

# transition

THE ENERGY TRANSITION MAGAZINE BY DENA | #2021

19 20 **21** 22 23

**“Any technology  
that helps us to reach  
the goal faster  
is welcome.”**

The road to climate neutrality requires a paradigm shift:  
dena’s Chief Executive, Andreas Kuhlmann, talks to  
economist and member of the German Council of Economic  
Experts Veronika Grimm.

## CLIMATE NEUTRALITY

How we can achieve net zero emissions

## THE SYSTEM AT A GLANCE

How we plan the infrastructure of the future

## ANNIVERSARY

What dena has achieved over the past 20 years





Photos: Zacarias Pereira da Mata / shutterstock, photothek

EDITORIAL

# transition

The motto of our dena Energy Transition Congress back in November 2020 was ‘The Future is Now’. The motto at this year’s World Economic Forum (in Davos) was ‘The Great Reset’. And these are just two examples of the countless major headlines you can find today. There’s no doubt that this issue of *transition*, dena’s annual magazine, comes at an incredible time for us all. Is what we’re currently experiencing ‘the new normal’? Are we already in the midst of upheaval? Or are we just at an interim stage? We don’t know yet. But what we do see is that something is happening.

At the beginning of the COVID-19 crisis, there were concerns that climate action might fall by the wayside seeing as all eyes were now on managing the crisis. Those fears never came to pass. Even before the crisis, the German federal government had identified its key priorities with the German Climate Protection Act (Klimaschutzgesetz), the introduction of a carbon price for heating and transportation and a climate package worth €55 billion. The €130 billion economic stimulus programme from June 2020 earmarks another €50 billion for measures related to the energy transition and climate action. There is a consensus in Germany and in the European Union that the recovery needs to be built around topics that look to the future. And climate action is the future – if not *the* topic of the future.

In 2020, Germany generated a good 50 per cent of its electricity from renewable energies and produced 40 per cent fewer carbon emissions than in 1990. Much has been achieved, but we’re still a long way off from reaching the goal that everyone is striving for – climate neutrality (page 8). The European Green Deal has injected fresh momentum at international level, while Germany’s hydrogen strategy (page 50) is ambitious at a national level, as are the solutions for specific local applications in industry (page 44). Climate neutrality is the new benchmark, and it will usher in significant changes. “Global value chains will change,” says Professor Veronika Grimm, a member of the German Council of Economic Experts (page 16). There is no underestimating the gravity of that statement. But you can’t want to change the world while also hoping that everything will stay the way it is. States, cities and companies have already embarked on their journeys. A new dawn is breaking. Political will is joining forces with vast financial resources and the available technologies. For all the hardship brought on by the current crisis, it’s also a moment that has set a lot of things in motion. Or to put it in a nutshell: the future is now.

We can’t wait to show you a glimpse of this future with our fourth issue of *transition*, and we hope you enjoy reading it.

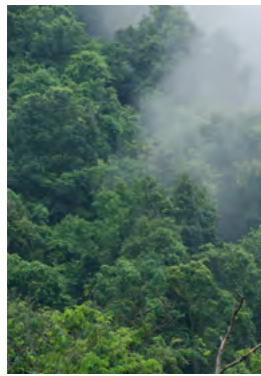


**Kristina Haverkamp**  
Managing Director



**Andreas Kuhlmann**  
Chief Executive





**COVER PICTURE:** Image comes from the MINE project – Mapping the Interplay between Nature and Economy (Professor Malte Faber, The Alfred Weber Institute of Economics, Heidelberg, Germany) [www.nature-economy.de](http://www.nature-economy.de)

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**EDITORS:** DEUTSCHE ENERGIE-AGENTUR GMBH (DENA), GERMAN ENERGY AGENCY, HANNE MAY, ROMAN ZURHOLD, MICHAEL DRAEKE, PHILIPP RUPP

**PICTURE EDITOR:** SILKE REENTS

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MARCUS FRANKEN, RALPH DIERMANN, KATHARINA WOLF, MARTIN KALUZA, JAN OLIVER LÖFKEN, BIRGIT WETZEL

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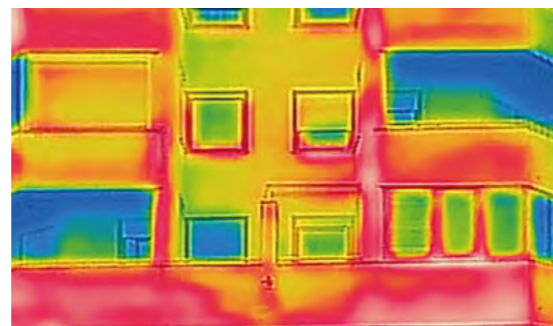
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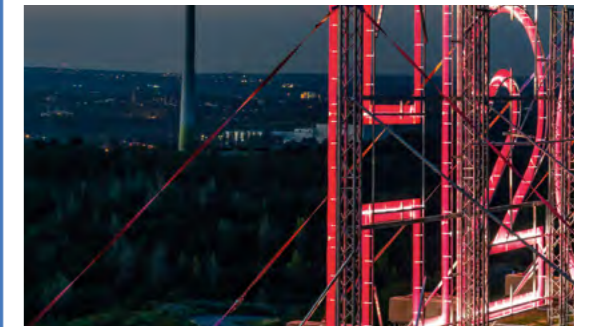
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**20**

2009 was the year of the desert and hydrogen. The PS 20 solar tower power plant near Seville in Spain was commissioned and the Desertec industrial initiative was launched. Together, they were designed to collect vast quantities of sunlight from the south of the country and transport it to the north of the country. 2009 also saw dena investigate what Germany's demand for hydrogen will look like in 2050. Although plans to utilise the desert and hydrogen may have been somewhat shelved in the years since then, they are now back with a bang.

Photo: Paul-Langrock.de

# THE BIG PICTURE

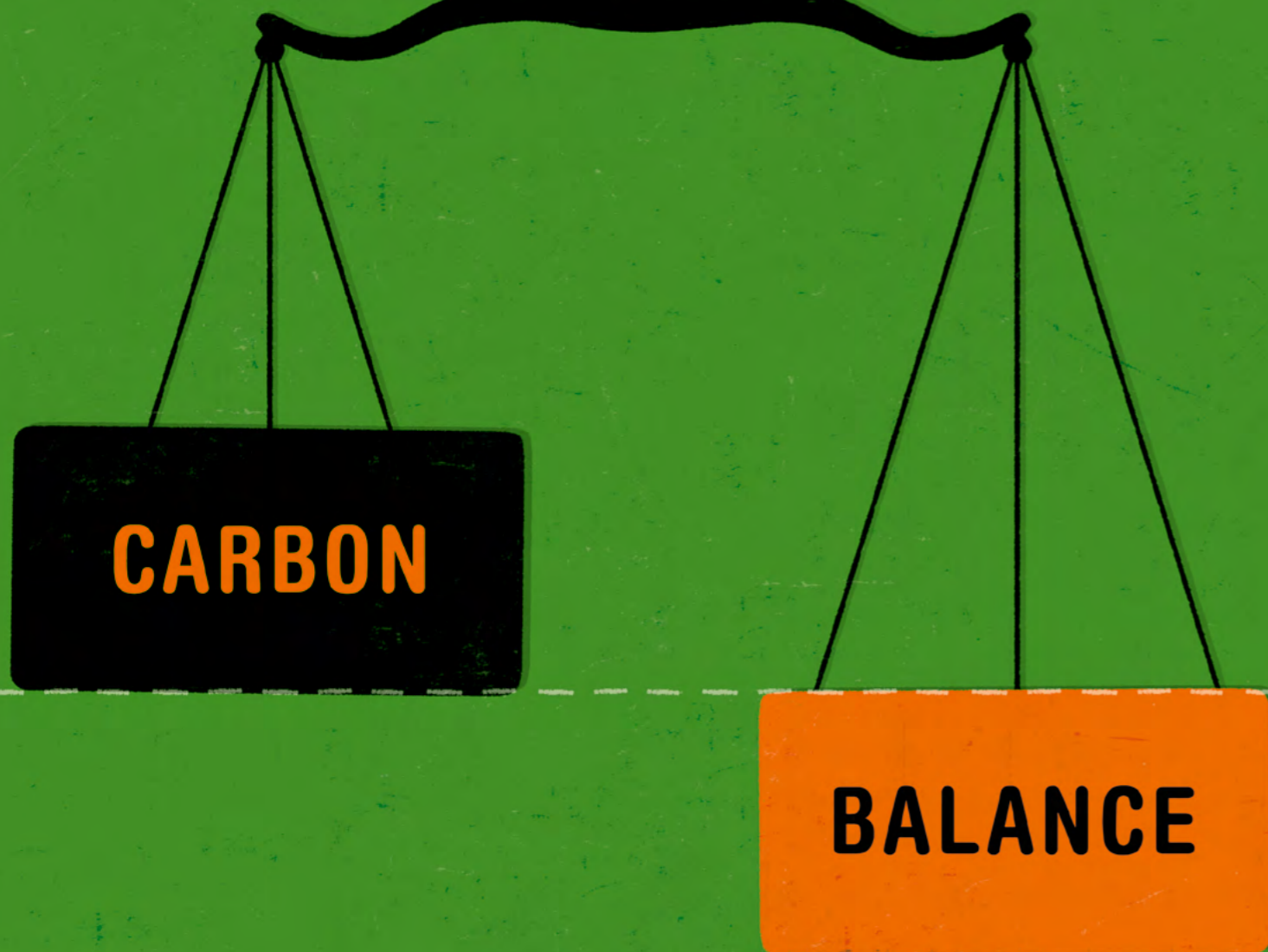
The energy transition and climate action haven't lost their importance, even in the age of the Corona-virus. On the contrary: they are a part of numerous programmes around the world designed to steer the economy and society out of the crisis, as well as align them to the new goal: **climate neutrality**. In **The Big Picture**, we take a look at the challenges and opportunities this entails. What does climate neutrality mean exactly? What **solutions** do we need? Who has already started on the road to achieving carbon neutrality?



# THE NEW ZERO LINE

From Berlin to Brussels to Silicon Valley, governments and companies are pledging their commitment to climate neutrality. How this will look in practice is still largely unclear. Initial approaches and frameworks.

TEXT Michael Draeke, Marcus Franken, Hanne May



While it went mostly unnoticed by the general public, Germany entered into a wide-reaching commitment in December 2019. The first German Climate Protection Act is nine pages long and has one core message: the country will be greenhouse gas-neutral by 2050.

What started with the signing of the Paris Climate Agreement is now anchored here in national legislation. The strategy that had been laid out since 2010 in the Energy Concept for an Environmentally Friendly, Reliable and Affordable Energy Supply was to decrease emissions by 'at least 80' or '80 to 95 per cent'. The goal is now 'Greenhouse Gas Neutrality by 2050'. Or even better: down to the net zero line.

How can this be achieved? How do we define the zero line? What frameworks are needed for this? A clear plan was outlined in December 2019: starting in 2020, work flat out on new legal frameworks in Germany and Europe, massively expand funding, push innovations, develop concrete solutions for a wide range of economic areas and roll out a particular strategy to develop and expand a hydrogen economy.

## Black swan, white swan

And then the coronavirus hit. The rapid spread of the COVID-19 pandemic has been described by some as a 'black swan' – a rare occurrence that is highly unlikely and can have extreme consequences. The term comes from a book by publicist Nassim Nicholas Taleb, who is reluctant to classify the coronavirus pandemic as a 'black swan', however. A global pandemic is clearly described in his book as "an event that is certain to happen at some point," he writes in the *Neue Zürcher Zeitung* newspaper. This means that COVID-19 is a 'white swan'.

But whether it's black or white, the virus is having enormous consequences, with once flourishing companies sliding towards insolvency and millions of people fearing for their jobs. The economic consequences of the pandemic are immense, and its medium- to long-term effects are difficult to foresee.

That said, the crisis has also spawned new ideas. It is challenging what we considered to be certainties. The switch to working from home has been a success in many companies and has triggered a push towards digitalisation. The amount of air traffic and the number of people travelling, both for professional and personal reasons, are experiencing a massive decline, and meetings are mainly taking place via a digital medium. Many are convinced that these effects will continue to have an impact after the threat of COVID-19 has passed. Combined with the decrease in energy consumption as a result of the economic slump, this could have unexpected consequences for Germany: the long since abandoned climate target for 2020 – a 40 per cent reduction in carbon compared to 1990 – is within reach. As a matter of fact, on an international level, COVID-19 has caused the largest temporary decrease in greenhouse gas emissions out of all the crises that have occurred in recent decades.

## Getting out of the crisis with climate action

An initial concern that the pandemic might push the energy transition and climate action into the background didn't come to pass.

Action is still being taken – sometimes even more decisively than before the crisis. According to former President of the Wuppertal Institute for Climate, Environment and Energy Professor Peter Henricke, the "rate at which people are willing to take action is skyrocketing and there is a distinct social acceptance for large-scale intervention – also in terms of the grander ambition required when it comes to climate action."

Back in April 2020, German Chancellor Angela Merkel committed to a clear course of climate action to get out of the crisis. "Europe will be the world's first climate-neutral continent by 2050," emphasised Merkel, echoing the statement made by President of the European Commission Ursula von der Leyen. Merkel went on to say it was important "that we don't save on climate action, but that we invest in climate action," referencing the COVID-19 economic stimulus programmes. UN Secretary-General António Guterres also made an appeal to the international community: "If we use taxpayers' money to save the economy now, then green jobs and sustainable growth must be created. Bailouts must not be used to protect outdated, environmentally harmful industries."

The economic stimulus packages that were adopted at national and European levels by the summer of 2020 enable unprecedented levels of investment in climate action and the energy transition. The German federal government's COVID-19 package from June 2020 amounts to over €130 billion. According to an analysis performed by dena and consulting firm Navigant, 20 of the package's 57 measures are related to climate and energy policy. The level of financing is estimated at up to €56 billion and is to be used, for instance, to fund sustainable mobility, expand the digital infrastructure or strengthen the integrated energy transition. This is supplemented by the funds from the German federal government's climate package adopted in 2019, which adds a further €55 billion and around €40 billion for structural change in coal-mining regions.

And looking at the European level, the 'Green New Deal' is in place, despite all the challenges: in her first State of the Union address in September 2020, President of the European Commission Ursula von der Leyen confirmed that the EU climate target for 2030 will increase from 40 to 55 per cent compared to 1990. "We will also dedicate 37 per cent of the NextGenerationEU spending directly to the European Green Deal," she announced. That comes to a total of nearly €300 billion from the European economic stimulus programme.

## Mapping out paths to the zero line

The economy has received its first round of stimulus measures. And if the 27 EU states also formally adopt the joint goal of becoming climate neutral by 2050 by the end of 2020, the existing target trajectories will have to be adjusted to compensate. Otherwise, the curve would be too steep from 2030 onwards to say with any certainty that the zero line will be hit in 2050. This might mean that Germany will need to be more ambitious than reducing carbon by 'at least 55 per cent' by 2030 as laid out in the German Climate Protection Act.

And that's before factoring in the country's less-than-perfect starting position: the rate at which renewable energies are expanding is not where it should be. In 2019, only 325 new wind turbines



with a capacity of 1,100 megawatts were built in Germany. An increase of at least three times this capacity would be required per year to achieve the target of a 65 per cent share of renewable energies in 2030. The industry blames a lack of space and lengthy approval procedures. Slow grid expansion, a refurbishment rate that is too low and stagnant emissions in the transport sector complete the picture.

If Germany is serious about achieving this major goal, then it needs to lay out a roadmap and find solutions quickly, as well as provide clarity as to how climate neutrality is defined and which routes lead to the zero line. Enter dena with its pilot study, Towards Climate Neutrality (Aufbruch Klimaneutralität), which was started in 2020. The study is intended to provide companies with strategic orientation so they can align their business activities with the goal of a climate-neutral society and to give policymakers concrete recommendations for laying out the roadmap. “We want to help address the discrepancies between the ambitious goal of climate neutrality and the as yet limited success in getting there and, if we can, also help resolve these discrepancies,” says dena’s Chief Executive Andreas Kuhlmann (see box).

