perspective, however, it is of advantage to withhold one's own contribution and hope that other parts of society will take over. This leads to 'free rider' behaviour, a phenomenon known from game theory.

Deep trust in political decision-makers in general and fairness in the implementation of policies in particular can help to foster cooperative behaviour and, for example, increase public support for environmental policy reform.[7] The positive influence of trust is even more intense when there are conflicts of interest between the parties involved.8 Moreover, a smooth expansion of necessary infrastructure projects such as power lines[9] or wind generators[10] also depends crucially on the trust of the affected population, for

### Figure 2.5: Trust in politicians in a European comparison

Average values on a scale of 0 to 10, by country




Note: The question was: 'Please tell me on a scale of 0 to 10 how much you personally trust politicians.

Source: European Social Survey (ESS), waves 9 and 11.

example in the transparency of processes or the credibility of local decision-makers.

It is reassuring to know that, according to the European Social Survey, trust in policymakers in Germany is in mid-range for Europe and has even improved slightly since the pre-COVID-19 period (Figure 2.5). In 2008, Germany ranked 8 of 13, with an average score of 3.9. Compared with the other twelve countries for which the results of the 2023 survey are already available, Germany's score improved slightly to 4.0, or rank 7, in the current 2023 survey.[11]

With respect to the levels of participation in the energy transition, a similar pattern emerged as for the level of fairness perceived (Figure 2.6). Households that have little trust in fairness (values 0 to 3) also show disproportionately low levels of overall support for the energy transition. In 2022, just under 77% of households believed the energy transition was important or very important. In the groups with medium levels of trust (4 to 7) or high levels of trust (8 to 10), support was significantly higher, at 91% each.

In terms of willingness to take action, the trend was even clearer. According to the survey findings of 2022,

[6] Cf. Van Lange et al. (2013).

[7] Cf. Muhammad et al. (2021).

[8] Cf. Balliet, D. and Van Lange, P. A. M (2012).

[9] Cf. Ceglarz et al. (2017).

[10] Cf. Ellis, G. and Ferraro, G. (2016).

[11] Average values are based on a scale from 0 (no confidence at all) to 10 (full confidence).

the proportion of households that were willing to act increased from 46% (low level of trust) through 64% (medium level of trust) to 73% (high level of trust). Both increases are in line with the literature on the influence of trust.

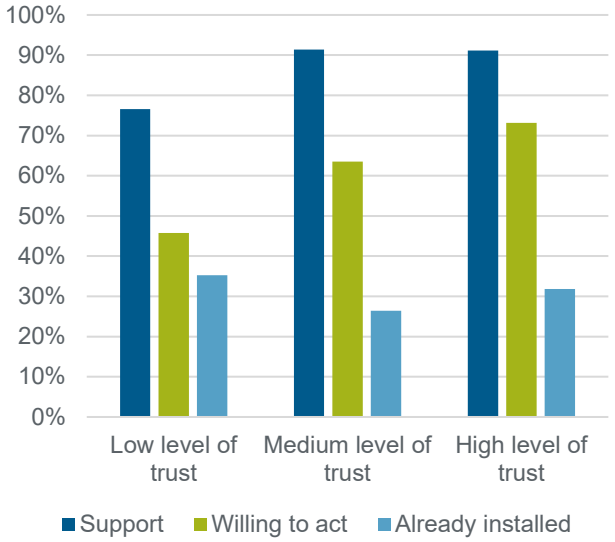
With regard to actual installation, the third level, there was no significant overall effect of trust, however. But it must be noted here that tenant households have no direct influence on the heating technology and thermal insulation installed in their dwellings. The same analysis conducted for owner-occupiers shows that property owners indeed use energy transition technologies slightly more often (already 'installed') when they have a high level of overall trust (47 vs. 41%).

Whereas no stark differences were found between varying levels of trust or perceptions of fairness with regard to installation, the KfW Energy Transition Barometer consistently finds clear disparities of installation levels depending on the household's net income and also between tenants and owner-occupiers (see also Chapter 3).

These findings suggest that motivational and financial aspects both play a key role for a successful transition. Households that have high levels of trust in policy-makers and a high perception of fairness are also more willing to contribute to the energy transition. Greater financial scope, planning certainty and suitable incentives, in turn, expand households' options for contributing – and are ultimately crucial to installation.

**Figure 2.6: Households with a high level of trust are more supportive and willing to act**

Shares of households, by level of trust




Note: 'Support' describes households that regard the energy transition as important or very important; 'willing to act' describes households whose willingness to act is at least 6 on a scale of 0 to 10; 'already installed' describes households that use at least one energy transition technology.

Source: KfW Energy Transition Barometer 2022

# 3. Energy transition activities of private households

The share of households using energy transition technologies grew to 31%.

Photovoltaic and battery storage systems saw particularly strong growth.

Almost 40% of owner-occupiers can imagine installing a heat pump.

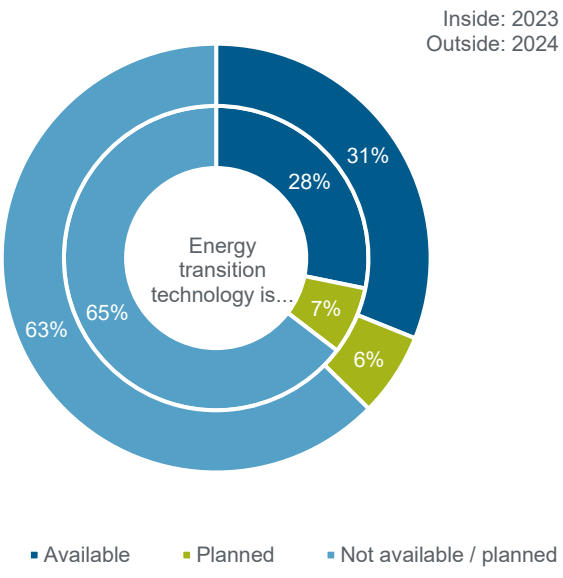
## 3.1 Share of energy transition stakeholders continues to grow

Around 31% of households – some 12.9 million – use at least one of the following technologies: Heat pumps, photovoltaic (PV) systems, solar thermal systems, home battery storage, combined heat and power, wood pellet heating, electric vehicles (Figure 3.1).

A further 6% of households plan to acquire one of these technologies in the coming 12 months.[12]

### Figure 3.1: Number of users of energy transition technologies is growing noticeably

Shares of households surveyed using or planning to use at least one energy transition technology




Note: The energy transition technologies considered are solar thermal energy, photovoltaics, heat pumps, combined heat and power, home battery storage, electric vehicles, and wood pellet heating.

Source: KfW Energy Transition Barometer 2023 and 2024

[12] The values are based on a refined method for measuring the dissemination of heat pump. It enables year-to-year comparisons to be made here, although comparisons with the figures published in the previous year have only limited informative value.

