

transition

THE ENERGY TRANSITION MAGAZINE BY DENA | #2022

20 21 **22** 23 24

'The innovation dynamics are good, but we need to speed up.'

**Disruptive innovations for climate neutrality:
SPRIND Director Rafael Laguna de la Vera talks to dena's
Chief Executive Andreas Kuhlmann**

CLIMATE NEUTRALITY

How technological innovations move us forward

INDUSTRY

How industry uses carbon dioxide

GROWTH

How dena is repositioning itself



EDITORIAL

transition

A peaceful revolution often goes hand in hand with energy transition and climate change. The transformation lifts our dependence on fossil fuels, which are only available in certain regions. This process has taken on dramatic significance since 24 February 2022. The unimaginable has happened – there is war in Europe. It's a tragedy for the people, and it comes with immeasurable suffering. A war, moreover, that plays on the potential of blackmailing countries for fossil fuels. This is a particularly difficult situation for Germany, which has relied heavily on Russian energy imports up to now. This makes our responsibility and obligation to tackle the goal of climate neutrality even greater. Yes, we will have to rethink many things now, but we are making good progress. Our cover story (page 8) and the many examples from our everyday work (from page 26) show where the journey could go.

We have also learned from more than two years of the global pandemic that it is important to continue working towards our goals, even in turbulent times, and to develop solutions in the short, medium and long term. Innovations play a decisive role here. Right now, we need to be more courageous and take risks. SPRIND Director Rafael Laguna de la Vera makes this very clear in the dual interview (page 14) in this issue.

The new German government's declared goal is to move towards a climate-neutral society, and they want the country to be climate neutral by 2045. We checked in with the heads of government (page 20): What are the most effective levers? What changes are on the horizon? We noticed something very striking: they all also see a great opportunity in the transformation. Rightly so. After all, new technologies, living spaces and markets emerge when the will to innovate is supported by billions in investments.

The electricity supply of the future will be renewable. For this to happen, reserve power plants that are climate neutral and can be deployed in the event of a blackout are needed (page 34). The industrial capture and processing of CO₂ is still in the development phase, but there have already been initial successes (page 36). Electric cars and charging stations can conduct business independently in the decentralised energy system of the future (page 62). dena itself is also developing rapidly: greater responsibility, more employees and locations, as well as a revamped structure (page 50).

We want to give you a vivid picture of the near future in the fifth issue of *transition*, our corporate magazine. We hope you enjoy reading it.



Andreas Kuhlmann
Chief Executive



Kristina Haverkamp
Managing Director

COVER PICTURE:

The cover picture (cover and inside front cover) shows a vision of the future of Berlin's Karl-Marx-Allee in the year 2035. The vision was developed in collaboration between futurists from the Fraunhofer Institutes and the architectural firm LAVA. (LABORATORY FOR VISIONARY ARCHITECTURE) www.l-a-v-a.net

Contents

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THE BIG PICTURE



8 Climate time machine

The view is clouded, but we look forward:
a future journey to climate neutrality

14 'It is a big mistake if we do not at least try innovations.'

An interview with SPRIND Director Rafael
Laguna de la Vera and dena's Chief Executive
Andreas Kuhlmann

20 A word with...

What awaits us in terms of climate policy?
Three questions to prominent politicians in
the German government

INSIGHTS



26 Establishing a hydrogen economy

The German National Hydrogen Strategy
aims to establish climate-neutral hydrogen.
Which stakeholders are relevant in this con-
text?

28 The climate giant

China: a rapid increase in energy consump-
tion vs. ambitious climate protection targets

32 Expertise makes efficient buildings

New energy-efficient buildings and energy-
efficient refurbishments can receive funding.
What considerations do we need to make?

34 Climate-neutral security of energy supply

The climate targets have been made stricter,
and the pressure to act is high: coal- and gas-
fired power plants have had their day.

36 CO₂ as a raw material

Carbon capture and utilisation (CCU) is
a ground-breaking process on the path
towards climate-neutral industry. Carbon
dioxide does not end up in the atmosphere,
but in products.

40 Maintenance and progress

Seven hundred climate protection managers
go door-to-door for climate protection in
their municipalities every day.

44 A standard for green gases

Germany 2030: should we import around
80 per cent of the green hydrogen we need?
Certification is urgently needed.

46 Micromobility with a macro effect

We also need micro-vehicles for the transport
transition. There has been less of a focus on
e-mopeds, e-scooters and cargo bikes.

FACTS & FIGURES



50 Fit for the future

About dena: from a startup created 21 years
ago to a strong partner of the German govern-
ment

NEXT



58 Energy transition: Women wanted!

The energy sector is dominated by men.
Female experts form networks to increase
the amount of female influence.

62 Smart contracts

Digitalisation with an impact on electricity
supply contracts: dena's Future Energy Lab
tests new solutions for a climate-friendly
energy economy.

64 'Investment is the key to off-grid energy'

Africa: six hundred million people without
access to electricity. Nithio, a startup, has
detected where things are getting stuck and
offers solutions.

Berlin's Tegel Airport has closed, creating space for the new Schumacher Quartier residential area. Berlin TXL – The Urban Tech Republic, an innovation park, is being built right nearby. Focal point: science, industry, commerce and research will develop, test and produce urban technologies here. The green technologies of the future being developed here will be implemented directly in the residential area.

THE BIG PICTURE

Climate protection and the energy transition are among the greatest and most exciting challenges of our time. In **The Big Picture**, we take a bird's eye view. What are the fundamental challenges? How can we best tackle them? In what manner can politics help? Where does industry need to step up? What can each individual do?

CLIMATE TIME MACHINE

Advancing climate change, a global pandemic, war – our view of our future is clouded by present-day events. Yet we have a lot of opportunities to address the challenges ahead.

TEXT Hanne May



The Morgenstadt project created this vision of the future of Berlin's Karl-Marx-Allee in 2035.

It is an age-old dream to want to be able to see into the future and know what is coming or to travel there. Since time immemorial, artists and researchers have been thinking about what the future might look like. 'Wonderful advances' compared to his own 'rudimentary civilisation' awaits the time traveller in the fantastic tale *The Time Machine*. And what time traveller wouldn't want to press the lever and select 2045 or 2100 like the protagonist in H. G. Wells' novel? You could travel there in the blink of an eye and know what the future of our energy and climate looks like.

Just like *Back to the Future*, it is possible to measure in hard reality what has become of the great ideas and visions of earlier times. You will discover some of these visions in the megacities of today if you look

back at the urban utopias from the literary world of the 1920s or 1930s. Development has quite often moved faster and more disruptive than expected, especially in information and communication technologies. In this vein, the large telephone exchanges of days long gone are visually reminiscent of today's data centres, but there are 'wonderful advances' in between.

Thanks to these enormous advances, our ability to see into the future is also becoming more reliable. **The time machines of today collect huge amounts of data, relate them to each other in an increasingly complex way and model developmental steps from them.** These 'machines' offer us the chance to outline the paths to a climate-friendly society and economy and to test their effects.

Five future journeys to climate neutrality

As far as our glimpse into the future is concerned, 2021 was an important year. Several ground-breaking studies dealing with the question of how Germany can manage the great transformation to climate neutrality by the middle of the century were published at one time. At the beginning of October, dena presented its pilot study *Towards Climate Neutrality (Aufbruch Klimaneutralität)* shortly after the Bundestag elections. A few months earlier, comprehensive analyses had been published by Agora Energiewende and the Climate Neutrality Foundation. The Federation of German Industries (BDI) and the Ariadne research project also produced comparable baseline studies.

In a further step, all study teams have compared where they agree and where there are differences, together with a fifth research cluster. **The central finding is that climate neutrality is based on four pillars: a significant increase in energy efficiency, the use of renewable energies as a primary source, the use of hydrogen and other powerfuels as well as the preservation and development of new CO₂ sinks.**

In all studies, natural gas plays an important role as an energy source beyond the year 2030. Natural gas remains Germany's number one energy source at this point, even if consumption declines by 2030 in the various scenarios – with a share of final energy consumption of around one fifth to a good quarter. It's a picture of the

future that has been called into question since 24 February 2022 with Russia's invasion of Ukraine. Germany's climate future will have to go down a different path. And it will probably correspond more to the scenario of dena's pilot study, which assumes higher quantities of hydrogen and powerfuels than the other studies.

New government: off to a good start and then abruptly halted

The decision of the Federal Constitutional Court on the German Climate Protection Act showed in April 2021 how treacherously reality can influence even the most well thought-out prognosis. Germany's highest court demanded that the act must take better account of the life interests of younger generations.

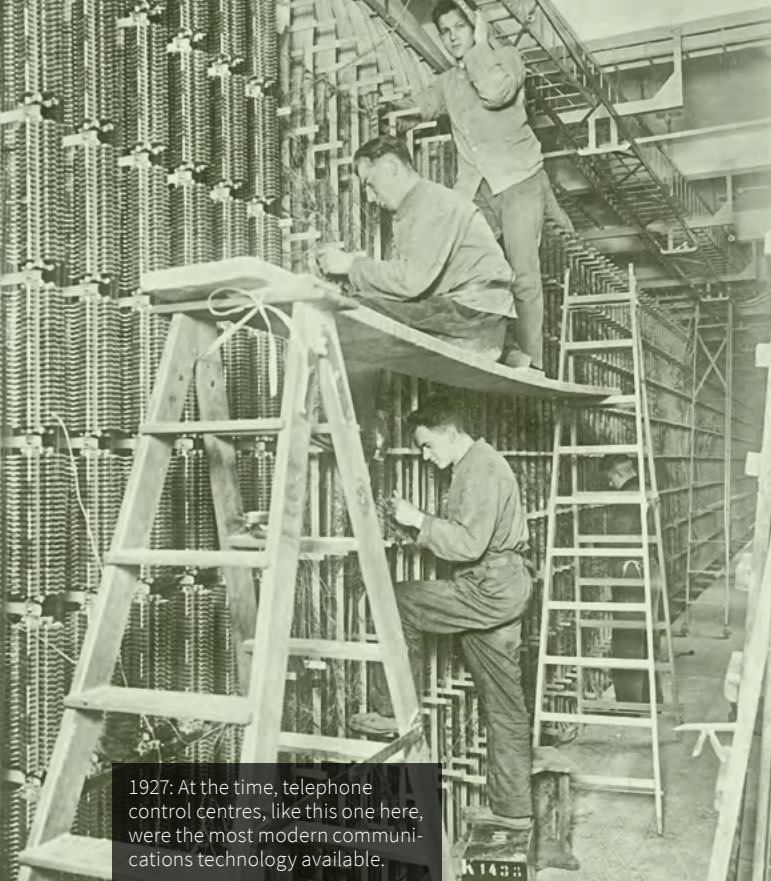
As a consequence, the German government had to adjust its target corridor and aim for climate neutrality for 2045 instead of 2050. Modelling was therefore carried out anew and the level of ambition was raised in the study projects mentioned above, too.

This watershed event also signalled a trend: acceleration on the way to the goal. Germany's newly formed government set a fast pace right from the start, with ambitious plans in the coalition agreement, an upgrading of the entire topic area and a more pronounced formulation of responsibilities. The new Minister for Economic Affairs and Climate Action, Robert Habeck, immediately set off on a tour of Germany after his comprehensive opening statement at the beginning of the year and the announcement of two major legislative packages (Easter package, Summer package) (see also interview on page 20). His aims were to emphasise cooperation, to involve the federal states more strongly in order to drive forward the energy transition and climate protection as a joint project, and to resolve potential conflicts more quickly – for example, in the specifications for the expansion of renewable energies.

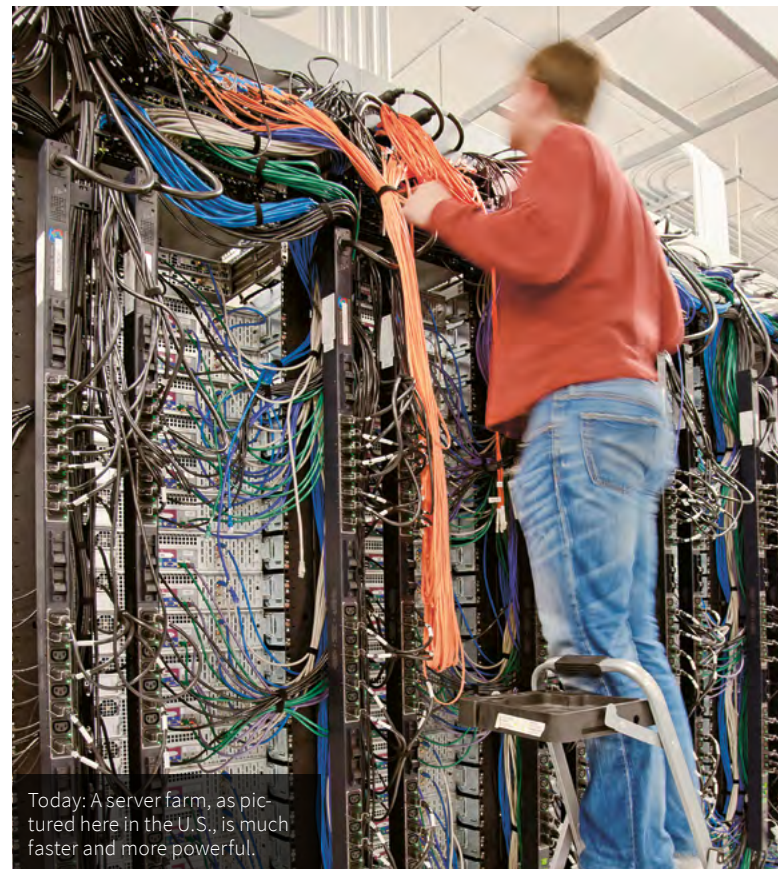
But Russia's war against Ukraine has changed things. The about-face in terms of the energy transition and climate protection proclaimed by German Chancellor Olaf Scholz means that we need to rethink things. Even though we know we need to tackle things quickly, it needs to go even faster now. Instead of touring Germany, Minister Habeck and his team are working flat out to find new suppliers worldwide to replace the high levels of energy imports for coal, oil and gas from Russia that we've seen in the past. Some people probably wish they could throw Germany as a whole into the time machine – and come out in a safe, resilient and climate-neutral energy future.

Redefining energy security

The war in Ukraine has hit Germany's energy system particularly hard. Dependence on energy imports is still very high and Russia is by far the largest supplier, despite all the advances made in the energy transition and climate protection. 34 per cent of imported crude oil, 45 per cent of hard coal and 55 per cent of imported natural gas came from Russia in 2020.



1927: At the time, telephone control centres, like this one here, were the most modern communications technology available.



Today: A server farm, as pictured here in the U.S., is much faster and more powerful.

These fossil raw materials are used everywhere: in households, in the energy industry, in the transport sector, but above all, in industry.

How quickly can these raw materials be replaced? And at what price economically and politically? What risks are we prepared to take? And how does our new energy system become resilient? These are key questions in the debate.

One thing is certain in these uncertain times: for Germany, there is no going back to the times when fossil fuels were cheap. Since CO₂ pricing has been deliberately introduced as a tool for the energy transition, this development is in line with political goals. But the current situation harbours the danger of spikes, which will be difficult to control. Not only are the new alternative supply sources in the short and medium term more expensive per se, the price jumps in the global market for gas and oil that already occurred in autumn 2021 are likely to intensify for winter 2022/2023, as many economists fear. In addition, there is the danger of real shortages, depending on the course of the war and the decision in Europe or by Russia to impose a supply embargo.

Had there been a longer period of frost in January or February, things could have already been tight right now because the gas storage levels in Germany were at a particularly low level last winter. This, fortunately, did not happen. Both Germany and Europe have now introduced regulations on minimum storage levels for all operators. This is an important building block. However, the essential steps to get through the next winter and beyond are: develop new supply sources, replace gas with other energy sources, and save, save, save. This is the new three-pronged approach for energy security.

Collecting terawatt hours

Energy efficiency is not only one of the four pillars on the path to climate neutrality. It is also the fastest and most effective countermeasure in times of crisis. If we optimise it, we can greatly contribute to mobilising society as a whole, enabling concrete action and thus countering the widespread feeling of powerlessness. This has been shown by the experience of the first oil crisis in 1973 and subsequent crises. The broad mobilisation campaign by the German government not only helped to overcome the acute shortages among the population, it laid the

foundation for many policies in the years that followed. The long-sightedness of these regulations can be seen, for example, in the fact that the Energy Security Act of 1975 was only comprehensively revised this year.

1973 to 2022 – that is five decades of energy efficiency policy. What can still be achieved today? And more specifically, how many terawatt hours can be saved? dena has taken a close look at the potentials and found out the following: in the short term, that is, until next winter, behavioural changes in the building sector and in the transport sector will have the greatest impact. If we exhaust all of our possibilities here, we could save around 110 terawatt hours – about half in natural gas and half in oil. The greatest potential lies in the building sector and in optimising ventilation, heating and cooling. For each degree the average heating temperature in buildings decreases, the more considerable are the effects on the overall figure. Many people are aware of this, but they need to be reminded of it through comprehensive communications and implement it.

The most effective measures in the transport sector are also not new. Leave your car at home and use public transit, in-

troduce a speed limit – both measures will bring savings in the double-digit terawatt range. What will it take? Conscious action on the part of all consumers and the will of politicians to also enforce concrete specifications such as a speed limit.

But achieving short-term savings in industry will be more difficult. Saving energy in production would be quick and effective, but that is problematic from an economic point of view. Savings are often associated with longer-term changes in production processes, such as a change of energy sources for process heat from gas to electricity or better use of waste heat. However, the potential is considerable. The consumption of gas, coal and oil could be reduced by 150 terawatt hours by 2030 according to the modelling of dena's pilot study 'The Start of Climate Neutrality (Aufbruch Klimaneutralität)'. These potentials could be tapped much more quickly with precisely tailored funding programmes, accelerated approval procedures and more offers for small or medium-sized enterprises in terms of energy consultation.

The German Association of Energy and Water Industries (BDEW) also found in an analysis that the industrial sector has the lowest potential in the short term. A look at the energy sector also shows that if we extend the operating lives of the remaining German nuclear power plants, which is also being discussed, it would have hardly any effect. We can save eleven times more natural gas if electricity generation in gas-fired power plants is optimised.