Similar to the previous study conducted in 2018, the new dena pilot study again aims to present the transformation paths leading to an integrated, climate-neutral energy system. The way the study is designed continues the model of looking at mobility, building and energy industry development in terms of sectors and supplements it with the cross-sector research areas. “As with the first pilot study, we’re relying on working together with partners from the scientific, political and business communities to build up an overall picture from as many industry and expert perspectives as possible,” says Hannes Seidl, dena’s Head of Division for Energy Systems and Energy Services.

The aim is to design feasible transformation paths and, despite all the challenges, to show that climate neutrality “can be an innovation driver for Germany as a business location,” adds Christoph Jugel, Head of Energy Systems at dena. He is convinced that

“using process technologies that generate very few greenhouse gases or that are climate neutral, as well as using negative-emission technologies across the board and at an early stage, opens the door to major commercial and industrial opportunities.”

### Pacesetter economy

Some companies have recognised this and are leading the way. Chemical group Bayer, for instance, is aiming to become climate neutral by 2030. The traditional company, which employs over 100,000 members of staff worldwide, has committed to the goals of the Paris Agreement of limiting global warming to significantly below two degrees Celsius. Bayer CEO Werner Baumann stated in the German-language business newspaper *Handelsblatt* that companies can’t wait for national climate policy: “the priority isn’t what governments ask us to do, but what we identify as the right thing to do.” As Baumann stresses, business must be even more resolute in acknowledging its responsibility for climate action. Bayer is planning to reach the zero line by implementing energy efficiency measures and switching to electricity generated from 100 per cent renewable energies. It intends to offset any remaining emissions with certificates benefitting climate action projects.

Even Silicon Valley tech giant Apple is targeting climate neutrality by 2030 and wants its suppliers to do so, too. One of these is German battery manufacturer Varta, which supplies the button batteries for AirPods, Apple’s wireless earbuds. Apple is committed to manufacturing energy-efficient products, a carbon-free aluminium production process, green electricity and offsetting measures such as reforestation in Kenya and the preservation of forests and mangroves in Asia and America. Other tech companies such as Microsoft or Germany’s 1&1 want to switch their power supply completely to electricity generated from wind and solar power.

Most companies are following the same approach to planning as Apple and Bayer and are using a wide range of measures to do so. These include saving energy in production, recycling and using electricity from renewable energies, as well as carbon credits from reforestation programmes and other offsetting measures that avoid carbon or recapture it. Yet everyone knows that offsetting cannot be anything more than an interim, niche solution – it is not enough to solve the global problem of climate change (see box).

A look at each individual industry provides an idea of just how high the hurdles are on the road to neutrality. Take the property industry, for instance. There has been a distinct lack of success in terms of climate action here despite the high heating oil prices that have occurred at times in recent years. According to the German Institute for Economic Research (DIW Berlin), the heating energy demand in blocks of flats remains at an average of 130 kilowatt hours per square metre of heated living space per year – the same as it was in 2010.

“This demonstrates that although carbon pricing in the building sector is an important instrument, financial incentives alone are not enough,” says Christian Stolte, dena’s Head of Division for Energy-Efficient Buildings. Especially, he continues, seeing as it’s not socially acceptable to put rent prices up arbitrarily due to rising energy prices. Stolte is also calling for intensive energy



Among other things, Apple supported the development of an aluminium production method that doesn’t release greenhouse gases.



Carbon storage in Iceland: at the Hellisheiði power plant site, a pilot plant filters carbon dioxide out of the air, which is then mineralised and stored underground.



Taking responsibility for climate action: a researcher in a lab belonging to chemical group Bayer.



The rate at which renewable energies are expanding is not where it should be in Germany: construction work at the Feldheim wind farm in Brandenburg.

Photos: Paul-Langrock.de, Apple, Climeworks/Sandra Ó. Snaebjornsdottir, Bayer

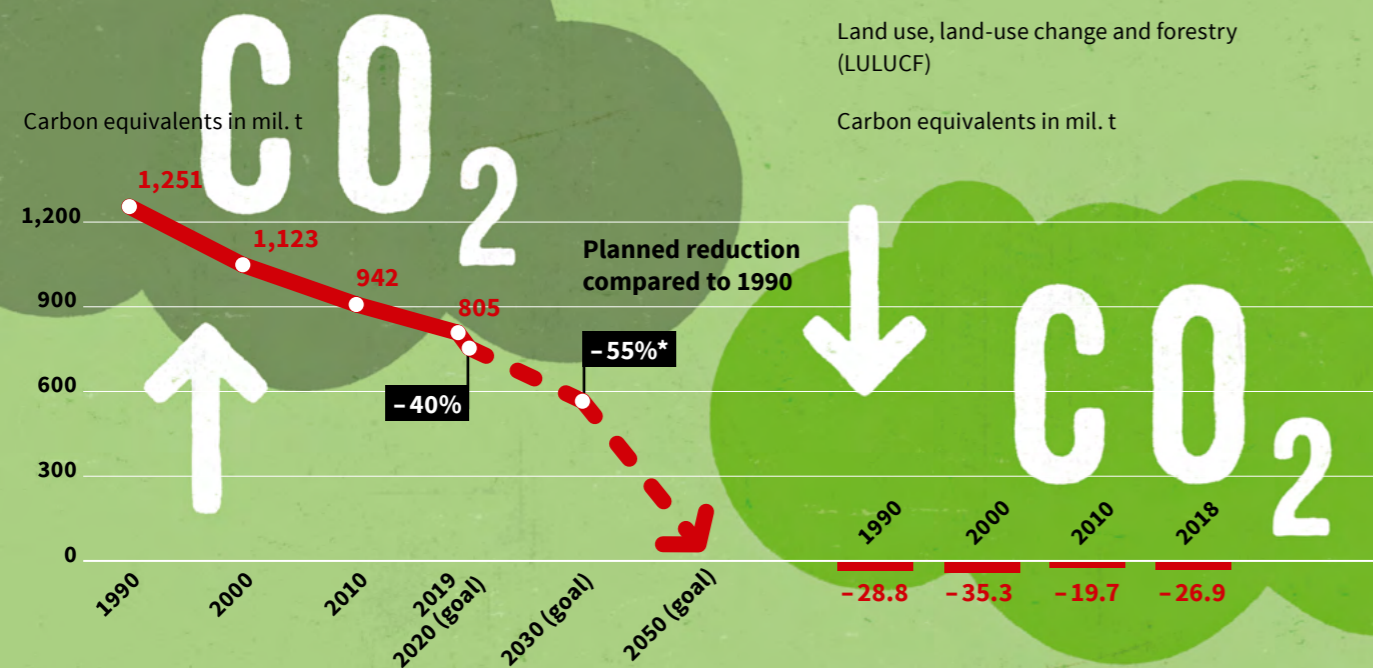


Greenhouse gas emissions in Germany:  
historical development and goals

Greenhouse gas sinks in Germany:  
historical development

Land use, land-use change and forestry  
(LULUCF)

Carbon equivalents in mil. t



\*According to the German Climate Protection Act 2019  
Source: Federal Environment Agency

Values rounded  
Source: Federal Environment Agency

consultations for homeowners to draw attention to the attractive subsidies for insulating the building envelope, sturdy windows and heating systems based on renewable energies. “An individual refurbishment roadmap shows you the best route to making a building efficient. A good building envelope, efficient technology, heat pumps, solar thermal energy, wood-fired heating or even heating grids are appropriate parts of this,” he adds.

#### In search of game-changing technologies

While the housing industry already has a plethora of technologies at its disposal, some industries are just starting out. Cement factories are responsible for up to eight per cent of the world’s total greenhouse gas emissions due to the calcium oxide they burn. In Germany, this figure is two per cent, according to the trade association VDZ (Verein Deutscher Zementwerke). All of the approaches designed to bring this number down are still in the research stage.

The steel industry is also facing major challenges. Many of the 84,000 people who work in the industry in Germany are employed at one of the eight steel mills with furnaces, steel works and rolling mills throughout the country, from Bremen to Völklingen. Not only do these steel mills consume 24 terawatt hours of electricity annually, they also emit 50 million tonnes of carbon – mainly because iron ore is converted into pig iron using coke, making it carbon free. Technically, steel could also be produced by reducing the iron ore with hydrogen, but that would cause the price of steel to skyrocket from a reasonable €500 per tonne to €800–950 and quickly force German steelworkers out of the market. That’s why

the German federal government has made it clear in its steel action plan that it wants to promote the introduction and expansion of climate-friendly technologies. The idea is that green steel ‘made in Germany’ in the mills where steel is recycled in electric arc furnaces will become a leading export in the future. Individual facilities such as ArcelorMittal steel mill in Hamburg should lead the way by setting a good example. The company expects to receive investment grants of more than €50 million on top of another €120–200 million per year to offset the additional costs. ThyssenKrupp also wants to make its blast furnaces climate neutral using green hydrogen and build its own hydrogen infrastructure to reduce coke. The International Renewable Energy Agency (IRENA), however, recommends reducing the coke at its source and where green hydrogen could easily be produced using solar power: in Australia.

#### A neutral takeoff

The aviation industry is also experiencing some turbulence on its journey towards a climate-neutral future. Its share of greenhouse gas emissions is between two and five per cent, depending on whether you look at just the carbon emissions themselves or whether you factor in their impact on the upper layers of the atmosphere as well. Airlines such as Lufthansa are offering their customers the option of voluntarily offsetting their carbon emissions, but this is merely a short-term solution – new technologies are what are needed in the long term. European aircraft manufacturer Airbus has promised the first commercial zero-emission aircraft with a capacity of up to 200 passengers for 2035. “It’s going to cost us billions

of euros. We can’t do it by ourselves,” says Glenn Llewellyn, VP, Zero Emission Aircraft. Hydrogen is at the centre of things here, too: “it’s the fuel that a huge number of industries need,” says Llewellyn.

#### The ultimate fuel to reach the zero line?

Whether it’s as storage for surplus wind and solar electricity, as fuel in a small-scale fuel cell power plant in the basement or as fuel for aircraft, ships, trains and heavy goods vehicles, hydrogen is supposed to fill the many gaps that the move away from fossil fuels is opening up. “Hydrogen is the crude oil of tomorrow,” says German Minister of Research Anja Karliczek (see page 50).

The miracle fuel’s untapped potential is spurring people into action: President of the European Commission von der Leyen wants to create European ‘hydrogen valleys’ as a modernisation programme for the economy and to revitalise rural regions. The German federal government’s hydrogen strategy is more specific in its proposals: hydrogen produced in a way that doesn’t damage the environment should help to reduce carbon emissions in areas where there is little room left to optimise energy efficiency further or use more electricity from renewable energies directly, such as in industry and transportation, for instance. To make this happen in Germany, power generation plants are going to be ‘built on an industrial scale’ and a market for carbon-neutral hydrogen is going to be established, which will create more than five million jobs.

#### A framework for the zero line

Innovations are needed to overcome the technological challenges in the industries and sectors. But innovation is in just as much demand when it comes to the political framework as well. Economists such as member of the German Council of Economic Experts Professor Veronika Grimm even speak of the need for a ‘paradigm shift’ to introduce the right incentives to reach the ultimate goal of climate neutrality (see page 16).

Up to now, the framework for the energy transition and climate action in Germany has been characterised by an overabundance of small-scale regulations that are managed and adjusted in increasingly complex procedures. The German Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz, EEG) alone contains over 100 paragraphs and quite a number of regulations. There are regulations on energy efficiency for homes, household appliances and waste incineration plants. Greenhouse gases from cars, chainsaws, trains, aircraft and even barges are also subject to painstakingly meticulous legislation that regulates individual emission standards.

That’s why there has long been a consensus among economists that change is needed in two major areas. One is that the system of taxes and levies in the energy sector needs to be reorganised, and the other is that there needs to be a focus on market-based instruments such as carbon pricing and carbon trading.

As a first step towards reforming the levy system, dena, together with the FiFo Institute for Public Economics at the University of Cologne and the Foundation for Environmental Energy Law (Stiftung Umweltenergierecht), has proposed lowering the EEG surcharge to zero. Among other things, the electricity tax will be increased to finance this. This move could increase the scope for investment in

## WHAT DOES CLIMATE NEUTRAL ACTUALLY MEAN?

The basic principle is tantalisingly simple, but the reality is complex. This can be seen in the number of terms and definitions alone: climate neutrality, greenhouse gas neutrality or carbon neutrality are often used as synonyms. In fact they describe different concepts. All of the approaches refer to a balance between emissions and sinks. However, the exact position of the zero line can vary massively:

**CLIMATE NEUTRALITY** in its broadest form means: All man-made (anthropogenic) and natural factors influencing the global temperature increase must be offset. This allows the average global temperature to remain unchanged as a result. The relevant factors include, for instance, air pollution – caused by soot or particulate matter, cloud cover and the albedo of the Earth’s surface.

**GREENHOUSE GAS NEUTRALITY** describes a state in which a balance is struck between anthropogenic greenhouse-gas emissions and sinks. The Paris Agreement defines greenhouse gas neutrality as a general goal of “(...) [achieving] a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century (...)” Alongside carbon dioxide (CO<sub>2</sub>), greenhouse gases also include methane, nitrous oxide, various fluorides and fluorinated hydrocarbons.

**CARBON NEUTRALITY** is the least ambitious as it only refers to offsetting carbon dioxide emissions, not the other greenhouse gases.

There are also different approaches as to how a state of neutrality can be established. Offsetting by purchasing emission rights is a rather weak option. The proceeds are used to fund activities that reduce emissions in other areas such as reforestation. However, it’s difficult to balance these mechanisms universally. Direct offsetting through negative emissions is considered to be more effective, either through natural carbon sinks such as oceans and forests or through technologies that capture greenhouse gases from the atmosphere.

You can read a detailed description of the various approaches in dena’s analysis ‘Climate Neutrality – A Concept with Far-reaching Implications’ (Klimaneutralität – ein Konzept mit weitreichenden Implikationen).





## “We could start storing carbon in farmland right away”

Scientist Jessica Strefler from the Potsdam Institute for Climate Impact Research (Potsdam-Institut für Klimafolgenforschung, PIK) is conducting research on carbon sinks and negative emissions, i.e., using natural and technological methods to remove carbon from the atmosphere.

### Carbon sinks have been in IPCC reports for years. Why are they becoming an issue now?

**JESSICA STREFLER:** Without negative emissions, it'll be difficult to meet the two-degree goal. Germany and the EU have decided that they want to be greenhouse gas-neutral by 2050. To bring net emissions down to zero, we will need to remove carbon from the air. This is because emissions in agriculture or in industries such as aviation, heavy goods transport, glass, concrete and steel can't be avoided completely.

### What options are there to do this?

**STREFLER:** We have a lot of options available to us. One of those is, of course, reforestation or increasing the density of existing forests. Another option is storing carbon in soils, for instance by cultivating farmland and fields more carefully, leaving crop residues behind or using cover crops. This increases the organic carbon content in the soil and removing the carbon from the atmosphere can be combined with ecological benefits. Technological methods such as Direct Air Capture (DAC), in which carbon

is filtered out of the air and stored geologically, on the other hand, are very energy intensive. Of course, this energy would have to be generated in a carbon-neutral way. In Iceland, for example, there is a plant that captures carbon in basalt rocks using electricity from a geothermal power plant. With any technology, we need to take a close look at costs, scalability and environmental sustainability.