The share of energy transition stakeholders increased by 2.9 percentage points on the previous year. This increase means that around 1.2 million households began to use energy transition technologies last year. The increase is evident across all regions and groups of society in Germany (Figure 3.2).

To be sure, southern Germany has the highest share of households using energy transition technologies (41%) and eastern Germany the lowest (24%). Still, the number of households contributing to the energy transition is growing noticeably in all four regions. In northern and western Germany, the share of households active in the energy transition is now also close to the national average, at around 29%. A look at the individual federal states confirms the regional patterns (Figure 3.3).

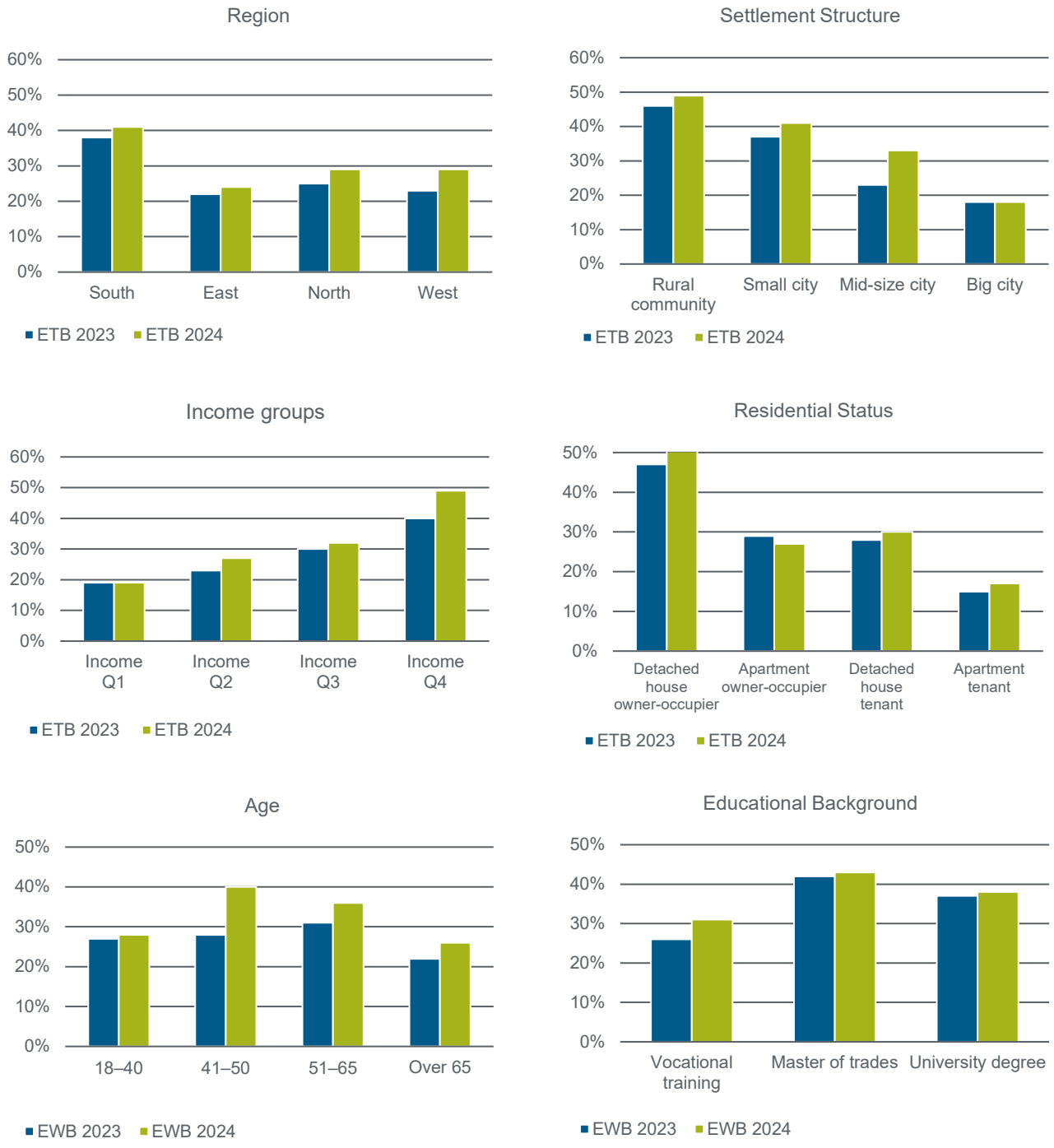
The development is stagnating in large cities, and the share of energy transition stakeholders is the lowest here as well. This is likely due in part to the tenancy/ownership and dwelling structure. Large cities have many tenants and only few households living in detached or semi-detached houses. But for these households it is more difficult to implement the energy transition technologies under consideration here because they are often dependent on the action of landlords or the consent of co-owners.

There are clear disparities in regard to household incomes. Those in the highest income quartile are more than 2.5 times as likely to be energy transition stakeholders as households in the lowest income quartile (49 vs. 19%). The dynamic in higher income groups is also stronger. The share of energy transition stakeholders grew from 40 to 49% in the highest income group but remained unchanged at 19% in the group with the lowest incomes. The weak dynamic in low-income groups is challenging in two respects: First, it is important for both the success of the energy transition and its societal acceptance that all households can contribute to it. Second, households with low incomes are particularly affected by high energy costs and are more likely to live in dwellings with low energy efficiency.[13]

[13] Cf. Römer and Salzgeber (2022b, 2022c).

## Figure 3.2: Energy transition stakeholders are increasing across all regions and groups of society

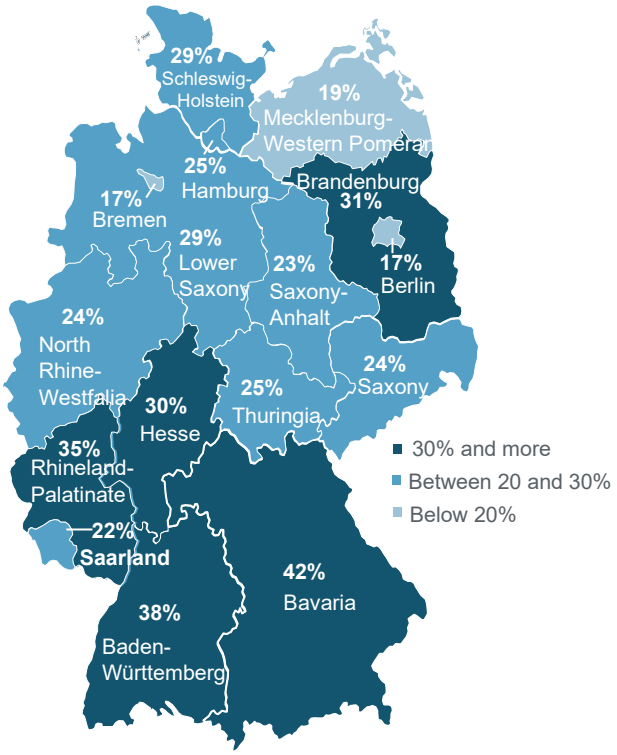
Shares of households using at least one of the energy transition technologies considered




Source: KfW Energy Transition Barometer 2023 and 2024

**Figure 3.3: Regional differences in the dissemination of energy transition technologies**

Shares of households surveyed that use at least one of the energy transition technologies by federal state, averaged over the years 2023 and 2024




Source: KfW Energy Transition Barometer 2023 and 2024

With respect to housing situation, owners of detached and semi-detached houses are by far the strongest group of energy transition stakeholders, recording the highest increase of 6 percentage points. Tenants living in apartments are clearly below-average, at 17%, while owners of apartments and tenants of detached and semi-detached houses are slightly below the average, at 27 and 29%, respectively.

