

# German SMEs invest EUR 22 billion in climate action to remain viable and competitive

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Transitioning to a climate-neutral economy is undoubtedly one of the key challenges of the 21st century. It will require monumental efforts. Not least, a green investment surge would set the foundation for the economy to be successful and competitive going into the future. Small and medium-sized enterprises, which make an essential contribution to value creation and employment in Germany, have a special responsibility here. For the first time, the climate action investments being undertaken across the breadth of the entire SME sector have now been quantified on the basis of the KfW SME Panel.

In 2020, around 460,000 SMEs invested a total of EUR 22 billion in measures that also serve to protect the climate. That was around 12% of all small and medium-sized enterprises, or 26% of SME investors. In other words, around one in ten euros invested in the year 2020 was spent on climate action projects. Almost 100,000 SMEs – around 3% – invested exclusively in climate action projects. And SMEs’ activities are likely to increase. Just over one in seven small and medium-sized enterprises plan to invest in such projects by the end of 2022 but have not yet done so.

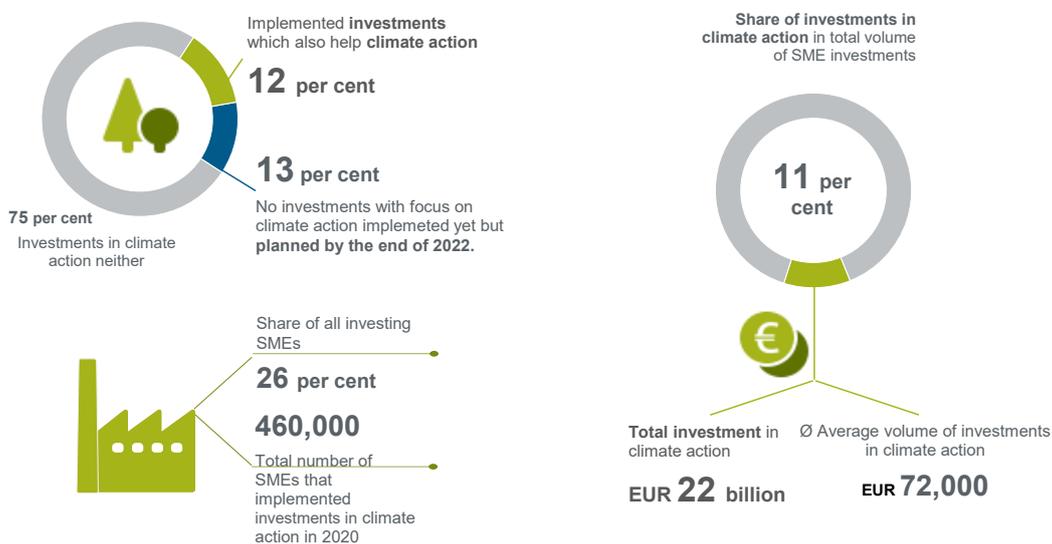
The spectrum of possible measures is broad and ranges from investments aimed at improving energy efficiency in production and existing buildings to the use of renewable

energy or climate-friendly means of transport.

Businesses that implement projects with climate relevance do so with a considerable average volume of EUR 72,000. That is one in every four euros they invest. However, half of the projects cost no more than EUR 15,000. Large SMEs and manufacturers are more willing to invest and the amounts they invest are also higher on average. The share of climate action projects in aggregate investment expenditure, however, is around 11% in all size classes and sectors and therefore sits at a similar level across all businesses.

As the global climate system responds very slowly and sluggishly, the rise in global temperatures would initially continue even if all carbon emissions were stopped immediately. Thus, besides preventative action, measures aimed at adapting to the inevitable impacts of climate change such as the rising frequency and intensity of extreme weather events are increasingly moving to the fore. Many SMEs are aware of the need for adaptation measures. Around one in ten plan to invest more in adaptation measures in the coming years. Here, too, a critical factor is the size of the business, which ultimately reflects the financial and human resources it has to tackle the challenges of climate change.

Figure 1: SME investment in climate action in 2020 – an overview



Source: KfW SME Panel 2021.

Note: This paper contains the opinion of the authors and does not necessarily represent the position of KfW.