### At what stage are the methods you mentioned in their development? And which ones are economical?

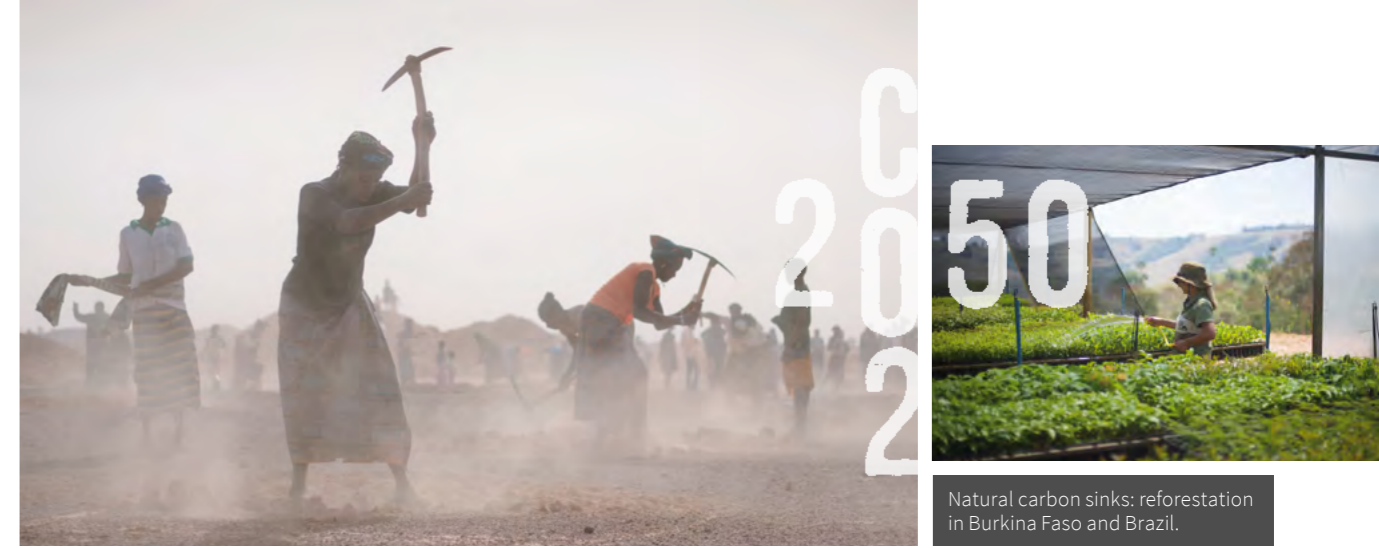
**STREFLER:** We could start storing carbon in farmland right away. We can't go wrong with this from an ecological point of view either. That said, this solution can't be scaled up endlessly as the soils can only absorb a certain amount. In contrast, extracting carbon from the air using technological methods can permanently capture huge quantities of carbon. The downside is that the costs are still extremely high right now. Other methods are still in the research stage. For instance, using fibres produced by carbon dioxide in concrete would be interesting.

### How does the footprint of carbon sinks compare to avoiding carbon emissions?

**STREFLER:** We're only going to meet the climate targets if we avoid emissions. Renewable energies and other technologies for avoiding carbon are the more favourable solutions by far. The sinks that we're talking about today are only beneficial for emissions that are very difficult to avoid. If we wanted to recapture the 40 billion tonnes of carbon emitted globally each year using DAC right now, we would have to build an industry that is ten times the size of today's crude oil industry – and which would consume almost all of the energy produced in the world today.

### What role does the carbon pricing system have to play?

**STREFLER:** The emissions trading price is the benchmark for whether a technology is economical. This also applies to carbon sinks. Technologies that extract carbon from the atmosphere are only economical if they are cheaper than avoiding emissions – that means if they cost less than the carbon price.



Natural carbon sinks: reforestation in Burkina Faso and Brazil.

climate neutrality, clean up the regulation system and remove the hurdles standing in the way of new business models. “We need to remove the current restraints in order to drive the integrated energy transition, by which I mean increasing the use of electricity in the heating and transportation sectors, and the starting point for this is a competitive electricity price that isn't weighed down by high levies,” explains dena's Chief Executive, Andreas Kuhlmann.

The second area: a universal carbon pricing system. Starting in 2021, Germany has launched a national trading scheme for fossil fuels in the heating and transportation sectors. Prices start at €25 per tonne of carbon, which will then gradually increase over the following years to a maximum of €65 in 2026.

Prices in European emissions trading are also going up. The EU had decided to reduce the total quantity of emission rights gradually by 2.2 per cent per year from 2021 even before the pandemic. As it stands, this is only in place until 2030 – emission rights must be restricted further to meet the EU's new, long-term climate goals.



### DENA PILOT STUDY – TOWARDS CLIMATE NEUTRALITY

The aim of the new pilot study is to identify transformation paths that can be used to achieve an integrated, greenhouse gas-neutral energy system. It is intended to provide stakeholders with a strategic orientation on which to align their business activities and to give policymakers concrete recommendations for laying out the roadmap. This follows on from dena's Integrated Energy Transition (Integrierte Energiewende) study published in June 2018. As with the first pilot study, partners from the scientific, political and business communities will be involved so as to acquire as many industry and expert perspectives as possible. Publication of the final report is planned for autumn 2021.

Learn more at [www.dena.de/en/integrated-energy-transition](http://www.dena.de/en/integrated-energy-transition)

This will likely affect the 11,000 plants in the energy industry, energy-intensive industry and (since 2012) intra-European air traffic, which combined are responsible for around 45 per cent of the EU's carbon emissions, first.

### Negative emissions to produce a positive result

As has been shown in this article, there are a few elements that are essential to reaching the ultimate goal of climate neutrality – more urgency in renewable energies and energy efficiency, using hydrogen in a wide range of applications and a sound market economy framework. But they are not enough, as there will still be emissions in 2050 that can't be avoided, for instance methane and nitrous oxide produced by agriculture and process emissions from industry. This is where other factors come into play: carbon sinks, carbon capture and storage (CCS) and carbon capture and utilisation (CCU) (see Interview).

The Intergovernmental Panel on Climate Change (IPCC) includes provisions that make it mandatory to extract carbon from the atmosphere in almost all of its scenarios for the future – a fact that has long gone unnoticed. This is a delicate subject in Germany after operators of coal-fired power plants tried to save their old piles from the impending phase-out of coal-fired power generation in the 2010s by using CCS – and failed due to the resistance put up by people at the sites.

This conflict has now been resolved thanks to the confirmation in 2020 that coal-fired power generation will be phased out, opening up an opportunity for a new beginning. In a joint article for ZEIT Online, dena's Chief Executive Kuhlmann and Oliver Geden, Senior Fellow at the German Institute for International and Security Affairs (Stiftung Wissenschaft und Politik, SWP), insist that Germany urgently needs a discourse based on facts, more research and expertise and a carbon storage strategy. 90 to 95 per cent of greenhouse gas emissions could be avoided by implementing various climate action measures. This would then leave the remaining five to ten per cent that cannot be avoided, which for Germany amounts to around 60 to 120 million tonnes per year. That's two to four times more than is currently being captured from the atmosphere via reforestation and better forest management.

Ultimately, the future depends on both these elements working in tandem: reducing as many emissions as possible as well as extracting as many of them as necessary from the atmosphere – and in the end, hitting the zero line. ■





Store hydrogen without loss and transport it safely: Andreas Kuhlmann and Veronika Grimm stand in front of the storage lab at the Energie Campus Nürnberg.

# “Global value chains will change”

**Climate neutrality is achievable, both in Germany and Europe. However, this will require a paradigm shift in policy instruments. dena Chief Executive Andreas Kuhlmann and Professor Veronika Grimm, a member of the German Council of Economic Experts, discuss the opportunities that this will open up and where the key starting points are.**

INTERVIEW Hanne May PHOTOS Giulia Iannicelli

**Climate neutrality is currently the talk of the town. But are we all actually talking about the same thing? What does climate neutrality mean to you and what are the main criteria?**

**VERONIKA GRIMM:** It's pretty clear if you want to put it simply: it's about neutralising global greenhouse gas emissions. You can argue what that means exactly in a number of dimensions: which greenhouse gases do we mean? How do you view nuclear power or blue hydrogen? And many more. I think it's dangerous to want to clarify these issues in advance, as then we'll just end up spending a long time discussing it and not take enough action.

**ANDREAS KUHLMANN:** That would be a bitter pill to swallow because achieving climate neutrality by 2050 also means above all that we have no time to lose. For me, climate neutrality means that everything we do mustn't harm the climate overall. This is mainly to do with greenhouse gases, but not exclusively. Aerosols from aircraft can also have an impact on the climate, for instance. One thing is clear when it comes to greenhouse gases: we won't be able to bring the emissions in every process in every sector down to zero. That means we

also need to talk about sinks. There are, of course, natural sinks through forestry and agriculture, for instance, but there are also technological sinks, such as extracting carbon from the air directly. I would also put CCU, CCS and an innovative circular economy in that bracket, too. Sinks are often used as an argument by people who want to avoid the issue and they make modelling more complex. But I'm absolutely certain that anyone who wants to achieve climate neutrality needs a strategy for sinks.

**GRIMM:** Or to put it another way, the 85 per cent scenarios were a good excuse not to look at certain things at all. Hydrogen and synthetic fuels have long been a controversial subject. Do we really need them? Aren't we just duplicating the infrastructures? The 100 per cent scenarios make this old news. The main issue now is: how do we do it? What I find exciting is that this all comes with a new role for major industrial groups. They are typically the main causes of emissions and as far as climate activists are concerned, they have been on the opposing side up to this point. Now, they've suddenly become allies to drive the energy transition forward, with oil, chemical and automotive groups all seeing new business fields in the hydrogen sector and developing product

technologies. Some people are still annoyed by this, but we also have to realise that we can get completely different alliances here and drive the climate issue forward with more oomph.

**It sounds like you're optimistic that Germany could actually become climate neutral by 2050.**

**GRIMM:** 20 or 30 years is a relatively long time. If you had told me 20 years ago that I'd be using a smartphone today, I'd have probably asked you which science fiction book you had read that in! So on that basis, I would bet a lot on us being able to manage that in Germany, and Europe, too. But the global question is the key one here. Europe is only responsible for a small proportion of global emissions. We now have to keep a close eye on what happens next. Will people say that what we're doing isn't having an impact on a global scale, or that we have to take the opportunity to develop various technologies? The sooner the technologies are ready to be climate neutral, the better.

**KUHLMANN:** I am with you 100% there. I'm not one of these people who say that the technologies are already there and all we need to do is implement them. Any technol-



**PROFESSOR VERONIKA GRIMM, PhD** holds the Chair of Economics at the Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) with a focus on economic theory. She is head of the Energy Market Design (Energemarktdesign) research division at the Energie Campus Nürnberg (EnCN) and focuses on economic and regulatory frameworks for the transformation of the energy system. In April 2020, she became a member of the German Council of Economic Experts (Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung).

ogy that helps us to reach the goal faster is welcome. That's also the reason why we at dena are fully committed to innovation and collaboration with start-ups. Sadly, they often fail because of the frameworks. That's where we need to start.

**GRIMM:** Absolutely. If industry, mobility, heating supply and the entire energy sector are going to collaborate and work towards climate neutrality, it will take a huge amount of coordination. One of these won't be able to work economically without the others driving their business models forward. Small-scale support mechanisms aren't suitable for this simultaneous development. What we need is an energy pricing system that is consistently oriented on the market, for instance.

**What might a suitable framework for reliably putting Germany on the road to climate neutrality look like?**

**GRIMM:** In 2019, a special report by the German Council of Economic Experts and various other advisory bodies proposed a cross-sector emissions trading scheme. This will now be introduced in 2021, even if the price level is not quite where it should be. In our proposal to stimulate the economy during the coronavirus crisis, we recommended leveraging synergy effects for the energy transition. Specifically, reducing or completely abolishing levies and surcharges in the energy sector, such as the surcharge imposed by the German Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz, EEG). In the future, the revenue lost from this surcharge could be refinanced with the proceeds from the carbon price. This would then make climate-friendly business models more attractive relative to ones based on fossil fuels.

**KUHMANN:** Consistently orienting the economic framework towards avoiding carbon is absolutely conclusive and we have at least made progress along this path. But transformation also has to factor in other frameworks. Take the speed at which stocks change, for example: tangible and intangible stocks, buildings and vehicle fleets, institutions and social customs. Sociologists

say that we need to tackle this using 'community funds'. The issue of speed not only relates to the economic framework. The tension between economic theory and this web of problems is complicated, but it can be solved.

**GRIMM:** True, it's not something that can just be done in the blink of an eye. That would cause immense problems for so many people, which is why it's important to keep expectations in mind during a transformation. For the carbon price, for instance, this means communicating it as the future guiding instrument with a specific price trajectory. I see fewer problems in abolishing surcharges and levies. It would be a massive benefit to many socially disadvantaged people. It's more that there is a budgetary challenge. If you wipe the slate clean, that's

**"Global value chains will change with the trade in climate-neutral gases and material energy sources."**

**Veronika Grimm**

€30 billion you need to find each year. But if I do it gradually and give everyone involved the expectation that this is the framework in which you can operate in the long term, then there will also be significant savings in other areas. Then I don't have to promote the transformation with expensive support schemes. Here's an example: hydrogen regions only receive funding for a limited period of time. They build relatively expensive plants but have no idea whether they have enough funding to operate them in the long run. If an attractive market environment is foreseeable after the funding window has closed, then this can significantly increase the willingness of companies to invest.

**KUHMANN:** Setting a new goal in a way that's credible and reliable, and underpinning it with the right measures, can unleash

an enormous amount of potential. It influences investment decisions to a degree that is often underestimated in economic models. If everyone knows that carbon is gradually going to get more expensive, then medium- and long-term investment plans will change pretty much immediately. The entry price is by no means the deciding factor here, but there is another key aspect: the energy transition and climate action are becoming more and more spread out and complex. Every day there's a new idea, a business model, a technology. It's impossible to manage and regulate this in detail, and policymakers shouldn't even try to. Instead, they should offer the right overarching incentives.

**GRIMM:** That's exactly the point – we need to mobilise a large amount of capital from the private sector to really achieve the transformation, and this requires a paradigm shift. Recent developments surrounding the climate crisis as well as the COVID-19 pandemic have created momentum. We now have the opportunity to send a clear message: please change your approach. We need to move away from thinking in terms of legislative periods and strengthen market-oriented instruments. Price differences must be dependable, long lasting and tangibly geared towards the future.

**We have already mentioned what is happening at the European level, where the goal of climate neutrality for 2050 is being discussed. Will it actually happen? And what will it mean for Germany?**

**KUHMANN:** I think this goal is set. China has also proclaimed it will achieve carbon neutrality by 2060. All of this is truly incredible. In our dena pilot study Towards Climate Neutrality, we are going to take a hard, long look at what this means in concrete terms and how we can shape it. We're planning to present the results in autumn 2021.

**GRIMM:** That's also how I see it. The goal has been set at a policy level. The crucial thing now is that there is more communication between the various disciplines and within the general public. This is because

sometimes there is a large amount of scepticism in some quarters. Some acceptance debates have been promoted by the fact that there are often alternative paths that involve less hardship for individual groups. The expansion of power lines, for instance: there have, of course, been studies that have said we can be much more decentralised. While that's true, we need completely different frameworks on the markets to implement decentralised solutions.

**KUHMANN:** We're having exactly the same discussions in the dena Grid Study III. The aim is to create an integrated approach to infrastructure planning, in other words, for the gas and electricity grids. The basis of all this should be a common vision of possible goals – a system development plan that has emerged during the socio-political discourse and reflects the entire debate. We are now piloting this approach. I see a real concrete opportunity to improve the processes here. But one question is also on my mind: how much strength does an economy need to develop to be sure that it can manage this conversion to climate neutrality?

**GRIMM:** It's not as if we have additional costs coming our way that we're going to have to shoulder. It's actually becoming more apparent that the global market for climate-neutral technologies and products will be divided up in the coming years. If we fail to make certain investments or create the environment for these investments, then we may fall behind on the global stage. In Australia, China, Japan, Canada, South Korea and the US, for instance, the key com-

**ANDREAS KUHMANN** has been dena's Chief Executive since 2015. The physicist believes that reliable frameworks are crucial on the road to climate neutrality, in order to promote investments in climate-friendly technologies.