Having courage for a broad range of ideas

Short-term effective measures are enormously important in this crisis. However, for more resilience in the energy system, it is even more important to accelerate both medium-term and long-term measures at the same time. Innovations play a central role here. The need for action has been highlighted by the Tech for Net Zero Alliance initiated by dena. Here's an example: researchers at Germany's universities are diligent and productive; but the transfer of these ideas into practice and the spin-offs of start-

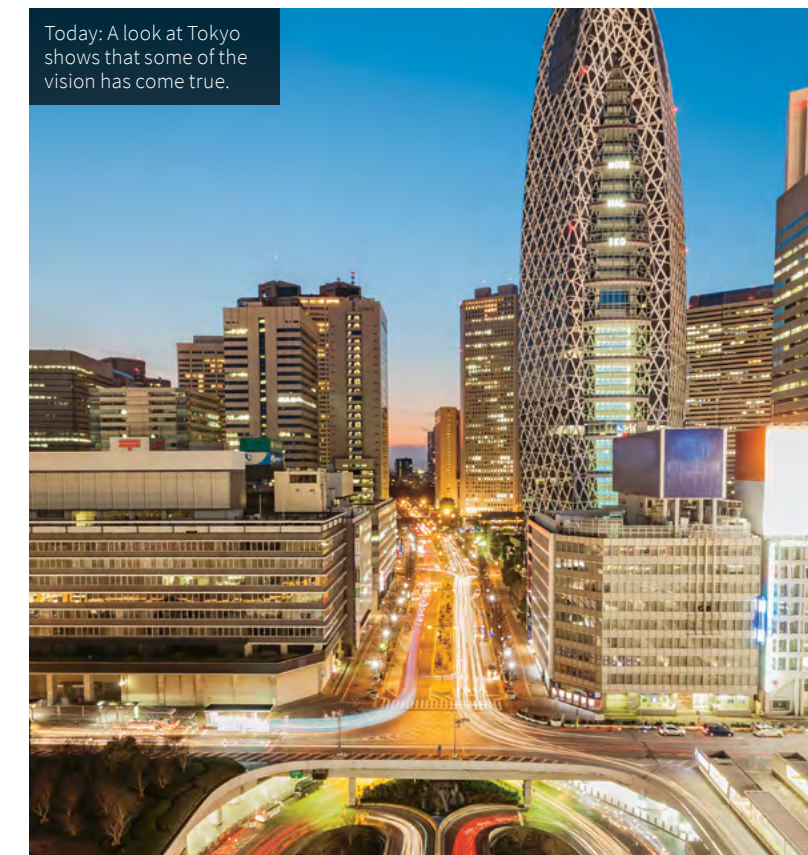
ups are not going smoothly. Administrative barriers and unclear responsibilities mean that patents that have been meticulously developed simply remain unused. The EU Commission has found something similar in a report for industry. It criticises too little investment in pilot projects for new technologies and the market ramp-up of proven technologies in Europe. **If both Germany and Europe, plan on achieving their climate targets, new ideas must move more quickly from the laboratory into practice, as Rafael Laguna de la Vera and Andreas Kuhlmann emphasise in an interview in this issue (see page 14).**

Major solutions are also needed. Some of them are not so new, but they are relevant again. One example: the idea of the 'supergrid'. Some people laughed when Irish entrepreneur Eddie O'Connor raved about his vision of a huge, interconnected power grid in the European North and Baltic Seas around the years 2008/2009. There are now multiple infrastructures in place connecting different countries.

Photos: SZ Photo/Scherl/Bridgeman Images, Kim Steele/Getty Images, ullstein bild, Zhang Xun/Getty Images



1925: A future vision of a big city in the year 1975.

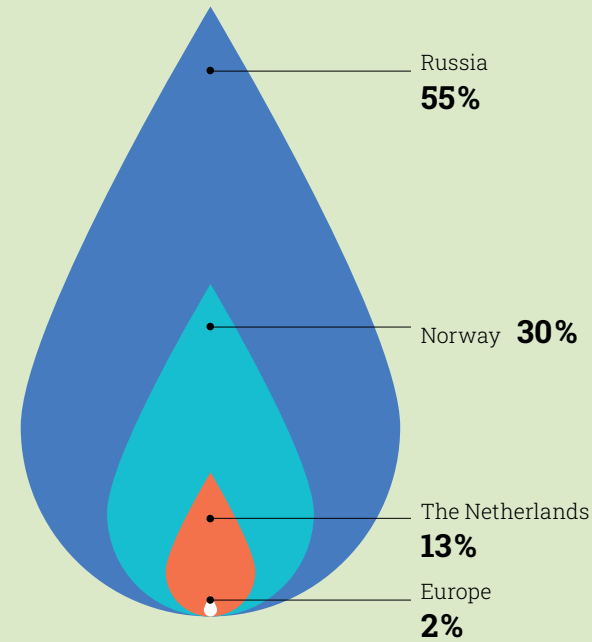


Today: A look at Tokyo shows that some of the vision has come true.

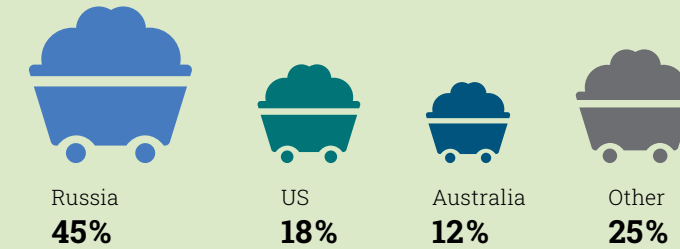
Where did oil, natural gas and coal come from in 2020?

Energy imports to Germany; all data for 2020

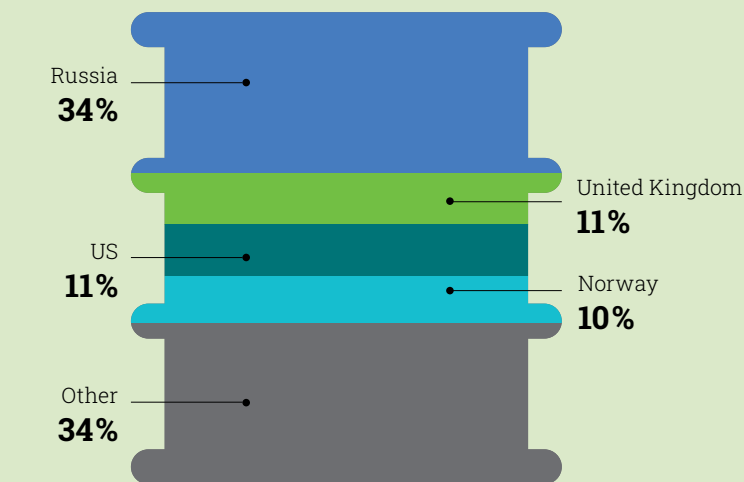
Natural gas imports 103 mn cbm



Hard coal imports 31.8 mn tonnes



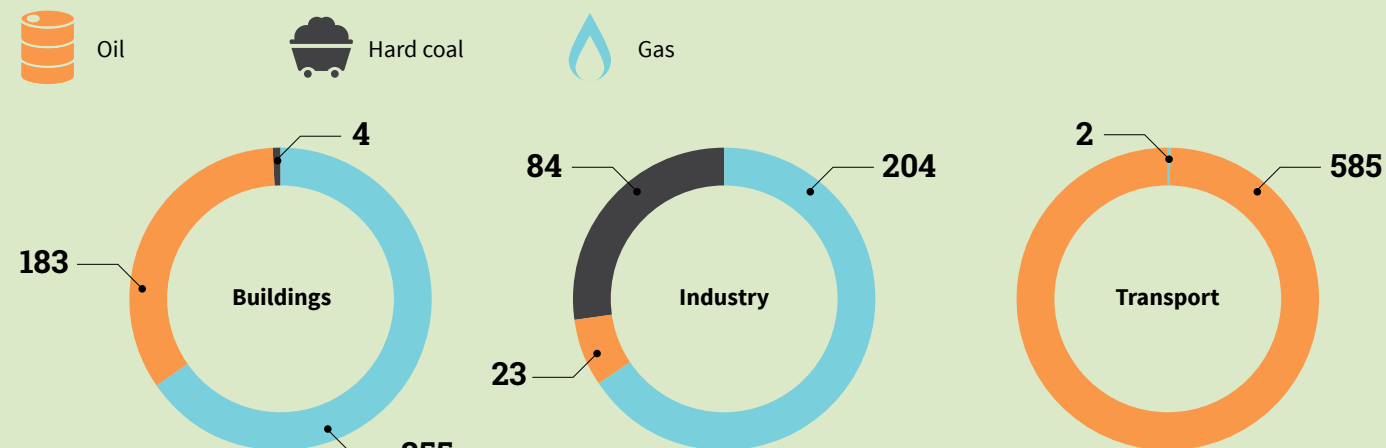
Crude oil imports 83 mn tonnes



Sources: BP Statistical Review of World Energy, BAFA, Association of Coal Importers

Where were oil, natural gas and coal consumed in 2020?

Final energy consumption in selected consumption sectors; all figures in TWh for 2020



Sources: AGEB; dena pilot study Towards Climate Neutrality (Aufbruch Klimaneutralität)

There are also several energy islands in the planning stage. These aim to couple wind energy and hydrogen production and use the corresponding infrastructure to bring their production to shore. Another example: the 'Desertec' concept. It's often told using a red square on the desert, symbolising an area that would be sufficient to produce energy for the entire planet. A captivating idea. But this approach got lost in the desert sand, so to speak, because the later economic initiative of the same name only involved representatives from Germany, and they wanted to push a single technology: large-scale solar thermal power plants. Now, the idea is getting a second wind with the prospect of being able to produce not only electricity and heat in the desert, but also hydrogen.

Spaceship Earth

Big ideas need big support. Which is why the subtitle of dena's pilot study is a 'task for society as a whole' when it comes to the goal of climate neutrality. But what about us as individuals, about society as a whole? How great is our imagination and our readiness for change? Things do not seem to be going well for us at first glance. We are all exhausted from the global pandemic. The pandemic has created social conflicts and revealed how difficult it is to agree on rules that come with restrictions. The pandemic has also reinforced a long-standing trend regarding a loss of trust in politics. According to an Allensbach poll from April 2022, 31 per cent of respondents say they live in a 'sham democracy', one 'where citizens have no say'.

And on the other hand, the war has increased the economic pressure on many citizens to act and strengthened their willingness to engage in solutions that lead out of the crisis. This is a great opportunity for energy transition and climate protection, with energy efficiency leading the way. They have the right offerings and can reduce the pressure and force the transformation. It is an urgent task being placed on politicians to ensure that this message reaches many people quickly because a one-time traveller with a vision cannot achieve the climate transition. For that, all of us in Spaceship Earth have to help. ■

Photos: picture alliance/ZB/euroluftbild.de



Transformation: the former Lohberg coal mine is now a space for creativity and art.



'It is a big mistake if we do not at least try innovations.'

The challenge of climate neutrality cannot be met without disruptive innovations. dena's Chief Executive Andreas Kuhlmann and SPRIND Director Rafael Laguna de la Vera are convinced that this will require more courage to take risks and make mistakes.

INTERVIEW Hanne May PHOTOS Thomas Imo/photothek

transition: everyone agrees that innovation is a central basis for the successful transition towards climate neutrality. At the same time, there is a dispute over the principle here. The dispute asks: do we need many new technologies to achieve this ambitious goal? Or is everything actually already there and just needs to be rolled out consistently? What is your assessment? How much innovation do we need for climate neutrality?

ANDREAS KUHLMANN: I find it sad that there is this conflict. We must not play one off against the other. Many companies in industries that we need to change make a large part of their turnover with products that were developed only a couple of years ago. But I'm certain that we need to scale innovation in a specific way. Progress needs a direction, and people are always looking for progress. We need to create the right framework for innovation to go in the right direction. No one should have anything against that.

RAFAEL LAGUNA DE LA VERA: Exactly! I don't see a contradiction at all. We need to get moving forward with existing technologies. But something dramatic has to happen before we can become completely CO₂-neutral, even in industry. We actually have to become CO₂-negative to get back to pre-industrial levels. This is not possible with the existing technologies and their capabilities right now. Sometimes we decide against innovating a technology so that we can make it really clean first. My favourite example is nuclear power, where we stopped investing 30 years ago and phased out ten years ago. Yes, it was dirty, especially in terms of final storage. But it would of course be a great solution if it could work. It is a big mistake if we do not at least try innovations.

KUHLMANN: We can also learn from the past. Ten years ago our view of the energy transition and climate protection was different than it was five years ago. And five years ago, it was different from today. If we work

with a certain level of trust in the advances of the future, we will be positively surprised, and we need these surprises.

This new thing, what does it look like exactly? Are we already working on many approaches, but haven't found the right trick yet? Do we optimise existing technologies, or do we need completely new approaches?

LAGUNA: We need to experiment as much as possible, in a mix of incremental improvement, new approaches and, in some cases, a shift in the technologies. We will see new types of electricity grids or nuclear fusion. There are many paths to nuclear fusion, some of which we have been researching for decades, and many of which we are only at the beginning of. Maybe the breakthrough will come from something completely new. At SPRIND, we are also working on engineering improvements, such as the high-altitude wind turbine. If we move the generator down lower and rotate the whole tower, we don't need a gearbox and, in the process, we create an asymmetrical design that makes hub heights of 300 metres and more possible. And at much less cost than before. That sounds incremental, but it's more like three times incremental multiplied together – meaning it's disruptive. Such innovations are within reach in the next five to ten years.

KUHLMANN: Some say that everything already exists in the building sector and we don't need anything new. But we see an incredible number of innovative ideas among the startups, especially in this area: from building materials and energy management to the integration of various components for the building. These approaches need new regulatory concepts and they require a different behaviour. Innovation is technological, regulatory and social, and in all three of these dimensions, we need an openness and interaction.

Typically you would narrow things down to specific solutions when working toward a successful inno-

RAFAEL LAGUNA DE LA VERA has been the founding director of the Bundesagentur für Sprunginnovationen (SPRIND) since 2019. SPRIND seeks out and promotes new research ideas that have the potential for disruptive innovation with a willingness to take risks, be flexible and accept mistakes. In this way, inventions will be able to give rise to new technologies and markets that will secure prosperity in Germany and Europe. Laguna founded his first startup as a teenager and went on to establish several technology companies.

vation. How do we break up such developments again in order to be able to tap further potentials that we need for the ambitious goal of climate neutrality?

LAGUNA: This phenomenon is called path dependency. Nuclear energy is one example of it. It traces its origins to the Manhattan Project in the US, where plutonium was to be produced for an atomic bomb. All other nuclear fission technologies that did not provide nuclear bomb material for the military were not pursued because we had already developed the path dependencies with uranium and plutonium. Secondly, you have to be careful not to create a monopoly. There is nothing wrong with an industry locking into one technology and optimising it as long as there is demand for other participants in the market. You can't drive out the top dog with the same rules and the same technology.

You need to want to do something different in order to do it better – this is what encourages innovation. We just have to make sure that we give these small players a chance. Participation in tenders is often so expensive that that small companies drop out right from the start.

KUHLMANN: This is a very important point, and it hasn't yet been properly anchored in politics. There are many ideas here, but too often they get tangled up in all these specifications. We are simply too risk-averse in too many areas and need to be more courageous.

LAGUNA: Administrators are trained to avoid negative audit results, which makes them very risk-averse. If you don't want to make mistakes, you also won't experiment, and you'll prefer to work with the well-known players from past years. We have created a system that is incredibly resistant to change. We have to dismantle this, for example, with organisations like SPRIND. Our job is to take risks and finance project ideas that can also fail sometimes.

KUHLMANN: Surveys show a declining interest in startups in Germany on the one hand. But on the other hand, the number of startups is increasing. Nevertheless, we are still about average in Europe. But there is a large amount of movement in the market, so that some are already complaining that initial assessments are too high. Basically, we have a great dynamic; we just need to speed it up.

We have the dynamic, and we have capital flow. What else do we need in

this ecosystem for innovation if we are going to improve things?

KUHLMANN: For example, spin-offs are too complicated. On the one hand, of course, we want research institutions to also think entrepreneurially and have an interest in being involved in the companies they initiate themselves. On the other hand, we often lose a lot of time, patents are left unused and

companies don't get out fast enough. We would have to change the regulations here in order to speed things up for the spin-offs.

LAGUNA: I think we need to have an innovation privilege here. Those who create the intellectual property during their work at universities and institutes should be able to take it with them free of charge when they start a company. Sure, it was paid for using taxpayer money, but it was developed through an academic research commitment to education. But we also don't charge students a licence fee when they apply what they learn outside in life. The government has to look at this from an economic point of view. Ultimately, startups create jobs, markets and products, and this fact pays off many times over.

I see a need for action in the financing cycle. There are quite a few gaps there. The later in the development phase a startup is looking for funding, the less likely it is to find it in Germany. When it comes to the series C and D funding, when €50 or €100 million are at stake, the foreign investors almost always take blocking minorities.

Nothing against foreign investors, but they should not get control over these companies. We have all heard about the SoftBank Vision Fund, which has €100 billion in capital.

So do we need a German version of the SoftBank?

'We need to have an "innovation privilege". Those who create the intellectual property during their work at universities and institutes should be able to take it with them free of charge when they start a company. Sure, it was paid for using taxpayer money, but it was developed through an academic research commitment to education. But we also don't charge students a licence fee when they apply what they learn outside in life.'

Rafael Laguna de la Vera

LAGUNA: European or German, absolutely! Germany has set up the 'Future Fund' into which €10 billion will flow initially. Other vehicles such as the High-Tech Gründerfonds have also been upgraded and endowed with more funding. And now we have to shine a light into the dark corners where nothing is happening yet. And last but not least, we need a European mid cap stock exchange. Investors will also want to cash in when companies are through with late-stage financing – and that is usually managed through an IPO. We need to create better conditions for this.

What are the preconditions for the really big innovations, the disruptive ones, in Germany? We see ourselves as the land of poets, thinkers and inventors. But how well are we positioned today?

LAGUNA: We're living off the disruptive innovations of 100 or even 120 years ago. They shape our economy today. Companies in the chemical, pharmaceutical or automotive industries often still bear the names of these inventors. We have created a very successful system for science, but it is a closed system. Science and the economy are not connected well enough, which is why industry primarily produces incremental innovation. That is why we have SPRIND. After just under two years, we can say that they still exist, these inventors. We have received over 700 project submissions, of which at least ten per cent have the potential to be disruptive innovations. We have financed 20 projects and are investing seven- to eight-figure sums in five of them.

