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Renewing prosperity in a climate-neutral way

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A. Introduction: a reliable framework for the climate-neutral renewal of our prosperity

As a result of Russia's war of aggression against Ukraine, the year 2022 was dominated by acute crisis management: the energy crisis had to be contained, inflation had to be controlled, the German economy stabilised and the burden on the population eased. The Federal Government succeeded in achieving each of these goals. Within months, Germany had become independent of Russian energy imports, a new energy infrastructure had been set up and continues to expand, and new supply contracts are now being concluded. We acted quickly and pragmatically to secure energy supplies and then to ensure that the energy prices, which were rising rapidly as a result of the crisis, were slowed down. The economy and society followed suit: lots of people saved energy by making use of the possibilities available to them and in so doing achieved a great deal by pulling together: our country managed to get through the winter comparatively well and has become increasingly independent. At the political level – and also in a variety of intensive discussions with business and society – we have laid important foundations for what has become an unavoidable renewal of our energy and economic system. This is now – especially in view of the geopolitical escalation – a prerequisite for political sovereignty and the future viability of the country.

At the beginning of 2023, the energy policy and economic situation in Germany remains tense, but thanks to the overall efforts that have been made, it is much more stable and better now than had on occasion been feared. We can now take the next steps to renew our prosperity and to protect freedom and security. Because that is what climate action is all about.

Important steps have already been taken towards achieving these goals – for renewables in particular with the measures included in the 2022 Easter and Summer Packages and the EU Emergency Regulation, and for industry with the drafting of Carbon Contracts for Difference. Overall, the BMWK – with 29 laws passed by the Cabinet and 35 sub-statutory regulations in the past year alone – has created a basis for tackling the coming changes together with business and industry, institutions and citizens.

What we have to do now is identify and remove any other barriers that hinder sustainable value creation and energy supply, in addition to strengthening and stimulating innovation and investment. It should be noted that the diverse processes that have been launched by the BMWK are designed to achieve climate neutrality by 2045. They also complement each other: increasing renewable generation capacities, increasing transport capacities and ensuring system stability in the electricity sector, setting up a hydrogen infrastructure, decarbonising industry, the heat transition, more efficient use of energy and greater energy savings – all these processes are interlocked.

At the centre is a double helix consisting of the renewal of our energy supply and the renewal of our industrial value creation in small, medium and large enterprises. These are inextricably linked strands. The present report provides a view into this "transformation workshop" of the Federal Ministry for Economic Affairs and Climate Action.

What is important is that the socio-ecological renewal of our prosperity goes hand in hand with a renewed participation in prosperity that will ensure decent work for future generations, strengthen common infrastructures and in which the burdens of the required change will be borne in solidarity. And for this reason, it will be based on cooperation between all the ministries involved.

As the Federal Government, we are responsible politically for providing a binding framework and reliable guidance. To ensure that this framework is given substance, however, it will require combining the strengths of all those involved – the Federal Government, the federal states, municipalities, business undertakings, associations, trade unions, civil society organisations and also the citizens themselves.

The good thing is that the recognition of how necessary the changes are is widespread in society as a whole. A lot of people are now aware that renewable energies are important as a key factor for achieving a prosperous future and are included among the priority technological projects. Last year in particular, many people came to the conclusion that phasing out fossil energy imports not only means more climate protection, but also more security, freedom and independence.

These are undoubtedly challenging times, a time also of uncertainty: the return of war in Europe, global shifts, and the climate crisis. The future is often associated with anxiety. And yet, in spite of this – or perhaps also because of this – there is a great deal of willingness and a strong need to take things into one's own hands and bring about change in concrete terms, wherever one can. People economised during the energy crisis in order to save energy and to increase their independence. The progress that has been made in all corners of the country is visible: tens of thousands of heat pumps are now being installed, windows and doors replaced, houses refurbished to improve their energy efficiency, solar panels are being mounted on roofs or placed on balconies. The demands made on those who carry political responsibility are often sufficient: make it simpler, easier, remove hurdles – so that we can do what we can do ourselves.

Despite all this, we are seeing the start of a new momentum in society that was partly delayed and hindered, and partly accelerated by the Russian war of aggression, the high energy prices and inflation, but certainly not held back by them.

In 2022, Germany showed what it can do when it wants to and has to. The **start of the renewal process** has been achieved. All of this gives us confidence. **As a country, we now have the opportunity to build momentum together.**

Renewing prosperity in a climate-neutral way

Energy system

- Expansion of renewables
- Climate-neutral electricity grid
- Hydrogen ramp-up
- Heat transition
- Grid expansion

Industrial value creation

- Carbon Contracts for Difference
- Industrial strategy
- Industrial electricity price
- Climate-neutral steel and chemicals industry
- Renewal of automotive industry

B. Where we stand: goals, development and classification

Germany has committed to becoming **climate neutral by 2045**. In doing so, we are making our contribution to limiting the increase in average global temperature, if possible, to 1.5 degrees as envisaged by the Paris Climate Agreement. In the EU, we have also agreed on drastic emission savings and want to reduce emissions by at least 55 percent by 2030 compared with 1990 levels. We are doing this to preserve our livelihoods, to protect our prosperity, our freedom and our security. To ensure that Germany and Europe will be able to maintain their competitiveness and prosperity in the medium and long term in the face of global upheaval, and to increase participation in prosperity, the fundamentals of value creation must be renewed in a climate-neutral way, above all through the massive expansion of a reliable and affordable supply of renewable energy.

By 2030, **700-750 terawatt hours of renewable electricity** will be needed in Germany. This means more than double the current amount in just a few years. For this reason, the accelerated expansion of wind and photovoltaics in particular will play a decisive role: in the case of onshore wind farms, the aim is to increase the installed capacity from 58 gigawatts in 2022 to 115 GW in 2030 and 160 GW in 2040; in the case of offshore wind energy, from 8 GW (2022) to 30 GW in 2030 and 70 GW in 2040. For photovoltaics, the aim is to achieve an installed capacity of 215 GW by 2030 (2022: approx. 67 GW) and 400 GW by 2040.

This massive expansion is also necessary because the most **direct use of electricity** is the most cost-effective way of using energy for business and consumers alike. It will contribute to greater competitiveness and to ensuring that energy bills for households are kept as low as possible. For this reason, we are also placing our focus for heating and mobility primarily on electrification: on installing 500,000 heat pumps every year in homes and putting 15 million battery-powered electric vehicles on the roads by 2030. By 2030, 6 million heat pumps are to be installed (2022: 1.4 million) and 15 million all-electric cars registered by 2030 (2022: 1 million).

We are working to establish a **new electricity system in an expanded electricity infrastructure**. This includes the accelerated expansion of grids and storage facilities, digitisation and a regulatory framework that promotes flexibility.

Green hydrogen and hydrogen derivatives make climate protection possible wherever molecules are needed because there is no cheaper electricity solution. Hydrogen is needed as an energy carrier and industrial raw material primarily for the energy industry and for the decarbonisation of industry, aviation and shipping. This is the reason why we will be doubling the expansion target for electrolyser capacities in Germany to ten gigawatts by 2030 and are moving ahead with our build-up of import infrastructure. For a transitional period, we also see the need to use blue hydrogen, i.e. low-carbon and in combination with CCS, in order to build up a hydrogen infrastructure.

We want to lay out the course now for a long-term **competitive industry**. Those who want to produce competitively after 2030 must now gear their investment decisions towards climate neutrality. That is why we are supporting industry in its efforts to fundamentally change its production processes and are promoting a variety of measures to this end, including the use of the **Carbon Contracts for Difference** (CCfD) instrument, the industrial electricity price or, at European level, the Green Deal Industrial Plan.

On the way to climate-neutral prosperity, we will have to specifically address bottlenecks in the economic factors of production, in labour, in capital, in technologies and productivity: this is the core of a well-understood, **transformative supply policy**. In the case of economic renewal, it is imperative that the macroeconomic environment be taken into account. We are doing our utmost to ensure that climate neutrality becomes the next chapter in the success story of our economy – in Germany itself and with the Green Deal in Europe.

We have great confidence in the efficiency and innovative strength of companies and their employees in **fair and free market competition**. A case in point: the transformation requires large quantities of valuable raw materials, such as lithium in battery production, especially for electromobility. For this reason, we support projects for the sustainable extraction of raw materials. Engineers throughout the country today are already working to make battery production more efficient and to find alternatives to lithium, for example. The technological development of new products never stops where it first began. It is precisely the scarcity, the price and the high demand that will lead to innovative leaps forward in this field and at the same time increase the importance of resource efficiency, recycling and the circular economy.

Having great confidence in market-based innovation requires a **reliable political framework** for centralised, shared infrastructures in order to be able to make **future-driven and sustainable investment decisions**. This is why the decisions taken at European level in the Fit for 55 legislative package are so important. They implement the rules for markets – because the automotive industry, for example, needs to know where it is going, because buyers make purchase decisions dependent on the charging infrastructure and because the supply of clean electricity must be driven forward accordingly.