**"Every day there's a new idea, a business model, a technology. It's impossible to manage and regulate this in detail, and policymakers shouldn't even try to. Instead, they should offer the right overarching incentives."**  
**Andreas Kuhlmann**







ponents for the future economy are well positioned around climate-neutral gases and material energy sources.

**What role does hydrogen have to play here in Germany in achieving the goal of climate neutrality? And which fields of application would make sense for the initial market launch?**

**GRIMM:** If you want to be climate neutral, you need hydrogen or other material energy sources. There are some sectors in which synthetic energy sources are essential – in heavy goods mobility, for instance, in shipping or in aviation. Industry already needs hydrogen on a large scale, but it's currently produced using fossil fuels. Plus, markets will also emerge where people are not reliant on hydrogen, but they may opt for hydrogen products, depending on the frameworks. If the filling station infrastructure exists, it may be better to drive a hydrogen vehicle if I want a heavy, large vehicle and frequently travel long distances with it. People don't always buy the cheapest car that meets their requirements as it is. It's always the question of how different products perform on markets.

**KUHLMANN:** I completely agree. Some people say, "Watch out, we need to be very careful with hydrogen, it's champagne." Others say, "No, it's the new oil." We're still lacking a common assessment of where the starting point is and what can be done over the next few years. Looking ahead to 2050, however, we can probably say that at least one third of the energy supply will not be directly electric; it won't be possible without molecules.

As far as fields of application are concerned, no sector should be ruled out for the time being. But which sectors need funding?

**"Any technology that helps us to reach the goal faster is welcome."**

**Andreas Kuhlmann**

The steel industry is an obvious candidate. The processes in this industry could be converted to direct reduction and start with natural gas, which is then steadily replaced by hydrogen. But this would then need vast quantities, just like the chemical industry. In the transportation sector, on the other hand, people and companies are very willing to pay, so electrolyzers might quickly become cheaper on the market. But we also hear from the building sector that hydrogen might be needed to reach the climate goals in the existing building stock.

**GRIMM:** It would be important for the steel industry because there are investment

decisions pending. In general, however, there is still a great deal of uncertainty as to where it would be worthwhile. There are plenty of candidates, and we should clarify this quickly in a roadmap process. And by quickly, I mean we need to have created the roadmap in six months and put together and presented a paper in 12 months. We have the opportunity to use the existing bodies, for example, the German National Hydrogen Council (Nationaler Wasserstoffrat) or the Center Hydrogen.Bavaria (Zentrum Wasserstoff.Bayern), to work with partners to demonstrate the possibilities. If we succeed in developing roadmaps that are compatible with the goal of climate

**"We need to mobilise a large amount of capital from the private sector to really achieve the transformation, and this requires a paradigm shift."**

**Veronika Grimm**

neutrality and show at what point we can become active in which areas and under what conditions, then this will fuel the discussion about the right frameworks.

**KUHLMANN:** As far as I see it, we'll need such large quantities overall that it would be unwise to impose restrictions on ourselves. There will actually be only green hydrogen for the next five years. We should implement all of the projects that are currently available so that we can gain experience. I don't see there being a project in Europe that can deliver significant quantities of blue hydrogen before 2025. And hydrogen from pyrolysis won't be available

until between 2028 and 2030 at the earliest. However, we'll definitely need all of this along the way as well, so it's important we take care of it in good time.

**Discussions about hydrogen and powerfuels aren't exclusive to Germany and Europe. Activities are going on and investments are being made all over the world. A new global market is emerging. Will we see even bigger changes in global trade in the future?**

**GRIMM:** Countries such as Australia, China, Japan, Canada, South Korea and the US are making intensive preparations to ensure

they are well positioned in terms of the key components for the future economy relating to climate-neutral gases and material energy sources. That's why we're doing very well in the European Union to create frameworks that make it profitable for companies to invest here. Many European companies have global supply chains, and that's not going to change. But global value chains will change with the trade in climate-neutral gases and material energy sources. This is because goods that can be produced using hydrogen or other climate-neutral energy sources can also be transported.

**KUHLMANN:** That scenario is certainly possible. It's a special challenge for Germany as an industrial centre that shows that we have to rethink a number of things. But you can't want to change the world while also hoping that everything will stay the way it is.

**What does this mean for policymakers as a consequence? What would they have to do to react to the new requirements?**

**GRIMM:** Policymakers need to create attractive frameworks for climate-friendly technologies on markets, in Germany, Europe and beyond. Infrastructures need to be put in place, and states should act with consistency, even at the risk of making a wrong decision. I hope we can also use the Hydrogen Council's work to collect as many perspectives as possible and get a discussion going between the various stakeholder groups. There are, of course, some people involved who have been on different sides of environmental and climate issues, but now we all face a common task. That makes me very optimistic. ■



# WE NEED TO TALK... ...ABOUT DENA TURNING 20!

dena is celebrating its twentieth birthday in 2020. The 'Agency for Applied Energy Transition' has grown steadily in its remit. What was its most important contribution to climate action and the energy transition? Where will we be in 2030? And what can dena do to help Germany achieve its climate goals? We asked five major partners.

**1**  
What is dena's most important contribution to climate action and the energy transition?

**2**  
Where will we be in 2030 in terms of climate action and the energy transition?

**3**  
What can dena do to help Germany achieve its energy and climate goals?



**Peter Altmaier**  
Federal Minister for Economic Affairs and Energy



**Svenja Schulze**  
Federal Minister for the Environment, Nature Conservation and Nuclear Safety

dena has taken the opportunity that its founders saw 20 years ago – to reconcile the goals of the energy transition and the concerns of the economy and to advance both as one. dena has used innovative projects to develop the interface between policymakers and the business community. And the long-term success demonstrates just how important dena's work is for the energy transition and climate action, as well as for energy efficiency and the security of supply.

dena gets companies involved in the political process. This is where dena, with its close links to the business community, plays an important role in integrating corporate positions into political processes and developing proposals on how companies can help shape the transition to a climate-neutral world. Another important contribution is providing companies with expert support in the implementation of climate action measures – in the Energy Efficiency Networks Campaign, for instance.

In 2030, we'll see whether the roadmaps to achieving climate neutrality by 2050 were laid out accurately. We have created the best conditions for this with the Climate Protection Programme 2030, the 'Protect the Climate and Strengthen the Economy' initiative that I presented and the climate policy orientation of the Economic Stimulus and Future Package. We have to make the most of the European Green Deal as it offers the unique opportunity to drive forward and reconcile climate action and the economy as one. We can achieve climate neutrality by 2050, including the interim targets that need to be achieved by 2030, if we can use innovation and technology to secure jobs while also creating new ones. We need to focus all our efforts on working together to make this happen.

The German Climate Protection Act, with its binding sector targets, annual monitoring and mandatory emergency measures for missed goals, will ensure that we'll achieve the targets for 2030. The carbon pricing system starting at the beginning of 2021 will introduce incentives to stop using fossil fuels for heating and motor fuels. German companies will account for a significant share of the market in terms of technologies that use green hydrogen. E-mobility has momentum because the benefits – less noise and pollution – are tangible.

Germany has set ambitious targets. We need to strengthen our efforts even further to be able to achieve them. Since we will only be successful in the long term with competitive solutions, we need an objective view of what is feasible and the limits of that – and a forward-thinking dena that has new solutions and paths in mind.

Turning our attention to the challenges of the energy transition, dena can successfully organise discussions between the business community, politics, administration, science and civil society and develop well-founded, accepted and applicable solutions based on these discussions. dena has already named key fields of action for this: infrastructures and energy markets, climate-neutral production processes, heating in buildings and e-mobility.

Photos: BPA/Steffen Kugler, BMU/photothek/Thomas Trutschel





**Kerstin Andreae**

Managing Director of the German Association of Energy and Water Industries.



**Professor Ottmar Edenhofer**

Director of the Potsdam Institute for Climate Impact Research and the Mercator Research Institute on Global Commons and Climate Change (MCC)



**Jules Kortenhorst**

CEO Rocky Mountain Institute (RMI)

**1**  
**What is dena's most important contribution to climate action and the energy transition?**

dena has become a key player in making the energy transition a successful one. It provides important ideas in all relevant fields of application time and again with its projects and publications. These include, for instance, the dena Grid Studies, the dena 'Integrated Energy Transition' pilot study and the energy efficiency networks. It is thus making an important contribution to the carbon-neutral energy world of tomorrow.

dena makes important contributions to developing sustainable approaches to making the energy transition in Germany successful. It is committed to the conversation between the scientific, political and business communities – and this conversation is vital. In doing so, it also highlights the discrepancies between ambitious emission reduction targets and the measures that have been taken so far, and helps to strengthen practically oriented solutions to the greatest extent possible, such as a stronger carbon pricing system.

Similar to RMI, dena has an important focus on the systemic nature of climate action and the energy transition, including three main elements: energy efficiency, energy systems design and renewable energy. We believe that this type of comprehensive approach is essential to move all elements of the complex energy system more quickly towards decarbonisation. As the climate crisis is time sensitive, it is critical to transition every part of the energy system as quickly as possible.

**2**  
**Where will we be in 2030 in terms of climate action and the energy transition?**

I hope that come 2030 we'll be able to tick the box and say that the climate goals for 2030 have been achieved. Whether we will be able to, however, depends on whether we can lay out the right roadmaps now. We need more electricity from renewable energies, more grid expansion, more electric cars and a true heating transition. We also need to create a hydrogen economy. The more determination with which we up the pace here, the more likely it is that we will reach the milestone in 2030.

By then, the carbon pricing system will hopefully have established itself as the guiding climate policy instrument in implementing the European climate goals, with sectoral expansion and a minimum price that increases as expected. Then we'd probably be on the right road to achieving climate neutrality in Europe by 2050. The rising carbon price has also had a positive impact on the energy transition: electricity production from coal is decreasing even faster than planned year by year, while renewables are growing. In light of this, there are already negotiations with China to link the Chinese emissions trading system with the European system.

The science is clear: by 2030 we must have reduced total global emissions 50% for a chance at hitting the 1.5 degree target, and by 2050 we must reach net zero emissions. The physical limits of the climate system do not leave any room for negotiation on these targets, and so we simply must align our energy transition pathways with this reality. Therefore, we should focus our efforts on a dramatic increase in energy efficiency, making our electricity clean and electrifying as much of our economy as possible, and then addressing the remaining emissions across every sector of the economy.

**3**  
**What can dena do to help Germany achieve its energy and climate goals?**

The most rocky part of the road to climate neutrality is still ahead of us. So with that in mind, I'd like to wish dena a happy birthday and hope that it can continue to contribute to achieving the climate targets with many more successful projects. It should not ease up in its vital work and should continue to constructively support the energy transition and drive it forward. I can't wait to get involved with the interesting discussions and the wonderful collaboration!

Major efforts are still needed to achieve the ambitious goal of a climate-neutral Germany in 2050. dena should work together with the scientific community – such as Ariadne, the major research consortium on the energy transition – to show policymakers which energy and climate policy instruments can work in practice and which ones cannot. And it should help to organise support from the business community to drive forward policy.

Building on the excellent work dena has contributed for the last 20 years, the organisation now has the opportunity to drive Germany further towards its energy and climate goals. In particular, the most recent work by the RMI on financial mechanisms for retiring coal plants early could help dena make an even stronger case for rapidly transitioning away from coal in Germany and more quickly deploying clean energy solutions, along with greater efficiency and improved, smarter power grid solutions.

Photos: BDEW/Roland Horn, Thomas Köhler/ photothek, Rocky Mountain Institute



A thermal image of a multi-story building facade. The image uses a color scale from blue (cooler) to red (warmer) to show energy loss patterns. Windows and doorways are clearly visible as cooler areas, while the surrounding walls and roof are warmer. The overall appearance is that of a heat map overlaid on a photograph of a building.

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Since it was founded in 2000, dena has been heavily involved with energy efficiency in buildings. Thanks to the knowledge of our experts, houses have been refurbished, energy consultants have been trained, consumers have been informed, new standards such as the refurbishment roadmap or the energy performance certificate have been developed and introduced.

## INSIGHTS

In **Insights**, we show you where and how we are making progress on the energy transition and climate action, both in Germany and worldwide. We take a look at how we are designing a new infrastructure plan for the entire energy system, what's on the agenda during the bilateral cooperation with Turkey, and which innovative climate concepts we are supporting in industry. This section reveals more about the **spectrum of our work** and its impact.



# THE SYSTEM AT A GLANCE

**The energy system is becoming more and more complex, and the number of interfaces between the sectors is increasing. Current planning processes can no longer meet some of the requirements. In Grid Study III, dena is working together with a number of partners to develop a concept for a new, integrated planning process for electricity and gas grids. This follows on from previous Grid Studies, which were fundamental for the energy transition.**

**TEXT** Ralph Diermann

When construction work on a new type of hybrid power plant began in Prenzlau, Brandenburg, in 2009, the operators at renewable energy project developer Enertrag were delighted to welcome a very special guest: German Chancellor Angela Merkel herself laid the foundation for the world's first power-to-X plant.

Today, the site is still home to three wind turbines, each of which generates electricity with a rated output of 2.3 megawatts. If this electricity isn't needed in the grid right away, an electrolyser converts it into hydrogen, which can be fed into the gas grid. Alternatively, it can be used to power two combined heat and power plants, or the hydrogen can be bottled. This ensures greater flexibility, as fluctuating wind energy generation can be integrated into the overall system more efficiently. "As the energy transition progresses, the number of these types of interfaces between the individual sectors is increasing significantly," explains Stefan Mischinger, Team Leader for Electricity Grids at dena.

## Greater flexibility

The demand for power-to-X has grown steadily over the past decade. Today, green hydrogen is seen as a key element in continuing to drive the energy transition forward

(see page 50). The plants that are currently planned are far larger than the pioneer in Prenzlau. "We want to build several large power-to-X plants which also feed into the gas grids," says Simon Müller, Head of Energy Systems at Enertrag. "To do this, however, we need to be sure that the electricity and gas grids at the potential sites are equipped for this and that it's possible to connect individual projects to a hydrogen grid," he continues. For this, the planning for the further development of the various energy infrastructures must be better coordinated. Müller is critical that this is currently not the case: "We can see an urgent need for better coordination here."

Steadily rising numbers of decentralised energy producers and the increasing amount of interfaces between the sectors are making the system as a whole more complex. The resulting interactions and links can no longer be managed by planning subsystems in parallel, as has been customary up to now. Plus, there are also problems with acceptance of the grid expansion. "We need a paradigm shift away from separate planning and towards a holistic approach that is more focused on the energy system," emphasises Mischinger. This is the only way to link power plants, electricity grids, gas services and renewable energy plants efficiently. And it is the only way to make the



## DENA GRID STUDY III

With Grid Study III, dena is currently investigating, on behalf of the German Federal Ministry for Economic Affairs and Energy, how the planning of energy infrastructure can be optimised in terms of an integrated energy transition. As part of this, dena is working together with around sixty partners from the energy industry, politics, the business community and civil society. dena has presented the first interim result of the three-year study, which will run until the end of 2021, the system development plan, a concept that improves the methodology of network planning. In the second project phase, dena and its partners will substantiate the concept and test it in practice.

Learn more at  
[www.dena.de/grid-study](http://www.dena.de/grid-study)

most of the opportunities afforded by this convergence.

The planning processes for the various infrastructures have been largely separate so far. The plans are based on different principles, explains Nadine Bethge, Deputy Head of Energy and Climate at Environmental Action Germany (Deutsche Umwelthilfe, DUH): "Planning for the electricity grid is based on the requirements of the energy transition. These types of scenarios haven't been factored into the expansion of the gas grid until now – for instance, it doesn't take into account the amount of green electrolysis hydrogen that will one day have to be transported from A to B in Germany."