ANDREAS KUHLMANN has been dena's Chief Executive since 2015. He holds a degree in physics. When it comes to the energy transition and climate protection, he always keeps the big picture in mind. And he is convinced that clever framework conditions and the necessary degree of openness create the right climate for innovation.


In which fields would we need disruptive innovations to better meet the challenges of climate neutrality?

KUHLMANN: Integrated concepts will be how we will primarily make progress and tap into potential in the future. Molecules, that is, hydrogen and power-to-X, will also be quite prevalent. The entire spectrum of recycle and reuse is a gigantic task, and we are still at the very beginning. Innovations in the huge field of food, agriculture and mobility are of course extremely important. All sectors that are central to the energy transition and climate protection, that is, mobility, energy, industry and heat, digitalisation – everywhere where dynamic developments interact with each other. In turn, this creates an enormous dynamic that is almost impossible to predict.

LAGUNA: We have all these topics in our project submissions, such as building materials that are also capable of reducing CO₂ or new biochemical processes for recycling. It's crazy! They always say that disruptive innovations are very risky. Yes, things can go wrong in many places. But there are so many. Eventually something will work out in each of these areas. But we have to be careful not to leave technology paths too early. Technological developments are often messy at the beginning. You need to keep at it long enough.

'The numerous transformational changes in which we find ourselves, or that are still to come, require a great deal of social innovation. If we don't empower and encourage people to follow these paths, there will be quite a lot of chaos.'
Andreas Kuhlmann





'If you don't want to make mistakes, you also won't experiment and you'll prefer to work with the well-known players from past years. We have created a system that is incredibly resistant to change. We have to dismantle that.'

Rafael Laguna de la Vera

'Basically, we have a great dynamic; we just need to speed it up.'

Andreas Kuhlmann

KUHLMANN: The discussion about the necessity of bans fits in with this. Annalena Baerbock said during her election campaign that every ban is also a driver of innovation. That's true, but only in part. Because bans also always close off possible options for achieving the climate targets. In the end, we need the reasoning powers of decisive politicians and the right sense of openness if you want to be successful.

LAGUNA: In our experience, we see that the departmental structure at the federal level tends to hinder such openness. That is why such a major issue as climate neutrality would require the creation of an independent non-departmental office within the government. It should only be staffed by experts, and not politicians. After all, we would first have to formulate a competent strategy that is free of special interests. The defined tasks could then be distributed among the various departments or ministries again.

KUHLMANN: In any case, all core ministries for climate neutrality should have structures and contact persons for the topic of innovation in their respective policy departments. We will only be successful if we manage to create and nurture ecosystems, provide an appropriate budget and give a lot of freedom to the stakeholders. There are two, three hundred people who are experts on the subject. And they would then spread the expertise to all industrial sectors. This would be a huge win for us! But such an approach needs conviction. It will require overcoming many structural obstacles.

Are there other organisations or countries where this works the way it was just outlined here? There is plenty of money, freedom and time to drive innovation. Are there any success stories here?

LAGUNA: For example, the US has DARPA, the Defense Advanced Research Projects Agency, after which we modelled our organisation SPRIND. The aim was to create an instrument that is independent of departments and ministries and that can provide funding and financing in a very agile manner. They are attached to the secretary of defence, but they are entrusted with the task, allocate a budget and have the power

'It is only partly true that every ban is also a driver of innovation. Bans also always close off possible options for achieving the climate targets. In the end, we need the reasoning powers of decisive politicians and the right sense of openness if you want to be successful.'

Andreas Kuhlmann

to give the go-ahead. DARPA had already funded ten companies to work on advancing mRNA technology in 2011. These include the US-based company Moderna and the Germany-based companies Biontech and Curevac. The agency has provided several million dollars each and produced technology – nanolipid technology in this specific case. Which is exactly what is used in these vaccines today. And it was a long shot. It took almost ten years after starting in 2011 and a lot of private money for mRNA technology to be applied to a pandemic, which was not easy to predict back then. But that is what characterises good platform technologies and disruptive innovations.

KUHLMANN: We could have similar potential in Europe. But we don't leverage it enough. We need to direct our attention to this more: green lead markets, public procurement and all these things. The European Single Market must provide us with the conditions for what we need in future. Only then will we gain the scaling potential to be able to operate globally as well.

We have talked a lot about technological innovation. What about people and their capacity for change to deal with these new technologies? What role does social innovation play in the grand scheme of things?

KUHLMANN: An important role. When you put mobility concepts for rural areas out to tender, it involves social innovation. When you look for new forms of participation,

that is social innovation. The numerous transformational changes in which we find ourselves, or that are still to come, require a great deal of social innovation. If we don't empower and encourage people to follow these paths, there will be quite a lot of chaos. On the other hand, there is also a very great openness of societies to embrace innovative developments. I'm not a historian, but I know of no culture in the past that managed to emerge from a crisis by doing nothing or even less than nothing. It mostly went forward through leaps in innovation.

LAGUNA: I don't believe that social innovation happens in a vacuum; it is always triggered by changes in the environment, technologies and economic cycles or by crises. There are often disruptions along the way and this also causes damage. So why bother? At SPRIND, we use the sustainable development goals (SDGs) when selecting projects. If the balance going in is negative, it is probably not one that benefits as many people as possible. In the free market, there are innovations that, with a lot of risk capital, nestle in between consumer and producer and, once they have taken the monopoly position, lock things down in both directions. These are negative-sum games that harm more people than they help. We need to avoid these situations. It's our mission as a government-funded agency in any case. But I think that you should also look critically at innovation in your own life in the same way. And when you do that, you make sure that the social innovations that go with it happen. ■

A WORD WITH...

The new federal government has been in office in Germany since December 2021. The energy transition and protecting the environment are at the top of their agenda. What specific plans do they have? How can the transformation be accelerated? We spoke to key figures in the federal government to ask what the most important issues are right now.

1
What is the most effective tool available in your field for helping us achieve our climate targets?

2
We often spend a lot of time focusing on problems. To turn that on its head: what opportunities does the transformation offer?

3
What will be the most noticeable changes for all of us?



Robert Habeck

Federal Minister for Economic Affairs and Climate Action



Annalena Baerbock

Federal Foreign Minister

There is no single measure for us; the only way to succeed is by using a mixture of tools and ensuring everyone pulls together. If we don't introduce additional climate measures, we will, in all likelihood, fall well short of the 2030 targets in all emissions sectors: transport, construction and housing, power generation, industry and agriculture. We need to do more and increase the pace. That is why we in the federal government, and my department in particular, have been working at full steam to produce the Easter Package, the largest energy policy amendment in decades. In future, renewable energies will be in the public interest and serve public safety; this will decisively accelerate their expansion.

An ambitious implementation of the Paris Climate Accords will require close international cooperation. We already have some positive examples of this, such as the *Global Methane Pledge* and the *Just Energy Transition Partnership* with South Africa, which aims to promote a socially just and sustainable energy transition. We are using our current G7 presidency to strive for more partnerships along these lines. Establishing greater cooperation with major emitters is the only way for us to conquer the climate crisis.

The transformation process offers enormous opportunities. On the one hand, it is the most important key to energy sovereignty and thus, in light of the Russian aggressions in Ukraine, a question of national and European security, now more than ever. At the same time, good climate policy will also modernise our country and secure Germany's status as an industrial hub. Investment decisions in recent weeks and months have shown that renewable energies have already become a decisive location factor. In addition to this, the world's most important economic regions have made a commitment to achieving climate neutrality by the middle of the century. Germany needs to be at the forefront of the global race for the best technologies and become a driving force once again.

The Russian war of aggression on Ukraine has been a painful lesson, showing us that dependence on fossil energy imports is an issue not just for the climate, but in terms of security as well. The transformation gives us a way of becoming more independent and will help to safeguard our free way of life. At the same time, it also brings with it huge development opportunities. The cards of the global economy are being reshuffled. Disruptive innovations in the field of energy supply could lift millions of people out of poverty. We want to be a part of this process, be that through technology transfer, partnerships or other means. For example, there are ports in Africa that present the perfect supply locations for climate-neutral synthetic fuels. And with our hydrogen diplomacy offices in the region, we are already helping to push this development forward.

One thing is clear: there will be changes. Wind turbines, a different form of mobility, the restructuring of industry; these changes come with great opportunities, but they also require something of us as people. It is important to me to make these changes socially acceptable and to explain the processes involved to the people. But I'm certain that I firmly believe that if we get it right, we can establish a new dynamic and trigger a boom in new technologies, creating new jobs and branches of industry.

The climate crisis acts as an accelerant for conflicts over scarce resources and represents a risk to global security. Extreme weather events often hit hardest for those who are largely defenceless against them. This is why we support initiatives like the strengthening of ecosystems such as mangroves, which form a natural bulwark against flooding, and we are helping to establish insurance systems so that vulnerable groups do not lose their livelihoods as a result of these disasters.

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Steffi Lemke

Federal Minister for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection

In the BMUV, the main tool we have at our disposal is natural climate protection. Nature is a huge carbon store. Before Easter, I presented key points for a natural climate protection action programme that would strengthen near-natural forests, peatlands, floodplains and other carbon sinks. I also spoke about a national peatland protection strategy with incentives for the rewetting of peatlands. In addition to this, we can also look to recycling and waste management and climate adaptation, especially in the form of forward-looking urban and regional planning.

The transition from the fossil age to the future can act as a long-term safeguard for our livelihoods – and thus for our security and prosperity. In addition to the climate crisis, species extinction must be stopped and an era of renaturation ushered in. This will contribute to our new prosperity and help us achieve a better quality of life. For example, green cities are not only good for biodiversity and the climate, they also provide fresh air and help to regulate the temperature and the water balance.

Change is constant. What matters is making sure those changes take us in the right direction. That isn't something we can take for granted. It's something we have to fight for, and it requires smart politics. The German federal government sees adherence to our planetary boundaries as a guiding principle. Among other things, we need to make sure that the more sustainable products and services are also the more attractive ones – that goes for electric cars, buses, trains, reusable solutions and much more besides. Heat pumps and a right to repair are part of this, too. These things will help us to protect our environment, our resources and our climate in equal measure.



Daniela Kluckert

Parliamentary State Secretary to the Federal Minister for Digital and Transport

The climate protection targets we have set ourselves in the transport sector are ambitious. As such, all carriers need to do their part. We need alternative drive vehicles on the roads, we want to shift freight transport to the railways, improve cycling facilities and digitalise local transport and make it more attractive. These are just some of the issues we are currently addressing. It is clear that road transport accounts for the largest share of greenhouse gas emissions in the transport sector. Therefore, it is of particular importance to me to implement effective and socially sustainable measures in this regard.

The transformation offers us a wide range of opportunities for the mobility of tomorrow. Clean and quiet electric vehicles will completely change the way we experience mobility. And with the possibilities offered by digitalisation, we will be able to make use of new services and links in local transport. Rather than our problems, we should be using this positive image of climate-friendly mobility as the starting point for our discussions. Such an approach would be beneficial to the mobility economy, too.

I firmly believe that it won't be long before we start noticing how pleasant lower-emission mobility can be. New mobility products and services are already attracting plenty of enthusiastic users, and large numbers of people are discovering the benefits of cycling as well. Policymakers need to ensure that climate-friendly mobility choices become a matter of course. However, one thing is clear: mobility is not something that can be decreed from above. Every citizen needs to be able to decide for themselves what mode of transport they use. Politicians can come up with good ideas and opportunities, but the people have to have the final say.



Klara Geywitz

Federal Minister for Housing, Urban Development and Building

Here at the new Federal Ministry of Building, we want to play a key role in helping the country achieve its climate goals. The climate, housing and construction go hand in hand. In concrete terms, this means advancing the energy transition in the building sector and providing incentives for conversions and resource-efficient construction from the outset. Last but not least, we want to make progress with the expansion of wind energy, which is an area we are involved in as the ministry responsible for regional planning.

First of all, we always need to be aware that climate change presents us with major problems. But regardless of this, the transformation also brings with it incredible opportunities. Take housing, for example. This is an area we can now rethink completely: you start with an integrated neighbourhood concept, then that is linked to other important urban planning issues, such as nature conservation, housing and social aspects. This kind of holistic approach offers enormous potential not only in terms of energy efficiency, but also in the way we live together as a whole.

We will have to be even more conscious, sustainable and economical with the way we use our existing resources. This means looking at using existing building space first by converting attics, renovating old buildings or converting properties, rather than going straight to creating new living space as the default option. There will also be changes with regard to building materials – wood as a sustainable resource for construction will be key. Smaller living spaces will be too – but offset by larger communal areas. This will also help us to combat loneliness in our society.

Photos: Bundesregierung/Steffen Kugler, Deutscher Bundestag/Inga Haar, Werner Schüring



Is this what the future of semi-urban life looks like? A self-sufficient village model that makes do with little space.

INSIGHTS

In **Insights**, we show you where and how we are making progress on climate action, both in Germany and worldwide. dena provides insights into a selection of projects: from the National Hydrogen Strategy to climate protection managers, the lull in wind and solar power, efficiency buildings, green hydrogen and e-scooters to carbon dioxide in your couch.

BUILDING A HYDROGEN ECONOMY

The use of hydrogen as a source of energy will be one of the key pillars in the transition to a climate-neutral energy system. dena is assisting the German federal government in the establishment of a hydrogen economy.

With the publication of the National Hydrogen Strategy (NWS) in June 2020, the German federal government set the country on a political course to quickly establish a market for hydrogen. Efficient technologies for generation and transport, a hydrogen infrastructure and a suitable regulatory framework are all crucial to the success of this initiative. Various federal ministries are involved in initiating and promoting related measures, and they have commissioned dena as one of a number of organisations to implement these measures. The organisation chart shown here depicts some of the important actors involved in the development of the hydrogen economy. There are also other stakeholders and projects not included on the chart. Detailed information on federal funding opportunities is available from the Hydrogen Pilot Centre (Lotsenstelle Wasserstoff). This is part of the federal government's 'Research and Innovation' funding advisory service and provides initial advice on the relevant support options.

The German National Hydrogen Strategy (NWS)
The NWS provides the framework for action to establish the generation, transport, use and re-use of climate-neutral hydrogen. The goals of the NWS are to achieve climate neutrality, to establish new value chains for the German economy, and to foster international cooperation on energy policy.

'Green Hydrogen' Innovation Officer
Dr Stefan Kaufmann, who directs the BMBF's research and development activities, is the driving force behind this initiative, taking innovative approaches from research and putting them to practical use.



EXAMPLES OF DENA PROJECTS

Implementation of the National Hydrogen Strategy (NWS)
dena is assisting the BMWK in the implementation of NWS measures, for example by organising stakeholder dialogues. In 2021, for example, part of these technical dialogues revolved around the question of the decentralised production and use of hydrogen.

The Hydrogen Coordination Office
dena is one of the organisations charged with setting up and operating the Hydrogen Coordination Office. The Coordination Office provides organisational and communications support to the National Hydrogen Council (NWR). Coordination between the federal government and the individual federal states is also part of its remit. Since June 2021, the Coordination Office has had its own headquarters in the Green Garage on Berlin's EUREF campus.

Global Alliance Powerfuels
The Global Alliance Powerfuels is an association of leading multinational companies and scientific institutions that was founded in 2018 on the initiative of dena. It aims to drive forward the development of a global market for powerfuels.

H₂ dezentral
H₂ dezentral is a platform for decentralised hydrogen projects that supports market players at every stage of the value chain, as well as research and pilot projects. dena carries out moderation and coordination work for the platform. The focus of the platform's work is on the current state of the art, potential business models and suitable framework conditions.

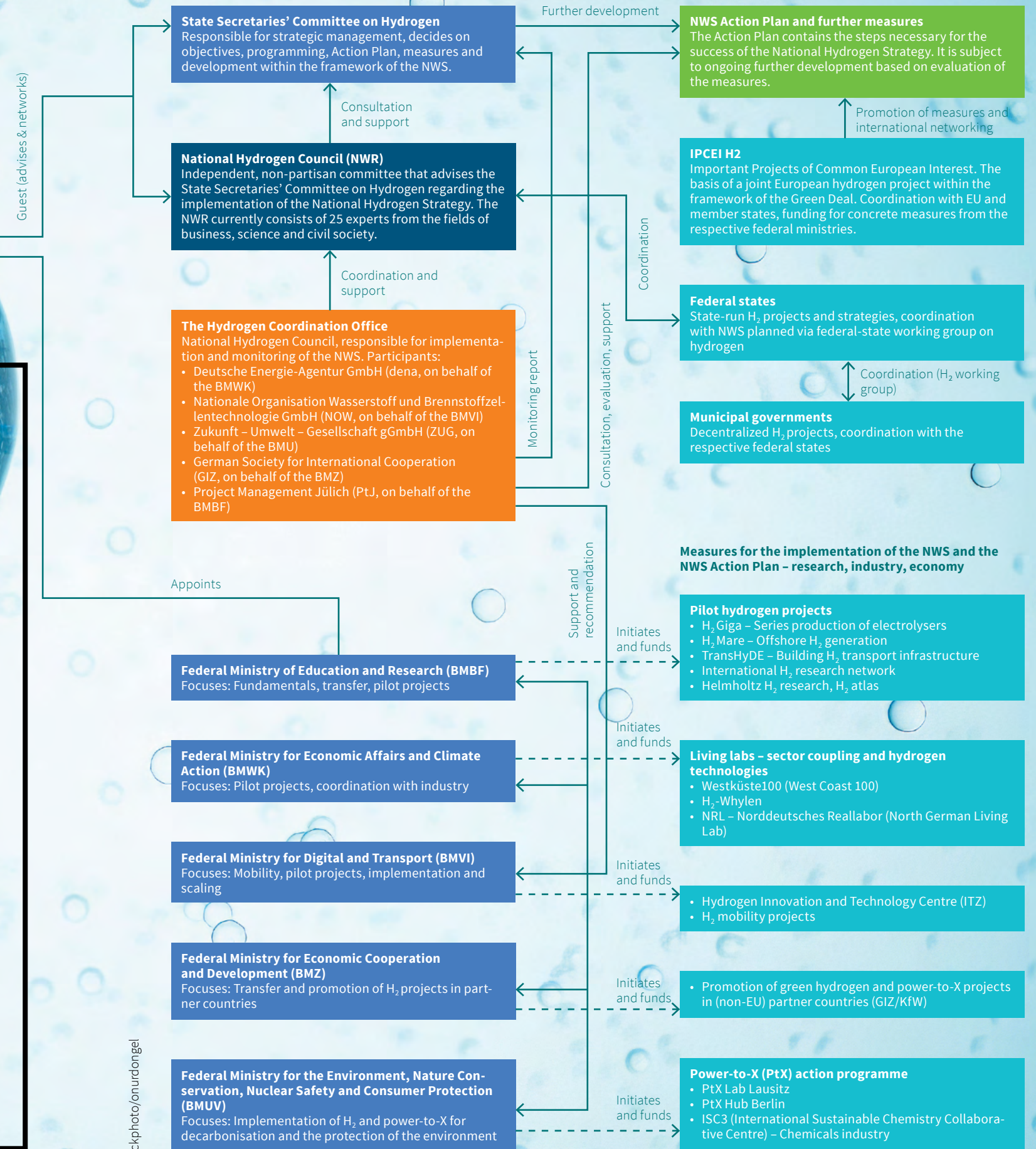


Photo: iStockphoto/onurdongel

THE CLIMATE GIANT

The world's largest emitter of CO₂ wants to become climate neutral. Beijing's leadership has set ambitious goals to help the country achieve this. For the time being, however, China's energy consumption continues to grow apace, and its emissions are also on the rise. Experts from dena are among those helping in the race to reverse these trends.