Transforming our country into a climate-neutral industrialised country is not only a technological and economic **challenge**, it is also a **social one** and one that affects **society as a whole**. It is all the more important, therefore, that the opportunities brought about by change benefit as many as possible - and that its temporary burdens are borne in solidarity. As we understand it, transformation includes the task of shaping the changes that take place in such a way politically that they can be accepted by the citizens as their own cause. This means that participation, in both political and material terms, will be an important factor: a wind turbine in which citizens and the municipality share the financial benefits is still a wind turbine, but it will be accepted differently than if only an unknown investor profits from it. Accordingly, we have improved the requirements for citizens' energy, provide support for refurbishments and are working intensively to make it as easy as possible in areas where citizens can take action themselves. This is another reason why eliminating red tape and progress in the energy transition go hand in hand.

I. Status of climate targets and renewal

In view of our climate targets – as set out in the Federal Climate Action Act – the **pace of emission reductions**, compared with the current situation, must more than double overall in the years to come and then almost triple by 2030. Only in this way will Germany also make an appropriate contribution to achieving the European and global climate targets. This challenge, as outlined in the BMWK's "Germany's current climate action status" of January 2022, remains unchanged.

Efforts to achieve this goal are taking place at three different levels, all of which are equally important if the goal is to be achieved: at the national level, the lower and upper houses of the German parliament (the Bundestag and the Bundesrat) set the main direction in July 2022 with the immediate action package for energy as the **largest energy policy revision for decades**. We have also implemented many measures to significantly reduce our energy consumption, to drive forward the heat transition and to bring the phase-out of lignite in North Rhine-Westphalia forward to 2030. The Federal Government's Climate Action Programme, the aim of which was to have all the necessary laws, regulations and measures in place by the end of 2022, has still not been completed, but essential measures are already being implemented. It goes without saying that the negotiations in the coalition should be concluded as soon as possible, however. At EU level, we have driven climate action and the energy transition forward with landmark decisions in the "Fit for 55" package, and at international level, the Heads of State and Government of the G7 have decided to establish a Climate Club during Germany's G7 Presidency.

We changed many rules for the better at national and European level in 2022. However, these have only been in force for a few weeks now and it takes time for them to take effect. As a result, there are still major tasks ahead before we can achieve the goals we have set. The figures that the Federal Environment Agency will present on 15 March with the **Emissions data for 2022** will once again make it clear how much "homework" the Federal Government needs to get done.

Emissions from the energy industry, which is responsible for roughly one third of all emissions in Germany, must be reduced to 108 million tonnes of CO_2 equivalents by 2030 according to the targets set by the Climate Change Act. In 2021, greenhouse gas emissions in this sector amounted to 247 million tonnes of CO_2 equivalents. According to the Federal Government's 2021 projection report – more recent data is not yet available – based on the measures adopted by autumn 2020, a gap of 100 million tonnes will remain by 2030 (cumulative). In 2022, we had to use more fossil fuels in electricity generation to save gas, which will also be reflected in the emissions balance. In spite of this, the energy sector is well on the way to meeting the 2030 climate target if we stay on the ambitious expansion paths for renewable energy sources that have since been planned (cf. Chapter C.I).

Emissions from the industrial sector, which account for almost a quarter of the emissions in Germany, must be reduced to 118 million tonnes of CO_2 equivalents by 2030 according to the targets set by the Climate Change Act. According to the Federal Government's 2021 projection report, based on the measures adopted by autumn 2020, a gap of 178 million tonnes will remain for the period 2022-2030 (cumulative). We have already taken important steps to decarbonise industry and are working on their swift implementation in order to achieve the climate targets for this sector (cf. Chapter C.II).

The **building sector**, which accounts for 15 per cent of the emissions in Germany, exceeded the envisaged emission volumes in both 2020 and 2021. As a result, despite the savings achieved to date, it has not been possible to achieve the targets for the building sector laid down in the Climate Change Act. The sector fell short of the target value for 2021 of 113 million tonnes of CO_2 equivalents by 5 million tonnes of CO_2 equivalents. The Climate Action Act stipulates that emissions from the building sector must be reduced to 67 million tonnes of CO_2 equivalents by 2030. According to

the Federal Government's latest projection report of 2021, based on the measures adopted by autumn 2020, a gap of approx. 152 million tonnes will remain for the period 2022-2030 (cumulative). The immediate action programme containing 15 measures submitted jointly by the BMWK and the BMWSB last year – together with an increase in fossil fuel prices – is expected to lead to the building sector returning to the target path in 2030. Heating with renewables in particular must now gain momentum quickly and become the new standard in both new and existing buildings.

According to the Projection Report 2021 of the Federal Government, the **transport sector**, which accounts for 19 per cent of the emissions in Germany, still has a cumulative reduction gap of approx. 271 million tonnes of CO_2 equivalents in the period between 2022 and 2030 compared with the targets laid down in the Climate Action Act. According to experts, the immediate action programme submitted by the Federal Ministry for Digital and Transport in 2022 will have a cumulative GHG reduction effect of 13 million tonnes of CO_2 equivalents and a maximum annual reduction effect of around 3 million tonnes of CO_2 equivalents in 2030. For this reason, further effective measures to reduce emissions in the transport sector must be developed and adopted quickly.

With 61 million tonnes of CO_2 equivalents, the **agricultural sector** accounted for some 8 per cent of the total German emissions in 2021. Although the sector is expected to meet its climate targets in the years ahead due to a methodological adjustment in emissions reporting – by 2030, there will still be considerable need for action in this sector as well; not least in order to be able to meet all the requirements of the EU's Effort Sharing Regulation and to get on the right path to achieve climate neutrality.

For the year 2020, an emissions balance of around minus 11.5 million tonnes of CO_2 equivalents was reported for the **land use, land use change and forestry sector** in the German Greenhouse Gas Inventory 2021. It is the only sector to act overall as a net sink for carbon dioxide in Germany. The average emissions balance – i.e. the protection and restoration of peatlands and forests in particular – will have to be significantly improved to minus 25 million tonnes of CO_2 equivalents per year by 2030 in order to achieve the targets for this sector laid down in the Climate Action Act. The Federal Action Plan on Nature-based Solutions for Climate and Biodiversity, which is currently being coordinated within the Federal Government, is designed specifically to serve this purpose, while at the same time it is intended to make a substantial contribution to the conservation of biodiversity in Germany.

II. Status of economic goals and renewal

Renewing prosperity specifically means shaping the necessary structural change on the path towards greenhouse gas-neutral value creation in a sustainable manner through the interplay of political frameworks, entrepreneurial initiative and social commitment. An important prerequisite for this is **macroeconomic stability**. This was put to a serious test in spring 2022. The abrupt, massive gas and electricity price increases in the wake of the war in Ukraine overstretched short-term adjustment options and threatened to cause enormous damage to the German economy. Private households and businesses alike were confronted with considerably higher prices – especially but not only for energy: quite recently (in February 2023), the inflation rate was 8.7 per cent.

The dynamic development of the price level is accompanied not least by noticeable losses in real income. This is also relevant in terms of distributional and social policy, since people with low incomes and few assets can hardly absorb price increases by digging into their savings or cutting back on consumption, and are therefore particularly vulnerable. It is also against this background that the Federal Government has provided **relief on a historic scale** (a protective shield for companies affected by the war, 95 billion euros as part of three relief packages and up to 200 billion euros as part of the economic defence umbrella) and, in particular, introduced the energy price brakes. In its annual projection, the Federal Government also expects a significant decline in the inflation rate in the course of 2023.

Despite the strong headwind, **economic output in Germany increased in 2022**: adjusted for prices, the gross domestic product rose by 1.8 percent, although some observers had been expecting a dramatic decline due to a gas shortage in the order of as much as 10 percent. This success is due primarily to the tremendous joint effort of politicians, business and society. In its annual projection for 2023, the Federal Government expects GDP growth of 0.2 per cent, with a phase of economic weakness during the 2022/23 winter period, followed by a revival later in the year.

In the wake of the energy price increases, special attention was paid to industrial development. In 2022, adjusted for prices, the entire German industrial output declined by only 0.7 percent. The industrial share of gross value added fell by only 0.5 percentage points to 23.5 per cent. This is remarkable proof of the **strength of small, medium-sized and large industrial enterprises in Germany** when faced with the challenges of responding to crises and securing the future.

Meanwhile, overall economic **employment continues at an unbroken high level**, despite all adversities: in January 2023, seasonally adjusted, the number of people in employment was 45.8 million. Unemployment remains low by historical standards (seasonally adjusted unemployment rate in February 2023: 5.5 percent): the number of registered job vacancies (February 2023: 806,000), which represents **bottlenecks in labour supply**, is now the focus of economic policy attention.