Without a doubt, global climate change is one of today’s most pressing challenges for society and policymakers. In order to make an effective contribution to the fight against climate change, Germany has set itself the goal of becoming climate neutral by 2045. Specifically, this means drastically cutting greenhouse gas emissions in all economic sectors in the next 24 years, as well as offsetting unavoidable emissions using natural sinks (e.g. afforestation) or negative emissions technologies (e.g. carbon capture and underground storage). The necessary transformation requires extensive investment. A study commissioned by KfW Research has estimated the investment required by the middle of the century at around EUR 5 trillion, or EUR 191 billion each year on average.<sup>1</sup>

As a defining element of the German business ecosystem, the SME sector also has a responsibility. Key approaches to reducing greenhouse gas emissions in the SME sector include measures aimed at improving energy and resource efficiency in production and company buildings, transitioning to low-emissions mobility and logistics, as well as the use of renewable energy.

Such investments serve not only to protect the climate but to secure the viability and competitiveness of SMEs themselves. Besides Germany and the European Union, a growing number of industrialised countries have committed to the goal of climate neutrality.<sup>2</sup> So there is little doubt that the era of fossil fuels and fossil business models will come to an end. Moreover, it is foreseeable that rising carbon prices will make the use of fossil energy sources increasingly more expensive. That means businesses which significantly reduce their carbon footprint and adjust their business models early will gain competitive advantages.

Customers, too, are keeping a closer eye on companies that contribute to environmental protection and climate action. Not least, climate action as part of a comprehensive sustainability concept is becoming increasingly relevant for financing decisions of capital providers. Frameworks set by policymakers such as the Sustainable Finance Initiative of the European Union or the ‘EU Taxonomy’ play a particular role here.<sup>3</sup> Climate-friendly products and system technologies represent growth markets.

So far, however, little is known about the role which investments in climate action play for small and medium-sized enterprises. The KfW SME Panel 2021<sup>4</sup> helps to close this gap.

**One in four SMEs have climate action projects on their agenda**

In 2020, 12% of small and medium-sized enterprises in Germany made investments that also help protect the climate (Figure 2). That was roughly 460,000 enterprises. Another 13%, or approx. 490,000 enterprises, made no such investments in the same year but plan to do so by the end of the coming year 2022. That means one in every four SMEs – nearly one million small and medium-sized enterprises – are currently planning climate action investments. Conversely, however, this also means that three in four companies did not complete any investment projects with a focus on climate action in the same year nor plan to in the foreseeable future. So there is great potential for further climate action investment in the SME sector.

**Figure 2: Status of climate action investment under implementation or planned in the SME sector**

Proportion per segment in per cent



■ Yes, climate action investments carried out in 2020 ■ No, but planned by the end of 2022 ■ No, also not currently planned

Comments: The corresponding question asked under the KfW SME Panel was: “In the year 2020, did you carry out investment projects that also aim to protect the climate?” A note was added that climate action investment means investments in measures aimed at preventing or reducing greenhouse gas emissions which include, among others, investments aimed at conserving energy or increasing energy efficiency, measures that involve the use of renewable energy, or investment in climate-friendly transport such as the acquisition of electric vehicles, for example. It was also pointed out that the climate action aspect of the investment decision did not have to be the top priority. This takes into account the fact that businesses often do not consider climate action aspects in greater detail until they have to make replacement investments.

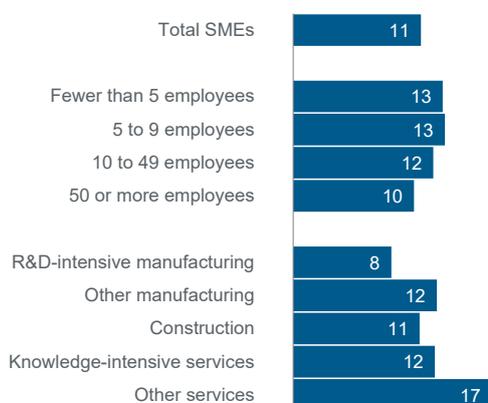
Source: KfW SME Panel 2021.

Investments already realised, in particular, have clearly been found to be size-dependent, as the frequency of such investment projects increases with the size of the enterprise. In 2020, a mere 10% of micro-businesses invested in climate action compared with one in three large SMEs with 50 or more employees (36%). The sector comparison shows that greater climate action investment is undertaken by SMEs in the manufacturing sector, where a high share of the larger SMEs are situated.