TEXT Fabian Kretschmer

If you want to see the climate policy ambitions of Beijing's state leadership with your own eyes, you'll have to take a two-hour flight west of the Chinese capital, to the province of Gansu. The poorest of all the regions in the People's Republic, Gansu is an arid wasteland on the edge of the Gobi Desert peppered with moon-like crater landscapes. It is also home to what is by far the largest wind farm in the world, whose huge turbines generate more than 10 gigawatts (GW) of electricity. Construction on the wind farm took more than twelve years to complete. In the end, the large-scale project cost the equivalent of more than €13 billion – many times more than the initial investment estimate.

A promise with impact

These are the kinds of record-breaking efforts that will be necessary if the world's most populous country is to achieve its ambitious climate goals. In September 2020, China's head of state Xi Jinping caused a sensation in environmental policy during the UN General Assembly in New York. 'China will strive to peak carbon dioxide emissions before 2030 and achieve carbon neutrality before 2060,' the 68-year-old said. This was the first time the People's Republic had presented a timetable for achieving a climate-friendly future.

'This is a really big deal. In China, when the strong man at the top says something, it gets done,' says Trey McArver, of consultancy firm Trivium China. This is because, in China's hierarchical political system, when the president makes such a promise on the international stage, the country's authorities have no choice but to

implement it. At the same time, any move by such a giant neighbour is sure to trigger dynamic change throughout the entire region. This was demonstrated only a few weeks later, when South Korea's government announced its intention to become climate neutral by 2050.

The reactions of international civil society were generally euphoric. Think tank Climate Action Tracker spoke at the time of the 'largest CO₂ reduction we have ever estimated,' saying the move would 'lower global warming projections by 0.2 to 0.3 degrees by 2100'. 'China should set more specific near-term targets, but China's direction of travel toward a zero-carbon future is coming into focus,' said Helen Mountford of the World Resources Institute in Washington, one of many experts to welcome the change.

The country finally took its first real step towards implementation in July 2021, when it launched the world's largest emissions trading scheme, which boasts participants from over 2,200 companies in the energy sector. Together, these companies produce around one seventh of the world's total fossil fuel emissions.

China key to climate solution

The world's most populous country, which has risen from abject poverty to the world's second largest economy since opening up its economy in the early 1980s, has long been the largest emitter of CO₂ on the planet. However, the double-digit annual growth rates achieved by China's economy in recent years have come at a high price. In the early 2010s, the large cities along the country's east coast suffered from such sky-

high particulate levels that citizens looking out of their front windows could often have been forgiven for thinking they had woken up in an apocalyptic science-fiction film.

In 2020, the country accounted for 31 per cent of global greenhouse gas emissions – more than all the other industrialised nations combined. – By way of comparison, the USA – the country placed second in the ranking – was responsible for a much lower figure of 12.6 per cent. Per capita, however, Chinese energy consumption is below the OECD average and lower than that in Germany, for example (see infographic). That won't be the case for long, however. Calculations predict that China's primary energy consumption will double by 2040, accounting for a quarter of global demand. There can be no doubt about it: the climate issue can only be resolved if China is willing to work with the global community and increase its own efforts.

The importance of this issue to the world's two leading powers is reflected in the regularity with which the USA and China's special climate envoys meet and talk. John Kerry's most recent visit to the People's Republic was in early September 2021, while both nations also participated in the 26th World Climate Conference, which was held in Glasgow in early November 2021. The climate issue is one of the few fields in which the two competing states debate with one another and show a willingness to cooperate.

'CO₂ neutrality is simply a necessity if we take the results of science seriously,' says Li Shuo, energy expert at Greenpeace's Beijing office. 'This not only requires massive investments, but also immediate,



ANG YE

dena Team Leader, International Building & Construction

How is dena's project work in China going?

The announcement of China's carbon neutrality target for 2060 has breathed new momentum into our partnership – especially in the fields of energy-efficient construction and low-carbon eco-cities. For example, we are currently working on assessment systems for climate-neutral buildings and neighbourhoods, as well as consulting services to aid with this process.

What is the biggest challenge for you here?

The municipal administrations we work with still see achieving carbon neutrality primarily as a job for the energy suppliers – without considering the way it ties in directly with factors such as buildings and mobility. We want to tackle the matter differently and foster a cross-sectoral mindset.

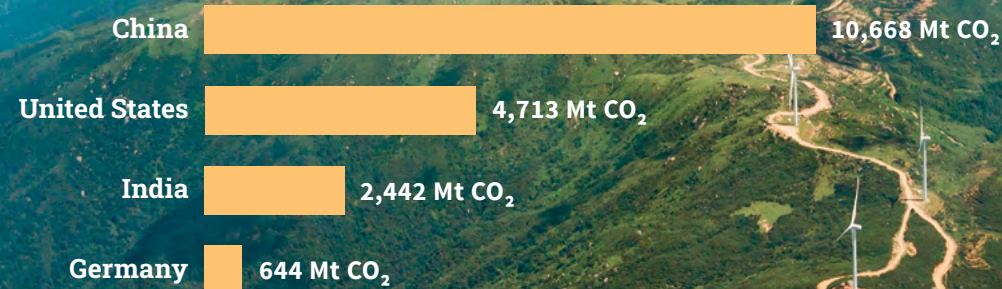
How can we communicate this integrated approach?

We are continually striving to incorporate the integrated energy transition into all our Chinese building and urban development projects. This gives us a great opportunity to demonstrate our holistic approach using practical examples. The dena pilot study, 'The Start of Climate Neutrality (Aufbruch Klimaneutralität)' has also been a useful tool for us in communicating how the different factors all tie together across sectors.



Energy-efficient construction techniques are taught at regular dena workshops in China.

CO₂ emissions in 2020



Mt = megatonnes, t = tonnes
Source: www.globalcarbonatlas.org

CO₂ emissions per capita in 2020



unprecedented efforts – including a construction freeze for new coal-fired power plants.’

Here, too, the current situation is sobering: half of all the coal-fired power plants in the world are located in China, and the country’s coal production reached a record 4.07 billion tonnes in 2021. The powerful coal lobby is seen by environmental experts as one of the biggest challenges to a successful energy transition.

Investment in renewables and electromobility

At the same time, however, the People’s Republic is investing more in renewable energies than Japan, the USA and the European Union combined. In 2020 alone, Chi-

na installed 72 GW of generation capacity in the form of wind turbines, and 48 GW in solar plants. In 2021, China generated 29.8 per cent of its own electricity consumption from renewable energies. The aim is for more than 50 per cent of the country’s electricity production to be generated from non-fossil sources by as early as 2030.

In terms of the transport transition, the Chinese state has already demonstrated how rapidly the country can push through its goals. The number of factories being built for electric cars in China is almost equal to that in the entire rest of the world. State funding has provided an infrastructure of 800,000 public charging stations across the country, and despite the

crisis, the government invested the equivalent of €1.2 billion in 2020 alone. By way of comparison, figures for the first quarter of 2022 recorded slightly more than 27,700 charging stations throughout Germany and about 41,000 in the United States.

However, China’s government officials are well aware that they will only be able to achieve their self-imposed goal with help from abroad.

German-Chinese cooperation

One example of such assistance is the German-Chinese Energy Partnership, which was founded in 2006 and discusses approaches to solutions for a successful energy transition through various forms of communication. In addition to government representatives, leading players from the business community also participate in this initiative. The main focuses of this partnership are on the promotion of renewable energies, developing a sustainable heat supply and implementing innovative financing models. In the long term, it is hoped that this will improve the security of supply in both countries.

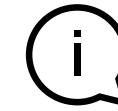
EnTrans (the Sino-German Energy Transition Project), which is run jointly by dena, the Gesellschaft für internationale Zusammenarbeit (German Society for International Cooperation/GIZ) and Berlin think tank Agora Energiewende, is another example of such efforts. The main focus of this project lies in the exchange of knowledge between Germany and China in the form of workshops and studies. From the smart grid to energy efficiency in industry, the project

aims to gradually integrate renewable energies into the Chinese energy system. In the long term, the project is intended to help the People’s Republic of China achieve its goal of climate neutrality.

‘We have noticed that there is still a lack of expertise in China. This is the case in areas such as municipal energy and climate protection management (ECM) and in quality assurance for energy-efficient construction,’ says Ang Ye, Team Leader for International Building & Construction. ‘With that in mind, we have trained a large number of managers in ECM in recent years and provided specialists with training to ensure better quality assurance in the construction process. We have also launched projects in the areas of urban energy concepts, urban infrastructures and building standards.’ Before the pandemic, Ang Ye regularly travelled to the People’s Republic to supervise projects and exchange ideas with political decision-makers.

Huge potential in climate-friendly construction

The political will for the energy transition is definitely there, as the China expert knows. Since Xi Jinping’s promise of CO₂ neutrality, there has been a real race at mayoral level to see who can be the most innovative and effective in serving the central government’s goal. ‘The holistic approach of our work in Germany, in which we have been shaping the energy transition together with the involvement of relevant sectors and stakeholders, can be very helpful for our Chinese partners,’ says Ye.



dena promotes the exchange of knowledge and experience through a variety of German-Chinese projects. Important areas of focus include buildings, industry, electricity grids and urban development.

More information:
www.dena.de/china

to follow suit. Around 150,000 tonnes of CO₂ have already been saved thanks to dena’s pilot projects. And the effects are likely to be many times greater in the medium term – after all, China builds the equivalent of Germany’s total existing building stock every two years.

Rethinking economic growth

Unlike in Germany, where a large number of actors and an active civil society exert public pressure on policy, climate targets in China are always issued by the one-party state. Within the Communist Party, there is always trench warfare between the environmental authorities and the conservative economic planners, whose attention is focused purely on the numerical growth of the country’s gross domestic product. One of the Communist Party’s most fundamental fears is that discontent could rise among the population if the economic expansion engine falters. In the future, however, the Party wants to fundamentally rethink economic growth to incorporate ecological aspects alongside the monetary criteria already included in its figures. Environmental experts are celebrating this as a genuine breakthrough in incentivising local governments to act sustainably.

Only a few years ago, dena expert Ang Ye’s partners in China were still telling her that the country needed to develop its economy first before turning its attention to climate change, which was considered a luxury problem. Now, a rethink has begun: ‘Everyone is talking about the CO₂ target,’ says the dena expert. ‘We are in good spirits.’ ■



Stefan Schirmer and Yu Chual (centre) of dena provide expertise on building materials in Haidong, China.

Photos: shutterstock/SnwvSnnvSnnv, dena

EXPERTISE MAKES EFFICIENT BUILDINGS

A building contractor invests, an energy efficiency expert assists with the process, the state provides funding – that's how the three-way alliance in energy-efficient building works. dena provides a wide range of support in this area, bringing together builders and subsidies in a way that serves everyone's goals.

TEXT Ralph Diermann

Carrying out energy-efficient renovations and constructing new energy-efficient buildings are complex tasks. If a contractor wants to apply for state subsidies for a new building or renovation, they will need expert knowledge to ensure their success. That's where energy efficiency experts come in, guiding those who want to build through the entire process. But how does one go about finding experienced professionals in their local area? Who advises the advisors? Where can experts exchange ideas? And who checks and inspects the subsidised buildings?

Finding local experts

Anyone who wants to carry out an energy-efficient construction or renovation with the help of a subsidy can use the Database of Energy Efficiency Experts to find competent experts in their area. The expert energy consultants, architects, engineers and craft-people registered in the database cover

every aspect of construction, from private residences to municipal and commercial buildings, and even listed buildings and architectural monuments. Their qualifications are checked by dena. Only those who are listed in the database are allowed to apply for funds for their clients under Germany's federal funding scheme for efficient buildings. dena maintains the database on behalf of the Federal Ministry of Economic Affairs and Climate Action (BMWK), the Federal Office for Economic Affairs and Export Control (BAFA) and promotional bank KfW. www.energie-effizienz-experten.de

A portal for professionals

Even experts also need professional assistance. Gebäudeforum klimaneutral (the Climate-Neutral Building Forum) offers quality-assured information for professionals on climate-neutral buildings and neighbourhoods. This is a place where experts in the field of energy-efficient, climate-neutral building and renovation can network with one another. dena operates this platform on behalf of the BMWK. www.gebaeudeforum.de

Construction controls

KfW promotes energy-efficient renovations and new builds through low-interest loans and grants. For many projects, the level of funding available is linked to efficient house or efficient building standards. On behalf of KfW and with assistance from local partners, dena carries out random site inspections to check whether the buildings in question are in line with the desired standards.

Energy efficiency experts provide assistance with refurbishment, construction and subsidy applications.



KATHARINA BENSMANN

Head of Planning & Consulting for Climate-Neutral Buildings at dena

What is the biggest factor in the success of energy-efficient construction and renovation?

Our 13.000 experts. They know all the latest theories on energy-efficient construction and can put them into practice, too – in the form of sound advice, planning and sustainable concepts.

What are the biggest challenges at the moment?

The shortage of skilled workers and the implementation of integrated concepts that go beyond the individual building. Firstly, we need more experts, and secondly, we need to start working with larger dimensions. There is huge potential in looking at larger units such as neighbourhoods, municipalities and building portfolios. Holistic approaches require a high level of expertise, good standards and networking between the different actors involved.

What are the most important next steps?

Attracting more experts and providing them with better support than ever, in the form of good tools that will help them in their day-to-day work. Working closely with the experts and talking things through will enable us to identify and remove the obstacles in our path. We also want to make our successes more visible in order to provide motivation and encourage imitation.

10 TIPS FOR A SUCCESSFUL FUNDING APPLICATION

dena knows from practical experience that there are a number of mistakes people typically make in their accounting and applications. Luckily, these are easy to avoid.

1 List separate calculations for mixed-use buildings

If a building is used both for residential and other purposes, it may make sense to list separate calculations for the two different parts of the building. In some cases, separate calculations are actually mandatory.

2 Apply for new-build funding for extensions and expansions

If an extension to an existing building or an expansion of previously unheated rooms creates a new, separate residential unit, this new residential unit can only be subsidised as a new build. The existing building, on the other hand, is considered a refurbishment. The residential units do not always have to be listed separately.

3 List heated rooms as heated in your accounts

It is important to draw your 'system boundaries' correctly. For example, heated rooms – i.e., rooms with radiators installed in them – must be listed as such in your accounts. This applies regardless of whether the heating system is actually used.

4 Make sure you list the contributions of your heat generators correctly

Another common mistake occurs when listing the calculations for heat generators in residential buildings. When doing this, it is important to ensure that you apply the actual contribution of your solar thermal systems. If your plans include heat pumps, for example, you will also need to factor the power consumption of the heating element into your calculations.

5 Specify actual use of space

Information on the use of non-residential buildings must be provided using standardised use profiles. As such, it is important to use the appropriate usage profiles for your calculations. Applicants often select profiles (per DIN V 18599) that do not correspond to the actual use of the room.

6 Create individual usage profiles in accordance with the relevant standard

The usage of some non-residential buildings will not fit into the predefined usage profiles listed in the DIN standard. In such cases, there are two ways you can proceed: either classify the spaces as other common areas, or develop a custom usage profile. This individual profile must be developed on the basis of DIN V 18599 and requires an assured general level of knowledge. Generally speaking, simply tweaking individual parameters is not permitted.

7 Calculate drinking water requirements correctly for non-residential buildings

When calculating drinking water requirements for non-residential buildings based on the area of the building, the required coverage area is sometimes used as a basis. Rooms with a water supply, such as kitchens and shower rooms, contribute to a building's required coverage area. However, the figure that is actually relevant to the calculation is the area that generates the requirement, e.g., a production hall, as it is the size of such areas that determines how much drinking water the building actually needs.

8 Calculate your photovoltaic systems correctly

Adding a photovoltaic system to calculations for non-residential buildings is a common source of mistakes. For example, the specified module area is sometimes larger than in reality – or maybe the module area isn't specified at all. Unlike with previous regulations, it is now possible to deduct a fixed amount from your energy requirement based on the rated power installed (manufacturer's specifications). If you have battery storage, this amount will be higher.

9 Stick to your plan during construction

In practice, developers sometimes end up using building components whose insulation thicknesses and thermal conductivities do not match those in the plan. Differences in system technology are also common. Your plan must match the reality of your project once it is completed.

10 Submit evidence and tests in full

Making sure you provide all the necessary documentation in full is crucial if you want your application to be successful. Examples of the types of documents required include certification/tests for the hydraulic balancing of the heating system, for airtightness or for thermal bridges.

Climate-neutral security of energy supply

On the path towards a 100 per cent renewable electricity supply in Germany, today's coal and gas-fired power plants are being phased out as reserve power plants. New climate-neutral plants that guarantee a secure supply of electricity during lulls in solar and wind power generation are needed.