The ecological transformation is already a major economic and employment factor. In 2021, for example, industrial companies spent around 3.4 billion euros on investments in climate action to drive the decarbonisation of their production – around a third more than in 2013. Sales of environmental goods and services amounted to around 80 billion euros in 2020 (latest available data), and the trend is rising. Employment relating to investments in energy-efficient modernisation of existing buildings was around 540,800 people in 2020. In 2021, some 350,000 people were employed in the renewable energy sector alone – by comparison, around 20,000 people were still working in the coal sector. All in all, this shows that we have been on the path to climate-neutral renewal of our prosperity for quite some time now – and are now moving resolutely forwards.

C. The progress factors of renewal

To ensure that energy and business can be renewed in a climate-neutral way, a number of fundamental conditions must be met: major infrastructure and investment projects need to be planned and approved quickly, production capacity and raw materials are needed for wind turbines, PV modules and heat pumps, etc., an adequate supply of skilled workers is needed and, finally, capital needs to be mobilised in order to finance private and public investments. These are all factors for progress.

This is the reason why the BMWK is working with the other government departments, the federal states and municipalities, in addition to numerous actors from business, science and labour to improve these factors of progress.

I. Progress factor planning and approval

The renewal of our prosperity is also a far-reaching infrastructure project. Thousands of installations, hundreds of kilometres of railways and electricity grids must be built within two decades – in addition to being planned and approved beforehand. **Effective procedures for planning and approving transformation projects** are therefore indispensable. There is a glaring problem in this area in Germany. A case in point: at the end of 2021, the approval of onshore wind turbines on designated wind areas in Germany took around 4 to 5 years (including an average of 2 years for the approval procedure alone). This approval procedure is routinely preceded by a planning procedure, which took 5 to 12 years.

In view of this kind of situation, we are making considerable efforts to significantly speed up planning and approval procedures. To this end, a large number of new statutory regulations and reforms were introduced last year: with the introduction of the immediate action package for energy, the principle that renewable energies and the expansion of the electricity grid are in the **overriding public interest** and serve public safety has now been incorporated into law. With the Onshore Wind Energy Act, the problem of a lack of available land has been remedied by regulating binding land-use targets for onshore wind energy, and planning has been significantly simplified. With the Offshore Wind Energy Act, the planning and approval procedures for offshore wind farms and connection lines have also been accelerated. A series of legal adjustments (in the Federal Requirements Plan Act, Energy Industry Act and Grid Expansion Acceleration Act) will streamline the procedures for electricity grid expansion.

In addition, the so-called EU Emergency Regulation has just been transposed into national law to once again further accelerate the expansion of renewable energies and electricity grids significantly. In addition, the overriding public interest was extended to include distribution grids in outdoor areas, and to those below 110 kV.

The further development of planning and approval procedures continues to remain on the energy, infrastructure and industrial policy agenda and accordingly is being vigorously pursued.

Next steps:

- The Federal Government will implement a pact with the federal states this year to accelerate planning, approval and implementation. Against this background, the BMWK will further accelerate the planning and approval procedures for renewables and grids.

- In addition to the electricity grid, a hydrogen grid will also be needed in the future and will primarily supply industrial centres and power plants. For the expansion of a hydrogen infrastructure, including import infrastructure and domestic electrolysis capacity, the BMWK will introduce an acceleration law this year.

II. Progress factor production capacities

Germany is a strong and extremely powerful industrial location. There are countless success stories in a wide variety of sectors from mechanical engineering to the automotive industry, from the big players to the hidden champions throughout the country.

At the moment we do not yet have sufficient industrial production capacities in the area of transformation technologies. As a basic principle, the following applies: for all technologies relevant to the energy transition, production capacities need to be tripled or even quadrupled in order to meet the growing demand in Germany and Europe. In terms of our strategic sovereignty, this demand must be met from a variety of sources and, to a large extent at least, from European production. Germany and Europe have already started to **build up their own production capacities**, as in the case of electrolysis, battery cell production and other key capacities. In order to avoid bottlenecks in the availability of energy transition technologies, such as photovoltaic and wind turbines or batteries and electricity grid components during the expansion of renewable energies, the BMWK, in partnership with industry, is committed to diversifying value chains and stimulating investment in production capacities for these technologies in Germany and Europe.

For this reason, at European level, the Federal Government has advocated the establishment of a European platform for transformation technologies and welcomes the fact that, with **Clean Tech Europe**, an appropriate forum has been created by the European Commission.

At national level, the BMWK launched the **Stakeholder Dialogue on Industrial Production Capacities for the Energy Transition (StiPE)** in the second half of 2022, in which representatives of the photovoltaic, wind and electricity grid sectors along the entire value chain took part, including small and medium-sized enterprises in particular. Together, specific obstacles to the ramp-up of production in the affected sectors were analysed and recommendations for action developed, which were then published in February 2023.

Many of the recommendations for action that resulted from this process are already being implemented, particularly in the areas of planning reliability, land availability and the streamlining of approval procedures, adjusting EEG tenders to price developments, in addition to skilled labour and raw materials policy.

Next steps:

- Prepare a proposal for a **transformation fund** by summer 2023 that supports investments in the decarbonisation of industrial production processes through equity and hybrid capital.
- Make use of the instrument of **investment premiums** for transformation technologies.
- Develop an instrument for **operational funding**.
- Develop a temporary **hedging instrument** particularly for manufacturers associated with wind energy and power grid expansion.

- Prepare a feasibility study on the **relocation of the PV industry in Germany**; to examine the rapid implementation of IPCEIs for "renewable energy sources", primarily PV, and setting up a supranational industry consortium.

- Support the European **Green Deal Industrial Plan** and an ambitious implementation of the **Net Zero Industry Act**.

III. Progress factor raw materials

The transformation to greenhouse gas-neutral technologies will be accompanied by a considerable increase in demand for specific mineral and metallic raw materials. Electric cars, heat pumps, wind turbines, solar panels and microchips - the faster countries decide to switch to these technologies, the faster global demand will grow. Even if the transformation towards climate neutrality reduces demand for raw materials noticeably in certain areas, e.g. by phasing out coal, the **demand for raw materials** in other areas will increase significantly in the years to come. The global demand for lithium, for example, will increase by a factor of 3-6. For the expansion of key technologies, the demand for scandium will also increase eightfold and the demand for cobalt fourfold (DERA Raw materials for emerging technologies 2021). At the same time, the COVID-19 pandemic and the Russian war of aggression against Ukraine have clearly shown how fragile global supply chains are and what risks related to the security of raw materials supply exist for Germany and Europe. More than 80 percent of rare earths are mined in China. South Africa and Russia, with a market share of around 80 per cent, have a dominant position in the mining of platinum and palladium (DERA Rohstoffinformationen 49, 2021).

This is why, at the beginning of January 2023, the BMWK supplemented the **Raw materials strategy of the Federal Government** of 2020 with a BMWK key issues paper on a sustainable and resilient raw materials supply to meet these challenges. The focus of this paper is on strengthening the circular economy, resource efficiency and recycling, diversifying the supply of raw materials and ensuring a fair and sustainable market framework. To achieve the latter, the Federal Government is working with international partners in the **Minerals Security Partnership**. At European level, the BMWK also supports an ambitious drafting of the **Raw Materials Act**, which aims to support industry in the efforts required to diversify and achieve greater sustainability in the supply of raw materials.

Next steps:

- Support the development of a comprehensive **national circular economy strategy** under the leadership of the BMUV

- Launch a new BMWK research programme entitled "Raw Materials for the Transformation"

- Strengthen domestic and European raw materials extraction: the BMWK is developing core principles for the **modernisation of the Federal Mining Act**.

- Accelerate the **strategic expansion of international raw materials partnerships** to fill supply gaps in the long term. A current example is the newly agreed German-Chilean Partnership for Mining, Raw Materials and the Circular Economy at the end of January.

- Support the European Commission in the ambitious drafting of the **Raw Materials Act**; draft expected in spring 2023.

- Launch a **commodity fund** by 2024 to provide grants, equity, loans and guarantees to finance raw materials extraction, processing and recycling projects within and outside the EU in accordance with the highest ESG standards.

- **Monitor** critical raw materials supply chains by DERA expanded to include real-time monitoring and the inclusion of recycled raw materials.

IV. Progress factor skilled workers

A key progress factor for the transformation to climate neutrality is having an **adequate supply of skilled workers** – be it in the field of heat pump installation, the assembly of photovoltaic systems or the production of transformation technologies themselves: skilled workers are needed everywhere. In the wind and solar energy sector alone, there is already a shortage of over 200,000 skilled workers (according to the Competence Centre for securing skilled labour, based on data from the Federal Employment Office). Sanitary, heating and air-conditioning systems is a particularly crucial field. In this case there is a shortage of 15,000 skilled workers who are also needed for installing heat pumps and are thus in great demand in several sectors. In the semiconductor industry there is a shortage of a further 62,000 skilled workers, which means that every second job is not being filled (study on the semiconductor industry 2023 commissioned by ZVEI and BDI). The shortage of skilled workers will rise even further in the years to come due to demographic change. It all the more important, therefore, to see the transformation as an opportunity for the renewal of decent work. By doing this, we can tie Germany's competitiveness under the conditions of climate neutrality to a renewed promise of prosperity.