The stronger commitment of large SMEs and manufacturers can be attributed in part to the segments' traditionally greater willingness to invest overall. Besides, the production and working processes in the manufacturing sector are often more energy-intensive compared with the services sector<sup>5</sup>, which gives them greater incentives to implement energy-saving investments, for example. In line with their business model, enterprises providing other services – which include retail and wholesale, personal services, hospitality and catering, broad segments of the tourism industry, nursing care, training and education as well as arts, culture and sports – all exhibit a slightly lower than average willingness to invest in climate action.

**Figure 3: Share of climate action investment in total investment volume**

In per cent



Source: KfW SME Panel 2021.

### Climate action projects have considerable investment volume

EUR 72,000 was the average amount which SMEs reported having invested in projects that also serve to protect the climate in 2020 (Figure 4). That is a considerable amount in relation to the total spent by these businesses on average to meet all their investment goals, which averaged EUR 262,000 in 2020. Accordingly, businesses that undertook climate action investments spent around 27% of their total investment volume – more than one in four euros – on projects with climate relevance. Still, the vast majority of projects have a moderate volume. Half the investment projects focusing on climate action had a volume of less than EUR 15,000 (median value).

Given the impact of the coronavirus crisis on SMEs<sup>6</sup> last year, businesses may also have given lower priority to

climate action investments. It is conceivable that funds earmarked for investments were primarily channelled into investment projects more strongly directed at maintaining or adapting business operations (for example, modifications to the product or service offering or to the business model). Above all, changing to or using additional digital sales channels proved to be critical for many businesses to be able to continue earning an income.<sup>7</sup> It is possible that limited capital allowed climate action investments to be made only in lower volumes (or not as originally planned at all). In any case, it would have been plausible for companies to divert or direct budget funds away from climate action investments.

### Large SMEs and manufacturers have the largest projects

The larger the enterprise, the higher the amount invested in climate action projects tends to be. On average, large SMEs invest 12 times more in their projects than micro-businesses (EUR 346,000 compared with EUR 29,000).

In a sector comparison, SMEs in R&D-intensive manufacturing<sup>8</sup> and other manufacturing<sup>9</sup> stand out. That means large enterprises and manufacturers do not just conduct climate action investments more often. On average they also invest significantly higher volumes. These higher amounts are likely driven by the more frequent implementation of capital-intensive measures. Earlier studies by KfW Research have shown that these segments conduct investment measures aimed at improving energy efficiency and reducing energy costs (as a subsegment of climate action investments) significantly more often.<sup>10</sup> These include investments in energy-efficient production facilities and equipment, investments aimed at making operational buildings more energy-efficient, and investments in improving the energy efficiency of vehicles and logistics. By contrast, smaller enterprises mainly focus on measures that can be put in place rather swiftly and cost-effectively. It is true that efforts by SMEs to improve energy efficiency and save energy costs represent only a small portion of climate action investments. However, the basic pattern is likely to be similar.