With respect to age, middle-aged people are particularly well represented among users of energy transition technologies. These are typically households that are settled in their jobs and therefore financially secure but still young enough to not be deterred by longer-term planning horizons.

No clear picture emerges with respect to educational qualifications. To be sure, the share of energy transition stakeholders tends to be higher in households with higher levels of educational attainment than in households with no qualifications or undergoing training. Still, a clear hierarchy is not apparent. This indicates that it is not so much the level of formal education per se but the financial capacity enabled through education that likely determines participation in the energy transition.

## 3.2 Strong increases in PV and battery storage systems

If we look at the energy transition technologies in use, PV systems clearly top the list (Figure 3.4). This applies to both current adoption rates and planned acquisition. In this survey, nearly 15% of households responded that they were using a PV system compared with around 12% in the previous year. Among owner-occupiers, even more than 25% of households are PV users (around 19% in the previous year).

Solar thermal systems rank second among the most widespread technologies. Around 9% of all households and 17% of owner-occupiers use a solar thermal system. Growth of this technology, however, stagnated last year. The planned rates of acquisition were also relatively low.

Battery storage systems, on the other hand, saw very dynamic growth. While only 3.7% of households – and 6.3% of owner-occupiers – reported using a home battery in the KfW Energy Transition Barometer 2023, that share nearly doubled to 6.7% for all households in the KfW Energy Transition Barometer 2024. For owner-occupiers, the current rate of 12.9% is even more than twice as high as in the previous year.

Heat pumps also saw strong growth on the previous year. In the KfW Energy Transition Barometer, 6.4% of all households – and 11.9% of all owner-occupiers – indicated using a heat pump as a primary source of heating, compared with 4.8% and 8.2% in the previous year.[14]

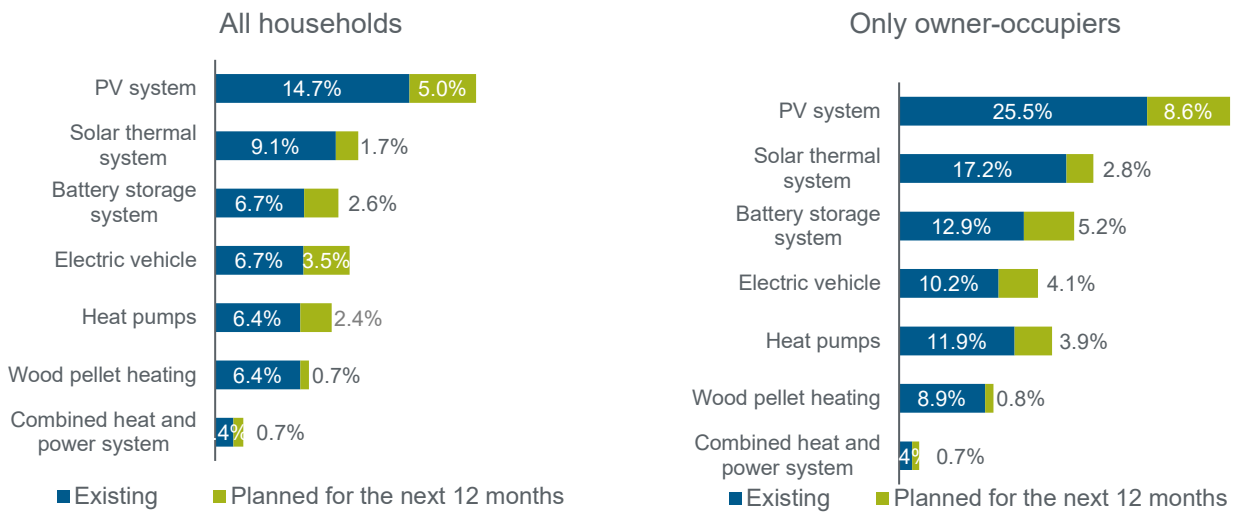
Wood pellet heating showed a similar rate of distribution (6.4% of all households, 8.9% of all owner-occupiers). However, the growth rates and planned acquisitions for the coming 12 months are well below those for heat pumps.

Electric vehicles are currently being used by 6.7% of all households and 10.2% of all owner-occupiers. For the coming 12 months, further acquisitions are also being planned by 3.5% of all households and 4.1% of all owner-occupiers. Combined heat and power systems do not play a significant role in terms of actual distribution nor planned acquisitions.

[14] The previous year's percentages were recalculated using a more refined method.

**Figure 3.4: PV and battery storage systems had the strongest growth rates**

Shares of all households and owner-occupiers using or planning to use at least one of the energy transition technologies




Source: KfW Energy Transition Barometer 2023 and 2024

## 3.3 More and more households are combining energy transition technologies

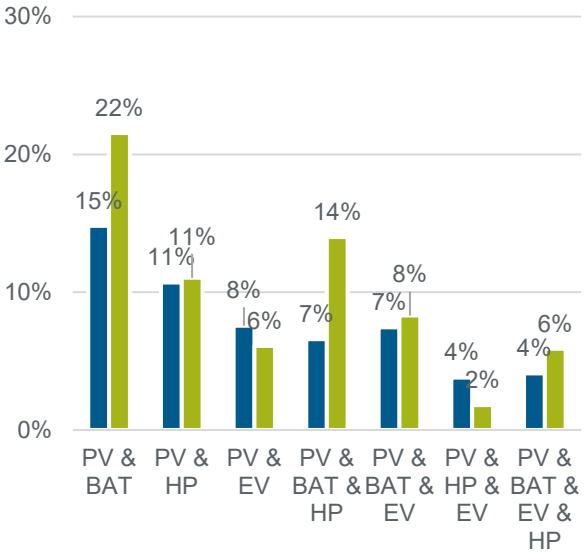
Photovoltaic (PV) systems in particular are well suited for combination with other technologies. Both home solar batteries and electric vehicles enable surplus energy to be stored, significantly increasing the amount of self-generated electricity consumed by households. More and more households appear to be wanting to leverage these potentials, as the combination of PV systems with other technologies is much more common in the KfW Energy Transition Barometer 2024 than in the previous year (Figure 3.5).