## Overarching approach

This is where Grid Study III comes in: it is looking for an overarching approach to planning that focuses on the entire energy system. "We want to coordinate the individual processes more closely in an upstream, integrated planning step," says Mischinger. The aim is to close gaps and to focus more on the interfaces. "Holistic, however, doesn't mean combining everything into one process," he stresses, as that "would make planning too complex." The dena expert believes it would be highly beneficial if the electricity and gas grids were planned based on the same assumptions at a few key points, such as how much electrolyser and gas power plant capacity is needed and in which regions this should ideally be located.

Grid Study III follows on from the previous two dena Grid Studies, which were published in 2005 and 2010. The central issues of these were the integration of renewable energies and the associated expansion of the electricity grids. Both studies were carried out in close cooperation with the energy industry, politics and the business community. "This involvement was incredibly important, because a project as wide-reaching as the development of the energy infrastructure needs a broad consensus," emphasises Hannes Seidl, dena's Head of Division for Energy Systems and Energy Services. "That's why we're also working intensively with all of the relevant stakeholders for Grid Study III, too."

The first Grid Study in 2005 developed scenarios for how renewable energies could contribute a share of 20 per cent to electricity generation in Germany between 2015 and 2020. The focus was on the expansion



Photo: Silke Reents



of wind energy, the renovation of the power plant fleet, reforms in how electricity is traded, and the necessary expansion of the electricity grids – an issue that has been the subject of intensive debates for years now. Both electricity grid operators and the wind energy industry were involved in the study. The German federal government later incorporated the new sections listed into the German Power Grid Expansion Act (Energieleitungsausbaugesetz), as urgent grid expansion projects.

“At the time, we showed with our study how system operation remains reliable if significantly more electricity generated from wind and solar power is fed in. That was fundamental in this early phase of the energy transition,” says Seidl. “Before that, it was often said that the further expansion of wind and solar energy would pose a threat to the security of supply.” Jürgen Trittin, the Federal Environment Minister at the time, commented on the publication, saying that the key statements of the dena Grid Study “remove any factual justification of the pessimism against the expansion of wind power.”

**Expansion and conversion of the grid**  
Expanding and converting the electricity grids were also the central themes of the

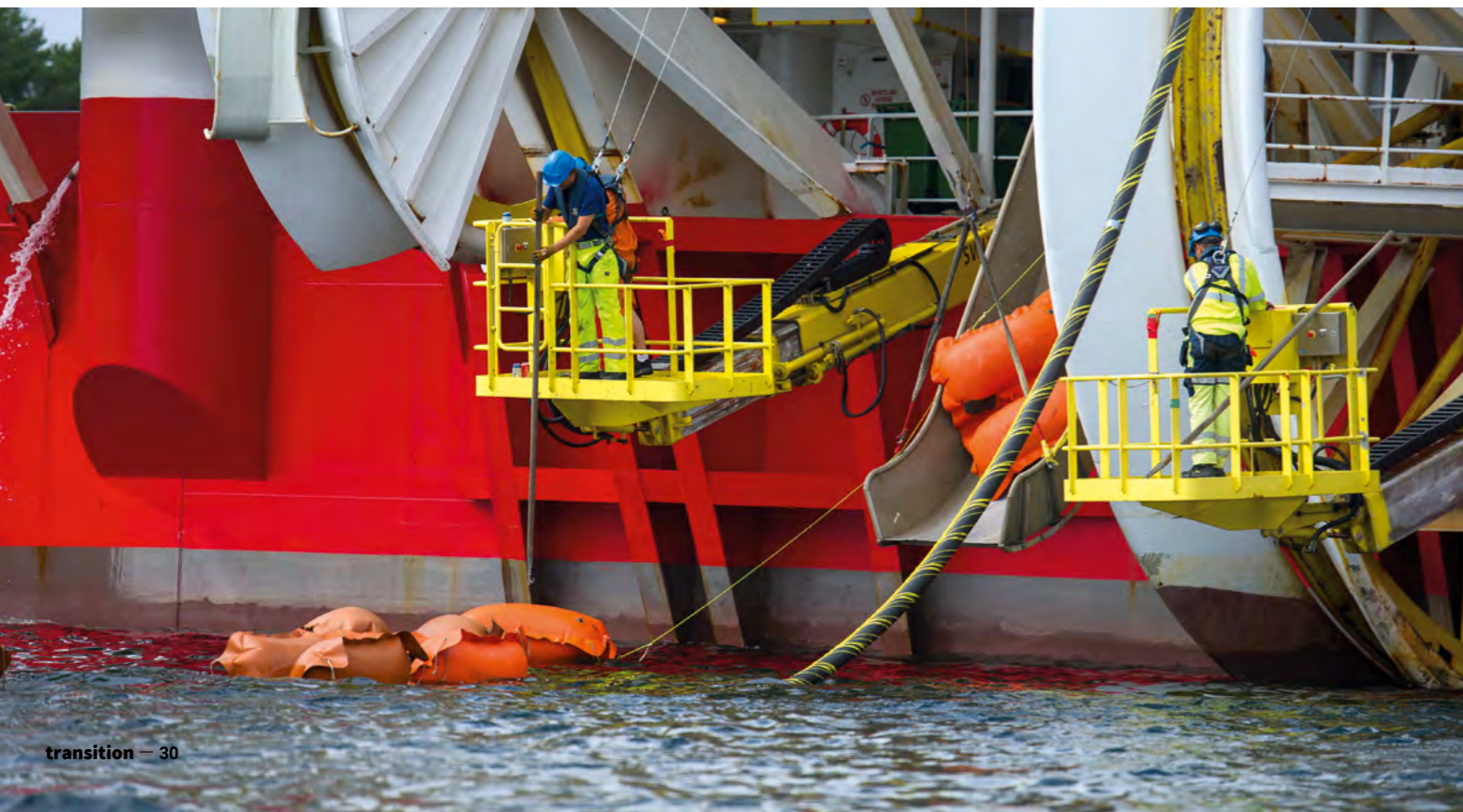
second Grid Study, published in 2010. The focus was on the issue of how the electricity grid could be prepared to handle a renewable energy share of 39 per cent by 2020/2025. The forecast that the expansion of renewables would require around 3,600 kilometres of new extra-high voltage lines was the subject of much discussion. It is now clear that the increased expansion targets for renewable energies and a stronger European electricity transit place far greater demands on the electricity grid. However, the priority has since moved away from building new lines and towards converting or reinforcing existing ones. Grid Study II contained proposals on how innovations could be implemented to better utilise or operate existing grids more efficiently, for instance by adapting the operation of overhead lines to weather conditions, referred to as overhead line monitoring, which is common practice for grid operators nowadays. The study thus laid the foundation for the NOVA principle, which still prevails today: grid optimisation before reinforcement before expansion.

However, both studies were also met with criticism. Among other things, environmental associations questioned the necessity of expanding the grid on the

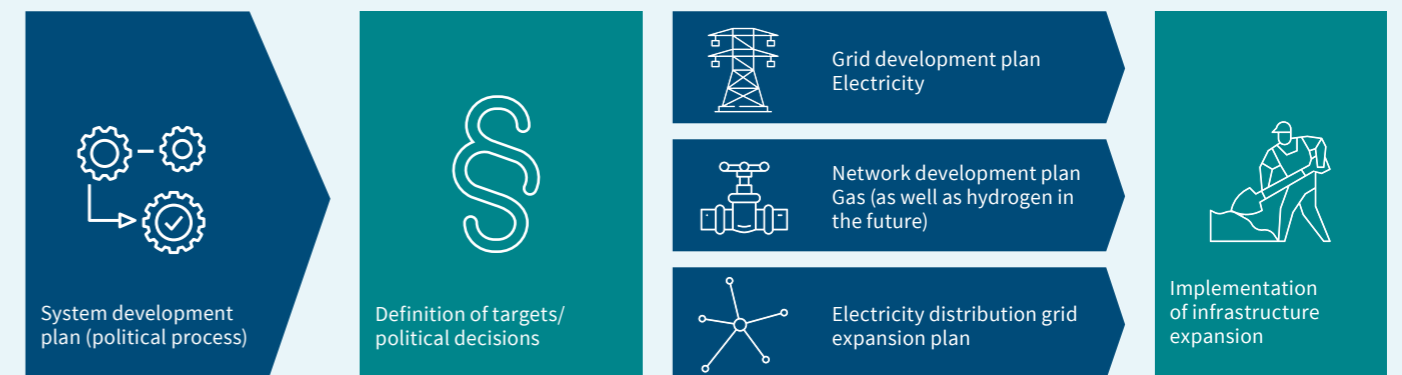
scale presented and criticised the fact that new conventional power plants had also been factored into the scenarios. However, the fundamental necessity of grid expansion finally found its way onto the political agenda with Grid Study II. “If we don’t expand the grid, it’ll be impossible for renewable energies to grow further,” said Hildegard Müller, then Chair of the General Executive Management of the German Association of Energy and Water Industries (BDEW), commenting on the results of the second Grid Study.

The expansion of the grid and the disruption to the landscape that comes with it meant that the acceptance of the energy transition and public participation became increasingly important, and remain so to this day. That’s why the current Grid Study III is also investigating the question of how existing planning processes can be improved further in regards to this. “When it comes down to it, it’s about enabling a social debate before planning the infrastructure – before policymakers set targets and the grid development plan translates these into concrete infrastructure measures,” explains Mischinger. “It ultimately makes planning easier if you involve people right from the start,” he continues.

More European electricity transit: laying the first NordLink submarine cable bundle between Denmark and Norway.



Grid Study III: new process for planning electricity and gas grids



20

DENA GRID STUDIES

Grid Studies I and II laid the foundation for the important discussion on the expansion of the electricity grids as part of the energy transition in Germany. In doing so, they started a debate that shaped the following years. The comprehensive change needed in the electricity markets could be discussed in a structured framework thanks to the studies, as they were carried out in close cooperation with partners from the energy industry, politics and the business community. The German federal government incorporated the new sections listed in Grid Study I into the German Power Grid Expansion Act (Energieleitungsausbaugesetz), as urgent grid expansion projects. The second Grid Study created the basis for the two-pronged strategy of grid expansion and optimised grid utilisation that is still pursued today. The dena Grid Study III aims to establish the idea of upstream system planning for the integrated development of electricity and gas grids.

Photo: Anders Martinsen/Nexans/Tennet

So far, the debate on the targets of the electricity grid expansion in Germany has been part of the consultations regarding what are referred to as scenario frameworks (Szenariorahmen), where policymakers, citizens and other participants can get involved. In the opinion of Markus Doll, Head of Network Development at the German Federal Network Agency, this fundamental political discussion does not belong there. “The purpose of the scenario framework is to serve infrastructure planning, but not to come to an understanding on how to implement the energy transition as a whole,” he emphasises.

**New process to answer the fundamental questions**

One of the most important components of the dena Grid Study III is, therefore, a system development plan – a new process that should take place before the electricity and gas grids are actually planned. The system development plan is designed to highlight development opportunities for the overall energy system and to provide policymakers with a basis on which they can make decisions when laying out the central roadmap in the infrastructure sector. Central ‘coordinates’ are to be discussed in the system development plan process, such as the ra-

tio of domestic electricity generation to imports or the required transport capacity, for instance. This data is then used as the basis for all further planning processes.

All of this should take place in a close discussion between policymakers, society, the scientific community and the business community. The system development planning process could thus become the central platform for a broad debate on the further design of the energy system, like those which already exist in other countries, like Denmark, for instance. The proposal was well received by the German Federal Network Agency. The technical grid planning and the political discussion in the general public surrounding the goals of the energy transition require greater separation from one another, says Doll. The system development planning process can also make a contribution here: “In this way, we depoliticise the actual grid planning.”

As it stands, the system development plan only exists as a rough concept, which dena presented together with the partners of Grid Study III after the first project phase was completed. What this might look like in concrete terms is now to be developed in the second project phase. The initial results are expected to be available at the end of 2021. ■



# Serial, social and climate neutral

**The market is huge, the learning curve steep: Germany is seeing its first serial refurbishment projects based on the Energiesprong principle come to life. The new approach could open up new business fields and help the housing industry meet its climate targets. But practice also shows that there are still challenges.**

TEXT Marcus Franken

The wonderfully named residential area of Kuckuck ('Cuckoo' in English) in Hamelin, Lower Saxony, hasn't enjoyed a particularly good reputation in years gone by. The district on the outskirts of the city was long considered to be a socially deprived area. The municipal administration has been working for years to improve the housing and living conditions. Successfully. As of recently, the area can even boast a genuine attraction – it is now home to Germany's first serially refurbished building. A two-storey residential complex built in the 1930s has undergone modernisation work based on the Energiesprong principle.

The buildings were given new façades, which were prefabricated in one piece including doors, windows, insulation, larch-wood cladding and a ventilation system and mounted in front of the house walls. The roof also consists of prefabricated parts. Building services now include a photovoltaic system and a heat pump with two storage facilities. Berlin-based start-up ecoworks planned the pilot project and implemented it as a general contractor. The first tenants are expected to move in at the end of 2020, says co-founder Emanuel Heisenberg. The company is developing the serial refurbishment process, which relies on digital technology for measurement and planning, for the German market.

## Learning from the pilot project

However, the pilot project in Hamelin also showed that the devil is literally in the detail. The condition of the buildings was worse than expected. There was fungus in the walls and in the cellar. The external walls were so warped that some of them had to be repaired manually. "The entire industry can take a lesson from Hamelin about just how important precise planning and coordination are," says Heisenberg.

The learning process is a part of the project as serial refurbishment in Germany is still in its infancy. The concept originated in the Netherlands, and the process is now used in several countries across Europe. The serial approach promises shorter planning and construction times, a better quality of life, guaranteed energy savings and lower costs to boot – in some places in the Netherlands, these costs have been kept so low that some landlords guarantee there will be no increase in rent and utility costs. Seen over the year, the refurbished houses are climate neutral.

In Germany, the Energiesprong approach is in the trial phase; the legal frameworks and the building structure are different here. dena is coordinating a Germany-wide serial refurbishment project for apartment buildings, which is being funded by the German Federal Ministry for Economic Affairs and Energy. According to dena's calculations, there are around 300,000 tenement buildings with up to four storeys built between the 1950s and the 1970s in Germany alone that are particularly suitable for serial refurbishment.

## Economic solutions

Those calculations are why housing companies and the property industry are following the development closely. "The industry is desperately looking for viable and affordable solutions to meet the climate goals in the building sector," explains Fabian Viehrig, an expert at the Federal Association of German Housing and Real Estate Companies (Bundesverband deutscher Wohnungs- und Immobilienunternehmen, GdW). The association is a supporter of the Energiesprong initiative in Germany. Cost-efficient refurbishment solutions are being sought in particular for tenement buildings with a simple outer shell, as was typical between 1950s and 1970s, seeing as the rents in many of these buildings cannot increase any further for social reasons.



## ENERGIESPRONG IN GERMANY

dena has been helping housing companies and the construction industry to develop serial refurbishment concepts for apartment buildings since 2018. As part of this, it is working together with non-profit organisation Energiesprong, which has successfully established this refurbishment market in the Netherlands. The volume deal signed at the end of 2019 was the first breakthrough in Germany, which saw 22 housing companies provide around 17,000 flats for serial refurbishment.

Energiesprong Deutschland is receiving funding from the German Federal Ministry for Economic Affairs and Energy (BMWi). The Federal Association of German Housing and Real Estate Companies (Bundesverband deutscher Wohnungs- und Immobilienunternehmen, GdW) is supporting the project. The first pilot projects are being funded by the EU's 'Mustbe0' Interreg NWE programme.

Learn more at  
[www.dena.de/en-energiesprong](http://www.dena.de/en-energiesprong)



Before and after: Germany's first serially renovated building in Hameln (visualisation).

Photo und Visualisierung: ecoworks

The B&O Group, a German housing service company based in Bad Aibling in Bavaria, is also investigating the new approach. "Serial production in new buildings has made housing affordable. We want to have this impact in refurbishment as well," says Nadin Bozorgzadeh, who is responsible for the project. Prefabricated façades and roofs based around timber frameworks are nothing new for the company. "We are basically already using timber systems for new buildings and loft extensions," explains Bozorgzadeh.