TEXT Marcus Franken



Several lignite power stations in the Lausitz region of Germany, a block of a gas-fired power station on the river Lippe and a further gas-fired plant in Emden are the fossil-fuel power plants which, as of late 2021, provide reserve backup capacity to safeguard the German energy transition. The operators, LEAG, Statkraft and RWE, have 1,056 megawatts (MW) of standby power plant capacity in case the solar/wind plants and energy storage systems in Germany temporarily cease to deliver power. This costs power consumers roughly €71 million per year since the German state has secured, via auction, the standby capacity provided by the power plants to prepare for the eventuality of a lull in wind and solar power (Dunkelflaute). It passes these costs on as part of the grid fee reflected in the electricity price.

Growing demand for reserve power capacity

The higher the share of renewables in the electricity mix, the more reserve capacity will be needed in the system: in the auctions for 2023 and 2024, the Federal Network Agency has already put out 2,000 MW of reserve capacity to tender to cover possible lulls in wind and solar generation. This is at a time when the share of renewable electricity is only around 50 per cent.

If the share of renewables in 2030 increases to around 80 per cent and the last remaining coal-fired power plants are taken offline, the required reserve capacity will continue to grow. Not only that, it will also have to be climate neutral.

When the capacity market for reserve power plants was introduced in 2015, the German government was able to purchase or lease existing gas- and coal-fired power plants, most of which would otherwise have been shuttered, as reserve capacity at very low prices. No new investments were needed. At that point it was clear that this would only be a short-term solution during the transitional period.

Stricter climate targets and mounting pressure to act

Since then, the climate targets have been tightened and the new German government is looking to significantly accelerate the expansion of renewables: one goal is to slash CO₂ emissions by 65 per cent and phase out coal by 2030. Another is to become climate neutral by 2045. There is no room for fossil-fuel power plants, even if they only supply power for a few days a year during lulls in wind/solar generation. In the case of coal-fired power plants, this is further aggravated by the fact that there is only limited scope to control them when providing reserve capacity. They are simply not flexible enough to perform this function.

At present, climate-neutral standby power plants only exist on paper, however. Furthermore, the only plants that can achieve this from a technical perspective are biomass or gas-fired power plants, which can then be operated with green gases or hydrogen in the future. dena estimates that demand for such climate-neutral reserve power plants will be at least 13,000 MW in the future, compared to 2,000 MW today. The real question is how to finance the construction of new carbon-neutral plants that provide standby capacity.

The wide gap between available and required reserve capacity

'We urgently need to find a replacement for the current conventional reserve power plants. In addition to making better use of flexibility in the electricity system, we will also have to promote the construction of flexible, climate-neutral power plants,' explains dena expert Tim Mennel, who coor-

dated work on market design in the Grid Study III.

The past few years have shown that these new plants cannot be financed solely through high prices on the electricity market, which automatically go up when the supply of renewable electricity is insufficient. According to 50Hertz CEO Stefan Kapferer, 50,000 MW of coal-fired and nu-

consultants at consentec are non-committal as well: 'It is not possible to make any particular recommendation as to which market design is the best to achieve the lowest overall costs when it comes to ensuring the security of supply.'

Incentives for climate-neutral power plants

For dena expert Mennel, there are three main pathways to promote the construction of new climate-neutral gas or hydrogen power plants beyond today's tendering procedure for reserve power plants.

Firstly, the Federal Network Agency could revise and update the reserve model. However, this would require new climate-neutral power plants to be put out to tender, with corresponding implications from a cost perspective. The disadvantage of this approach is that the power plants would then only be available when there is insufficient power available and that they would not contribute additional profits on the market while serving in the role of providing reserve capacity.

Another option would be a selective capacity market. In this case, the Federal Network Agency would issue an invitation to tender for new plants, which would receive a premium for new construction and subsequently take part in the normal electricity market. These premiums would likely be a more cost-effective option than procuring the plants as reserve capacity.

The decentralised capacity market is another model whereby responsibility shifts from a central government body to the market participants. Under this model, all major electricity consumers, such as municipal utilities and industrial electricity users, are required to obtain the power they need at all times via supply guarantees from climate-neutral power plants or firms that provide load flexibility. A market like this, with a multitude of suppliers and consumers, is considered to be highly efficient. One like it is in successful operation in France, for example, today.

It is up to the new German government to decide how to guarantee the security of the power supply in future. This decision must be made quickly since the power plants have to be planned and built. 'We need a quick decision from policymakers,' states Mennel, stressing the urgency of the matter. ■



DENA PILOT STUDY TOWARDS CLIMATE NEUTRALITY

Security of supply means that there is a sufficient amount of energy to meet demand at every hour of the year and at any time during the transformation process. This can be achieved by using hydrogen-ready gas-fired power plants and through flexibility. Section 9 of dena's pilot study Towards Climate Neutrality (Aufbruch Klimaneutralität) details how a secure, climate-neutral energy supply could be achieved in Germany.

More information:
www.dena.de/leitstudie

clear power plants will be taken offline in the coming years, while only 1,200 MW of flexible gas-fired power plants are currently under construction. The study by the consultancy firm consentec commissioned by 50Hertz concludes, like other studies also have, that there is no reliable way to 're-finance based on the price peaks that occur in the market, which are very difficult to predict'. The previous German government's hope that the plants would be built magically, thanks to the 'invisible hand' of the market, proved illusory.

The question of how the federal government can optimally promote the construction of climate-neutral reserve power plants has yet to be resolved. The team of



Flexible foam for mattresses: A team led by researcher Dr Christoph Gürtler has discovered a catalyst that allows CO₂ to be used in the production of plastic.

Covestro has developed a sock made of fibres containing CO₂.

Manufacturer Covestro utilises up to 20 per cent CO₂ in a plastic component made at this production facility in Dormagen.

CO₂ AS A RAW MATERIAL

Carbon capture and utilisation (CCU) is an important step on the path towards climate-neutral industry. Instead of being emitted into the atmosphere, CO₂ should be used in products. The goal is to create a carbon cycle that is as closed as possible, i.e. long product use or reuse.

TEXT Hans-Christoph Neidlein

Turning harmful waste gas into reusable materials: Materials manufacturer Covestro has shown how this can be done while also breaking new ground in creating useful raw materials from CO₂. At a high-tech production facility in Dormagen outside of Cologne, the company uses carbon dioxide instead of petroleum to manufacture a new type of plastic. 'This allows us to reduce the amount of fossil fuel that would typically be needed by up to 20 per cent,' says project manager Dr Persefoni Hilken.

The CO₂ reacts with the petroleum derivative propylene oxide during the manufacturing process and is fully incorporated

into the intermediate plastic product. The low-energy reaction is made possible by a custom-made catalyst. 'The final product of combustion – CO₂ – is highly inert. It first has to be activated in order to form a chemical bond,' states Hilken, describing the challenge faced in making the process work. For decades, experts had searched in vain for a catalyst and technology for the process. A few years ago, Covestro researchers, working together with specialists from RWTH Aachen University and the CAT Catalytic Centre in Aachen, finally achieved a breakthrough. In 2016 industrial-scale production of Cardyon began, with an annual output of 5,000 tonnes. Cardyon is now used in the production of mattresses and upholstered furniture as well as in automotive interiors and to surface playing fields. The CO₂ comes from a nearby chemical company, where it is captured during the production of ammonia.

Innovative approach to CO₂ capture

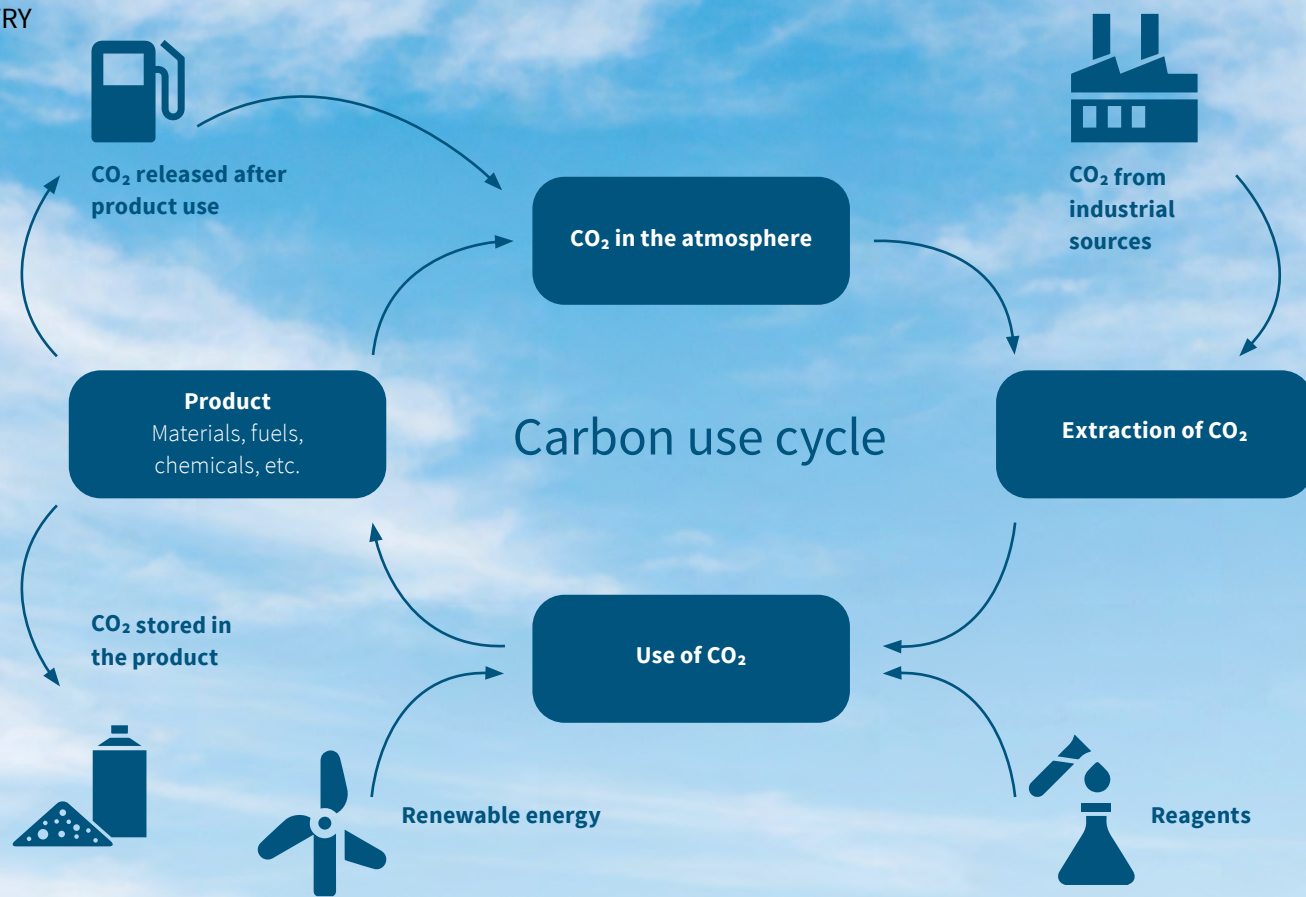
The Helmholtz-Zentrum Hereon has developed a highly efficient way to capture CO₂. A special membrane technology utilises a material that allows CO₂ to pass through more easily than other gas components. UK-based Cool Planet Technologies is now gradually implementing this technology at a cement plant operated by the Holcim Group near Hanover.



DENA PILOT STUDY TOWARDS CLIMATE NEUTRALITY

Carbon capture technologies can be used to eliminate emissions or achieve negative emissions. Whether emissions are net negative (carbon sinks), carbon neutral or net zero depends on the origin and the carbon sequestration period. The origin can be biogenic, atmospheric or fossil carbon. The sequestration period varies by product and is correspondingly short term or long term. To achieve net zero emissions by 2045, natural and technical sinks will need to generate negative CO₂ emissions of at least 70 million tonnes annually. A detailed analysis of the importance of natural ecosystems and technical sinks is provided in section 10 of dena's pilot study Towards Climate Neutrality (Aufbruch Klimaneutralität).

More information:
www.dena.de/leitstudie



‘More R&D is needed before CCU is ready for market’

The role of CCU in a climate-neutral energy system is not yet clear. Three questions for Dietmar Gründig, Head of the Industry Business Area at dena.

INTERVIEW Hans-Christoph Neidlein

What potential does CCU offer in terms of the decarbonisation of industry?

There are industrial processes that cannot be carried out from a technological perspective without CO₂ emissions in the foreseeable future, including the production of cement clinker by burning limestone. These emissions can be captured as a point source and either injected underground (CCS) or used as a raw material for use in the CCU process, especially in the chemical industry. To give you a sense of the vast potential of CCU, if the most important basic organic chemicals in Germany (simple alkenes and aromatics; roughly 12 million tonnes/year) were to be produced using CCU, about 38 million tonnes of CO₂ would be required annually.

What applications are currently the most promising?

Most point sources are technically suitable for carbon capture, though those that will still be around in a climate-neutral energy world – as opposed to fossil power plants – are of critical importance. These include cement plants and waste incinerators, individual processes in the metal and chemical industries, and processes involving biomass (BECCU: BioEnergy with Carbon Capture and Utilisation).

In most processes, simple organic compounds such as methanol are synthesised from the captured CO₂ using green hy-

drogen, which in turn is used to produce precursors for the production of plastics such as olefins. Another example is the production of urea as a raw material for products like fertilisers or synthetic resins. Today, petroleum derivatives are used for this purpose; this will no longer be possible in the future.

What challenges do you still see?

Today, CCU is not yet performed on an industrial scale. Even if the technologies are already available, further R&D is needed before they are ready for market. A transmission infrastructure, such as pipelines, will have to be built to transport the CO₂ from the source to the consumer.

It is also important to create incentive structures to facilitate the development and market penetration of such technologies. In addition to initial funding, sustainable market models will also be needed. In the long term, this may also mean integration into the EU emissions trading system.

Last but not least, it is also necessary to have a social debate to discuss what role CCU and CCS should play in a climate-neutral energy system. In our view, they are indispensable for achieving climate neutrality and becoming net negative in the long term.

This membrane technology consumes less energy than other carbon capture processes and does not require any additional chemicals, making it both cost-effective and versatile. The captured CO₂ is made available in ultra-pure liquid form and can be used for production in other industries.

Potential for the chemical use of CO₂

Industry must now be put on track to achieve climate neutrality in order to counteract the increasing pace of global warming.

In spite of this, the elimination of fossil fuels, the transition to renewable energies and improved energy efficiency still remain central goals. But there are areas where it will not be technically feasible to reduce CO₂ emissions to zero in the foreseeable future, such as in cement production or in certain chemical industry applications. This is a view shared by the authors of the condensed Prognos report on technical CO₂ sinks, which was prepared as part of dena’s pilot study ‘The Start of Climate Neutrality’. There is potential in the chemical use of CO₂ in particular, be it for conversion into other materials, base/special chemicals, plastics or mineral building materials.

Negative emissions not possible with CCU

At the same time, the condensed report outlines the limitations of CCU. Since there is no sink effect from the short-term and medium-term use of CO₂, this could be a useful technology to help reduce existing fossil

emissions, though it would not be possible to generate negative emissions. ‘The question of where the CO₂ ends up is crucial for balancing the climate impact of CCUs,’ explains Dietmar Gründig, Head of the Industry Business Area at dena. The process is only climate neutral if the carbon cycle is closed. For this to be the case, the product must either be extremely long-lasting, e.g. insulation materials in buildings, or the carbon must be reused in the end-of-life phase of the product, e.g. through recycling or disposal at a waste incinerator with CO₂ capture, he states.

CO₂ cycle with recycling

Covestro recently commissioned a new pilot plant for the chemical recycling of flexible polyurethane (PU) foam from old mattresses to fully recover the raw materials. Polyol is the precursor for polyurethanes (PU). In future, the CO₂ cycle of mattresses made from Cardyon could also be closed – or at least extended. ■



Innovative CO₂ capture method at a Holcim Group cement plant near Hanover.



Lena Jakob (on the right, pointing) discusses local climate protection with young people in Erlangen.

MAINTENANCE AND PROGRESS

Highs and lows often go hand in hand when it comes to climate protection in local communities. Whether or not climate pledges are indeed met is down to the decisions made by local authorities and collaboration on a local level.

TEXT Marcus Franken

Frank-Michael Uhle is probably the happiest climate protection manager in the world. The Rhein-Hunsrück district where he lives has received a number of climate awards over the years. It produces three times as much electricity from renewable energies as it consumes, while also creating dozens of jobs in and around climate protection and renewables. To top it off, Rhein-Hunsrück also generates significant revenue from the energy it generates, including €7 million annually from wind turbine leases alone. And because the district has switched to wood-fired heating systems and banned many oil-fired furnaces, another €2 million flow into the local economy every year. 'That's a lot of money around here – and it really helped win everyone over,' says Uhle. He has been at the job for more than 20 years.

Jakob Müller*, on the other hand, is ready to move on. 'As far as climate protection on a local community level is concerned, it's been very frustrating,' says Jakob, who has been climate protection manager in a city of 40,000 in southern Germany for a year. If you're looking for the word 'climate' on the city's website, you won't find it. Müller had hoped to promote bike paths or environmentally friendly heat planning in the city. He wanted to do something practical instead of just continuing to write policy papers as an environmental scientist. But he could not even get a proposal passed by the city that would have required municipal offices to make the switch from virgin fibre to recycled paper. 'This was not possible with paper used at all local government offices because recycled paper apparently cannot be archived,' says Müller in frustration.

Is it really not possible to use recycled paper? 'Of course it is,' says Frank-Michael Uhle. The Rhein-Hunsrück district switched completely over to recycled paper years ago. In the meantime, Jakob Müller has found a new job in the environmental field where he can achieve more.

Are the schools being renovated? What does public procurement do? Are new bicycle lanes being built, and will there be less space for cars? How can municipal climate protection managers implement the lofty climate goals set out in the Paris Agreement while also having to deal with the little things that make up their day-to-day work? For them to succeed on a local level, local authorities have to take a strong position – and they need support from their higher-ups.

Going door to door to promote climate protection

There are around 700 municipal climate protection managers in Germany. They need patience and have to talk a lot. Not only that, they also have to bring together local stakeholders and go door to door to promote climate protection. Kathrin Klaffke knows this from personal experience. She is the climate protection manager in the Hümmling energy region in Lower Saxony, an association of four municipalities in Emsland. The Hümmling rises a modest 70 metres up from the flat Emsland region. The land between the Hümmling and the North Sea is even flatter.