At present, the combination of PV system and home battery is the most widespread. Around 50% of property-owners using PV systems also have a home battery, a sharp rise on the previous year (33%). This proportion is made up of households that only use a home battery in addition to the PV system (22% compared to 15% in the previous year), those that also use a heat pump (14% compared to 7% in the previous year) or an electric car on top (8% compared to 7% in the previous year) and finally those that combine their PV system with a battery storage system, a heat pump and an electric car (6% compared to 5% in the previous year).

A combination of PV and heat pump is also frequently used (11%), while the exclusive combination with an electric vehicle is somewhat less common (6%).

**Figure 3.5: Combination of technologies**

Share of owner-occupiers with a PV system who additionally use a home battery (BAT), a heat pump (HP), an electric vehicle (EV) or a combination of these.




Source: KfW Energy Transition Barometer 2023 and 2024

# 4. Assessments of energy transition technologies

The share of households that could imagine acquiring an energy transition technology decreased on the previous year.

Reducing costs, being able to contribute to climate action and gaining independence were the perceived benefits of energy transition technologies.

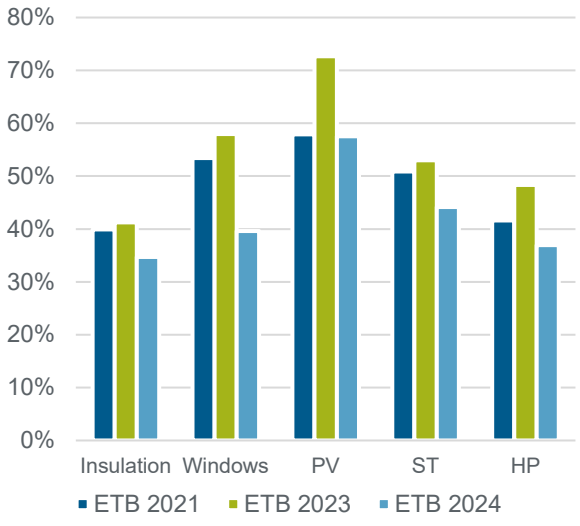
Financial constraints, on the other hand, were the main barrier to the acquisition of energy transition technologies.

After more households than ever could envision using energy transition technologies in the previous year, that proportion dropped again sharply in the current Energy Transition Barometer. For most technologies, the rate was even lower than in the KfW Energy Transition Barometer 2021. This probably reflects some degree of uncertainty. It is worth noting here, however, that the relevant data was collected prior to the launch of current support programmes. Rising demand, for example under the heating replacement programme, which was launched this year, suggests that sentiment may have shifted here somewhat again.

At the time of the survey, just under 60% of households that did not have a photovoltaic system could envision the acquisition of this technology, down from 73% in the previous year. Dwelling upgrades such as thermal insulation or new windows were conceivable for 40% and 35% of households. In the previous year, the corresponding figures were 58% for new windows and 41% for insulation. Likewise, fewer households could imagine acquiring a solar thermal energy system (44 vs. 53%) or a heat pump (37 vs. 48%).

**Figure 4.1: Openness towards technologies**

Shares of owner-occupiers who are not yet using the relevant technology but can envision a future acquisition




Note: PV: photovoltaic system, ST: solar thermal system, HP: heat pump

Source: KfW Energy Transition Barometer 2023 and 2024

## 4.1 Perceived advantages

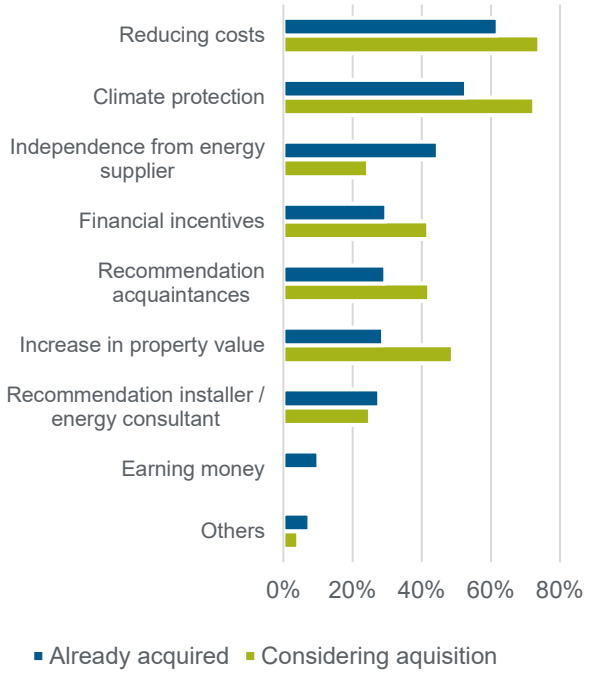
Given the trend described above, the underlying perception of benefits and drawbacks of the surveyed households are of particular interest.

Starting out with an analysis of the perceived advantages, it turns out that households that already use energy transition technologies and those that can imagine an acquisition have rather similar perceptions (Figure 4.2).

In both groups, the main motives are reducing costs and contributing to climate action. For many households that have already acquired a technology, being independent from an energy utility also played an important role.

**Figure 4.2: Advantages of energy transition technologies**

Shares of households that currently use or can imagine acquiring an energy transition technology and see the relevant aspect as a benefit, average across all technologies



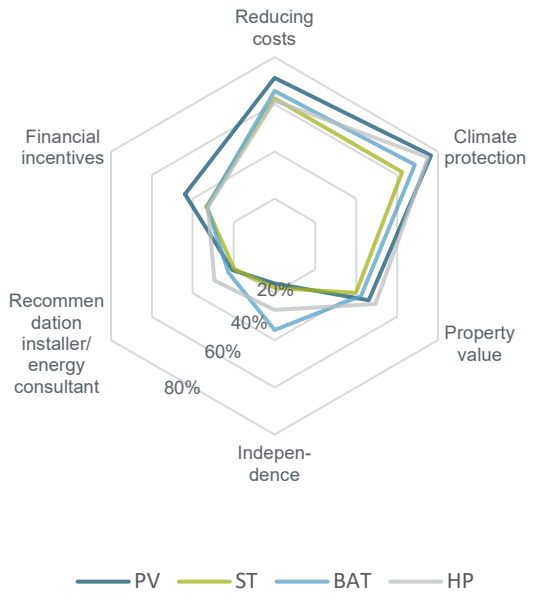

Source: KfW Energy Transition Barometer 2024

Households that are considering an acquisition often do so with the aim of increasing the value of their property. The motivation of earning money, on the other hand, hardly plays an important role for any household.