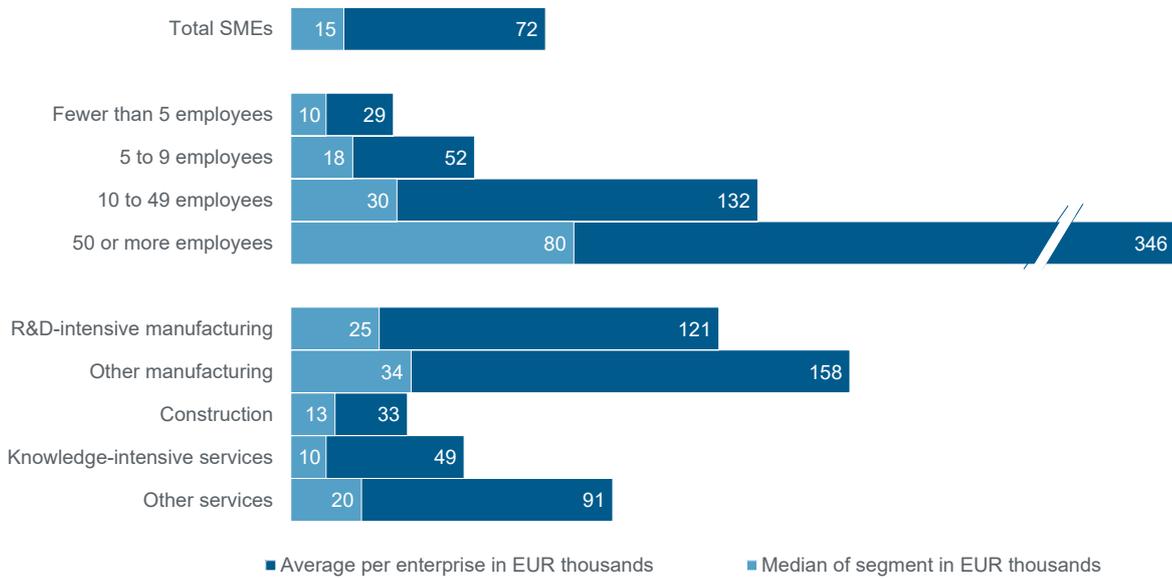
### EUR 22 billion for climate action

In 2020, SMEs invested around EUR 22 billion in projects that also serve to protect the climate. In other words, roughly one in ten euros (11%) of the total sum of EUR 204 billion invested by SMEs in 2020 was used for this purpose, with only very minor differences between individual segments (Figure 3). The funds committed by the SME sector to climate action investments were roughly the same as their expenditure on digitalisation (2019: EUR 17.5 billion), the second important area of transformation.<sup>11</sup>

The strong involvement in climate action investment and the very high project volumes of larger SMEs are reflected in the aggregate investment sums (Figure 5, left side). Large SMEs with 50 or more employees accounted for 37% or EUR 8.1 billion of SMEs' investments in climate action measures. SMEs with 10 to 49 employees still made up 29% or EUR 6.3 billion.

**Figure 4: Investment volume for climate action projects**

EUR in thousands



Comments: The calculation includes only businesses that actually implemented investments which help protect the climate in the year 2020.

Source: KfW SME Panel 2021.

Because of their high number of 3.1 million firms, micro-businesses with fewer than five employees shape many aggregate values and developments of the SME sector overall. With an aggregate of EUR 5.5 billion in climate action investments, however, this numerically strong segment lags behind the larger size classes. The sizes of projects are simply very small – as they generally are in investments in this company size class (Figure 4). Half of all climate action projects are for no more than EUR 10,000 (all investment projects: median amount EUR 13,000 / average EUR 42,000). Their commitment is also below average thus far. Both have a dampening effect on investment volume.

**Despite extensive projects sole focus on manufacturing falls short of the mark in the SME sector**

The public debate around the issue of climate action by businesses often focuses on the potentials and constraints of manufacturing firms. This is plausible given that the entire industrial sector accounted for a high share of 28% of Germany’s final energy consumption<sup>12</sup> and 24% of greenhouse gas emissions in 2020.<sup>13</sup> In other words, the sector faces very significant challenges.

Our findings now provide indications that, at least in the SME sector, services businesses also appear to be mobilising heavily in the area of climate action investments. To be sure, the proportion of SMEs undertaking climate action investments is higher in the industrial SME sector (Figure 2). The investment volumes there are also higher than average (Figure 4). Both are a reflection of the greater transformation pressure on the industry. However, the sector aggregates (Figure 5, right side) also show that manufacturing SMEs ultimately account for only a small portion of the overall SME investment volume with a climate action focus (16%). Both

SME manufacturing subsectors spent a total of EUR 3.6 billion on climate action investments in 2020. The reason is that they are less numerous. Despite receiving much attention from economic policymakers, manufacturing accounts for a relatively low share of approx. 6.5% of all small and medium-sized enterprises (around 249,000 SMEs).