Klaffke came to her job like many other climate protection managers. She studied 'something associated with the environment' – in her case, economics with a focus on the environment. She worked at the University of Hanover and then moved to the Emsland region. After a stint in adult education, she stumbled on a posting for a job as a climate protection manager. Climate protection was exactly what she wanted to do.

It was a job that did not really exist prior to 2015. 'I first had to prove to local authorities that there is a purpose to my job,' says Klaffke. This also has to do with the history of climate protection managers. They were not created by the municipalities

themselves. In 2012, the German government set up a programme that it uses to provide 50 per cent funding for local climate protection managers in municipalities, limited in each case to three to five years.

Success comes when leadership gets involved

'A climate protection manager is basically an ambassador for environmentally friendly behaviour,' writes the 'KOMMUNAL' magazine. Klaffke was a successful ambassador and also had luck on her side. Her very first project – 'an energy-saving model to foster climate protection at schools' – was awarded a climate protection lighthouse in the Lower Saxony competition 'Klima kommunal' in 2018. This got the two best allies a climate protection manager could ever hope for on her side: the public and the mayor.

For climate protection managers in Germany, being close to the top administrators is crucial. This can work both ways, however. As climate protection manager, Jakob Müller's boss assigned him to the ten or so employees in the urban planning/environment department. The role of climate protection managers does not even appear on the municipal website, and he has no sway or influence over other departments. As part of her staff unit, Kathrin Klaffke, on the other hand, is directly affiliated with the



Energy-plus housing estate in Erlangen: More energy is produced here than the residential buildings consume. Climate protection is firmly established at Erlangen's local administration.



Climate protection manager with over 20 years on the job: Frank-Michael Uhle (right) with chief administrator officer Dr Marlon Bröhr in front of a renovated school in the Rhein-Hunsrück district.

mayor's office of the joint municipality. She knows her boss has her back. Indeed, he has since promoted her from a project employee to a permanent member of staff. Since then, there has been excellent progress in the long-term projects.

Permanent position creates trust

'It was a turning point in terms of the success I was having in my work when the local authority made my position permanent,' says André Lachmund, Wilhelmshaven's climate protection manager. Lachmund had built up a network, and everyone was very nice to him. 'But many people did not contact me until my position was made permanent. That's when they knew: if we team up on a project, it's a long-term collaboration,' he goes on to add.

Thanks to the network he built up, Lachmund, with only 80,000 inhabitants, can offer its residents something that many larger cities cannot: car sharing. Car sharing companies tend to shun small towns and cities because they don't get enough users there. In Wilhelmshaven, Lachmund was able to leverage his contacts to convince management at the local savings bank, the university and the municipal hospital to switch their vehicle fleet over to car sharing. 'The three companies have guaranteed minimum sales in the triple-digit range per vehicle and month, thus ensuring critical mass,' says Lachmund. Despite the COVID-related

slowdown, which caused a significant drop in demand at all providers, car sharing is now a solid business. During the week, the cars are used a lot by employees of the three companies, while on weekends they are used by locals. Lachmund: 'We now have ten vehicles at five locations, and Cambio, the car-sharing provider, is planning to provide another vehicle at its own cost.' With this, car sharing seems to be on a sound financial footing. At the same time, the city is expanding bike paths, increasing the number of bicycle stands, opening up one-way

streets to cyclists and setting up a bike station at the train station.

The most difficult part of a climate protection manager's job is when they do not have clearly defined targets. 'If a climate protection target has been adopted at the highest political level by the municipality, then climate protection managers can act on its authority,' says Daniel Philipp from the Bundesverband Klimaschutz e.V., the nationwide association that represents climate protection managers. That is why the association is calling on the German government to make climate protection targets binding. 'Otherwise, climate protection is not legally anchored at a municipal level in Germany – and there is no obligation to implement the targets,' says Philipp.

Lower Saxony makes climate protection binding

In Lower Saxony, where Kathrin Klaffke lives and works, this is slowly changing. As of 2022, municipalities are required by law to report on energy consumption in order to reduce power use at municipally-owned properties. 'Up until now, the municipalities often did not know how much energy they were consuming, or the topic would fall by the wayside because the building authorities responsible had too many other things to deal with anyway,' explains Klaffke. For residential areas not owned by the municipality, Klaffke has now commissioned a study to investigate the feasibility of local heating grids using renewable energy from geothermal and biogas plants. 'We



Kathrin Klaffke's hard work paid off. She now plays an active role in shaping the future in the Hümmling energy region.

A PARTNER FOR MUNICIPALITIES

The practical implementation of the energy transition and climate protection takes place on a municipal and neighbourhood level. For that reason, dena provides support for local stakeholders in numerous projects. It provides advice and information, conducts studies and pilot projects and works on digital solutions for tomorrow.

Municipal Heating Transition Competence Center (KWW)

The decarbonisation of heating is one of the keys to climate protection. To achieve a climate-neutral heating supply in municipalities, districts and neighbourhoods, appropriate municipal heat planning is an absolute must. In Halle an der Saale in Saxony-Anhalt, a region severely impacted by the phase-out of coal, dena has set up a nationwide Municipal Heating Transition Competence Center.

www.kww-halle.de

Contracting Competence Center

With the Contracting Competence Center, dena provides local authorities with information on the energy performance contracting (EPC) model. With the aid of EPC, municipalities can implement energy-efficiency measures together with an energy service provider in order to conserve energy and reduce costs. As part of its pilot project CO₂ntracting: build the future!, dena is providing examples of how this can be done.

www.kompetenzzentrum-contracting.de

Future Energy Lab

At the Future Energy Lab, stakeholders from the digital and energy industries work together to create digital solutions for municipal climate protection. In the CO₂ data demonstrator project, work is being done to collect and process municipal CO₂ emissions data. In an associated project codenamed 'klimakommune. digital', the transition to a climate-friendly smart city is being tested out, with the city of Hagen as the subject of the experiment. This is to be achieved with the help of data processing and a digital infrastructure.

www.future-energy-lab.de

The urban energy transition

A number of studies on integrated climate-neutral neighbourhoods and sites, the latest news as well as a digital map of projects from Germany and Europe can be found on the urbane-energiewende.de landing page.

www.urbane-energiewende.de

can show that it is feasible. But in the end, it is up to the city council to decide,' says the climate protection manager.

In Erlangen, many things that are still being discussed elsewhere are already a reality. 'We were one of the first municipalities in Germany to have an office for the environment,' states Lena Jakob, who has been working as a climate protection manager since 2013. Her employment contract was even printed on recycled paper way back then. Today, she is a well-respected climate protection advocate at the local administration. In Erlangen, all decisions made by the city council must undergo a climate compatibility check. Lena Jakob and her five colleagues work on sustainable mobility concepts or complement the work done by the city planning office when new buildings on the outskirts of Erlangen are built to the energy-plus standard. The city provides subsidies and funds for cargo bikes, energy-efficient building refurbishments, solar installations, e-bikes, not-for-profit climate protection projects and much more. It bans domestic flights on official business, serves primarily vegetarian and vegan food at catered official events and heavily subsidises monthly bus and train passes for city employees if they forgo a parking space at their place of work. Where there's a will, there's a way.

Climate neutrality in 2030

Erlangen demonstrates a lot of will: in 2020 the city made the decision to be climate neutral by 2030, just like Tübingen and Münster. 'Reaching this goal by 2030 will be extremely challenging,' reports Simone Zippel, Jakob's colleague and the climate manager tasked with making the city climate neutral. 'One local authority cannot do this on its own,' she explains.

The city's climate protection managers are seeking advice from an environmental research institute to map the path to climate neutrality. Zippel knows that she will have to do citizen outreach and win over businesses in the years to come. And since she is pursuing the goal of generating all the energy needed within the city in the region, she needs to partner up with municipalities in the surrounding area. This takes the job of a climate protection manager to a whole new level. But Zippel is optimistic: 'Our work depends on having the political support of the city. And we have that.' ■

*Name changed by the editorial team



One of the largest biomethane refineries in the world is located in Könnern, Saxony-Anhalt.

A STANDARD FOR GREEN GASES

Whether you're talking about hydrogen or biomethane, Europe is heavily reliant on imports of green gas to achieve climate neutrality. The product must be clearly defined, and reliable certification must be available in order to have a properly functioning market.

TEXT Marcus Franken



Hansewerk's power-to-gas plant in Hamburg uses wind energy to produce hydrogen through electrolysis.

Photos: Paul Langrock, Jörg Böhling

There is no shortage of big plans in the world of green gases. BDEW forecasts a tenfold increase in the production of green methane from biogas plants in Germany alone. The German government expects demand for green hydrogen to be around 100 terawatt hours (TWh) in 2030, while dena's pilot study 'The Start of Climate Neutrality' projects demand will reach 458 TWh in 2045. In its hydrogen strategy, the German government clearly states that the 'majority' of demand 'cannot be met locally'. 'In 2030 we will need to import roughly 80 per cent of our green hydrogen needs,' estimates Klaus Völler, dena expert on renewable gases.

New generation plants are being built

The market reacted promptly. 'After years of having only three certified plants, we now have 14 – and four more are in the pipeline,' says Michael Landspersky, environmental verifier at TÜV Süd, which has been testing hydrogen's impact on the climate and issuing 'green hydrogen' certificates since 2011. The eco-certified electrolysis plants are chiefly located in Germany, France and Belgium.

Globally, investors have reacted to policy announcements in Germany, the EU, the US and China. According to a study by the consultancy firm McKinsey commissioned by the German Hydrogen Council, 131 major new projects were announced in the first half of 2021 alone. McKinsey expects investments totalling around USD 500 billion from hydrogen producers, plant manufacturers or individual countries by 2030.

EU standards under development

But as much as governments, organisations and researchers agree on the central role of green gases in transport and industry, there is not yet a functioning market for climate-friendly methane or hydrogen. It is critical to clarify what should be classified as climate-friendly in the first place. 'The market needs sustainability standards on which reliable certification can be based,' explains dena expert Klaus Völler. Where does the gas come from? How is it produced? Is multiple sale effectively ruled out? And is the entire process validated by neutral organisations? These are the key questions when it comes to certification.

TÜV Süd currently bases its plant certification on EU standards, but these are still under development. 'CO₂ emissions from the hydrogen we will be certifying in future must be 70 per cent below the RED II reference value for biofuels,' Landspersky reports. That means the CO₂ footprint will need to be reduced from 94 grams of CO₂ equivalents per megajoule to 28.2 grams.

Certification of biomethane

The extensive experience gained in certification of the sustainability of biomass can be of great help here. There are global certification systems for biomethane, such as REDCert and ISCC. Certification ensures compliance with the requirements regarding sustainability and CO₂ emissions throughout the entire supply chain. Even when blended with other energy sources, such as on ships or in pipelines, transparency with respect to the composition of biomethane is maintained all the way to the end user.

Avoiding competition for renewable electricity

In December 2021, the European Commission presented a package of measures to implement the European Green Deal. This also



GERMAN BIOGAS REGISTER

dena maintains the German Biogas Register for verification of biomethane and storage gas. The register has succeeded in establishing a nationwide industry standard. Trade partners and end consumers can rely on it. Along with that, it also fosters the general evolution of the market.

More information:
www.biogasregister.de

includes criteria for electricity procurement and CO₂ emissions for green hydrogen. 'One of the key factors is the origin of the renewable electricity,' states Korinna Jörling, who also advises the EU Commission on the aforementioned criteria on behalf of the consultancy firm Guidehouse in Berlin. No renewable electricity from existing plants should be used to operate hydrogen electrolyzers. The EU does not want the energy used to produce green gas to be diverted from areas where it is already being used efficiently. For green hydrogen to have a positive impact on the climate, new wind turbines and solar plants must therefore be built.

Here's another issue: 'In Europe we are discussing how close the temporal correlation between renewable electricity production and hydrogen electrolysis needs to be,' says Jörling. In order for the electrolyzers to actually operate when the sun and wind are feeding in surplus energy, the permitted time delay could be anywhere between 15 and 60 minutes. Otherwise, the electrolyser could run on grey electricity long after the peak in renewable power in the electricity grid is reached.

Steering effect of the EU

Similar details are discussed under the criterion 'additionality'. A new plant that was previously subsidised (for example, under the German Renewable Energies Act (EEG)) was clearly not built with an electrolyser in mind. But would it make sense to use the electricity it generates to operate an electrolyser now that it is set to continue operation? In the end, details like this will also have an impact on the cost of green hydrogen.

If the EU establishes criteria, these will apply de facto to all countries that want to supply hydrogen to the EU. Since the EU will only recognise green hydrogen certified under its own criteria for climate protection in the EU states and the different economic sectors, the potential supplier countries for hydrogen must also comply with Brussels' decisions. Talks are currently ongoing between the German government and potential major suppliers such as Australia and Saudi Arabia. Time is of the essence. Entrepreneurs like Australian industrialist Andrew Forrest want to begin supplying hydrogen to German companies in 2023. ■



Micromobility with a macro effect

The debate on the transport transition is often about the shift to rail or electric cars. So far, the focus has been less on micro-vehicles such as e-mopeds, e-scooters and cargo bikes, which have the potential to make urban mobility in particular more environmentally friendly.

TEXT Martin Kaluza

The category ‘micromobility’ refers to small energy-efficient electric vehicles that can already run on 100 per cent renewable energy, making them extremely well suited for low-emission transport. In partnership with Bochum University of Applied Sciences, dena has produced the first life cycle analysis of e-scooters sharing services. The key finding of the study is that the carbon footprint of e-scooter sharing has improved compared to when the service was launched back in 2019. E-scooters have the potential to improve the environmental balance of the transport system in the short term if they replace other motorised forms of transport.

Micromobility is in its infancy

The automotive industry has also apparently recognised the potential of micromobility. Here is an example to illustrate the point: a number of high-profile manufacturers presented cargo bikes at the IAA in September 2021. They produce zero local emissions if used to make deliveries in city centres, for instance. ‘What we are seeing on the streets today is just the beginning. We haven’t even begun to scratch the sur-

face of what is possible,’ says Norman Wendt, Mobility Team Leader at dena.

‘Micromobility for goods and passenger transport really shines in densely populated areas. It is also an interesting option for the spaces in between, where the city and its suburbs meet, to traverse, for exam-

‘At the moment we are still thinking in terms of mobility as we’ve known it over the past forty years.’

Norman Wendt, dena

ple, the short distances from home to the metro station or from the metro station to the workplace.’

Compared to cars, lorries and rail, micromobility accounts for only a fraction of the annual demand for passenger and goods transport. But all signs are pointing towards growth, as dena’s pilot study ‘The Start of Climate Neutrality’ shows: For passenger transport, annual demand

for micromobility (including bicycle transport) could potentially treble from 39 billion passenger kilometres in 2018 to 116 billion in 2045.

Lack of subsidies hampers market penetration

‘Micromobility makes sense if it can close the first/last mile gap that public transport leaves,’ says Tobias Breyer, co-founder of the Berlin-based startup Swobbee. ‘It can do this if three conditions are met: it must be free-floating, set up as a sharing service and linked with public transport.’

Breyer’s company wants to offer electricity to power micromobility solutions. Swobbee now has 40 stations in operation where standardised batteries are exchanged and recharged. ‘Battery as a service’ is the name of the business field. Swobbee’s customers are e-scooter and e-bike sharing services as well as companies that use electric cargo bikes to deliver parcels or other goods. Seventeen charging stations are in pilot operation in Berlin alone. In London, Swobbee operates a charging station for a service that delivers Amazon parcels. Breyer is critical of the present lack of subsidies for micromobility.



DENA STUDY ON E-SCOOTER SHARING

E-scooter sharing services have the potential to make urban mobility more eco-friendly. They are highly energy efficient in use and reduce noise pollution and the amount of space taken up for private transport. Used to bridge the last mile, they also improve access to public transport and can thus increase its market share. The dena study shows that e-scooter sharing services can help reduce emissions in many ways, for example, by lowering emissions during production, increasing service life, using interchangeable batteries and utilising electric vehicles for maintenance trips/ride sharing (see infographic on greenhouse gas potential).

More information:
www.dena.de/e-scooter-studie

Photos: Paul Langrock, DPD Deutschland

Allocation of public space

One thing standing in the way of micromobility is outdated thinking. This is not only evident in the lack of subsidies, but also often in the general public’s perception. ‘At the moment we are still thinking in terms of mobility as we’ve known it over the past forty years. Micromobility is often perceived as an added burden, as part of densification and competition for space,’ Wendt explains. ‘It is important to think of mobility in a new and forward-looking way.’

It’s remarkable that while we see no problem with cars parked on both sides of the street, electric micro-vehicles are often a hotly debated topic. ‘Interestingly, there is no debate about private and commercial vehicles taking up public space. We have to move away from the belief that free parking for cars is a basic right and that commercial vehicle owners can also use public space for free,’ says Wendt. Road space needs to be reallocated over the next few years. Slowing down traffic also plays an important role here, one such example being 30 km/h zones. You can reduce the potential for conflict and accidents if the difference in speed between the different categories of road users is lowered.

Paris leads the way

In Paris, a speed limit of 30 kilometres per hour has been in place on most roads since August 2021. The reallocation of public space is also in full swing: under Mayor Anne Hidalgo, the city has eliminated 2,500 parking spaces near crossroads and reallocated them for e-scooter parking. Six scooters fit in each parking space. That’s 15,000 spaces across the city. The scooter sharing companies have also set up geofencing for



A parcel delivery driver seen swapping out the Swobbee battery on his cargo bike at a charging station in Berlin.

‘Micromobility must be free-floating, set up as a sharing service and linked with public transport.’