A comparison of individual technologies revealed that lowering costs (62-71%) and contributing to climate action (53-77%) were perceived as significant advantages for all the technologies considered here (Figure 4.3). Many households also see the possibility of increasing the value of their property (40-49%) and financial incentives under a support scheme (33-44%) as advantages. In addition, just under 40% of households see the ability to be independent from their utility by using a home battery as an advantage. This aspect is mentioned much less often for other technologies. A notable share of just under 30% saw the recommendation from installers or energy consultants to use a heat pump as an advantage, while that figure was only around 20% for the other technologies.

### Figure 4.3: Advantages of energy saving measures by technology

Average shares of all households that currently use or can imagine acquiring an energy transition technology and see the relevant aspect as a benefit, by technology




Note: PV: photovoltaic system, ST: solar thermal system, BAT: home battery, HP: heat pump

Source: KfW Energy Transition Barometer 2024

## 4.2 Barriers to acquisition

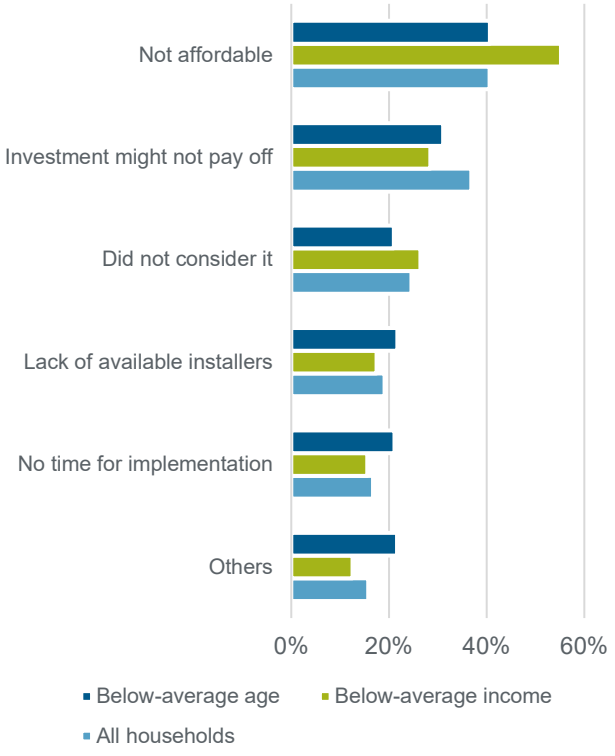
Financial aspects are the main barrier to installation. Around 41% of all households said that they would not implement an energy transition measure they would generally consider because they could not afford to. This was closely followed by doubts about the cost-effectiveness of the investment, the second most common barrier, at 37%. All other possible obstacles were mentioned much less often, at around 20% (Figure 4.4).

Households with below-average incomes are already prevented much more often from implementing an investment by their general inability to mobilise funds (55%), while cost-effectiveness considerations play less of a role (28%).

In households with younger people, cost-effectiveness concerns are also relatively less common (32%). In return, they mentioned slightly more often not being able to find an installer (22 vs. 19% on average) and generally having no time for installation (21 vs. 16% on average).

### Figure 4.4: Reasons against measures

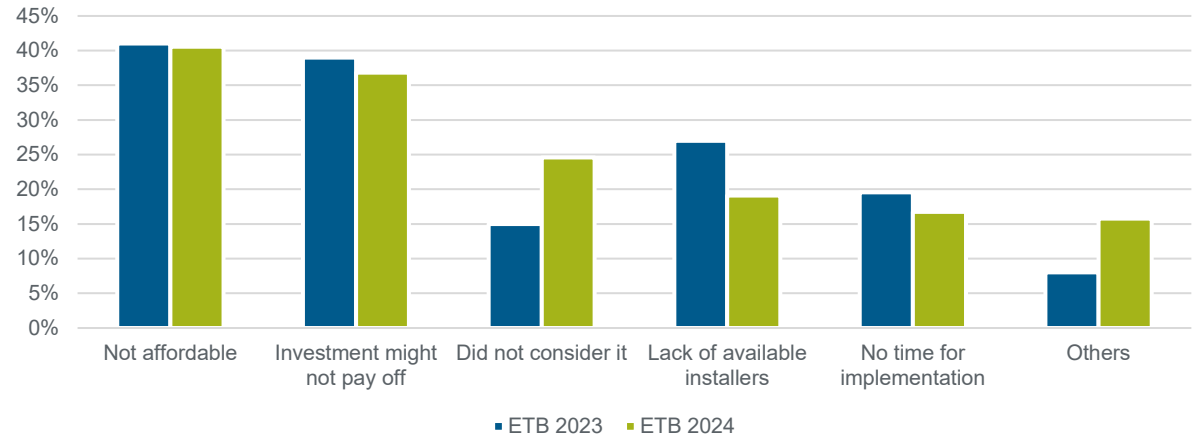
Frequency of reasons why a conceivable measure was not adopted, average across all energy transition technologies, by household group. Multiple responses were possible.




Source: KfW Energy Transition Barometer 2024

### Figure 4.5: Two-year comparison of reasons against measures

Frequency of reasons why a conceivable measure was not adopted, average across all energy transition technologies, by survey year. Multiple responses were possible.




Source: KfW Energy Transition Barometer 2023 and 2024

The barriers remained relatively steady compared with the previous year (Figure 4.5). The largest variation occurred for the statement 'We did not consider it', which was now mentioned by 25% of households compared with only 15% in the previous year. The share of people considering actual installation thus appears to have decreased slightly. In addition, lack of available installers was now mentioned as an obstacle to installation for only 19% of households, down from 27% in the previous year. Hardly anything changed from year to year for any of the other barriers.

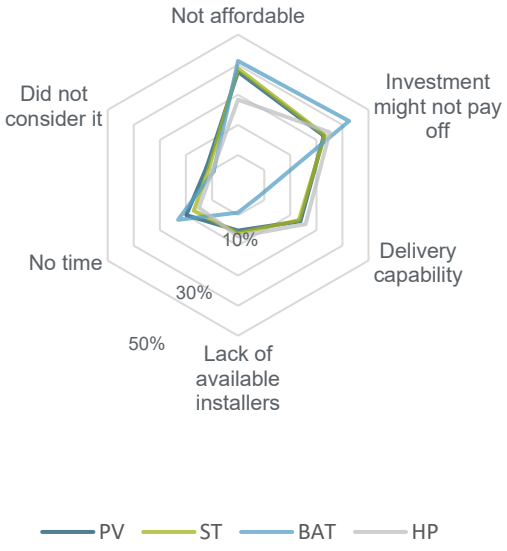
A look at the barriers to acquisition by technology reveals a largely very homogeneous landscape (Figure 4.6). Financial aspects were mentioned most often for all technologies. Nearly 40% of households reported that they could not afford PV, solar thermal or home battery systems but only 28% said the same about heat pumps. Around one third also responded that they did not believe an investment in PV, a solar thermal system or heat pump would pay off.

Cost-effectiveness concerns are disproportionately high for home battery systems, at 43%. Doubts about delivery capability, on the other hand, were particularly rarely mentioned as a barrier here (8%), as was a shortage of installers (9%). Being time-poor, on the other hand, was mentioned disproportionately often for home batteries (23%).