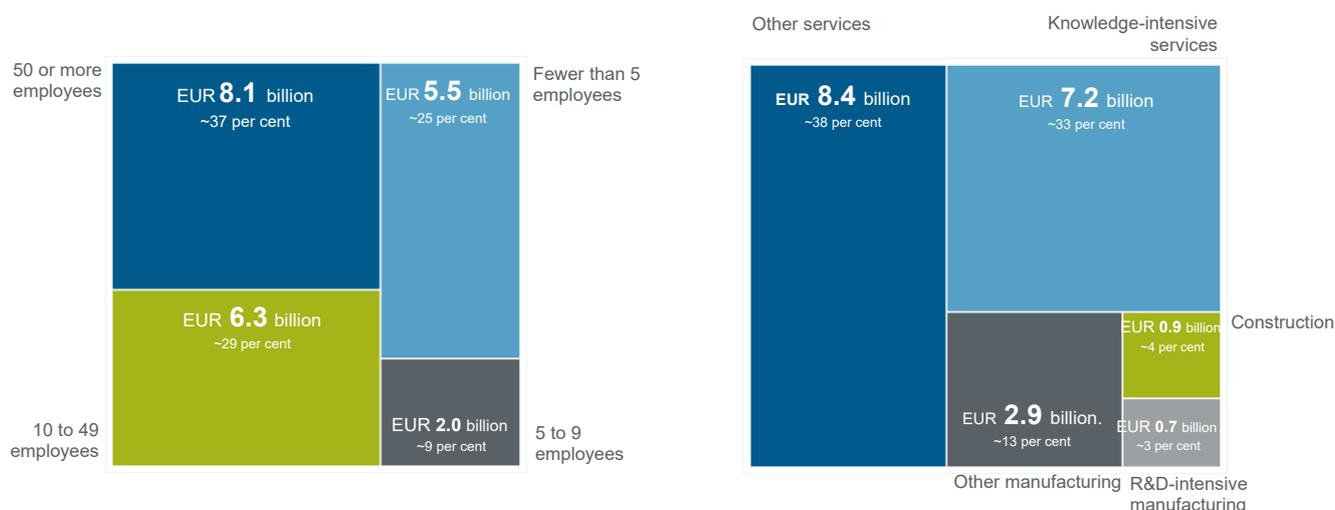
**Service providers are driving the volume up**

The drivers of the overall volume of SMEs’ climate action investments are to be found elsewhere, for structural reasons. The service sector is shaping economic activity very actively and the trend is rising continuously. The service sector comprises 2.89 million small and medium-sized enterprises alone. That is 76% of all businesses. It is therefore plausible that SMEs in services accounted for the greatest share of aggregate climate action investment by far in 2020. Overall, they invested EUR 15.6 billion, which was 71% of total investment.

The two subsegments of knowledge-intensive<sup>14</sup> and other services took roughly the same share overall. Still, it is worthwhile taking a closer look at the high volumes of funds invested by other services businesses (including retail, personal services, catering, hospitality, education and training, arts and culture). This is the segment that invests the highest share by far – 17% – of climate action-relevant investments in all investment undertaken. No group of businesses attaches great importance to the aspect of climate action in its investment activity (Figure 3). The average project size is also relatively large. In short: Although SMEs in this segment invest less in climate action than average (Figure 1), when they do invest at all, the relevance of climate action aspects in their investment decisions is higher. This is probably due to the high importance of self-occupied buildings in this sector. To the extent that they

**Figure 5: Distribution of climate action investment by size class and sector**

Volume per segment and share in total volume; size classes by full-time equivalent employees



Source: KfW SME Panel 2021.

initiate energy modernisation measures, these are likely to translate into relatively high investment volumes.

In summary: manufacturing accounts for a high share of GHG emissions, so there is particularly high leverage here, to be sure. Nevertheless, services businesses, the largest group of businesses in quantitative terms, are generally an important actor for achieving the goal of climate neutrality. Extensive investment will be necessary up to 2045 in order to make commercial buildings, fleets and ICT infrastructure in the services sector climate neutral, for example. Furthermore, roof surfaces and facades of office and commercial buildings provide significant potential for expanding photovoltaic solar energy generation. So in order to be able to achieve the greenhouse gas reduction targets established in the Federal Climate Protection Act for the building, transport and energy sectors by 2030, it will also be necessary to mobilise relevant investment in the services sector. Therefore plausible that SMEs in services accounted for the greatest share of aggregate climate action investment by far in 2020. Overall, they invested EUR 15.6 billion, which was 71% of total investment.