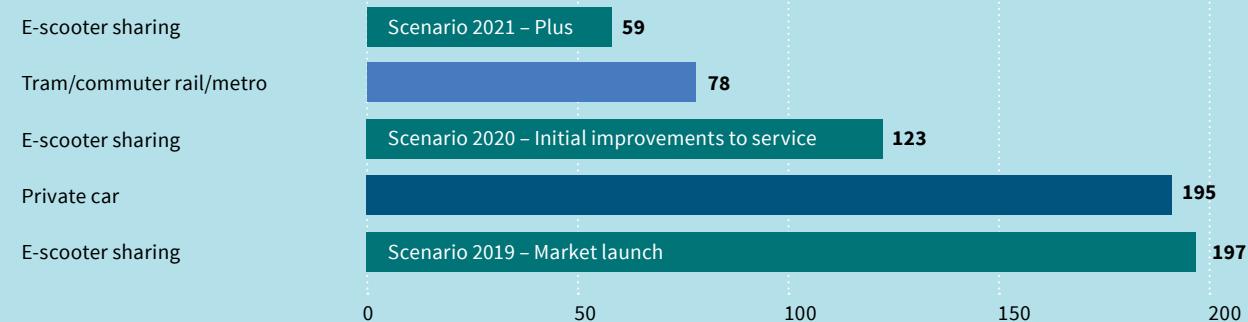
Tobias Breyer, Swobbee

their fleets so that the scooters can only be returned to the designated zones. In addition, they have teamed up with city officials to eliminate the issue of scooters parked haphazardly on the pavement.

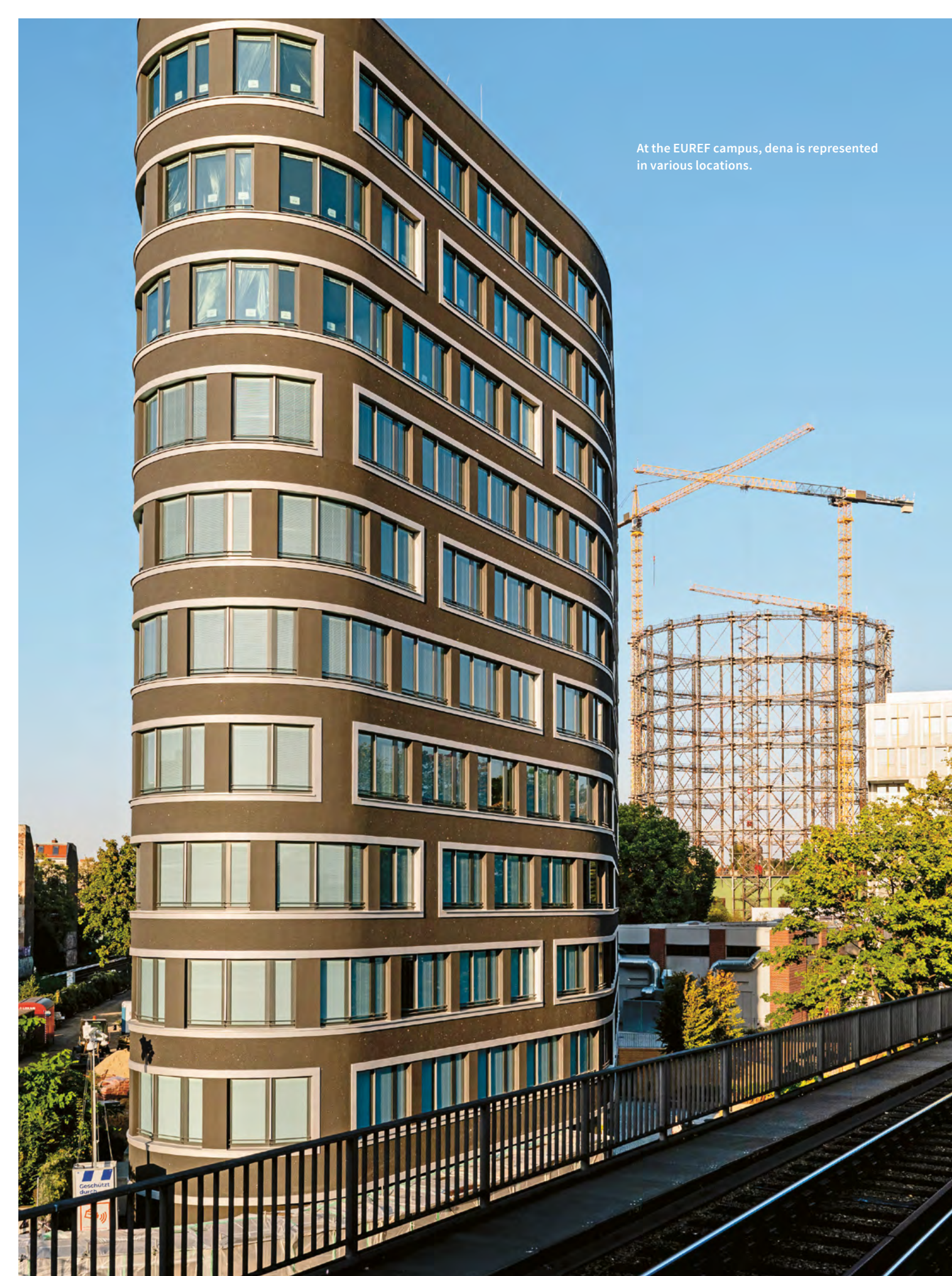
‘In every German city where we plan to launch a new e-scooter fleet, we present the Paris model for reallocating parking spaces,’ says Sebastian Schlebusch, spokesman for Plattform Shared Mobility (PSM). The industry sees solutions like this as an important way to achieve widespread acceptance of micro-vehicle fleets. Since its launch in 2019, the seven sharing services that are part of PSM have put 130,000 e-scooters on the road. The number of users is estimated at six to seven million. ‘There is hardly any new product or service that has experienced such rapid growth,’ says Schlebusch, ‘E-scooters eclipse everything.’ ■

Greenhouse gas potential based on a life cycle analysis

CO₂ equivalents in grams per person-kilometre



Source: dena study ‘E-scooter sharing – a comprehensive overview’, June 2021



At the EUREF campus, dena is represented in various locations.

FACTS & FIGURES

The dena of today has evolved greatly from what dena was 20 years ago. The German Energy Agency has been in existence since October 2000. In 2021, everything pointed towards growth and restructuring. In order to make an even better contribution to the success of the energy transition and climate protection, dena has realigned its organisational structure. Other locations have been added. In the **Facts & Figures** section, we give you an insight into our company.

FIT FOR THE FUTURE

As a strong partner of the German government, dena is working to implement the energy transition and protect our climate. This requires more employees, more locations and a new structure.

More locations, more employees

Around 20 years ago, when dena started out, it was the size of a startup, with only a handful of employees. Since then, it has grown enormously. Within the year 2021 alone, more than 100 new colleagues of many nationalities and different ages joined. Today, dena has about 430 employees. People who join dena come from many different biographical and professional backgrounds, but they are all, like many of us, in search of meaningful work in these times of climate change. They now work at six locations: in addition to the headquarters in Berlin-Mitte, there is the EUREF campus in Berlin-Schöneberg as well as other project-related locations in Berlin and Halle.

Closer ties with the shareholders

Since 2020, dena has been an in-house-capable company under the auspices of the German federal government. The lion's share (over 80 percent) of the turnover must be generated with the shareholders (the Federal Republic of Germany and

KfW Bank). dena is now officially involved nationwide and internationally in providing services to shape and implement the German government's energy and climate policy goals in the interests of all. Its role as an ambassador for the energy transition and as a shaper of the shift towards climate neutrality has thus been strengthened once again.

Equipped for the future

Steady growth in recent years and the challenges posed by the pandemic have triggered fundamental internal transformations. dena initiated a comprehensive strategy process in 2021 in line with the motto: 'It's time to gear up for the future – to help shape the energy transition and protect the climate with the focus they deserve.' The entire organisational structure was revised in view of future tasks in the context of the energy transition and the growing number of employees.

This new structure divides dena internally into seven divisions, 14 work are-

as and two staff units. The staff units are a novelty for dena: various fields of action in dena's work are bundled here and coordinated centrally. These new units deal with policy, strategy and fundamental issues as well as international cooperation. The 'Energy-efficient buildings' division was divided into two parts: 'Climate-neutral buildings' and 'Urban energy transition'. The 'Energy systems and energy services' division was split up to better deal with both the supply side and the consumption side of primary energy. This resulted in the following divisions: 'The future of energy supply', 'Industry, mobility & energy efficiency' and 'Digital technologies and start-up ecosystem'. In order to present dena's broad knowledge in a uniform manner and to set focal points in terms of content, the corporate communications department was also strengthened by the addition of further teams. Added to this is the administration to guarantee the organisation of dena's growth and all its day-to-day processes.

Staff members

42%
male

58%
female

~450
staff members
(as per July 2022)

Average age
39.1 years

> 20

Nationalities

Austria, Azerbaijan, Canada, China, Colombia, Croatia, France, Germany, Greece, Italy, Kyrgyzstan, Netherlands, Poland, Portugal, Romania, Russia, Spain, Switzerland, Turkey, Ukraine, United Kingdom, USA

Equal representation

at all levels



2004	2008	2012	2016	2018	2019	2020	2021
Part-time 14	Part-time 49	Part-time 63	Part-time 82	Part-time 102	Part-time 120	Part-time 113	Part-time 146
Full-time 57	Full-time 116	Full-time 121	Full-time 130	Full-time 127	Full-time 136	Full-time 192	Full-time 244
Female 55%	Female 56%	Female 51%	Female 54%	Female 52%	Female 55%	Female 55%	Female 58%

Illustration: de.freepik.com

DENA'S PROJECTS

dena is a federally owned project company. Around 100 projects are currently being implemented. The employees are active not only in Germany but also in other countries such as Kazakhstan, Ukraine and China. Since its founding, dena has carried out around 1,500 projects.

THE PROJECT SITES



dena maintains three project sites. Two of them are located in Berlin: on the EUREF campus and at the Königliche Porzellan-Manufaktur (Royal Porcelain Manufactory, KPM Berlin) in Berlin-Tiergarten. On the EUREF Campus in the Green Garage, dena and its project partners are supporting the German government in the implementation and further development of the National Hydrogen Strategy. At KPM Berlin, work is being done on digital solutions for a climate-friendly energy economy.

The largest project-related location to date is being built in Halle. The Kompetenzzentrum Kommunale Wärmewende (Municipal Heating Transition Competence Center (KWW)) supports municipalities in municipal heat planning on behalf of the federal government. Thirty new jobs will be created here over the course of 2022.



DENA'S CENTRAL LOCATIONS



dena's central and original location is Chausseestraße 128a in Berlin-Mitte. This is the base for management, staff units, communication and administration and the central contact point for the specialist departments. On the EUREF Campus in Berlin-Schöneberg, dena is in fitting company – all the resident companies and stakeholders on the campus are concerned with innovation and the energy transition. dena is represented with office space in buildings 1, 2 and 24.



HOW WE WORK



Work at dena is predominantly based on cross-team cooperation. dena's experts contribute their wide-ranging expertise and diverse skills and tailor them to the task or project in question.

To enable this high degree of flexibility in collaboration, dena relies both on location-independent, digital work and on creative on-site meetings in modern, well-equipped locations. dena is also continuously working to improve itself as a company – from within the workforce. Specialist topics are dealt with by working groups in order to achieve improvements in everyday working life. For example, a team works across the various divisions on dena's level of sustainability with reference to the standards of the German Sustainability Code (DNK).

Photos: photothek Jörg Carstensen, shutterstock/MaximilianCaptures, Euref/Ken Wagner, Jessen Nordhorst, dena, photothek/Florian Gärtner

OUR COMPANY, OUR LEADING MINDS: NEW STRUCTURE 2022

After years of constant expansion and intensification of its activities, dena realigned itself at the beginning of 2022. This was preceded by a comprehensive strategy process. The new structure allows dena to address all aspects of the energy transition and of climate protection. dena always takes a holistic view and integrates different perspectives from business, politics and society. dena's basic organisational structure consists of five specialist departments, two multidisciplinary departments and two staff units.



Philipp Litz Head of Division	Steffen Joest Head of Division	Christian Stolte Head of Division	Nicole Pillen Head of Division
The future of energy supply	Industry, mobility and energy efficiency	Climate-neutral buildings	Urban energy transition
H ₂ and synthetic energy sources	Industry	Networks and specialised public services	Districts and cities
Renewable energy sources	Mobility	Analyses and building concepts	Municipal heat transition
Infrastructure and energy system	Energy efficiency	Planning and consulting	International building and construction

The management team

Andreas Kuhlmann Chief Executive	Kristina Haverkamp Managing Director
'With our new structure, we are making it clear where we see crucial areas of responsibility for the success of the energy transition and climate protection. We are set up and ready to effectively support Germany on the path to climate neutrality.'	'Many new colleagues, more locations and increasingly international cooperation – that is both a strength and a challenge. In order to be able to continue working together flexibly we have consistently modernised ourselves in terms of digital and mobile working.'

Philipp Richard Head of Division	Nargis Wieck Director of Staff Unit	Christoph Jugel Director of Staff Unit	Hanne May Head of Division	Daniela Lück Head of Division
Digital technologies & start-up ecosystem	International cooperation	Policy, strategy and key issues	Communication	Administration
Digital technologies				
Start-up ecosystem				

Photos: photothek/Xander Heini, Thomas Trutschel, Hoffotografen



New concept for urban freight: the heavily loaded VoloDrone on a test flight in Hamburg at the ITS World Congress 2021. The VoloDrone is seamlessly integrated into logistical supply chains by means of an end-to-end freight transport demonstration.

NEXT

On the road to climate neutrality, innovations and new approaches are coming to the fore. How can the energy sector become more attractive for women? What opportunities do smart contracts offer? How can the power supply be improved in remote African regions? In **Next**, we focus our attention on what's coming up.

ENERGY TRANSITION: WOMEN WANTED!



Making connections at the BETD Women's Lunch. Here: Christine Lins (centre) of the Global Women's Network for the Energy Transition in conversation

The proportion of women in the energy sector is still low. Yet the sector has a lot to offer to women – and vice versa. Experts are forming networks to increase the proportion of women and female influence.

TEXT Katharina Wolf

For a long time, the energy industry was considered a classic male industry. Sturdily helmeted technicians operated heavy turbines or repaired power lines at dizzying heights; grey-haired engineers at their desks pondered the best solutions for tomorrow's problems. This is how the industry presented itself, creating the public perception that the energy industry was no place for women.

This image has been changing for some time. More and more female faces are appearing in image campaigns, on websites and flyers in the energy sector. 'When I first attended conferences on energy efficiency in 1996, I would be the only woman among a hundred participants. That is no longer the case,' says Christine Lins, Executive Director of the Global Women's Network for the Energy Transition (GWNEN). 'A lot has changed in the energy industry. But women are still significantly outnumbered.'

Women significantly outnumbered

This impression is supported by current figures. Statistics from the Federal Employment Agency show that in 2020 women represented just 21 per cent of workers in the mining, energy, water and waste disposal sector. Even fewer women are found in leadership positions: the study 'Frauen in der Energiewirtschaft' [Women in the energy industry] by the consultancy PricewaterhouseCoopers (PwC) found that the proportion of women was only 16 per cent in 2021 – which is only 3.5 percentage points more than in the year 2018. At the same time, the study shows that female managers are mainly active in fields involving communication: while in the field of advertising/marketing/press more than half of the managers are female (57 per cent), the share of female bosses in IT has decreased from 7 to 5 per cent. Startups in the energy sector are similarly male-dominated: 'The share of

female founders in our SET 100 list (the top 100 energy startups of each year) is, regrettably, under ten per cent,' says Alexandra Khripko, who was employed as an expert in startups at dena until January 2022. For several years she supervised the Start Up Energy Transition project, where new companies from all over the world can apply for a funding programme.

Setting a course early on

The reasons for the low proportion of women often begin much earlier than their career choice. All too often girls are given to understand, both at school and at home, that technical subjects are difficult and more of a man's job. The consequences can be seen in the proportion of women in what are known as MINT subjects at German universities (MINT standing for Mathematics, Information technology, Natural sciences and Technology). For example, according to the Federal Statistical Office, in the winter semester 2020/21, out of around 50,000 physics students only 15,000 were female, and among 170,000 mechanical engineers there were a mere 37,000 women. There are also very few women in electrical engineering: of just under 80,000 students, not even 12,000 are female. At the same time, the number of female students in the MINT subjects is pushed up by a disproportionately high share of foreign women. 'Encouraging girls to take an interest in MINT subjects has to start at school and at home. When it comes to choosing a profession or a subject at university, it's already too late,' says Irina Lucke. The managing director of Omexom GmbH with 170 employees is one of the pioneers of the offshore industry. She says that she personally always enjoyed tasks that required her to tread completely new paths – such as the construction of Germany's first offshore wind farm, AlphaVentus. Often she was the only woman on wind turbine instal-



NARGIS WIECK

Director, Staff Unit International Cooperation at dena

How can the energy sector attract more women?

Target women in the recruitment process, then give priority to women with the same qualifications. And, last but not least, continuously promote the existing women in the workforce.

What role do women play in the international energy sector?

Women are also underrepresented internationally. To identify the barriers, we conducted a study with partner countries in Eastern Europe and Central Asia. The results are an important basis for targeted support.

More information:
www.dena.de/female-energy-experts

Photos: stageview/Paula G. Vidal, Hoffotografien



Irina Lucke, Managing Director of Omexon Renewable Energies Offshore

lution vessels or at conferences. ‘It didn’t bother me,’ Lucke says. ‘But a lot of girls don’t even think of doing anything technical because of that, because there are no other girls there.’

A cultural and structural problem

It still happens far too often that when girls get poor grades at school in subjects like mathematics or physics, it is seen as less serious than when boys do. This is a viewpoint that Nargis Wieck, Director of the International Cooperation at dena, is completely unfamiliar with from her schooldays in the Soviet Union. ‘As a good student, you also had to have good grades in mathematics, chemistry and physics. No distinction was made between boys and girls,’ she recalls. In countries such as Iran, Turkey or Ukraine, the proportion of women studying MINT subjects is also significantly higher than in Germany.

So all is well in other countries? ‘No,’ says Wieck. Even in countries with many women doing university degrees or training courses in technical fields, the break will come at some point. ‘When their career begins or they start a family, women drop out. For example, because their male partners earn more, they are not given the same incentive to pursue this career. Or because it’s just the done thing for women to take care of the family and look after the children. Returning to work, especially to a leadership position, is then difficult.’

Alexandra Khripko also sees conflicts with family planning as a significant reason why few women start their own businesses. ‘There is always the question of what the circumstances in the background are like for women founders.’ For example, is there support from the government to make it easier for mothers to found companies and for fathers to take responsibility for family duties? It’s difficult for women to obtain capital. ‘Investors – even those with venture capital – are mostly male and conservative,’ she says. They have less trust in women and often feel more comfortable with a man as a business partner. This could also play a decisive role in why women have such a hard time getting into top management. ‘Hans sucht Hänschen,’ is how Irina Lucke sums up the policy of many companies – white male managers promoting the next generation of white male managers.