Given the falling prices of battery cells and PV modules, further cost-effectiveness improvements can be expected for these technologies – and therefore continuing strong growth in demand.[15]

### Figure 4.6: Barriers to acquisition by technology

Frequency of reasons why a conceivable measure was not adopted, average across all energy transition technologies, by household group. Multiple responses were possible.




Note: PV: photovoltaic system, ST: solar thermal system, BAT: home battery HP: heat pump

Source: KfW Energy Transition Barometer 2024

[15] Cf. The Economist (2024).

# 5. Heat pump as a key technology

Around 40% of owners of gas and oil heating systems can imagine installing a heat pump.

Doubts about their cost-effectiveness remain the most formidable barrier.

Scientific studies and Europe-wide comparison demonstrate broad applicability of heat pumps.

## 5.1 Installed heating system determines whether households consider a heat pump

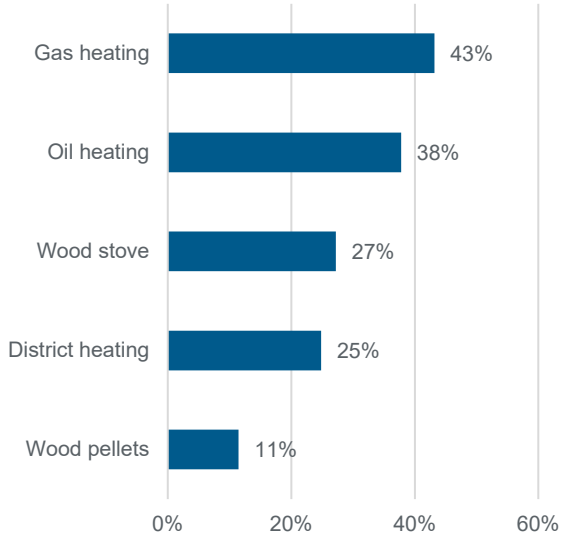
The broad use of heat pumps is a key building block of the heating transition. There is only a limited supply of biogas, and green hydrogen will not be available any time soon either. Researchers have repeatedly dismissed hopes that it might be possible to generate hydrogen-based decentralised heat. This is not only because the use of hydrogen is being prioritised for industry, but also because the planned core hydrogen network is not even designed to accommodate a further volume for heat generation.[16] Likewise, this technological option would constitute an extremely inefficient use of energy as it would require many times more green energy than a heat pump.[17] On balance, this technological option does not appear to be economically viable in the long term either. Installing new gas or oil-based heaters is therefore likely to be a cost trap for operators amid rising carbon prices.

At present, around 6% of all households and 12% of owner-occupiers use a heat pump as their primary source of energy. Besides, 37% of all owner-occupiers who are not yet using a heat pump can imagine installing one.

This applies particularly often to households with gas and oil heaters, the most widespread heating technologies in Germany (Figure 5.1). The users of other technologies, on the other hand, are much less willing to consider switching to a heat pump. This is plausible, as district heating use is also sustainable through climate-neutral decentralised provision of heat – and wood pellet heating is already regarded as climate-neutral.

**Figure 5.1: Receptiveness to using a heat pump by type of heating**

Share of owner-occupiers who can imagine installing a heat pump, by installed heating system.




Source: KfW Energy Transition Barometer 2024

## 5.2 Attitudes to heat pumps are mainly a question of money and age

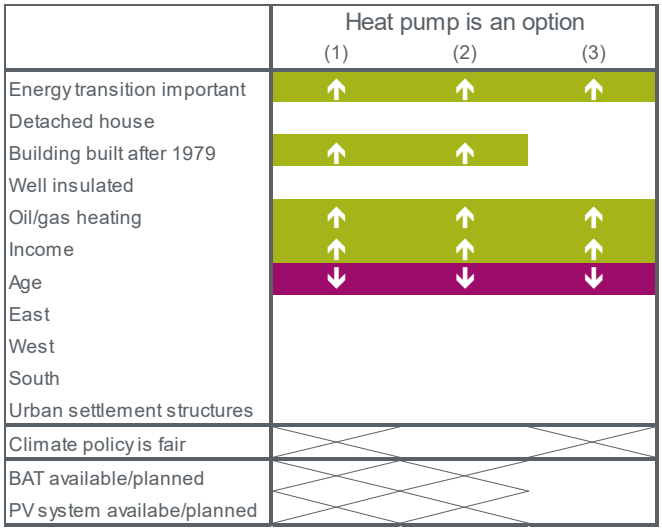
In addition, the influence of various factors on attitudes towards heat pumps was examined in a multivariate analysis (Figure 5.2). It revealed that homeowners who have a positive attitude towards the energy transition are more likely to consider installing a heat pump. It also confirmed that having a gas or oil heating system installed positively influences attitudes towards the acquisition of a heat pump.

Households residing in dwellings that were built after 1979 and therefore meet minimum energy standards are also more likely to consider installing a heat pump than households residing older dwellings. Likewise, households with higher incomes are more likely to consider installing a heat pump than those with low incomes. However, the likelihood of a household considering installing a heat pump decreases with the age of the homeowner. Users of oil heaters tend to be older than the average, which also explains their slightly lower inclination to replace them.

[16] Cf. Borderstep (2024).

[17] Cf. HAW Hamburg (2023).

### Figure 5.2: Determinants of the acceptability of heat pumps




Note: The figure presents the findings of weighted logistic regressions in which the binary variable 'heat pump is an option' is explained by the indicators listed in the left column. The analysis covered property owners who are not using a heat pump yet but are considering installing one. Statistically significant coefficients (at least to the 10% level) are marked by the coloured fields, with the arrow indicating the direction of the correlation.

Source: KfW Energy Transition Barometer 2024

With regard to regional differences, no striking disparities were identified. Nor is there any clear statistical correlation between attitudes towards heat pumps and urban or rural settlement structures. Whether a household perceives the energy transition as fair or not also has no measurable effect on its attitude towards the acquisition of a heat pump when controlled for its support of the energy transition (column 2).

Nor can a correlation be identified between the existence or planned acquisition of a PV and home battery system and a household's attitude towards the acquisition of a heat pump (column 3). It must be noted here that households that are already using heat pumps were not considered in the regression.