But B&O also knows that the approach used in the Netherlands can't be adopted in Germany without making some serious changes. In the case of multi-storey buildings, which are the main focus here, Germany's high fire protection standards have to be factored in, for example, says the expert. For instance, air slots must not be left between the house wall and the new attached façade so as to prevent a chimney effect from occurring in the event of a fire: "Making sure the façade connection is airtight is the be-all and end-all."

**Market launch and economies of scale**  
B&O is currently in the negotiation stages for two pilot projects. Bozorgzadeh reports

that the calculated costs are still higher than for traditional refurbishment work with exterior insulation finishing systems: "We're working on using volume to achieve an economy of scale – loosely based on the Aldi principle."

Everyone involved shares this hope as the success of Energiesprong depends on a broad market launch. The volume deal, which 22 housing companies have signed, might be the breakthrough: they are providing around 17,000 flats in 5,000 buildings for serial refurbishment (see box). GdW expert Viehrig is certain that "if serial refurbishment can really lower the costs by a significant amount, then the market for the process would be truly enormous."

Climate action would definitely benefit from it. "Even if we only manage to refurbish the most suitable apartment buildings, we will save seven million tonnes of carbon per year – and that figure will rise if we extend this approach to other building types," calculates dena Team Leader Uwe Bigalke. A climate-neutral building stock by 2050 might then be in reach. "And the construction industry would have an additional market volume of €10 billion." So that makes it a win-win situation for everyone. ■



The solar park in Konya: around six per cent of the electricity produced in Turkey comes from photovoltaics.

# Fewer imports, more efficiency

Turkey has increased the share of wind and solar energy in its power plant fleet to 16 per cent within a decade. Within the German-Turkish Energy Partnership, dena is working to support the next steps in the energy transition, including green hydrogen and energy savings contracting.

TEXT Marcus Franken

Sometimes, complex questions can be answered with one single number. \$54 billion – that’s how much money flows out of Turkey each year to buy coal, oil and gas from its neighbours. That’s 60 per cent of Turkey’s foreign trade deficit and more than six per cent of the country’s total economic output. For comparison, this value is less than two per cent in Germany.

From the rooms of the German-Turkish Chamber of Industry and Commerce in Istanbul, Zafer Koç looks directly over the Bosphorus and out onto the Beykoz district, one of the city’s greenest districts and home to 15 million people. “The Turkish government has two important tasks: reduce its dependency on coal, oil and gas imports and secure a cost-effective supply of energy,” explains Koç, who, as Head of the Market Consultancy Department, helps organise the German-Turkish Energy Partnership of the two state governments on behalf of dena. Coal and gas currently supply more than half of Turkey’s electricity. Hydroelectric power accounts for around 32 per cent, wind eight per cent and solar six per cent.

The combination of fewer energy imports and electricity consumption that has now risen to 300 terawatt hours per year makes the expansion of domestic energy sources just as necessary as improving energy efficiency.

## Expanding wind and solar power

Turkey has grown exponentially in renewable energies in recent years, with the country’s electricity generation from wind and solar energy almost doubling to 45.3 terawatt hours since 2016. And with an addition of 690 megawatts (MW) of wind energy and around 1,000 MW of photovoltaics in 2019, it continues to be one of the larger markets for renewables in Europe.

It was only in August 2020 that Turkish President Recep Tayyip Erdoğan personally opened a production factory for solar panels in Ankara. The system is planned as a gigawatt factory. The fact that it is being built is due to the Turkish tender system, as the new factory is required in order to build a 1,000 MW solar panel system, which was auctioned in the southern province of Konya. This link



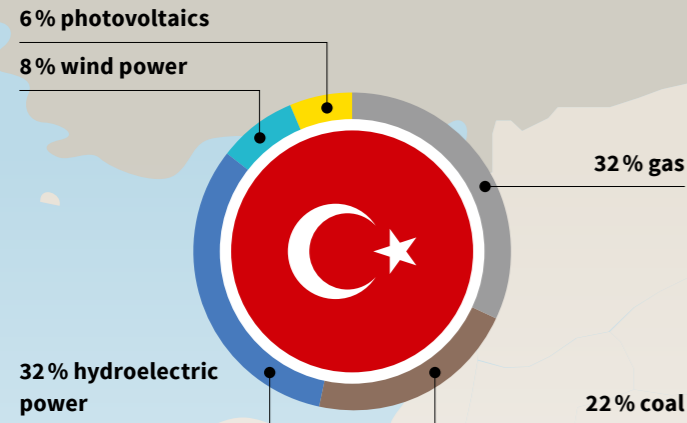
Since the German-Turkish Energy Forum was established in 2012, dena has been working with numerous stakeholders from both countries on the topic of energy efficiency on behalf of the German Federal Ministry for Economic Affairs and Energy (BMWi). At the beginning of 2020, the international commitment was expanded once again: dena is helping the BMWi and other federal ministries to implement and further develop energy partnerships, energy conversations and project-related energy cooperation with Turkey, Ukraine, Russia, Belarus, Kazakhstan, Uzbekistan and Iran. The overarching goal is to drive forward the global energy transition.

Learn more at [www.dena.de/energy-cooperatives](http://www.dena.de/energy-cooperatives)

Istanbul at night: the Turkish economy needs affordable energy.



Turkish electricity production in 2019



Source: German-Turkish Chamber of Commerce and Industry (Values rounded)

this, the installed capacity of solar power should increase from 6,000 MW to 10,000 MW. However, market observers are uncertain as to whether these targets will be met. The European association Solar Power Europe is sceptical: “the climate for solar power in Turkey has changed due to the country’s financial crisis and waning political support.” In addition, there is now discussion in Turkey of a switch in the green power tariff from dollars to Turkish lira, which is a major source of uncertainty for investors in light of the weak currency.

#### A focus on diversifying energy sources

“By expanding its renewable energies, Turkey is pushing forward with the diversification of its energy sources to increase the Turkish energy industry’s degree of autonomy,” says Koç, an expert on Turkish matters. In addition, the country hopes to discover new sources of natural gas and is risking a massive dispute with Greece and the EU in its attempts to do so. Turkey is also reliant on nuclear power. Located directly on the Mediterranean Sea, the Russian-Turkish Akkuyu nuclear power plant has been under construction since 2015 and is scheduled to be commissioned in 2023 with a capacity of 1,200 MW. Wind and solar energy will therefore probably only see another strong renewed increase, as was the case a few years ago, once coal-fired power plants are taken off the grid and replaced by renewables.

#### Hydrogen for Central Europe?

But progress can be made in Turkey’s energy transition in a wide range of different areas. That’s why the German-Turkish Energy Forum – launched by the Turkish Ministry of Energy and Natural Resources and the German Federal Ministry for Economic Affairs and

Energy (BMWi) in 2012 – is focusing its attention not only on expanding renewables, but also on issues that are still in their infancy in Turkey.

“The energy transition in Turkey is taking place on a number of levels. This also includes increasing the flexibility of the existing electricity system and funding energy efficiency measures. This is where we can help by drawing on our experience from Germany,” says Karsten Lindloff, Team Leader Energy Efficiency and Energy Services at dena. dena organises the work of the German-Turkish Energy Forum in the fields of renewable energy, energy efficiency and energy infrastructure on behalf of the BMWi.

Together with a Turkish partner, dena is currently investigating whether green hydrogen could be produced in Turkey and used in shipping or on islands, for instance. The investigation will also examine whether this hydrogen could be delivered to Europe after methanation using existing gas pipelines.

#### Energy savings contracting with Siemens and E.ON

Energy savings contracting can be used to increase energy efficiency in Turkey. dena draws on its experience in Germany to provide advice in this area and support pilot projects. In one of these projects, Siemens has submitted a design for a Turkish hospital that features energy efficiency measures and plans to finance and implement it as part of a corresponding agreement. E.ON subsidiary Enerjisa has presented similar proposals for the production site of an air conditioner manufacturer. Both projects kicked off in 2019 and then had to be put on hold due to the COVID-19 outbreak. They are now up and running again. ■

Photo: Anadolu Ajansı/Kalyon PV; Rafael Noster

**Turkey is considered one of the best locations for renewable energies in Europe.**



President Recep Tayyip Erdoğan (third from right) at the opening of a solar panel factory in Ankara.

should increase local content, that is, the proportion of value created by Turkey.

Turkey is considered one of the best locations for renewable energies in Europe thanks to its many hours of sunshine, good wind conditions and acres of open space. That’s why German solar energy companies such as IBC Solar AG and Juwi have also set up operations there. Hamburg-based manufacturer Nordex describes itself as the Turkish market leader in wind energy. According to its own figures, Nordex has installed wind turbines with a total capacity of more than 2,300 MW, followed by Enercon, Vestas and Siemens Gamesa.

#### Promoting local content

As with solar energy, Turkey is also pushing the expansion of local content in wind energy. This should also create green jobs. “There is a bonus in the feed-in tariff for every locally produced component such as rotor blades, towers or generators,” explains a spokesperson for Nordex. That’s why Nordex buys these components from Turkish machine manufacturers, while other companies have their own factories in Turkey.

The government has set a target to expand onshore wind power from the current 7,500 MW to 20,000 MW by 2023. In parallel to

A study trip as part of the German-Turkish Energy Forum: a visit to the German offshore EnBW Baltic 2 wind farm.





# CITY PLANNING WITH A STENCIL



A tram making its way through snowy Kiev: post-Soviet cities are in great need of modernisation.

**The infrastructures and buildings found in post-Soviet cities are very similar as they were built following the same plans. There's potential in this similarity: countries from Eastern Europe and Central Asia are working together via an international dialogue platform to exchange ideas on how to modernise their urban energy infrastructures.**

TEXT Philipp Rupp, Birgit Wetzel

Anyone looking at older residential complexes in cities such as Vladivostok, Nur-Sultan, Tashkent, Moscow, Kiev or Baku will immediately notice their similarities. The buildings have the same layout and the flats are all the same size. That's not an accident: back in the days of the Soviet Union, construction in all of the countries followed the same basic principles – a standardised design and floor plans built with industrially prefabricated components. During the Stalin era, these buildings were called 'Stalinka', which then became 'Khrushchyovka' under his successor. Around 108 million citizens benefitted from industrial standardised construction between 1956 and 1965 alone – more than one third of the total population at the time.

## Modernising the urban energy infrastructure

These buildings and districts were built during a time in which energy efficiency and climate action were not on the political agenda, and following the collapse of the Soviet Union, the finances needed to renovate buildings were often unavailable. The need for modernisation is still great today, with the heating supply, municipal waste management and building insulation being prime examples.

The once amalgamated states are now independent nations, but they still share a common goal: like Germany, the countries of Eastern Europe and Central Asia have set themselves binding climate targets. The huge similarities in the urban infrastructures also create opportunities. Successful concepts are very easy to apply from one nation to the next. But this requires a transnational discussion.

## A platform for international discussion

This is where the 'Urban Energy Infrastructure' transnational platform for dialogue comes in, which dena operates with support from the German Federal Ministry for Economic Affairs and Energy. The countries involved are Belarus, Germany, Kazakhstan, Russia, Ukraine and Uzbekistan. Representatives from politics, administration and the business community exchange ideas on the modernisation of urban energy infrastructure at conferences, in workshops and on study trips. These exchanges focus on the decentralisation of the heating supply, sustainable waste management, digitalisation and new financing models.

The international participants in the dialogue platform came to Berlin and Hamburg for a three-day study tour just before the coronavirus crisis broke out in March 2020. The group visited eleven Ger-

man modernisation projects, including projects for supplying city districts with renewable energy, using industrial waste heat for residential areas and generating energy from municipal waste.

The latter was particularly interesting for Vitaly Badmaev, Deputy Minister for Ecology in the Russian region of Krasnoyarsk, as he is committed to more sustainable waste management in Krasnoyarsk, among other things. The discussions he has had on the dialogue platform have fundamentally changed his view of energy efficiency: "I've realised how the issues of energy efficiency and environmental protection are interwoven and that complex solutions are needed to make real progress," he explains.

Valentyna Huch is an expert in energy efficient buildings and works in the Reform Support Team at Ukraine's Ministry of Regional Affairs and Construction, Housing and Communal Services. She took part in the digital platform workshops held in Minsk and Berlin in 2018 and 2019 respectively. She was able to integrate the solutions presented during these workshops into Ukraine's modernisation process. She says that the country has taken a number of important steps over the last few years: "an energy certification system for buildings was introduced, a market for energy audits was created and new, stricter mini-

mum requirements for the energy efficiency of buildings were adopted."

## The dialogue platform is growing

Since the beginning of 2020, the Republic of Azerbaijan has also shown great interest in the work of the transnational platform and is looking to participate. The collaboration between the country's Ministry of Energy and dena kicked off with an online conference in June 2020.

Azerbaijan is planning legislation to promote renewable energies and increase energy efficiency. This would also make market access more attractive for companies from abroad, too. "Having a regulatory framework in place can speed up the modernisation of urban infrastructures in Azerbaijan as it provides certainty in planning – both for municipalities and for companies," explains Nargis Wieck, Head of International Cooperation at dena.

The 'Urban Energy Infrastructure' transnational platform for dialogue is growing. There are now around 300 active users involved in the network. There is great interest in collaboration with German companies and their innovative technologies. The network provides companies and experts with regular opportunities to present their expertise and their solutions to improve efficiency in the urban energy infrastructure. ■



## TRANSNATIONAL PLATFORM: 'URBAN ENERGY INFRASTRUCTURE'

The transnational Urban Energy Infrastructure dialogue platform allows dena to promote cooperation between political and economic actors in Eastern Europe and Central Asia to support the transformation of energy systems. The countries involved are Belarus, Germany, Kazakhstan, Russia, Ukraine and Uzbekistan. dena helps German companies to access the market in these countries.

Learn more at  
[www.dena.de/  
energy-cooperatives](http://www.dena.de/energy-cooperatives)

Photo: shutterstock/Alina Filatova, dena



The central heating plant in Möckernkiez, Berlin - one of the destinations of the joint study trip.



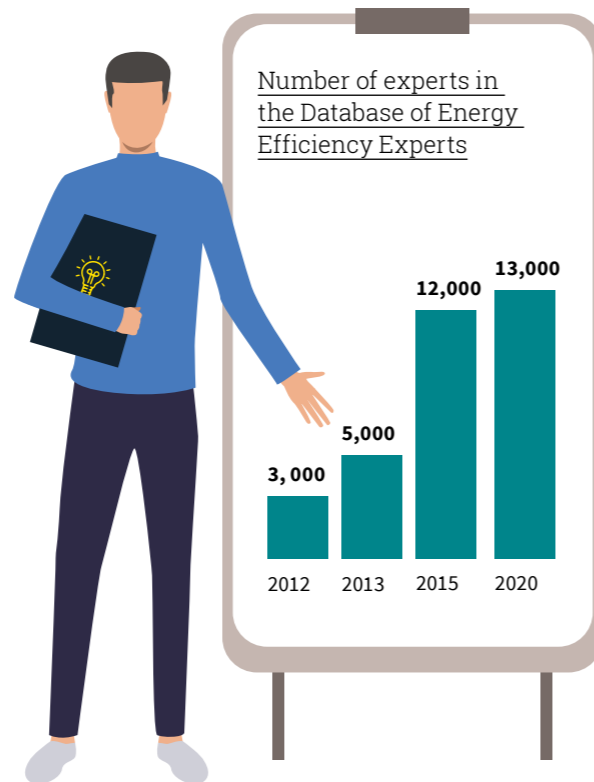
# VERIFIED QUALITY

**An in-depth energy consultation is the foundation of any successful refurbishment project. The requirements have risen continuously in Germany in recent years. The Database of Energy Efficiency Experts helps to establish consistent quality standards.**

TEXT Katharina Wolf

The marketplace of a small town in southern Germany a few years ago. It is hosting 'Energy Days', where companies and experts provide information about energy-efficient refurbishment. A volunteer consultant is at the event on behalf of the municipality. He dismisses the idea of thermal insulation, telling visitors that a 30-year-old house has no need for it. Dieter Bindel still gets angry on occasion when he thinks back to the scene. "I had put a lot of effort into giving people information about how they could refurbish their homes to make them energy efficient before they went and talked to him," recalls the Deputy Chairman of the GIH Bundesverband, a federal association of energy consultants. "But then they came back to me after they had spoken to the volunteer and said it was all over the top, they didn't need to do anything."