In diversity lies strength

It has long been proven that diverse teams work in a more goal-oriented and constructive manner and achieve better results, says Heike Winkler, Managing Director of WAB e.V., an industry association for wind energy. ‘Women lead differently: more goal oriented, less career oriented.’ Winkler started her career 13 years ago at the former wind turbine manufacturer Multibrud. She says that the energy sector, which is undergoing fundamental change, needs these skills.

The female perspective must also play a major role in the energy sector be-

cause women are more affected by climate change and its impacts than men, emphasises Alexandra Khripko. For example, according to UN figures five times more women than men died in a cyclone in Bangladesh in 1991. Women in emergency shelters are also significantly more affected by violence than men after such disasters.

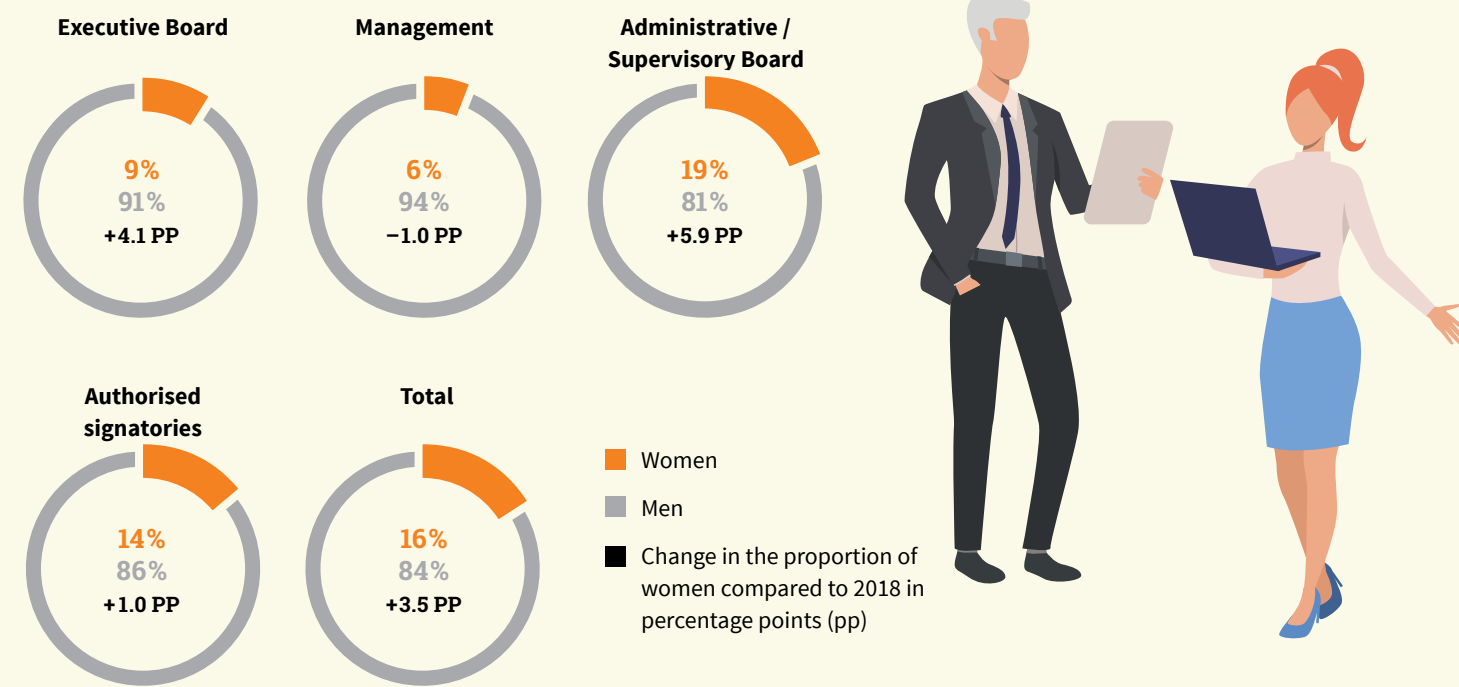
Moreover, without women, the energy sector is heading for a massive shortage of skilled workers: the International Energy Agency IRENA expects jobs to increase to 29 million worldwide in 2050, almost three times as many as 2017. At the same time, it is an industry that depends heavily on innovation. ‘We actually can’t afford to leave women out,’ says Heike Winkler. ‘The energy transition needs systemic and goal-oriented thinking and is thus predestined for women.’

National and international networks

Efforts are underway to attract more women to the energy world and to promote them. Networks have emerged at both national and international level in recent years to give women space for professional exchange, to promote careers and to make the female side of the energy world more visible overall. GWNEN (Global Women’s Network for the Energy Transition), founded in 2017, is one of them. The network has grown to more than 2,000 members in over 100 countries. ‘I was approached by women who wanted such a network as a safe space to interact,’ says Christine Lins, one of the co-founders. The most important thing as far as she is concerned is the way experienced women can act as role models for women starting out in their careers. ‘Our regional and international mentoring programmes involve women from all over the world who are incredibly encouraged by it.’ She herself was influenced by her parents. Her father was a power plant engineer. ‘Nevertheless, I ended up in the renewable industry more by chance than anything else. However, its sheer potential soon had me hooked.’

Barbara Lempp, Germany Managing Director of the European Federation of Energy Traders (EFET), has also founded a network to support women on their career paths in the energy industry. The Frauennetzwerk Energie [Women’s Energy Network] with its 400 members is ‘run on strictly matriarchal lines,’ has neither a

Gender distribution in management positions in the German energy industry in 2021



Source: PwC study ‘Frauen in der Energiewirtschaft’ [Women in the energy industry] (2022)

website nor a social media account and addresses women from all sectors of the energy industry. ‘We get by purely by word of mouth,’ says Lempp. Monthly meetings and an annual educational trip enable in-depth discussions on an equal footing – and with no (male) posturing.

But networking alone is not enough. The GWNEN study ‘Women for Sustainable Energy’ identified a whole bundle of measures for the advancement of women, such as quotas for women when filling management positions, gender-conscious wording of job advertisements, and more transparency and accountability.

All-male meetings rapidly losing credibility

Despite the hurdles, Barbara Lempp is optimistic about the role of women in the energy sector. ‘Change is a long process,’ she says. But diversity is playing an increasingly important role, especially at the European level. ‘Discussion panels exclusively populated by men are rapidly losing their



Heike Winkler, Managing Director at WAB

credibility.’ Even when new positions need to be filled, she is often asked through her network for a suitable female candidate. In addition, the energy transition is changing the perception of the industry: ‘Its bad image from the coal and nuclear era is gone, which attracts more women.’

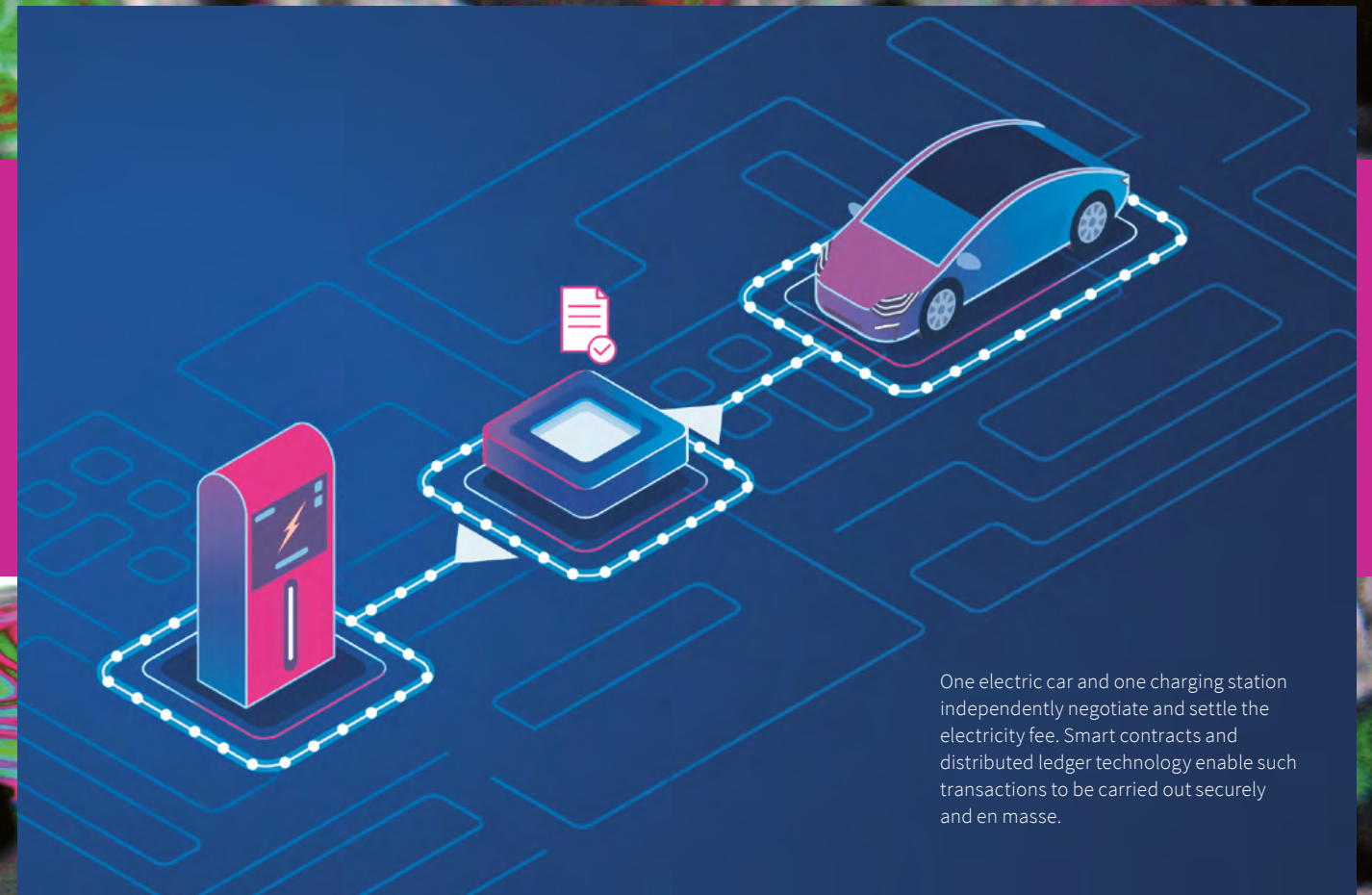
After all, the energy sector has a lot to offer women: ‘It’s a great industry: you’re working for the future of the younger generation,’ says Christine Lins. Especially in the field of renewables, where the structures are even more flexible than in the traditional energy industry, there are many opportunities for women to actively participate in the energy transition and to stop climate change, she adds.

‘If you are looking for meaningful work that shapes the future, the energy sector is the right place to be,’ sums up Hanne May, Head of Communications at dena. She is proud of the fact that the agency has managed to raise its percentage of women to 50 per cent and more, right up to the highest management positions. ‘This shows that it can be done if you specifically promote women.’ Now, with Fridays for Future, a movement is growing that is awakening additional interest in the topic of climate change and energy among many women. ‘I’m very excited to see what kind of impact that’ll have.’ ■

Smart contracts

In the decentralised energy system of the future, transactions will be automated. In the Future Energy Lab, dena is testing how smart contracts can increase flexibility.

TEXT Katharina Wolf



One electric car and one charging station independently negotiate and settle the electricity fee. Smart contracts and distributed ledger technology enable such transactions to be carried out securely and en masse.

A wind farm that independently offers its electricity on the power exchange, electric cars that make their battery capacity available at night to stabilise the grid, virtual power plants in which different electricity producers are interconnected: the energy world of tomorrow is renewable and small-scale. 'A few large energy producers are being replaced by millions of small units that support the energy system,' says Philipp Richard, Head of Digital Technologies & Start-up Ecosystem at dena. This does mean that digitalisation and automation are necessary to guarantee system stability, as he points out. 'The control of such a system, in which many volatile feeders have to be brought into line with flexible demand, simply would not work without processes that run automatically.'

But it's not just the technical side of the system that is changing. The contracts that legally secure cooperation within the energy industry must also be adapted or completely rethought. 'Electricity supply contracts between municipal utilities and private customers have so far usually assumed that the municipal utility supplies

electricity at a fixed price, and that the customer pays,' says Vincent Peikert, founder of the software start-up Noumena, giving an example. 'But this will change completely with new business models such as landlord-to-tenant electricity, flexibly controlled consumption or grid services from electric cars.' In order to develop and document these highly diverse contracts, the large static databases that are used today are no longer an adequate tool, he says. They are too inflexible to reflect the new business models.

Smart contracts: firm but flexible

'Smart contracts offer a great opportunity here because they are much more flexible and tailored to the specific use case,' says Peikert. He points out that the name is a bit misleading, because it is not just about contracts translated into code, but more generally about a new software approach. 'All processes, data, business logic, authorisations and messages are explicitly laid out in what are known as smart contracts. These are necessary for collaboration between the parties involved – people, companies or even devices.' It would be

relatively easy to implement systems that, for example, feed in electricity from the battery of a private individual's electric car when the price offered by a grid operator exceeds a certain limit.

'Smart contracts are particularly suitable for processes that occur repeatedly in large numbers and are standardised. They become particularly secure in combination with distributed ledger technology (DLT),' explains Linda Babilon, an expert for digital technologies at dena. DLT works like a digital ledger based on a decentralised database. The data records are distributed and stored among all users, for instance in a blockchain. 'The key advantage of this combination is that all automatic processes are stored transparently and traceably with all contractual partners,' says Babilon. This technology is particularly secure because unilateral changes to the data are not possible.

A practical example: the green electricity certificate

What does this look like in practice? 'We work with DLT to create green power certificates,' says Thomas Brenner, technical

director and shareholder of the startup OLI Systems, citing an example.

'It's a routine job: whenever a megawatt hour of electricity is generated, a certificate is created and stored in a blockchain.' In this way, a secure certificate is created that is specifically linked to a megawatt hour of electricity generated. If the electricity is then traded on this basis via a smart contract, the buyer – for example, an electric car driver at a charging station – can not only be sure that she is actually using green electricity, but also that the certificate is not being traded twice.

Legal and regulatory issues yet to be clarified

Currently, smart contracts are not widely used. Many issues, especially legal and regulatory ones, are yet to be clarified. A pilot project dealing with this topic is therefore being run by dena's Future Energy Lab. The lab was launched in August 2020 to promote interdisciplinary digital collaboration between start-ups, established companies, municipalities and scientists.

The pilot project concerns the Smart Contract Register, a database structure in-



FUTURE ENERGY LAB

Around 50 companies are networked in the Future Energy Lab. They test digital solutions for a climate-friendly energy industry based on technologies such as blockchain and artificial intelligence. This exchange of knowledge is possible on both a digital and analogue basis: the Future Energy Lab is located in the KPM Quarter in Berlin, with a co-working space and digital studio. The Bundesministerium für Wirtschaft und Klimaschutz [Federal Ministry for Economic Affairs and Climate Protection, BMWK] has commissioned dena with the project.

More information:
www.future-energy-lab.de

tended to form an initial basis for setting up such digital contractual relationships in a standardised way.

This would mean that, in future, audited smart contract elements could be available for use even by small players. 'The development of a smart contract can be a laborious process,' says Brenner, who is also involved in workshops on the Smart Contract Register. 'Since they are very hard to change due to their distributed application, some mental groundwork is required. You have to know beforehand exactly what you need in order to plan everything out correctly from a legal and regulatory point of view.' The planned register will open up new opportunities for small participants in the market – such as operators of photovoltaic and wind energy plants who would no longer receive subsidies and could then trade certified green electricity. 'An open source library for smart contracts would bring great benefits to the industry,' adds Vincent Peikert from Noumena. 'It would pave the way for completely new business models.' ■

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‘Investment is the key to off-grid energy’

Kate Steel, co-founder of the start-up Nithio, regularly sat in the dark in her Nairobi flat. She quickly realised that the power supply was not failing because of technology, but because of financing.



KATE STEEL studied mechanical engineering at Stanford, development technology in Melbourne and did her PhD on energy systems in Kenya at MIT. In 2018 she co-founded the startup Nithio and now heads its operations. The company enables investment in off-grid energy supply by providing credit risk data. Nithio was one of the finalists in the Start Up Energy Transition Awards 2021, which were organised by dena in collaboration with the World Energy Council.

The first thing I did after finishing my engineering degree at Stanford was to go travelling. I ended up teaching students in Nairobi. At that time, electricity was rationed. There was a timetable for my flat, but it was seldom adhered to. I often sat in the dark and thought about how to change that.

Currently, 600 million people in Africa have no access to electricity. Yet electricity generation is a relatively simple matter. I realised that politics, management and financing play an important role in energy supply.

When we founded Nithio, we looked at how we could improve the energy supply – especially off-grid, i.e. in remote areas away from the power grids. Demand is high, but many families have too little income to buy a simple solar installation. On the other hand, many could afford a loan.

But there is a bottleneck here. Investors are hesitant because it is difficult for them to assess people’s credit risk. It is less a question of whether the end customer will pay the loan back at all. Rather, investors wonder when, how quickly and how regularly a household will pay the instalments. This uncertainty is keeping many investors from injecting large amounts of

capital into the market. This is where Nithio comes in: we provide the missing information and make investments calculable.

Households that can repay their loans quickly make up a large market segment. We just don’t know who these people are yet. In practice, many local lenders proceed virtually blind. We can use Nithio’s technology to show lenders and investors how likely a potential customer is to repay regularly or irregularly, quickly or slowly.

We use AI to do this. The credit banks we work with provide us with data on past repayments. We also look at demographic statistics, such as property and education levels broken down by neighbourhood. When we combine these data sets, we can make predictions. We do not work with personal data.

I think that many people in developed countries have an inaccurate image of Africa. They only see the problems and believe that everyone there is in need of help. But of the 600 million people who have no electricity, half could afford a loan. The other half of households without electricity rely on public funds. Our system helps to reliably identify these people too, so that both loans and public money get to where they are needed most. ,

Photo: Nithio

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