## 5.3 Doubts about cost-effectiveness are the main barrier

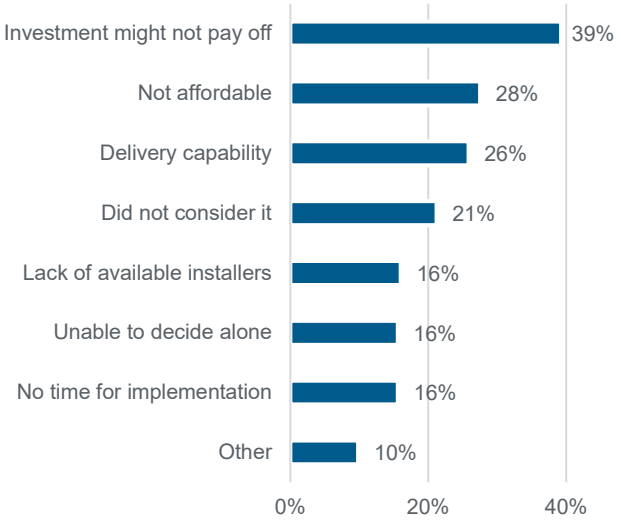
When asked for the reasons they are considering installing a heat pump but have not yet done so, households mainly pointed to financial aspects (Figure 5.3), with 39% of relevant households mentioning doubts about their cost-effectiveness. That was significantly more than just last year (31%).

Twenty-eight per cent of households stated that they could not afford the purchase. That was slightly fewer than just a year ago (29%). Doubts about the ability of the technology to deliver were also stated often (26%). And 16% of households mentioned lack of availability of installers as a reason. Last year, slightly more households still saw their plans frustrated by a shortage of installers, at 18%. Overall, however, this aspect appears to have only a minor influence. Moreover, a good one fifth of households reported not yet having seriously considered a possible installation.

Overall, this indicates that doubts about cost-effectiveness dominate while barriers around general feasibility have even decreased slightly.

### Figure 5.3: Barriers to the acquisition of heat pumps

Frequency of mentions as a barrier by household who are not using a heat pump yet but are considering installing one. Multiple responses were possible.




Source: KfW Energy Transition Barometer 2024

## 5.4 Doubts about cost-effectiveness tend to be overestimated

The question is how justified doubts about cost-effectiveness are. Scientific analyses usually paint a more positive picture of this. According to a recent study by the Fraunhofer ISE, heat pumps are not just more climate friendly but, taking into account the current regulations and promotional landscape as well as a useful life of 20 years in single-family houses, significantly more cost-effective than heating with gas.[18] Combining a heat pump with a home PV system can make it even more cost-effective.

It is often assumed that the building fabric is not adequate for operating a heat pump. Even if it is correct that its operation becomes increasingly worthwhile the

[18] Cf. Meyer et al. (2024).

more energy-efficient the dwelling is, it can also be used in dwellings with average insulation. The current study by Fraunhofer ISE demonstrates that the shift to a heat pump or district heating is more cost-effective than a new gas heating system even in multi-family dwellings – including in old buildings that are not or only partly modernised. Only in very inefficient multi-family dwellings, with energy efficiency class G or higher, is a gas heating system based on natural gas slightly more cost-effective. This changes as soon as the gas heater is operated with green gases – a future requirement – which would be significantly more expensive despite a modelled carbon price increase.[19]

The widening range of applications can also be seen in practice. According to the industry association, four in five heat pumps are being retrofitted to existing buildings.[20] A look across the border emphasises the broad applicability of the heat pump. Germany has comparatively well insulated buildings but occupies one of the last ranks for the use of heat pumps in Europe.[21] In the Scandinavian countries (Finland, Sweden, Norway), where heating requirements are high, heat pumps have had a market share of more than 90% for years.[22]

In Germany, real-world experience with heat pumps is still limited – with a technology that is also being continuously refined. Of concern in this context is the fact that only around 30% of users ended up motivated by advice from an installer or energy consultant (Figure 4.3). If these key actors themselves were more convinced of the technology, they could play an even greater role as an important catalyst of the energy transition.

Efficient operation, however, is largely dependent on proper installation and a relevant technical understanding.[23] Thus, as usage and experience increase, cost-effectiveness and acceptance can be expected to grow as well. In this context it is encouraging that the Federal Government has initiated promotional measures aimed at strengthening technical expertise in the field of heat pumps.[24]

After the record year 2023, the sale of heat pumps in 2024 progressed very slowly at first. But now the industry association believes the market has stabilised. In the first half of 2024, a total of 90,000 heat pumps were sold. The recently launched promotional programmes and significant increases in demand since April 2024, in particular, have caused the industry association to be more optimistic about the future.[25]

[19] Cf. Meyer et al. (2024).

[20] Cf. BWP (2024).

[21] Cf. Enercity (2023).

[22] Cf. European Heat Pump Association (2024).

[23] Cf. SBZ (2021).

[24] Cf. BMWK (2023).

[25] Cf. BWP (2024).

# 6. Conclusion and outlook

The systematic decarbonisation of the economy and society is a necessary transformation to keep the risks of climate change manageable and reduce energy dependencies. The energy transition is a key element of decarbonisation. It is essentially not an ideological or moral project but the answer to changing climate and geopolitical conditions.

The success of the energy transition is therefore in the interest of all groups of society. In the decarbonisation process, both Germany's economic competitiveness and the social compatibility of the transformation must be taken into account. The KfW Energy Transition Barometer provides insights that guide how to shape a successful energy transition.

One finding is that support for the energy transition among the population has weakened somewhat. This is a reflection of the current uncertainty in broad sections of the population. However, four in five households in Germany still back the energy transition project. This continues to be a very large majority.

The findings also demonstrate that trust in political decision-makers and the perception of fairness are important influencing factors. The KfW Energy Transition Barometer shows that both variables clearly correlate with support for the transition and individuals' willingness to contribute to it. Support is essential to ensure broad social legitimacy. After all, the energy transition is a marathon and not a sprint. Broad support can maintain its momentum particularly when it comes to challenging measures and controversial decisions.

It has also become clear, however, that households use climate-friendly technologies particularly when economic conditions are favourable – and essentially irrespective of individual attitudes towards the energy transition. Financial benefits are the most frequently mentioned reason for acquiring energy transition technologies. At the same time, lack of financial scope and doubts about the cost-effectiveness of the technologies are the most important obstacles. In the surveys to date, however, attitudes towards the energy transition by themselves have no tangible effect on the acquisition of PV systems, heat pumps or electric vehicles.

In the end, it is about investment decisions that must be viable in the long term in order to succeed in the market. A reliable economic and political framework therefore appears to be the most important foundation for the broad use of the technologies and the success of the energy transition. Clear economic aspects such as a rising and predictable carbon price coupled with accompanying support and a targeted equalisation of burdens for vulnerable groups of society thus constitute important elements for the further course of the transformation.

The role of economic pressure is also reaffirmed when considering the development of energy costs. Under the impression of the energy crisis, the KfW Energy Transition Barometer 2023 showed that more households than ever before were able to imagine using energy transition technologies, and the strongest ever willingness to play their part was measured. Now that energy prices have eased again, the willingness to act has fallen again, roughly back to the level of 2022.