### Climate change adaptation measures will be necessary despite climate action

Climate change manifestations in the form of higher average global temperatures, sea level rise and an increase in extreme weather events can already be observed today. The consequences of climate change are already noticeable in Germany too. Of particular relevance for Germany are climate phenomena such as heatwaves and droughts, as well as storms, heavy rainfall and flooding that may severely impact large areas but occur with varying frequency and intensity across different regions. The flood disaster in parts of North Rhine Westphalia and Rhineland Palatinate last summer brought this painfully to light. The greenhouse gases that are already in the atmosphere will continue to affect the global climate for many decades or centuries to come. Even

with ambitious climate action, climate change will continue to intensify for now. Climate action and climate change adaptation measures must therefore go hand-in-hand; it is the only way to minimise risks.<sup>15</sup> Governments, societies and businesses must adapt and prepare for the impacts of climate change.

### Three in ten SMEs intend to adopt more climate change adaptation measures

SMEs also face the challenge of strengthening their crisis resilience to climate change-induced impacts and investing in adaptation measures. These could involve, for example, improved insulation or air conditioning for buildings and facilities, enhanced flood control, the establishment of decentralised energy supply and the acquisition of emergency power generators, or maintaining larger stockpiles to prevent supply chain disruptions.<sup>16</sup>

Around 28% of all SMEs currently intend to invest more in climate change adaptation measures in coming years (Figure 6). However, investments that contribute to climate action and adaptation measures are not always free of overlaps, as illustrated by the example of building insulation. Significant size differences also exist in the planning of climate change adaptation measures. Thus, only around one quarter of businesses with fewer than five employees are envisaging adaptation measures but almost half of SMEs with 50 or more employees.

There are also clear sectoral differences. The R&D-intensive manufacturing sector stands out for adaptation measures as it does for climate action investments. Here the percentage of businesses intending to put more climate change adaptation measures in place is around 40%. The issue appears to have the least urgency in the construction sector. But here as well, one in five businesses intend to address adaptation measures more strongly in the future.

**Figure 6: Besides climate action, climate change adaptation is also an issue for SMEs**

Percentage of enterprises intending to invest more in climate change adaptation measures in coming years



Source: Sentiment update to the KfW SME Panel in September 2021.

The costs of such measures must be weighed against possible damage caused by climate phenomena such as extreme weather events. It will hardly be possible to fully prepare for all conceivable developments, particularly since there is great uncertainty about what events are likely to occur at what point in time and in which region. Rather, limited financial and human resources require prioritisation.

**What is also decisive is how businesses view the impact of climate change**

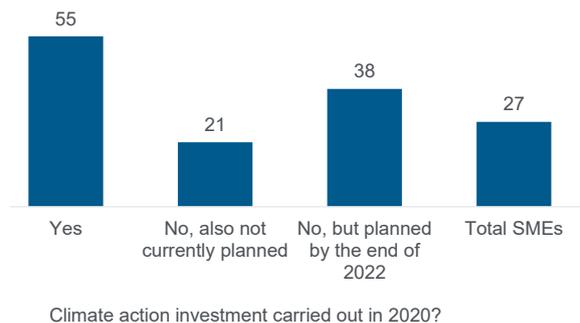
The perception of risks caused by climate change also plays a role in whether an enterprise attaches high priority to adaptation measures. If the impacts of climate change are assessed as relatively serious for the economy – more serious than the impacts of the coronavirus crisis, for example – then the individual willingness to adopt adaptation measures is also much higher. Thus, around 37% of businesses that expect significant climate change impacts want to invest in climate change adaptation but only 9% of enterprises that regard climate change impacts as less dramatic.

**Investing in climate action or adaptation: not either-or but both**

Despite limited financial resources, investments in climate action and climate change adaptation measures are not mutually exclusive. Rather, they go hand-in-hand in the German SME sector. After all, the percentage of businesses intending to invest in adaptation measures in coming years is particularly high among SMEs that also invested in climate action in the previous year (Figure 7). Thus, more than half of climate action investors also intend to put adaptation measures in place. Of the businesses that did not invest in climate action in 2020 nor intend to do so in the near future, only one fifth want to invest more in adaptation measures.

**Figure 7: Climate action investment goes hand-in-hand with adaptation measures**

Percentage of enterprises intending to invest more in climate change adaptation measures in coming years in relation to whether they implemented climate action investments in 2020.