In order to meet the number of skilled workers needed for the transformation in the years and decades that lie ahead, the existing measures and funding instruments will have to be expanded. To do this, **in addition to recruiting skilled workers who are already suitable**, it will be necessary **to train additional skilled workers for these task**s. There is no one great lever to achieve this goal. Levers will have to be applied in many places at the same time – this will include advising companies, especially small and medium-sized enterprises, providing further education and training, and will extend to immigration, integration and strengthening equal rights, as well as making use of and appreciating the knowledge and skills of older people. This is a task that can only succeed with the interaction of the entire government. A large number of specific steps in this direction have already been taken, ranging from providing better information and advice on careers in the field of climate protection through the Competence Centre for securing skilled workers (KOFA), which is funded by the BMWK, to improving vocational training options. All of this is an ongoing process.

Next steps:

- Training and further education is to be provided, as part of the **Continuing Education Act**, for employees in sectors particularly affected by the transformation; this will also benefit the renewables sector.

- The specific training needs associated with the conversion to renewable heat will be addressed by the BMWK through federal funding provided via the **Heat Pump Development Programme**. This is intended to provide incentives for skilled craft businesses, planning offices and energy advisors to take part in further training on the design, installation and adjustment of heat pumps.

- With the **Skilled Immigration Act**, the Federal Government will simplify labour-related migration to Germany this year and introduce a points system based on the Canadian model.
- The BMWK will continue to support numerous **initiatives abroad for recruiting skilled workers** (e.g. the Make-it-in-Germany job portal, the Women Energize Women programme, the Energy Academy of Germany and Jordan).
- The BMWK's **"Skills Experts"** programme will be further developed in 2023 to establish basic structures for the vocational training of local workers of German companies abroad in the area of "Green Jobs".
- We intend to attract more **young people** to complete training courses in the energy transition professions with numerous measures. Special funding for training is also planned for the lignite regions - with the BMWK's Training Cluster 4.0 programme in the Lignite Regions.
- We are continuing our broad-based **skilled labour campaign**, "A Nation of Skilled Labour", which focuses on continuing education and training in climate-related professions.
- We will continue to leverage potential for **increasing efficiency**, through a variety of measures, such as digitalisation, serial construction, automation of industrial manufacturing processes and robotics.

D. The key sectors of renewal

On the way to the climate-neutral renewal of our prosperity, we have placed a "double helix" at the centre, consisting of (1) a renewal of our energy supply and (2) a renewal of value creation in industry and SMEs. A reliable framework and momentum are needed in both fields.

I. Renewing our energy system in a climate-neutral way

One strand of the double helix is the renewal of our energy system. This is the key task for a sustainable and reliable energy supply for citizens and businesses, and also for achieving climate neutrality itself.

1. Renewal of the electricity system

The goal of achieving greenhouse gas neutrality by 2045, which is laid down in the Climate Action Act, presupposes that the electricity sector will be virtually climate-neutral by 2035. The expansion of renewable energy sources is the prerequisite for this. The sufficient **availability of renewable electricity** is the basis for the decarbonisation of transport, industry and buildings through the electrification of applications.

In order to be able to meet the goal of a largely greenhouse gas-neutral electricity system, we will continue to work simultaneously and interdependently on achieving progress in ten areas and are underpinning this with further specific measures again this year.

The areas are as follows:

1. Expansion of electricity generated from onshore wind
2. Expansion of electricity generated from photovoltaics
3. Expansion of electricity generated from offshore wind and interconnection of wind farms (offshore)
4. Import cooperation agreements and interconnectors for renewable electricity
5. Conversion of the power plant fleet to hydrogen power plants
6. Expansion of the electricity transmission grid
7. Forward-looking expansion of the distribution grid and system-friendly integration of electromobility, heat pumps and electrolysis
8. Providing security of supply and system reliability
9. Further development of the electricity market design
10. European collaboration in the electricity sector

The expansion of renewables in the last legislature fell significantly short of the possibilities and needs. In order to meet our goal, electricity generation from renewable energy sources must be **more than doubled in seven years** compared with today's level: increasing from the current level of around 250 terawatt hours (TWh) to an anticipated level of around 700-750 TWh. Compared with the expansion in the last legislature, the current plans in the Renewable Energy Sources Act (EEG) mean an increase by a factor of 3-4 for the period up to 2030.

It is precisely for this reason that the new Federal Government introduced a number of **ambitious measures** last year to bring about a change in direction:

- The biggest reform in the history of the **EEG** was implemented. The expansion targets and auction volumes for renewables were revised significantly upwards. The new goal is to achieve 215 GW of photovoltaic capacity by 2030, 115 GW of onshore wind and 30 GW of offshore wind. We have legally established that the expansion of renewable energies is in the overriding public interest and serves public safety.

- With the **Wind Area Requirements Act**, binding land-use targets were laid down for the federal states. By 2027, a share of 1.4 percent and by 2032 a share of 2.0 percent of the total German land area must be designated for onshore wind energy. Through amendments to the Federal Building Code, the land-use targets were integrated into planning law and in this way the planning procedures for the designation of wind energy areas were significantly simplified.

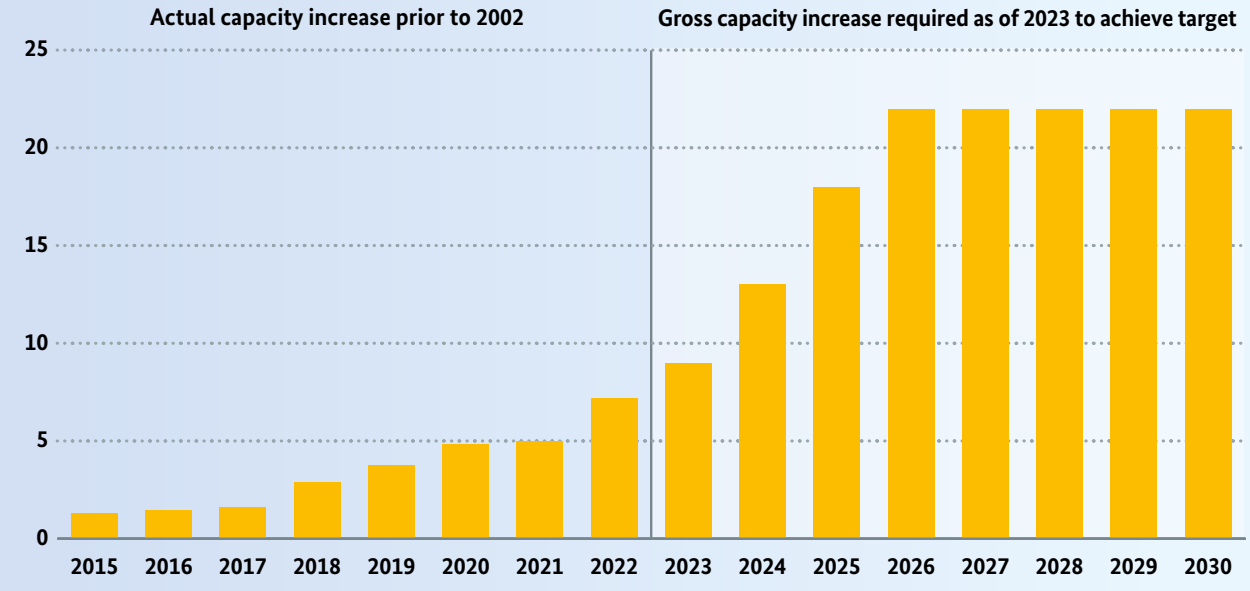
- **Tender conditions and funding rates** were made more attractive overall and now take higher commodity prices and interest rates into account. In order to support citizens' energy companies, they are now exempted from the obligation to participate in tenders if they do not exceed a certain size (18 MW wind/6 MW solar). In addition, a funding programme was set up for citizens' energy companies, with which up to 70 per cent of the costs for the planning and approval phase can be covered.

- In the case of solar power systems outside the tendering process, the **reimbursement rates** were raised significantly and their degression was suspended until 2024. The **ground area** was increased and new options for Agri-PVs, floating PVs and peatland PVs added. In addition, **small PV systems** for one's own roof with a capacity of up to 30 KW were exempted from income tax and VAT.

- The **uptake and transport of renewable energies in the electricity grids** was improved through legislative changes to accelerate the expansion of the electricity grid, to increase grid utilisation and load flexibility (Energy Industry Act, Grid Expansion Acceleration Act, Federal Requirements Plan Act).