At the same time, households' investment decisions remained relatively steady. The KfW Energy Transition Barometer 2024 shows that the number of households using energy transition technologies has increased by around 3% compared to the previous year. PV systems and heat pumps recorded some of the highest growth rates. In 2024, demand for heat pumps was on the decline at first but stabilised with the launch of the heating support scheme. After the emotionally charged rise in households' willingness to take action in 2023, a new, more level-headed approach to energy transition technologies may now follow that shifts the focus to the economic benefits, which definitely exist. For many households, it already pays off to install such a technology, and the benefits grow with increasing availability of renewable energy.

Such a new start could be good news for the long-term success of the energy transition. After all, the willingness to switch to a new technology remains high. If policymakers succeed in shaping the overall framework in such a way that it strengthens the attractiveness and cost-effectiveness of energy transition technologies, households will continue to push the project forward.

**The KfW Energy Transition Barometer**

The KfW Energy Transition Barometer is a study conducted annually since 2018 on the basis of a survey of a random sample of usually some 4,000 representative households in Germany. Responses from each household are taken from one household member of full age who takes decisions on household energy supply and consumption. The aim of the survey was to find out to what extent energy transition technologies are being used in the different households. The survey also covered any planned use in order to estimate in what areas the greatest growth was to be expected. Taken together, the data collected provide an overview of current sentiment and households' participation in the energy transition in Germany.

The field phase of the Energy Transition Barometer 2024 comprised around 19 field weeks from 5 December 2023 to 13 April 2024. For the first time, more than 6,000 households were surveyed. The larger database permits refined analyses to be conducted.

In addition, a methodological adjustment was made for the KfW Energy Transition Barometer 2024: The use of heat pumps is now defined more narrowly. While the mere presence of a heat pump was sufficient in previous years, it is now necessary for the heat pump to also be used as the primary heating technology. As a result, both the frequency of use of the heat pump and the proportion of energy transition households are lower overall. The question about the primary heating technology was introduced for the first time in the KfW Energy Transition Barometer 2023. This enables the calculation of corresponding shares for last year's edition based on the new methodology, as well as the comparison between the years 2023 and 2024 presented in this report. However, a comparison with heat pump shares in previous editions and recalculations for previous years is not possible.

Further information on the structure of the current survey of the KfW Energy Transition Barometer can be taken from the related volume of tables and methods: **www.kfw.de/energiewendebarometer**

# Bibliography


**AG Energiebilanzen** (2023)**:** Evaluation tables on the energy balance 1990 to 2021, Arbeitsgemeinschaft Energiebilanzen e.V.

**Balliet, D. and Van Lange, P. A. M.** (2012): Trust, Conflict, and Cooperation: A Meta-Analysis. Psychological Bulletin. DOI: 10.1037/a0030939

**Borderstep** (2024): Das Erdgasnetz, das Heizen mit Wasserstoff und die Wärmepumpe. (*The natural gas network, heating with hydrogen and the heat pump* – our title translation, in German)

**Bundesverband Wärmepumpe (BWP)** (2024): Wärmepumpenbranche verzeichnet Marktstabilisierung (*Heat pump industry records market stabilisation* – our title translation, in German), press release of 17 July 2024.

**Federal Ministry for Economic Affairs and Climate Action** (2023): Fahrplan Wärmepumpen-Hochlauf *(Roadmap for heat pump ramp-up* – our title translation, in German)

**Ceglarz et al.** (2017): Understanding the role of trust in power line development projects: Evidence from two case studies in Norway, Energy Policy 110 (2017), p. 570–580.

**Ellis, G. and Ferraro, G.** (2016): The social acceptance of wind energy, Science for Policy report by the Joint Research Centre (JRC), European Commission.

**Enercity** (2023)**:** Weltweiter Wärmepumpen-Boom: Zahlen, Daten & Fakten. (*Worldwide heat pump boom – figures, data and facts* – our title translation, in German)

**European Heat Pump Association** (2024): Market data.

**HAW Hamburg** (2023): HAW-Hamburg: Potentiale und Grenzen von grünem Wasserstoff (*Potentials and limitations of green hydrogen* – our title translation, in German), press release of 20 February 2023.

**Meyer, R., Fuchs, N., Thomsen, J., Herkel S. and Kost, C.** (2024): Heizkosten und Treibhausgasemissionen in Bestandsgebäuden – Aktualisierung auf Basis der GEG-Novelle 2024 (*Heating costs and greenhouse gas emissions in the building stock – update on the basis of the amended.Building Energy Act 2024* – our title translation, in German) Kopernikus-Projekt Ariadne, Potsdam. https://doi.org/10.48485/pik.2023.028.

**Muhammad et al.** (2021): Empirical Research of Public Acceptance on Environmental Tax: A Systematic Literature Review, Environments 2021, 8.

**Römer, D. and Salzgeber, J.** (2022a): Extremwetterereignisse: versichert sein oder nicht, das ist hier die Frage (Extreme weather events: to be insured or not insured, that is the question – in German). Focus on Economics No. 390, KfW Research.

**Römer, D. and Salzgeber, J.** (2022): KfW Energy Transition Barometer 2022, KfW Research.

**Römer, D. and Salzgeber, J.** (2022c): Energiewende bei Privathaushalten: große Potenziale im Wohnungsbestand (Energy transition in households: existing homes hold great potential – in German). Focus on Economics No. 410, KfW Research.

**Römer, D. and Salzgeber, J.** (2023a): KfW Energy Transition Barometer 2023, KfW Research.

**Römer, D. and Salzgeber, J.** (2023b): Wie reagieren die Menschen in Deutschland auf gestiegene Heizkosten? (How do people in Germany respond to increased heating costs? – In German) Focus on Economics No. 416, KfW Research.

**Römer, D. and Salzgeber, J.** (2023c): Between heating costs and climate action: How do people in Germany view current policy measures? Focus on Economics No. 423, KfW Research.

**Römer, D. and Steinbrecher, J.** (2021): KfW Energy Transition Barometer 2021, KfW Research.

**SBZ** (2021): Fachseiten für Sanitär, Heizung und Klima Wärmepumpe – so entwickelt sie sich weiter (*Heat pump – this is how it is evolving* – our title translation, in German), article dated 4 November 2021

**The Economist** (2024): The exponential growth of solar power will change the world.

**Transport & Environment** (2024): Fehlender Klimaschutz im Verkehr (*Lack of climate action in transport* – our title translation, in German), press release dated 20 June 2024.

**Wehnemann, K. and Schultz, K.** (2024): Treibhausgas-Projektionen 2024 – Ergebnisse kompakt (*Greenhouse gas projections 2024 – summary of results* – our title translation, in German), German Federal Environment Agency (ed.).

German Federal Environment Agency (UBA) (2024): Emissionsübersichten KSG-Sektoren 1990-2023 (*Emission overviews of Climate Change Act sectors 1990-2023* – our title translation, in German).

**Van Lange et al.** (2013): The psychology of social dilemmas: A review, Organizational Behavior and Human Decision Processes, 120(2), p. 125–141.