Source: Sentiment update to the KfW SME Panel in September 2021

**Pushing ahead with transitioning small and medium-sized enterprises to climate neutrality**

In order for the transition to climate neutrality to succeed, SMEs will have to be incentivised to join the often large enterprises from energy and emissions-intensive industries in taking action. To be sure, climate action is already on the agenda of many, particularly larger, SMEs and companies of the manufacturing industry. But compared with the total investment volume of the SME sector and with a view to the overall investment required to achieve climate neutrality, there is potential for increasing the amount of funds being invested in climate action. Small and medium-sized enterprises in particular are likely to require further advice and support when developing climate action and climate change adaptation strategies. Not least, an adequate financing and support framework needs to be established for investments in climate action – and climate change adaptation measures. Such investments make SMEs fit for the future.

Rising carbon prices and changed consumer behaviour create long-term competitive advantages for businesses that take the lead on climate action. Climate-friendly products and processes constitute future growth markets and thereby create opportunities for future growth and employment.

The findings indicate that businesses have very different views of the consequences of climate change and how it impacts them – and very different degrees of willingness to address the issue. An improved information base for businesses about the possible risks of climate events, such as flood maps or small-scale scenarios of possible extreme weather events, can support businesses in climate change preparedness. That would make the possible consequences of climate change more concrete and tangible for them and is also likely to increase their awareness of the need for climate change adaptation and climate action measures.

#### Database: The KfW SME Panel

The KfW SME Panel (KfW-Mittelstandspanel) has been conducted since 2003 as a tracking survey of small and medium-sized enterprises in Germany. The basic population of the KfW SME Panel includes all private-sector companies from all industries with annual turnovers of up to EUR 500 million.

With a database of up to 15,000 companies a year, the KfW SME Panel is the only representative survey of the German SME sector, making it the most important source of data on issues relevant to the SME sector. The analyses on climate action investments in the present report are based on the data collected in the most recent 19th wave of the KfW SME Panel (survey period: 15 February 2021 to 25 June 2021). A total of 11,403 SMEs took part in the current wave.

The analyses on climate change adaptation measures are based on a supplementary survey to the KfW SME Panel conducted in September 2021. All enterprises that had already participated in the main survey and had provided a valid email address were surveyed. Responses from a total of 2,400 enterprises were evaluated. As the supplementary survey is linked to the main database of the KfW SME Panel, its results also provide a representative picture.

Further information can be obtained at [www.kfw-mittelstandspanel.de](http://www.kfw-mittelstandspanel.de).

<sup>1</sup> Cf. Brand, S., Römer, D. and Schwartz, M. (2021): Investing EUR 5 trillion to save the climate – a surmountable challenge, Focus on Economics No 350, KfW Research (coming soon).

<sup>2</sup> As at August 2021, 14 of the G20 states explicitly committed to the goal of climate neutrality by the middle of this century (cf. Climate Transparency Report 2021).

<sup>3</sup> Cf. [https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance\\_en](https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance_en)

<sup>4</sup> Cf. Schwartz, M., and Gerstenberger, J., (2021), KfW SME Panel 2021: SMEs have proven to be adaptable in the coronavirus crisis but with visible cracks in the foundations of small businesses, KfW Research (coming soon).

<sup>5</sup> Cf. German Federal Environment Agency (2021): Energieproduktivität (Energy productivity), <https://www.umweltbundesamt.de/daten/energie/energieproduktivitaet#der-begriff-der-energieproduktivitaet-und-endenergieproduktivitaet-seit-1990> (retrieved on 10 November 2021).