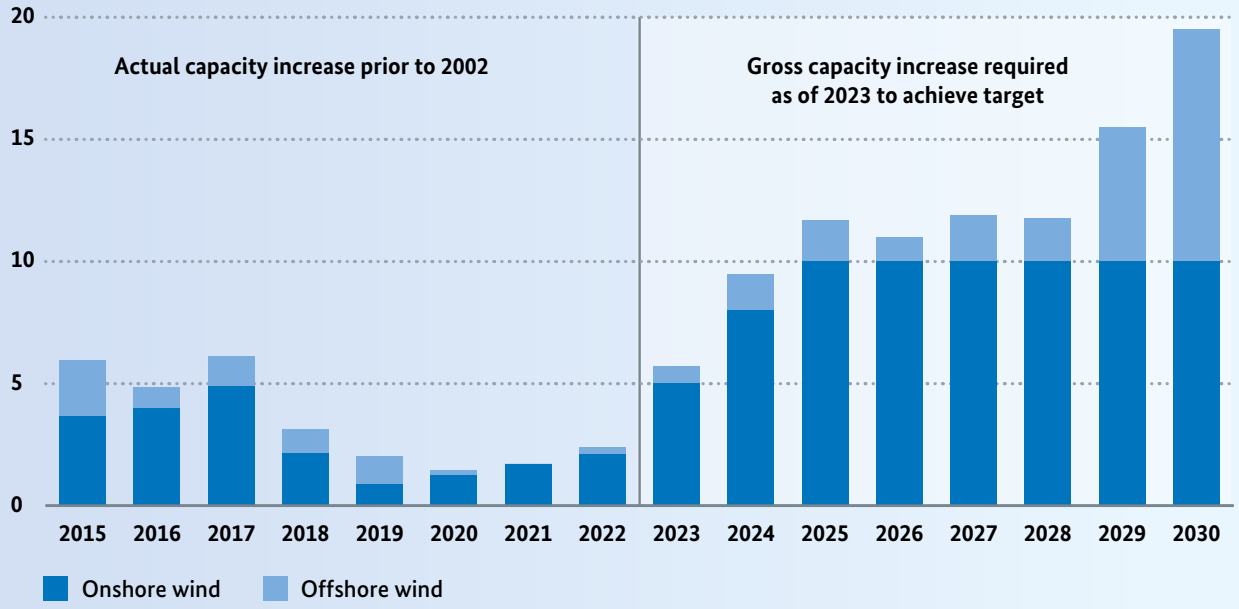
Initial successes are visible: the expansion of solar energy with approx. 7.2 GW has already accelerated noticeably (+26 percent compared to 2021). This means that we have achieved the expansion targets laid down in the EEG 2021 for the year 2022.

Solar PV expansion (capacity increase in GW)



Source: BMWK, Working Group on Renewable Energy Statistics (AGEE-Stat)

Wind energy expansion (capacity increase in GW)



Source: BMWK, Working Group on Renewable Energies Statistics (AGEE-Stat)

The momentum of the expansion, however, must now be increased. With the EU Emergency Regulation, which we advocated at EU level in 2022 and which has now been transposed into national law, major hurdles have been removed. Procedures for the expansion of onshore and offshore wind energy, electricity grid expansion and also for solar energy can now be speeded up significantly. In designated RE and grid areas that have already undergone a strategic environmental assessment, for example, the obligation to conduct an environmental impact assessment and species protection law review for renewable installations and grids is no longer required in the approval procedure. The EU Emergency Regulation also simplifies the procedures for repowering and solar plants. In the case of onshore wind energy, we expect this regulation alone to speed up the process by at least one year. The federal states and the licensing authorities now have the legal basis to forge ahead with the expansion of wind power. It is up to them now to do their part. They are also responsible for the success of the transformation project.

We will nevertheless also be adopting numerous **further measures** in 2023 at federal level in the areas of onshore wind, PVs and offshore wind. The key focus will be to increase the momentum of the energy transition through a large number of interdependent measures that will speed up and simplify the process.

Onshore wind: From 2025 onwards, we must achieve an annual capacity increase of 10 GW. To date, only 0.8 percent of the land area has been designated for wind turbines, and even less is available in fact. To enable us to make even more progress in this particular area, the next steps – which will also be taken in cooperation with other ministries of the Federal Government – have already been planned:

- We are currently developing an **onshore wind strategy** and will present key aspects at a **wind power summit** on 22 March. Following consultations with the federal states and the wind industry, we want to present the final strategy at a second wind power summit in April and then implement it.

- Among other things, we are examining **improved financing conditions** for installations outside the EEG – through default guarantees, for example, or a partial release from liability for PPA projects.

- Also under discussion is an **obligation to tolerate the laying of cables** to connect wind farms to the grid, as well as other options to make **more land area** available at short notice. For the **municipalities** in particular, we are examining **how their rights in the speedy planning of wind projects** can be **strengthened** and what is needed to support them effectively in their implementation.

Offshore wind: offshore wind generation is already an important pillar of the energy transition. Key developments and further measures:

- With the **Offshore Realisation Agreement** between the Federal Government, the federal states and transmission system operators (TSOs) involved, which was signed in November 2022, specific milestones and schedules were agreed to achieve the target of at least 30 GW by 2030.

- In January, the Federal Maritime and Hydrographic Agency published the new **Site Development Plan**, which describes the path to 30 GW in 2030 and even 50 GW in 2035, and thus clearly exceeding the target of 40 GW. In the past, auctions repeatedly resulted in zero-cent bids. With the new tendering procedures, we can in future even expect to see revenues that, among other things, will flow into nature conservation.

- To strengthen electricity imports and security of supply and to reduce costs, we are driving forward the concept of a **meshed offshore grid**.

- We are intensifying **multilateral cooperation in the offshore sector** and embedding it in an import strategy for green electricity.

- In addition, **more space** has been designated for offshore hydrogen production and we are working to provide funding for offshore hydrogen production.

Photovoltaics: The expansion of solar energy is already gaining momentum. We expect the expansion target of 9 GW to be reached this year, which is the greatest increase in capacity we have seen to date. However, we must then accelerate the expansion further to 22 GW as of 2026. In the case of solar energy in particular, there are numerous bureaucratic obstacles we intend to remove. To this end, among other things, we have carried out a feasibility check of photovoltaic systems in the commercial sector – a field with outstanding energy significance and, at the same time, multiple requirements at all levels: energy law, tax law and building law. We are taking into account the results of the consultations with the trade association, retailers, the energy agency and the rural district, and will remove specific obstacles in the PV sector. This means progress in the energy transition and less bureaucracy in one package.

- On 10 March, we will present a first draft of the PV strategy at a **PV summit** attended by industry representatives and important stakeholders. This draft will then be discussed with all those involved and further suggestions will be

included on the agenda. At a second PV summit on 3 May, we intend to present the final strategy and initiate the legislative process for a Solar package I in May, which is to be followed at a later date by a Solar package II.

- We also want to make **more ground area available for PV systems** through various measures, including making it easier to build in industrial and commercial areas.

- Finally, we intend to develop a new, simpler and more attractive model for **landlord-to-tenant electricity**. Balcony PV and reporting obligations are also to be simplified. In addition, the connection to the grid is to be accelerated.

Electricity market design: with an energy mix that relies on renewable energy sources, the demands on electricity grids, power plants, storage facilities and electricity consumers will change fundamentally. For example, thermal power plants in future will only have to produce electricity when there is no sunshine or no wind and as a result renewables are unable to feed sufficient energy into the grid.

- We are currently conducting an **intensive dialogue** in Europe and Germany on a new design for our electricity market. in April. the EU Commission will present proposals for reforming the EU electricity market design, which will lead to changes before the end of 2023.

- To provide advice, the Federal Government has launched the **Climate-Neutral Electricity System Platform**, which will address the financing of investments in renewable energies, the financing of new flexible power plant capacities and flexibilities of electricity demand, in addition to local grid and price signals. An initial report is expected in the summer, a second towards the end of the year.

Security of supply and system reliability, power plants and the coal phase-out: security of supply remains a key issue even in a climate-neutral electricity system. The Federal Network Agency's report on the "Security of Electricity Supply" concludes that, with the current plans of the Federal Government, the supply of electricity will continue to be guaranteed at a high level in the period from 2025 to 2031. In this context, we are implementing the following measures:

- By summer, we will present a **"Power Plant Strategy"**. We want to develop the power plant fleet further to ensure that it will also be able to produce electricity when it is not possible to feed sufficient wind and solar energy into the grid. There is a need to increase and modernise controllable capacity in the range of 17 to 25 GW by 2030. Thermal power plants should also be able to use hydrogen. We will include new instruments for hydrogen power plants to supplement the EEG and further develop existing instruments such as biomethane tenders and the Combined Heat and Power Act.

- We are also working to ensure that **additional gas-fired power plants** are available that can be converted to run on hydrogen.

- The BMWK is developing a **"System Stability Roadmap"** with broad industry participation. Due to the decrease in conventional power plants, their characteristics and system services must be provided by renewables and other systems (e.g. storage options, grid operating resources). The roadmap will also take into account the findings of the transmission system operators regarding the effects of an early coal phase-out in 2030 on the electricity grids.