These scenes were commonplace a few years ago. However, inadequate consulting before an energy-efficient refurbishment can have far more serious consequences such as construction defects or not saving energy as expected. "Energy consultant isn't one of the



professional designations that are protected by law in Germany," explains Bindel. Unqualified, self-proclaimed 'experts' often used to make the lives of legitimate professionals difficult. As a result, consumer confidence in energy-efficient refurbishment dwindled.

### Local expertise

In response to this, the German Federal Ministry for Economic Affairs and Energy (BMWi), the KfW Group and the German Federal Office for Economic Affairs and Export Control (BAFA) decided to create a unified 'Database of Energy Efficiency Experts for Government Funding Programmes' in 2011: homeowners can enter their postcode at [www.energie-effizienz-experten.de](http://www.energie-effizienz-experten.de) and see verified, qualified experts in their area.

dena maintains the list on behalf of BMWi, KfW and BAFA. There are now around 13,000 experts across Germany on the list. "The aim

was to make the market more transparent while at the same time ensuring that energy consulting and planning are of a high quality," emphasises Christian Stolte, Head of Division for Energy-Efficient Buildings at dena. "Anyone looking in the Database of Energy Efficiency Experts today will find experts with verified qualifications."

### Mandatory further training

Architects, craftsmen or engineers who want to be added to the database must prove their qualifications in the field of energy-efficient refurbishment and regularly undergo further training. Since 2014, access to federal funding has also been linked to the database. Anyone applying for funding from KfW's 'Energy-efficient Construction and Refurbishment' programme must consult experts from the database. For Hans Praßny from the state-owned KfW Förderbank (promotional bank), regular further training is a particularly important component. "It's important for energy consultants to

stay up to date to ensure the quality of their consulting," explains the Senior Product Manager.

This was not without its controversy among the experts themselves. "There was some resistance initially," says Bindel, a member of the GIH Management Board. Things have calmed down since. "The database of experts has become an established platform for finding qualified energy consultants," says Marita Klemnow, Spokesperson for the Management Board of the German Energy Consultant Network (Deutsches Energieberater-Netzwerk (DEN) e.V.): "We could also imagine even stricter requirements in the future."

### Increasing acceptance

The fact that the database is becoming more well known is also helping to increase energy consultants' acceptance. dena and the other stakeholders involved constantly promote the online portal. The database receives about 50,000 search queries every month. "Acquisition has become much easier," says architect Ute Modlmeier, who works as an energy consultant, planner and construction supervisor in Bremen and is a member of the 'Energy Experts - Partners of energiekonsens' network: "Clients have been coming more specifically to me since the database was created." Surveys by dena and KfW have shown that registered energy consultants attribute around a quarter of their requests to the database on average.

This also represents progress for the energy transition and climate action. "Energy consultants have a key role to play in the refurbishment of the building stock," stresses Stolte: "The decision as to whether homeowners opt for an energy-efficient refurbishment or not often comes down to the quality of the consulting." For that reason, the German federal government's new Buildings Energy Act (Gebäudeenergiegesetz, GEG) makes it mandatory for owners of detached and semi-detached houses to seek consultation before performing refurbishment work or selling the property.

The legislation has a clear goal of reducing the amount of energy consumed in buildings in Germany by 80 per cent by 2050. To achieve this, at least two per cent of the existing houses would have to be refurbished each year, which is around double the current number. The German federal government significantly improved the terms for energy-efficient building refurbishment in the climate package adopted in 2019. This means that there are now a number of incentives for property owners to refurbish their property in a climate-friendly way and energy consultants are not short of work. ■

## SUPPORT FOR ENERGY EXPERTS

dena has developed a number of different ways to help energy consultants in their work and reinforce consistent quality standards in recent years. The FEBS specialist portal for energy-efficient construction and refurbishment pools vital specialist information relevant to energy-efficient construction and refurbishment, and offers tools to help with planning and construction processes and tips for collaborating with customers. dena also developed the individual refurbishment roadmap (iSFP) together with the ifeu research institute and the Passive House Institute. The iSFP is a tool that structures the energy consulting process, presents suggestions for step-by-step improvement and presents them in an easy-to-read booklet for customers at the end.

Learn more at  
[www.dena.de/en/febs](http://www.dena.de/en/febs)

## DATABASE OF ENERGY EFFICIENCY EXPERTS

The Database of Energy Efficiency Experts for Government Funding Programmes is a Germany-wide directory of verified, qualified experts for energy-efficient construction and refurbishment. The experts registered in the database cover all aspects of construction, ranging from private residences to municipal and commercial buildings to listed buildings. dena's Database of Energy Efficiency Experts team consisted of five people when the project started in 2011. There are now 17 members of staff who answer about 1,000 calls and 1,200 e-mails each month. Energy consultants are offered around 4,000 training courses throughout the year.

Learn more at  
[www.dena.de/energy-efficiency-experts](http://www.dena.de/energy-efficiency-experts)

Photo: shutterstock/figistiana; Illustration: katemangostar - de.freepik.com





# A NETWORK ONE MILLION STATIONS WIDE

**The e-mobility market is coming to life, not least thanks to the German government's decision to subsidise the purchase of electric vehicles. Ironically, the crisis could help lead to the long-awaited breakthrough of climate-friendly driving. But the charging infrastructure will need to be expanded – and quickly.**

TEXT Michael Draeke

In the midst of the crisis, e-mobility stands out due to its fantastic growth rates. The first nine months of 2020 saw the number of electric cars in Germany increase by 105 per cent in comparison to the previous year. The registration figures for plug-in hybrids rose by even more, growing by nearly 300 per cent in the same period. This increase, however, is also due to lower starting values, as the share of fully electric vehicles and plug-in hybrids was only around ten per cent of all new car sales. But the trend is clearly upwards, mainly thanks to the German federal government's subsidies for purchasing electric vehicles.

If the market is to continue to grow as is hoped, it will need a well-developed infrastructure, as this is a key factor for many potential customers when they are decid-

ing whether or not to purchase an electric vehicle. "The ramp-up is starting now: customers want everything to work perfectly," says Claus Fest, Head of Product Development Energy Industry (B2C) at energy company EnBW, which operates Germany's largest fast-charging network and has around 450 locations across the country.

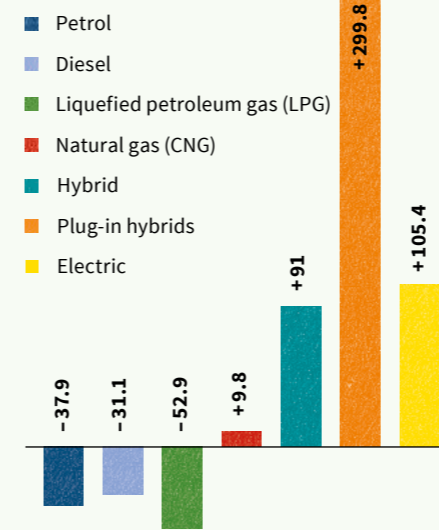
## Fast charging, anywhere

The German federal government's charging infrastructure master plan aims for there to be one million public charging stations in Germany by 2030. According to figures from the German Association of Energy and Water Industries (Bundesverband der Energie- und Wasserwirtschaft, BDEW), there are currently 28,000 public and semi-public charging points, most of which

are operated by energy suppliers, parking space providers, retail chains or hotels. Expanding the fast-charging network is also important. Charging stations with a capacity of up to 350 kilowatts enable an electric car to charge up enough electricity for the next one hundred kilometres within ten to fifteen minutes. The government is planning to install around 30,000 of this type of charging station by 2030.

As it currently stands, homeowners with a private parking space have an advantage since they can charge their electric car in the evening by simply hooking it up to their Wallbox. However, the majority of drivers in Germany live in apartment buildings and most of them are renting. Many electric car owners will therefore have to rely on public charging stations or

Number of new car registrations by fuel type in Germany between January and September 2020 in comparison to the same period in the previous year (in per cent)



Source: Federal Motor Transport Authority (Kraftfahrtbundesamt, KBA)

the property owner providing a charging facility.

The National Platform Future of Mobility (NPM) assumes that, in the coming years at least, 60 to 85 per cent of charging will be done privately. dena, together with Prognos AG, conducted an investigation on behalf of EnBW into whether private charging capacities will be sufficient if seven to ten million e-vehicles do actually end up on Germany's roads by 2030.

## Bottlenecks in congested metropolitan areas

The central findings of the study: detached and semi-detached houses have fewer problems. There is a huge potential of around eight to twelve million possible charging points lying dormant at these properties. The picture is not so rosy when it comes to apartment buildings – these could only house about 450,000 to 1.8 million potential private charging facilities. "Capacity for private charging points could become scarce as early as 2022, especially in more densely populated urban areas with high purchasing power," emphasises EnBW expert Fest.

To ensure that the market ramp-up doesn't fail due to a lack of charging stations, the authors of the study recommend accelerating the expansion of the public charging infrastructure, especially in these

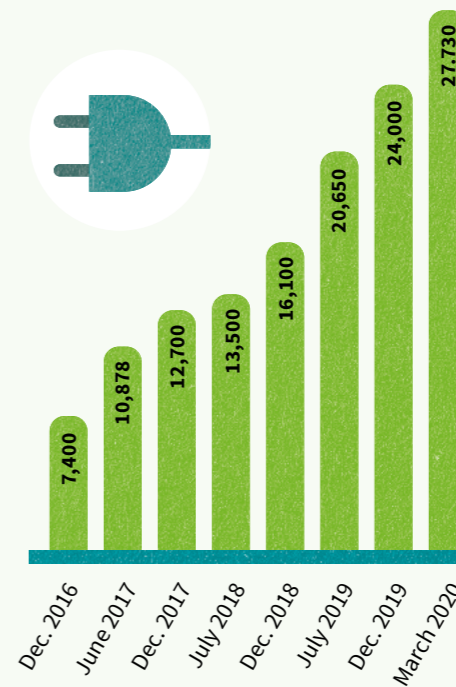
areas. "The first step should be establishing a basic network of charging points mainly in densely populated, congested metropolitan areas such as Munich, Stuttgart, Berlin or Hamburg," says Carsten Bamberg, senior expert on alternative fuel vehicles and sustainable mobility at dena.

The expansion should also be oriented towards actual demand. The study suggests setting up a special database that allows car manufacturers and planning authorities to share data, which would then help speed up the expansion of the charging infrastructure in regions where large numbers of electric cars are purchased.

## Legal right

The legal frameworks are already being continuously adapted. For example, the planned Federal Building Electric Mobility Infrastructure Act (Gebäude-Elektromobilitätsinfrastruktur-Gesetz, GEIG) will make it mandatory to install charging facilities in a minimum number of parking spaces when constructing new buildings or extensively refurbishing existing ones in future. And thanks to an amendment to the Residential Property Modernisation Act (Wohnungseigentumsmodernisierungsgesetz, WEMoG), tenants and owners of owner-occupied flats will be in a stronger legal position in terms of their right to install a charging points from November 2020.

## Number of public charging points in Germany



Source: BDEW



## DENA STUDY PRIVATE CHARGING INFRASTRUCTURE POTENTIAL

The dena study provides an overview of whether the building stock in Germany theoretically has the potential to cover the demand that seven to ten million electric vehicles would place on the charging infrastructure by 2030. The central assumption is that 85 per cent of all charging is done using private charging stations. Measures to further develop the charging network are derived from this.

Learn more (in German) at [www.dena.de/ladeinfrastruktur](http://www.dena.de/ladeinfrastruktur)

However, just simply investing in charging stations is not the only challenge. All too often, the climate-friendly driving experience is spoiled by parking spaces with charging columns being blocked by other cars, different payment systems and a less than transparent pricing policy. The German federal government wants to stipulate at least a uniform payment method for ad-hoc charging with the next amendment to the Charging Station Ordinance (Ladesäulenverordnung). Roaming has also become very common, reports dena expert Bamberg: "You don't need five different charging cards anymore."

The pricing structure is another element still taking shape. At the moment, electricity at public charging columns sometimes costs twice as much as the standard electricity rate at home. The reason for this is that the operators can barely cover the investment costs through the sale of electricity alone, even at frequently used locations. "The grid connection costs in particular are often comparatively high," says Stefan Siegemund, Head of the Sustainable Mobility and Alternative Energy Sources work area at dena: "Both innovative business models and improved frameworks are needed here to continue driving the expansion of the charging infrastructure and make e-mobility even more attractive." ■



# Tailor-made or off the rack?

Climate action presents industry with a wide range of challenges. The solutions to these are not available off the rack and each industry must find one that works for them. Here are three examples that are expected to set a precedent.

TEXT Marcus Franken

The list of difficult cases is long: steel furnaces, glassworks, the chemical industry to agriculture. While the transformation of the electricity sector has been described at least in broad strokes such as the phase-out of coal and the expansion of renewable energies, entire industries still have a mountain to climb with regard to the energy transition and climate action. Glassworks currently heat their gas furnaces almost entirely with natural gas and also produce carbon dioxide from the decomposition of soda ash (sodium carbonate) created during the process. How are they supposed to become climate neutral? Or the chemical industry – most chemical products can be built up from 300 base chemicals such as ethylene, butane or vinyl chloride, which are almost exclusively obtained from crude oil and natural gas. The production processes also require vast quantities of energy for heating and steam.

But this is a pressing issue. According to the Fraunhofer Institute for Energy Efficiency in Production's (EEP) Energy Efficiency Index, large German companies have indicated in a survey that they want to reduce their carbon emissions by one quarter on average as early as 2025. They are relying on renewable energies, offsetting measures and increasingly on efficiency to achieve this. "The importance of efficiency has never been more highly valued by industry," says Alexander Sauer, Head of the EEP in Stuttgart.

At the same time, the simple measures seem to have run out. Many companies have already replaced outdated lighting with modern LED lighting, installed thermal insulation or started using green electricity in their offices, explains Armin Kühn, Team Leader for Energy Efficiency in Industry at dena and responsible for the lighthouse projects for carbon reduction in industry. "Many are now left with no option other than to resort to technically demanding measures, which often entail high investment costs or a change in the production process," he says.

Closely related to practical reality with concrete examples and a lot of public relations work, the projects now being funded by the Ministry for Economic Affairs through the Federal Promotion of Energy Efficiency in Industry investment programme are, according to Kühn, designed to "shine a light into the sectors and into industry." The funding programme has been streamlined in terms of bureaucracy to attract companies that otherwise rarely reach out to funding programmes because of the time commitment, the reporting and the uncertainties they entail. dena's role in the programme is to help companies acquire the funding and to define the relevant eligibility criteria in each case. The knowledge gained from this is then used to help design new funding programmes, as the complexity and specifics of carbon reduction measures often pose a major challenge for funding providers and companies. This is where dena provides tailored, independent support to help reduce the risks for companies. Practical workshops are held to discuss what experiences companies have had when implementing carbon reduction measures in three selected industrial sectors, the results of which are then used to create project profiles and short guidelines.

Three selected companies from the lighthouse project – AGC f glass, ACO Guss and Holzmühle Westerkamp – provide detailed insights into the complex production processes and the highly tailored measures to reduce carbon emissions.

## CO<sub>2</sub> fertiliser for strawberries

Molten glass floats on a sea of tin inside the melting chamber. The mercury stands at 1,400 degrees. Up to 780 tonnes pass through a day. Windowpanes for the whole world, explains Henning Voß, Maintenance Manager of AGC f glass' flat glass production in the southwest of Magdeburg. His factory emits 14 to 15 tonnes of carbon dioxide an hour. Two thirds of these emissions are produced by

The ACO Guss foundry generates excess heat.