<sup>6</sup> KfW Research has continually monitored the impact of the coronavirus crisis on German SMEs since its outbreak with representative supplementary surveys as part of the KfW SME Panel. The key findings of the six supplementary coronavirus surveys conducted so far can be found here: Schwartz, M., and Gerstenberger, J., (2020), [SMEs are firmly in the grip of the coronavirus crisis but \(still\) holding on strong](#), Focus on Economics No. 286, KfW Research. – Schwartz, M., and Gerstenberger, J., (2020), [Coronavirus crisis in Germany's SMEs: Return to full economic activity still far off but gradual opening has eased pressure on liquidity](#), Focus on Economics No. 294, KfW Research. – Gerstenberger, J. and Schwartz, M. (2020), [KfW SME Panel 2020: Coronavirus pandemic has dampened expectations for 2020 – SMEs entered the crisis from a strong position](#), KfW Research. Gerstenberger, J. and Schwartz, M. (2021), [Zwar belastet die Corona-Krise den Mittelstand auch zu Jahresbeginn, allerdings bleibt die Lage trotz des Lockdowns stabil \(The coronavirus crisis is weighing on SMEs at the start of the year too but the situation is steady despite the lockdown – in German\)](#), Focus on Economics No. 315, KfW Research – Gerstenberger J. (2021), [Licht am Ende des Tunnels – die Lage im Mittelstand entspannt sich \(Light at the end of the tunnel – the situation in the SME sector is improving – German only\)](#), Focus on Economics No. 333, KfW Research. – Schwartz, M., and Gerstenberger, J., (2021), KfW SME Panel 2021: SMEs have proven to be adaptable in the coronavirus crisis but with visible cracks in the foundations of small businesses, KfW Research (coming soon).

<sup>7</sup> See also: Zimmermann, V. (2020), [SMEs are responding creatively to the coronavirus crisis](#), Focus on Economics No. 291, KfW Research.

<sup>8</sup> Research- and development-intensive (R&D intensive) manufacturing is defined as those manufacturing subsectors whose average research and development intensity (R&D intensity: ratio of R&D expenses to turnover) is higher than 3.5%. The definition is based on what is known as the NIW/ISI list of research-intensive industries and services, which in turn follows the Federal Statistical Office's 'Classification of Economic Activities (WZ 2008)'. Engineering, medical technology, instrumentation and control technology, vehicles, pharmaceuticals and office equipment are of particular quantitative importance.

<sup>9</sup> The subsegment of other manufacturing (non-R&D-intensive manufacturing) is mainly represented by enterprises operating in the food industry, wood processing and the manufacture of metal products, as well as other manufacturing not further specified.

<sup>10</sup> Schwartz, M. and Brüggemann, A. (2018), [As energy prices fall, SMEs have lower costs – and increased efforts for energy efficiency and energy cost savings](#), Focus on Economics No. 223, KfW Research. – Schwartz, M. and Braun, M. (2013), [Energy costs and energy efficiency in the SME sector](#), Focus on Economics No. 40, KfW Research.

<sup>11</sup> Zimmermann, V. (2021), [KfW SME Digitalisation Report 2020: Digitalisation activity fell before Corona, ambivalent development during the crisis](#), KfW Research.

<sup>12</sup> Cf. Federal Ministry of Economics and Technology (2021): Energy Data: Complete Edition – Data collection of the Federal Ministry of Economics and Technology (as at 27 September 2021).

<sup>13</sup> Cf. German Federal Environment Agency (2021): Joint press release by the German Federal Environment Agency and the Federal Ministry for the Environment: Treibhausgasemissionen sinken 2020 um 8,7 Prozent (*Greenhouse gas emissions fell by 8.7% in 2020* – our title translation, in German only), <https://www.umweltbundesamt.de/presse/pressemitteilungen/treibhausgasemissionen-sinken-2020-um-87-prozent> (retrieved on 10 November 2021).

<sup>14</sup> Knowledge-intensive services comprise service subsectors with an above-average share of university graduates in total employment, or services with a strong focus on technology. These include, for example, architecture and engineering firms, law firms, tax and management consultancies, data processing and telecommunication services. The definition is based on what is known as the NIW/ISI list of research-intensive industries and services, which in turn follows the Federal Statistical Office's 'Classification of Economic Activities (WZ 2008)'.

<sup>15</sup> Cf. German Federal Environment Agency (2015): Climate change adaptation, <https://www.umweltbundesamt.de/themen/klima-energie/klimafolgen-anpassung/anpassung-an-den-klimawandel-0#was-heisst-anpassung-an-den-klimawandel> (retrieved on 10 November 2021).

<sup>16</sup> Cf. Mahammadzadeh, M., Chrischilles, E. and Biebeler, H. (2013), *Klimaanpassung in Unternehmen und Kommunen – Betroffenheiten, Verletzlichkeiten und Anpassungsbedarf (Climate change adaptation in businesses and municipalities – impacts, vulnerabilities and adaptation requirements* – our title translation, in German only), IW Analysen No. 83, Köln.