Grid expansion at transmission grid level: the expansion of the electricity grids is necessary at all levels, from large electricity highways from northern to southern Germany to the distribution grids that deliver the electricity to the individual local consumers.

- In 2022, **major acceleration measures** for grid expansion at the transmission grid level were launched with the "Easter Package" and the Act amending the Energy Security of Supply Act and other energy-related provisions ("EnSiG 3.0"). Further relief will be provided with the **EU Emergency Regulation**, the possibilities of which must now be used in specific areas. At the same time, we are working within the EU to ensure that the acceleration measures will also have a lasting effect at EU level.

- In the **Electricity Grid Development Plan**, the transmission system operators determine the expansion requirements for the coming years, which will be submitted in the summer and subsequently transposed into law by the Federal Network Agency with an amendment to the Federal Requirements Plan Act 2024. The coalition agreement stipulates that the plan will focus for the first time on the climate-neutral grid in 2045.

Grid expansion and flexibility at distribution grid level: the key task at distribution grid level will be to connect the rapidly increasing number of decentralised generators (wind and solar plants) and consumers (including heat pumps and electric vehicles) to the electricity grid in a secure and increasingly intelligent and flexible manner.

- With the "Easter Package", the **legal framework for distribution network planning** was further developed to bring about forward-looking expansion.

- In its **industry dialogue** entitled **"Distribution grids of the future"**, the BMWK is supporting the expansion of distribution grids and the **implementation processes** included in the Easter Package.

- **Intelligent metering systems** (smart meters) are crucial for a secure grid operation and the market integration of millions of producers, consumers and prosumers. With the draft bill on relaunching the digitisation of the energy transition, the Federal Government has created the basis for accelerating the rollout of smart metering systems, while ensuring that the costs for consumers will be limited.

- The Federal Government will present proposals this year on how the **costs of the energy transition** can be distributed more fairly, because business and households today often pay higher electricity prices via grid fees, especially in regions where renewables are expanding very rapidly.

2. Renewal of the heating system

To date, over 80 percent of the demand for heat has been met by the burning of fossil fuels, which accounts for a good quarter of the CO_2 emissions in Germany. For this reason, if we intend to achieve climate neutrality, the way we heat our homes will have to change fundamentally within two decades. The Federal Government has set itself the task of generating at least 50 per cent of the heating demand in Germany by 2030 in a climate-neutral way and supplying virtually the entire heating demand from renewable sources by 2045. The end of Russian gas exports to Germany and the Russian government's attempt to use gas for political blackmail has now made the conversion of our heating systems, which had been planned in any case, a top priority – also for reasons of certainty and reliability.

What has already been achieved:

- Since summer 2022, the available tax funds have been allocated in a targeted manner, primarily in areas where the **beneficial effect for climate protection** is greatest: in refurbishments. **Funding for refurbishments** also helps people save money. Old windows, old exterior doors and old heating systems in particular are energy guzzlers – and are thus cost factors. We have therefore geared the **Federal Funding for Efficient Buildings programme** (BEG) more strongly towards refurbishments to ensure that the climate benefit, and thus the funding efficiency, is as high as possible. We have introduced a bonus, for example, that provides an additional ten per cent support for the refurbishment of a poorly refurbished building into an energy-efficient house, and have also introduced a 15 per cent funding bonus for serial refurbishments. In the case of **new buildings**, we have raised the legal standard in such a way that, as of this year, the permissible primary energy requirement must correspond to the Efficiency House 55 Standard.

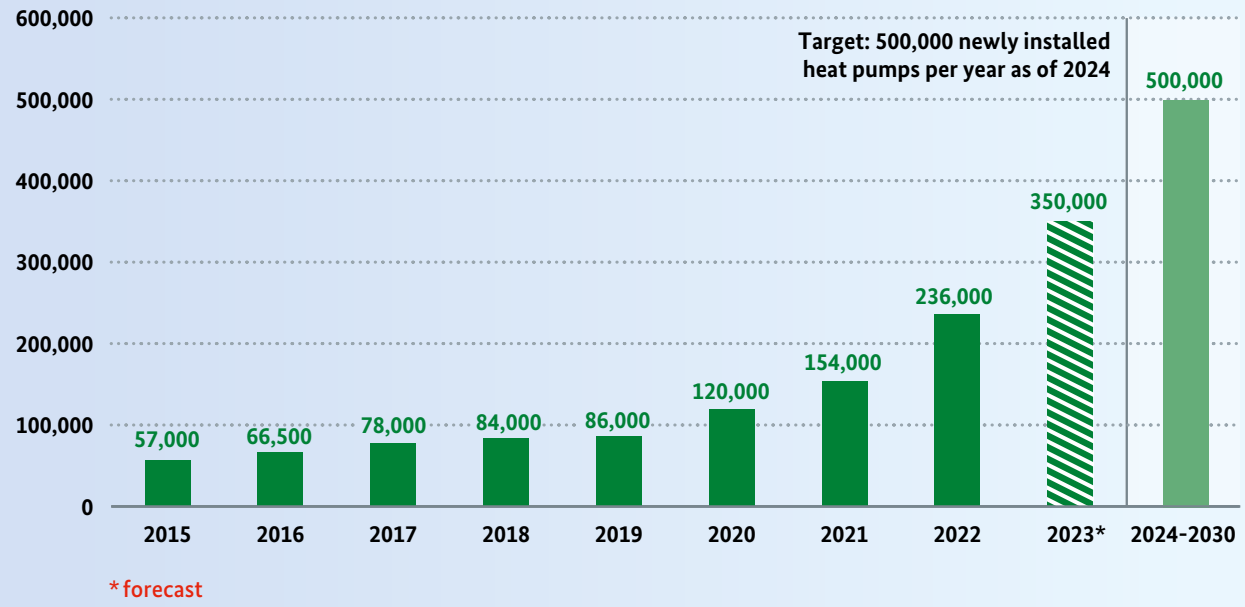
- We are also accelerating the expansion of green heat networks with the new **Federal funding for efficient heat networks scheme** (BEW). By 2026, we will make close to 3 billion euros available for the installation of renewable heat generation capacity from geothermal energy, for example, solar thermal energy and the use of large heat pumps, as well as for additional heat network infrastructure. The BEW is intended to promote the conversion of existing heating networks to greenhouse gas neutrality by 2045 and the construction of new heating networks with at least 75 per cent heat feed-in from renewable energy sources and waste heat.

- In urban areas in particular, Germany needs more **climate-neutral district heating**. Every district heating connection will also reduce the need to decarbonise the decentralised heat generation facility.

- The Federal Office for Economics and Export Control (BAFA), in line with the **Federal Subsidy for Efficient Buildings** (BEG), has approved some 500,000 applications for the funding of individual measures to date, of which almost 200,000 were for heat pumps, around 110,000 for biomass heating systems and almost 140,000 for refurbishment measures to the building envelope. In the case of the comprehensive refurbishment of residential buildings (BEG WG) and non-residential buildings (NWG), it was possible in 2022 to provide funding for the refurbishment of 30,000 residential buildings with over 140,000 residential units and 2,200 non-residential buildings.

- Heat pumps are the key technology for renewing heat production for all households that are not connected to a district heating network. Heat pumps are highly efficient and an ideal solution in many areas. The BMWK has therefore launched a major **heat pump campaign** with two heat pump summits and is working with a broad alliance consisting of representatives from business and commerce, industry, social partners, trade unions and science to drive the market ramp-up. Sales of heat pumps have already gained considerable momentum. With over 230,000 heat pumps sold in 2022, this represented an increase of more than 50 percent compared with 2021. For this year, manufacturers are already expecting a good 350,000. We want to build on this momentum and within the alliance have agreed on a roadmap for 2023 with specific measures to be in a position to install at least 500,000 heat pumps per year as of 2024.

Sales figures for heat pumps



Source: Bundesverband Wärmepumpe e.V.

Next steps:

- The German governing coalition has brought forward the **Amendment to the Building Energy Act** (GEG) on climate-neutral heating. Accompanied by participation processes with stakeholders ranging from estate agents associations and environmental organisations to consumer protection agencies and heat pump manufacturers, the BMWK and BMWSB have drafted a bill stipulating that from 2024 onwards, newly installed heating systems are to be powered by at least 65 per cent renewable energy – this is to become the standard for new heating systems; there are, however, numerous exceptions, interim solutions and deadlines in order to meet the specific demands of real-life situations. As part of a further revision of the GEG, we will further increase the efficiency standard for new buildings and also take into account the emissions released during building construction.
- With the **Heat Planning Act**, we intend to drive forward the expansion of the heat network. Since this will continue to remain the responsibility of the municipalities in future, we want to establish local heat planning throughout the country with the introduction of a new law and create a central coordinating instrument for local, efficient heat use and for strategic planning and investment decisions for a climate-neutral heat supply at local level.
- We are also preparing new specifications for the **operation of heat networks** in order to accelerate the decarbonisation of the district heating network. In order to make progress in this area with key stakeholders, we are planning a **district heating summit** in the summer of 2023.
- From April onwards, we will use the **"Heat Pump Development Programme"** to fund the participation of trained specialists from skilled

craft businesses, planners and energy advisors in training courses dealing specifically with heat pumps. This is a concrete step towards gaining more skilled workers for heat pump installation, as currently only around 15 per cent of businesses are able to do this.

- We will implement the **EU Buildings Directive** planned for the second half of 2023 as quickly as possible, in particular the minimum efficiency standards it contains.

Finally, we will set out an overarching legal framework for energy saving this year for the first time with the **Energy Efficiency Act**. In it, we will not only lay down the energy efficiency targets required within the national and European context. We will also for the first time describe a clear and plannable energy efficiency path.

3. Development of the hydrogen infrastructure

Hydrogen is important wherever we continue to rely on molecules and are unable to use electrons. Hydrogen can fill the gap that still remains open despite conversion to a renewable electricity system. The Federal Government's goal is to supply Germany with green, sustainable hydrogen. In the interim, we have recognised the need to use low-carbon hydrogen produced via fossil gas in combination with CCS (so-called blue hydrogen). The hydrogen ramp-up is of key importance as a prerequisite for achieving climate neutrality and also for increasing our security of supply and energy sovereignty. With the ramp-up of the hydrogen market, we will also ensure the renewal of our prosperity, the strengthening of competitiveness and the creation of good and secure jobs. It is our goal to massively accelerate the market ramp-up of hydrogen, its derivatives and its application technologies. This is something that affects the entire value chain: from securing sufficient hydrogen availability (setting up electrolysers, energy partnerships and import terminals) to creating a national and European hydrogen network (including hydrogen storage) and initial support for applications (primarily industry and power generation).

Current measures and next steps:

- We will complete the **update of the National Hydrogen Strategy** this year and thus establish the safeguards required for private investment in the economic and sustainable production, transport and use of hydrogen and its integration into the German energy system. This will create reliable framework conditions for the market ramp-up.

- Within this framework, we will raise the **expansion target for national electrolysis capacities** from the current 5 GW to at least 10 GW by 2030. For the funding of electrolysers in Germany, funding tenders with a total funding amount of 4.2 billion are planned from 2023 up to and including 2028. With the launch of "Important Projects of Common European Interest" (IPCEI) in the hydrogen sector, we are funding selected projects across the entire value chain. From 2023 onwards, we intend to fund pipeline projects with more than 1,800 km pipeline length and the first three converted cavern storage facilities. The Federal Government and the federal states will provide more than 13 billion euros in the years to come, of which around 7.5 billion euros will come from the BMWK.

- Our goal is the rapid and cost-effective development of a **hydrogen grid infrastructure** that will grow with the market and will be embedded in the EU internal market. To this end, the future European regulatory framework is

important, as it affects the ownership and operator structure of hydrogen grids and must be implemented in Germany in a way that makes sense. The system development strategy supports the development of framework conditions for the further cross-sectoral expansion of the hydrogen network. The development of an EU hydrogen network (EU Hydrogen Backbone) is in the interest of Europe as a whole and is being pursued by the Federal Government with high priority.

- **A hydrogen network company** is to be set up in order to demonstrate the coordinated and system-friendly development of a **hydrogen network** and its financial feasibility.

- We are also planning a **Hydrogen Acceleration Act** to adapt and simplify the regulatory and legal framework.

- We are building on the diversification of our energy partnerships around the world to ensure that our hydrogen supply is secure and that hydrogen and hydrogen derivatives are traded globally in the most effective and energy-efficient way. To this end, we are developing a **hydrogen import strategy** this year with a focus on transport options and the necessary import infrastructure both for transport by ship and transport by offshore pipeline. The aim is to open up broadly diversified import channels while avoiding new dependencies. At the end of 2022, we launched the first H2Global tender for the import of green hydrogen valued at 900 million euros. As this was the first global bidding process for the procurement of hydrogen, we can for the first time determine a market price for green hydrogen worldwide.

II. Renewing our industrial value creation in a climate-neutral way

The renewal of industrial production in Germany in small, medium-sized and large companies is the second “flywheel” on the path to new, sustainable and competitive prosperity. This is where the competitiveness of tomorrow, the future of good and secure jobs, value creation and its regional and social distribution will be decided. In 2022, German industry generated a gross value added of 820 billion euros, which is just under a quarter of Germany’s total gross value added. Ten million people are employed in the industrial sector, often in well-paid jobs with a comparatively high degree of democratic co-determination. At the same time, industrial companies in Germany now face the challenge of moving in new directions. The sector is responsible for almost a quarter of all German greenhouse gas emissions; to achieve Germany’s climate targets, these emissions must fall by about a third by 2030. At the same time, the technologies, products and services of industry are crucial to advancing the transformation in all sectors. In this context, medium-sized industrial companies are a key driver of the transformation.

1. Renewal of the framework conditions for industrial value creation

For the renewal of industrial value creation, the Federal Government is focusing on an efficient mix of market-based instruments (especially CO_2 pricing in European emissions trading and the Fuel Emissions Trading Act), targeted funding instruments and a reliable regulatory framework.

Current measures:

- With the **"Decarbonisation of Industry" programme**, the Federal Government has been supporting energy-intensive (basic) industries since 2021 in developing and investing in innovative climate technologies to avoid process-related greenhouse gas emissions. Five projects in the glass, steel, cement and chemical industries have already been approved, and further large-volume project proposals or applications are currently being reviewed. The BMWK is planning new calls for proposals at the beginning of 2023.

- In Germany, there are currently four projects (CCU in the cement industry, offshore wind with electrolysis, battery technology for the automotive industry and a renewable microgrid for an industrial site) valued at over 200 million euros that are also being financed through the **EU Innovation Fund**, which is financed from EU emissions trading revenues.

- The transformation will only succeed in close collaboration with SMEs. It was for this reason that in December 2022 the BMWK launched an **Action plan for a Dialogue and Work Process on "SMEs, climate action and transformation"**, which focuses on the specific requirements for SME value creation and indicates which support measures have already been implemented.

- At European level, the Federal Government supported the ambitious conclusion of the negotiations on key dossiers of the Fit for 55 package in December 2022. Among other things, the agreement provides for **more ambitious targets for emissions trading** to be able to efficiently reduce emissions in the industrial sector. Part of the revenues will go into the innovation fund for climate-friendly technologies. In order to address the risk of carbon leakage and to secure European competitiveness, a CO2 Carbon Border Adjustment Mechanism (CBAM) will also be introduced as of 2023, which will set the prices for imports from third countries that do not have comparable climate protection requirements.

Next steps

- A key event this year will be the presentation of a **new industrial strategy**, the aim of which is to strengthen the competitiveness of industry, and in this way renew prosperity and the participation in prosperity and to place it on a climate-neutral basis. To this end, the BMWK has invited representatives of associations, trade unions, civil society, science and the federal states to virtual workshop discussions and has held workshops on industry-related topics. The strategy will focus on the following core areas: transformation towards climate neutrality, strengthening technological sovereignty, improving resilience and reducing critical dependencies in supply chains by improving diversification, simplifying and accelerating planning and approval procedures, securing skilled labour through education and training, in addition to immigration and consistently exploiting the opportunities of digitisation. The BMWK has already initiated implementation measures in many of these areas and is now integrating the various instruments into a coherent and comprehensive industrial policy concept.

- The BMWK is also strengthening measures that will benefit **small and medium-sized enterprises** in particular during the transformation. For example, funding the conversion of production facilities from using fossil fuels to electricity for small businesses is being expanded and by 2025 will be funded with an additional

100 million euros. Another example is the "GreenTech – Innovation Competition" technology programme, which aims to strengthen Germany and Europe as a high-tech location for digital technologies and business models based on them, to achieve the climate and environmental targets and to strengthen sovereignty. In this context, the focus for BMWK is on the transfer of knowledge from science to small and medium-sized enterprises.

- In order to be competitive, industry needs **competitive energy prices based on sufficiently available renewable energy**. The wholesale prices for gas and electricity in Germany have again fallen significantly compared with their highest levels last summer, thanks also to decisive crisis management on the part of the Federal Government. Nevertheless, end-user prices are still considerably above pre-crisis levels and will remain so for the foreseeable future. High electricity prices are an obstacle to the transformation of industry towards climate neutrality, in which electrification and hydrogen are key factors. For this reason, the BMWK is working on a graduated model to enable industry to purchase electricity at internationally competitive prices. An industrial electricity price is to make cheaper electricity from renewable sources available to industry. To this end, the funding of renewable energy sources or individual segments is to be switched to **Contracts for Difference** (CfDs). The price achieved in the tenders would then be passed on to industry. Since this model will only work with new, CfD-subsidised installations, this decarbonisation electricity price will only be effective in the medium term. Based on the graduated model, options to support direct contracts between industrial consumers and renewable energy installation (PPAs) will also be explored. For a transition period, an interim model with direct subsidies is also being discussed at national and European level; in this case however, the entire Federal Government would have to decide on financing issues.

- The BMWK last year also implemented crucial steps for the introduction of Carbon Contracts for Difference (CCfDs) and published a draft funding guideline in December 2022. The instrument is intended to fund any additional costs that may arise from the construction and operation of climate-friendly industrial plants compared with conventional industrial plants and in this way contribute to making climate-friendly key technologies applicable on an industrial scale in the years to come. Carbon Contracts for Difference are a form of start-up financing aimed at ensuring that new types of climate-friendly industrial production are set up and operated in Germany. The programme is also available to companies with smaller production facilities, so that SMEs also benefit. Following consultation with various associations, the directive is currently being discussed within the ministries. The aim is for it to come into force in the first half of 2023, during which time the first procedure for awarding climate protection contracts can also be initiated.

- The transformation of industry includes the question as to how to deal with CO_2 emissions in Germany that are unavoidable or difficult to avoid and what possible business models will look like. To this end, the BMWK is developing a **Carbon Management Strategy** that will identify areas of application for the storage and utilisation of CO_2 (Carbon Capture and Storage, CCS, and Carbon Capture and Utilisation, CCU) and outline the legal and economic framework conditions. One focus will be on infrastructure. The development of the strategy is accompanied by

an extensive stakeholder dialogue with representatives of civil society, environmental associations, business and science.

- To ensure that by 2045 German companies only produce climate-neutral products, climate-neutral basic materials and industrial products will have to be launched on the market in the 2020s. For this reason, the BMWK in November 2022 introduced a cross-sector stakeholder process to develop a framework for the emergence of **markets for the first climate-neutral basic materials and products ("lead markets")**. Nine workshops are planned for the first quarter of 2023 with the aim of discussing definitions, measurement methods and measures.

- The BMWK is also involved internationally in efforts to agree on common standards and definitions for green industrial production. During the German G7 Presidency in 2022, a robust starting point was found for **agreement on definitions of green steel and cement**.

- The **Climate Club**, which was launched in December 2022 during Germany's G7 Presidency, is also pursuing the goal of launching climate-friendly basic materials such as green steel on the market faster and improving their chances of success.

- The BMWK this year will continue to fund innovative research and development (R&D) projects on material and energy-efficient **lightweight construction technologies** via the Lightweight Technology Transfer Programme, for which a total of 109 million euros will be made available for the first time in 2023. An amendment to the funding programme planned for 2023 is intended to address the area of **material efficiency** in particular and to secure the funding of small and medium-sized enterprises. This year, a **Lightweighting Strategy of the Federal Government's** is intended to strategically align the funding of the key technology of lightweight construction across all ministries and contribute to the resources turnaround by reducing the consumption of primary raw materials.

- As part of the Aviation Research Programme and the Maritime Research Programme, the BMWK continues to advance R&D projects for **climate-neutral aviation and shipping**. The Maritime Research Programme will be expanded to include the carbon neutral vessel funding priority. The updated funding guidelines are to be published in the first half of 2023. The BMWK is also supporting the PtX centre of excellence in Lusatia.

- German industry and the BMWK also want to work jointly to drive the **digital transformation** of industry forward. Germany is a pioneer in Industry 4.0 and can make a decisive contribution to shaping the outcome. A key goal is to take data-driven collaboration in industry to the next level in order to make new digital solutions and business models possible. As a result, the BMWK will shortly present a concept to provide start-up funding for **Manufacturing-X**. This initiative aims at cross-sector digital networking in industry with a special focus on the involvement of SMEs and the development of digital solutions for a sustainable and future-proof industry in Germany and Europe. Among other things, the initiative will build on the findings of the BMWK-funded Catena-X project for the digitalisation of supply chains in the automotive industry.

2. Renewal of the steel and chemical industry

The German steel industry has a special significance for the industrial value chains in Germany: innovations in the steel industry, as a result of the close interdependencies, also strengthen the automotive industry and engineering industry. It generates an annual turnover of 32.1 billion euros and employs around 87,000 people. The steel industry is also the largest industrial emitter. For this reason, its successful transformation is a decisive lever for achieving the climate targets of the industry as a whole. Switching to new production processes is challenging for the industry, which is subject to strong international competition. At the same time, the efforts required to renew the industry will result in a new and sustainable level of competitiveness.

- Through **funding programmes** such as the IPCEI Hydrogen, the Decarbonisation of Industry programme or the development of the concept for Carbon Contracts for Difference, specific support for the renewal process was targeted last year as never before.

- In addition to this, progress was made in creating green lead markets during **Germany's G7 Presidency**. In 2023, we will continue to move forward along this path and expect not only the approval of further applications from the programmes mentioned and the conclusion of the first Carbon Contract for Difference, but will also expect to make further progress with regard to green lead markets.

- In this respect, with the **"Steel Action Concept"**, we have a proven industrial policy guideline for the sector, which provides us with a basis for close dialogue with the various players in the industry.

The **chemical industry** is another important sector of our value chain and one that provides participation in prosperity. It employs around 466,500 people, most of them in small and medium-sized enterprises with fewer than 500 employees. About two thirds of the commodities produced in the chemical industry are directly processed in industry. At the same time, production processes in the chemical industry are both energy and emission-intensive. For the transformation towards climate neutrality, the fundamental conversion of processes in the basic chemicals industry is paramount.

- For this reason, the BMWK supports the chemical industry with targeted funding programmes, such as the **"Decarbonisation of Industry" programme**.

- The BMWK is also advocates the **scaling of biobased products and processes** on an industrial scale. Since last year, the funding has been supplemented by a model regions module. For the first time, support is being provided for the integration of highly-scaled biobased products and processes into industrial value-added networks and also for their transfer.

3. Renewal of the automotive industry

The automotive industry is of outstanding significance for Germany as a location for business and innovation. With a turnover of some 411 billion euros and almost 786,000 employees, it is not only Germany's most important industrial sector, but with its well-balanced value chains, especially in the SME sector, it is also essential for prosperity and employment. The innovative strength of German mechanical engineers, who are responsible for the global success of the industry, is now facing new challenges: With the increasing electrification

of powertrains, autonomous driving systems and new mobility services, the automotive industry is undergoing a far-reaching transformation process. The transport sector must be decarbonised by 2045, and 15 million battery-powered electric vehicles are to be registered by 2030. For this reason, the BMWK is implementing a variety of measures to provide targeted support to the automotive industry, which will include a broad-based bundle of funding programmes with a total value of more than 8 billion euros.

Current measures:

- In the summer of 2022, the BMWK set up the **Transformation of the Automotive Industry Expert Group** (ETA) to develop recommendations for action for a successful transformation of the automotive industry. In addition to the decarbonisation of supply chains, digitisation and automation, resilience of supply networks and standardisation, the work focuses on employment, continuing education and further training.

- In March 2021, the BMWK published four funding guidelines with a volume of over 2 billion euros for the **"Future Investments for Vehicle Manufacturers and Supplier Industries"** funding programme (2021-2026). The aim of the programme is to support the German vehicle industry (incl. rail vehicles) in its transformation to promote climate-friendly drive systems, autonomous driving, digitised and sustainable production processes and the innovative use of data. The programme is not only aimed at large companies, but also at small and medium-sized supplier companies along the entire supply chain. To date, over 700 projects have been supported in the funding modules. Together with the companies' own contribution, the projects have a total volume of over 2.5 billion euros. Further approvals are pending this year (duration until 2026). The programme also includes measures for continuing education and further training, which will be implemented under the guidance of the BMAS.

- The **"Future Fund for the Automobile Industry"** (2021–2025) complements this programme. As part of the funding recommendations made by the associated expert committee, the BMWK has established the "Regional Transformation Networks" (136 million euros, until 2025) and the "Development and Implementation of Transformation Hubs" (50 million euros, until 2025) funding instruments. The 27 funded regional transformation networks are intended to strengthen the exchange of experience and networking in the sector, secure good jobs and promote climate action. The 11 funded transformation hubs will promote the transfer of knowledge between companies, especially SMEs, and their employees, trade unions and municipalities with a focus on transformation processes along the entire supply chain.

- From 1 January 2023, the subsidy for electric vehicles (**"environmental bonus"**) will focus only on motor vehicles that have a proven positive climate effect, i.e. battery and fuel cell-powered vehicles.

- In the field of **battery cell production**, Germany is supporting the implementation of two battery IPCEIs for a total of 1.5 billion euros. Five German projects are being funded in the "Summer" IPCEI, and 9 German projects are underway in the "EuBatIn" IPCEI. The BMWK also intends to launch the "EuBatIn" IPCEI coordinated by Germany and in January 2023 initiated an expression of interest procedure to this end. In addition,

the BMWK has been supporting the development of a battery ecosystem in Germany since 2021 through a dedicated research funding call for 180 million euros and a funding guideline on training and securing skilled workers for 40 million euros. The BMWK is leading the work being carried out in the Global Battery Alliance to identify and track battery sustainability parameters.