Photo: ACO Guss/Marie Kammerer





Pfaff produced its sewing machines in its factory in Kaiserslautern until 2004.

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EFFICIENCY IN INDUSTRY

The efficient use of electricity and heat in industry is one dena's central concerns. Early projects such as the Energy Efficiency for Companies Campaign laid the foundation, and the Energy Efficiency Award is still being presented today – 14 times it has been awarded. The Database of Energy Efficiency Experts helps companies to find the right consultant, the Energy Efficiency Networks Campaign provides access to like-minded people and the lighthouse projects showcase exciting role models.



In future, the waste heat from ACO Guss will be used in the EnStadt: Pfaff project, a carbon-neutral, mixed-use district.



LIGHTHOUSES FOR  
CARBON REDUCTION IN INDUSTRY

dena is using the 'Lighthouses for Carbon Reduction in Industry' project to showcase viable ways to save energy and carbon in production. The project focuses on measures that are implemented using market-ready technologies and for which funding is available from the new Federal Promotion of Energy Efficiency in Industry investment programme. dena will support a total of 13 exemplary projects that aim to reduce climate-damaging emissions and publicise them throughout the industry over a period of three years. This will allow other companies to adopt models that have proven successful in reducing climate-damaging emissions. The projects pay close attention to four energy-intensive industries – the chemical industry, plastics processing, the glass industry and the foundry industry.

Learn more (in German) at  
[www.CO2-leuchttuerme-industrie.de](http://www.CO2-leuchttuerme-industrie.de)

the gas burners that heat up the mixture of quartz sand, soda ash and additives such as potash to the necessary melting temperature. The remaining third is caused by the decomposition of soda ash created during the process. This adds up to 130,000 tonnes of CO<sub>2</sub> per year.

"We have reaction-related emissions that are produced during manufacturing and we can't easily replace the natural gas that we burn here either, for cost reasons," Voß explains. "That's why we want to use the heat and capture some of the CO<sub>2</sub>."

The Wimex Group's greenhouse, which is now being expanded from 63,000 to 127,000 square metres – the area of 18 football pitches – on the neighbouring property, is crucial for both of these. A large heat buffer already sits on the border between the glass and strawberry factories. It has a capacity of 4,000 cubic metres and the pipes attached to it run in both directions – to the heat source and to the consumer. At around 10,000 megawatt hours per year, the greenhouses absorb around one fifth of the waste heat generated during glass production.

Thanks to the extension at the strawberry farm next door, Voß can now also plan to capture the first CO<sub>2</sub> from the waste gas of the natural gas firing in the glass melting plant. "Up to now, we couldn't capture enough CO<sub>2</sub>. But now that we have double the area, a CO<sub>2</sub> scrubber could be economical," says the maintenance manager. And since the glass factory can supply the CO<sub>2</sub> directly to the neighbouring greenhouses through pipes, Voß is confident

that he'll also be able to sell the bottled CO<sub>2</sub> previously used to fertilise the plants at a competitive price. It only costs €80 per tonne, and delivery is free of charge.

Heating for the sewing machine district

The ACO foundry also exports heat. In Kaiserslautern, there are plans to build a sustainable urban district on the old site of the Pfaff sewing machine factory. ACO is supplying the heating for the new homes in the form of previously unused waste heat from the production process.

The heat from the melting furnaces at ACO Guss is still released into the sky above the company's facilities. "We plan to exploit this potential in the future," says Energy Manager Thomas Rehan, referring to the large coolers on the factory floors of the 100-year-old foundry in Kaiserslautern. Especially as the company also buys heat from public utilities for more than a quarter of a million euros to heat the offices, the halls and the hot water on the premises – an impressive 3,000 megawatt hours (MWh) per year. "It's an expense that we'd really like to cut," says Rehan.

They have the opportunity to do just that. Right next to the large foundry, just the other side of the railway tracks, is the old Pfaff factory site, where the famous sewing machines were manufactured for almost a century until it closed in 2004. The defunct industrial site will now be transformed into a new district, which will also break new technical ground as a 'Regulatory Sandbox'.

There will be enough heat to go around, with the planners at ACO estimating at good 11,000 MWh per year. The demand from the neighbouring Pfaff district is forecast at around 4,500 megawatt hours in the final expansion phase. The challenge isn't in the total quantity of heat, it's primarily in supplying the heat in a way that best fits the needs of both internal company customers and the district. This will be a particular challenge for weekends during winter when there is no work going on in the factory and demand is high, or when the foundry shuts down for a fortnight for annual maintenance. A new boiler will have to be built to cover these periods.

Once this conversion is complete, ACO will be able to save a good 6,500 MWh of energy and 1,100 tonnes of carbon annually. And supply the entire neighbouring residential area with heat.

Dried on a wood fire

Holzmühle Westerkamp is taking an approach that is more focussed on heat generation. A cutting-edge woodchip firing system has supplanted the gas boiler here. And, thanks to the additional heat the company recovers, it saves more than a third of the heat again.

Everything at Westerkamp is made from wood – the raw material, the fuel, the product. Almost 30,000 tonnes of sawdust from wood processing pass through the factory gates of the wood flour manufacturer in Oldenburger Münsterland every year. "But the fresh chips first have to be dried before they can be ground into flour," explains Ute Goossens, who is responsible for energy man-

agement at the long-established company. Westerkamp is growing. And that's why the old drying system needs to not only be replaced, but scaled up, too. The drying process sees a conveyor belt transport the chips through a tunnel where they are blasted with hot air. "We used to neglect the energy potential in the steam that the process generates, but we see it now and want to harness it," Goossens explains. The new belt dryer – supported by funding from the German Federal Ministry for Economic Affairs and Energy's (BMWi) funding programme – now has a downstream system for recovering the heat. The hot, humid exhaust air flow of around 70 degrees is used in an air-to-air heat exchanger to preheat the fresh air for the drying process. This saves around 35 per cent of the firewood, which can then be used for a second purpose. Using the waste heat from the air compressor system should also save even more energy.

"When a company works as closely with sawmills as we do, wood is the obvious solution," says Goossens. It's also the best solution in financial terms, as the energy costs of wood are a healthy one cent per kilowatt hour, while the cost of gas is closer to three cents. This synergetic combination of woodchip heating and heat recovery allows the company to reduce carbon emissions by 3,700 tonnes per year compared to a gas-fired solution. This project, along with all the other lighthouse projects, perfectly demonstrates just how specific, complex and at the same time efficient efforts to reduce emissions can be. ■

Photos: Stadtarchiv Kaiserslautern, Graphic: ASTOC Mess 2018



ENERGY EFFICIENCY 2050 ROADMAP

**DENA ORGANISES  
STAKEHOLDER  
DIALOGUE**

The Energy Efficiency 2050 Roadmap is a German federal government dialogue forum that aims to develop cross-sector strategies to increase energy efficiency. The scientific community, the business community and civil society discuss concrete tools and measures that Germany can use to achieve its energy and climate targets by 2050, such as halving primary energy consumption. Experts exchange information in specific working groups for the building, industry and transportation sectors as well as across sectors. dena helps the German federal government to organise the stakeholder dialogue and serves as the point of contact for the Energy Efficiency energy transition platform. The roadmap is part of Germany's energy efficiency strategy. The dialogue process is expected to conclude in autumn 2022, when a strategy will be adopted.

COOPERATION

**GERMAN-UKRAINIAN ENERGY PARTNERSHIP  
ESTABLISHED**



The Ukrainian Energy Minister Olha Buslavets and the Federal Minister of Economic Affairs and Energy Peter Altmaier sign the declaration establishing the German-Ukrainian Energy Partnership. Germany and Ukraine are set to work more closely together in the energy sector. In August 2020, German Federal Minister for Economic Affairs and Energy Peter Altmaier and Ukraine's Acting Energy Minister Olha Buslavets signed a declaration establishing the German-Ukrainian Energy Partnership. dena is implementing the energy partnership together with the federal ministry, German project management companies on site, and companies and specialist institutions from both countries. The focal points of the bilateral exchange include increasing energy efficiency, integrating renewable energies and the transformation process in Ukraine's coal-mining regions. dena has been helping the German Federal Ministry for Economic Affairs and Energy with a number of different projects – relating to the municipal heating transition, for instance – in Ukraine since 2015. The 'System Transformation in Ukraine' project focuses on the integration of renewable energies into Ukraine's electricity system. The various activities of German federal ministries and institutions will be coordinated, communication bundled and joint exchange and consulting formats established as part of the energy partnership.

Learn more at [www.dena.de/german-ukrainian-energy-partnership](http://www.dena.de/german-ukrainian-energy-partnership)

URBAN ENERGY TRANSITION

**DENA CREATES STUDY FOR WWF CHINA**



The start of the cooperation in Beijing with Dr Qiu Baoxing (CSUS), dena's Chief Executive Andreas Kuhlmann, Professor Yu Gang (CSUS), Wang Weikang (WWF China) and Johannes Regenbrecht (German Embassy) (from left to right).

dena is developing a study on the urban energy transition in China on behalf of the nature conservation organisation World Wide Fund for Nature (WWF). In cooperation with the Beijing WWF office and the Chinese Society for Urban Studies (CSUS), the study aims to explore the potential of renewable energies in the building sector in Chinese cities and formulate recommended courses of action and solutions for implementation in the coming years. The analysis is expected to be available by the end of 2020. dena has been involved in the climate-friendly urban development sector in China in the form of the German-Chinese Eco Cities project since 2014. Twenty-five pilot cities in twelve Chinese provinces are currently participating.

Learn more (in German and Chinese) at [eco-city-china.com](http://eco-city-china.com)

NEW DENA LOCATION

**KEY HANDOVER ON THE EUREF CAMPUS**

dena is moving into a second location on the EUREF campus in Berlin-Schöneberg in autumn 2020: Managing Director Kristina Haverkamp received the keys from EUREF AG CEO Reinhard Müller at the beginning of October. "The continuous growth of the last few years has meant we've been able to welcome a lot of new colleagues to dena," explained the Managing Director. "The extra space is a real win for us. The EUREF campus has a lot of charm and we're moving into a highly innovative environment – one that includes many companies and organisations that are also committed to the energy transition," she continued. As part of the expansion, some of dena's staff will move into the new offices on the EUREF campus, while the location in Berlin-Mitte will remain. EUREF AG has been developing the urban district around the former gasometer in Schöneberg since 2008. Numerous companies and research institutions from the energy, sustainability and mobility sectors as well as start-ups are now located on the site.

Learn more (in German) at [www.dena.de/euref](http://www.dena.de/euref)



dena's Managing Director Kristina Haverkamp (right) receives the keys on the EUREF campus.

ALTERNATIVE FUELS

**EASILY COMPARE PRICES AT THE PETROL STATION**

It will soon be easier for motorists to compare the prices of conventional and alternative fuels. From 2021, they will receive information on the cost of petrol, diesel, natural gas, electricity or hydrogen at petrol stations in Germany and other EU countries. Comparative prices will then be given for 100 kilometres driven using different vehicle classes as examples. The German Federal Ministry for Economic Affairs and

Energy (BMWi), which is leading the project in Germany, had previously tested the additional price labelling as part of an EU-wide pilot project. dena supported the pilot project and will help with the launch in Germany. The campaign stems from EU Directive 2014/94/EU, which aims to establish an easy way for people to compare fuel prices throughout Europe. dena had also provided the EU with consulting in the form

STIMULUS PACKAGE

**POTENTIAL SYNERGIES FOR THE ENERGY  
TRANSITION**



In response to the COVID-19 pandemic, the German federal government adopted a comprehensive economic stimulus package totalling €130 billion in July 2020. A study conducted by dena in cooperation with the consultancy firm Navigant concluded that the programme will also act as a driver for energy and climate policy. Accordingly, 20 of the package's 57 measures are related to climate and energy policy. The study shows how the energy transition and the economy can be strengthened, what can be done to help sectors that have been particularly affected, and at the same time what needs to be done to provide impetus for modernisation and sustainability. dena had already provided impetus for a 'green recovery' with a series of digital colloquia (dk2020) back in spring 2020.

Learn more (in German) at [www.dena.de/konjunkturprogramm](http://www.dena.de/konjunkturprogramm)

Learn more at [www.dena.de/transparent-price-labelling](http://www.dena.de/transparent-price-labelling)





# HYDROGEN – THE BUSINESS OF THE FUTURE

**Many technologies for a climate-friendly hydrogen economy are ready to go. But not only does the switch require the rapid construction of hydrogen generation plants and the logistical infrastructure, it also, more than anything, needs promising business models.**

TEXT Jan Oliver Löffken



**G**lowing steel flows out of the blast furnace in Dillingen, Saarland. Using hydrogen to produce the metal – something that has so far only been a theory in Germany – could reduce carbon emissions by a third. The country will be able to take this major practical step for the first time thanks to the Dillinger Hütte und Saarstahl AG plant, which has been in operation since August 2020. The hydrogen gas replaces the coal dust that was previously indispensable as a reducing agent in steel production.

The steel industry isn't the only one taking the first steps towards using hydrogen. The chemical industry is also planning to switch to the gas, which is generated from wind and solar power. It is by far the largest consumer of hydrogen today, albeit obtained from natural gas. With a share of over 90 per cent, this is currently the most important method of producing hydrogen. Electrolysis – the electrochemical process of splitting water into oxygen and hydrogen molecules – could gradually displace the reformation of natural gas. This is especially true for hydrocracking, a process carried out in refineries in which hydrogen is used

to help split crude oil into petrol and numerous other liquid hydrocarbons. “Green hydrogen is an immensely interesting option for us,” says Alexander Kronimus from the German Chemical Industry Association (Verband der chemischen Industrie, VCI) in Frankfurt, referring to sustainable carbon reduction in his industry. “The chemical and steel industries are the most significant industrial sectors that want to switch to using hydrogen quickly,” confirms Jeanette Uhlig, dena Team Leader for Climate-Neutral Energy Sources.

## Promising use in heavy goods transport

Green hydrogen could also drastically reduce carbon emissions in the transportation sector, which have remained constant since 1990, despite a considerable increase in transport activity. The focus is not on electric cars with batteries, but on heavy goods transport on the roads as well as aviation and shipping. This is because the electricity storage capacity of batteries for lorries, aircraft and freighters isn't sufficient at present; they require fuels with a higher energy content. Hydrogen also acts as the basis for numerous synthetic alternatives ranging from methanol, dimethyl ether (DME) or oxymethyl ether (OME) to ammonia. The first shipping companies, such as Danish market leader Maersk, are already using ammonia for medium-sized feeder ships in coastal maritime transport. “But hydrogen quantities in the transportation sector won't be noticeable until 2030,” says Uhlig. As it stands, there simply aren't any plants that can generate large quantities of hydrogen from green electricity in a way that is profitable.

Production isn't the only major challenge. Developing business models and markets is also proving difficult. When and how is the construction of large electrolysis plants or hydrogen logistics worthwhile? Green hydrogen is currently priced at ten euros per kilogram, which is significantly higher than grey hydrogen – 80 per cent higher, in fact – making it prohibitively expensive. “There isn't really a business model that ticks all the boxes right now. This is largely due to the fact that carbon emissions are not priced in a way that is cost efficient,” complains Christian Breyer, Professor of Solar Economy at the Lappeenranta University of Technology in Finland. “But the next decade will be shaped by developing the first markets,” says Stefan Siegemund,



A high-temperature electrolyser for hydrogen production.

Head of the Sustainable Mobility and Alternative Energy Sources work area at dena.

## No impact without imports

It's clear, however, that energy-intensive economies in Europe will not be able to meet their growing demand for green hydrogen with their own electrolysis plants alone. Just like oil, natural gas or coal today, hydrogen will have to be imported in larger quantities in the future. “Large plants with large numbers of full-load hours and extremely cheap wind and solar power enable us to get production costs down to very close to two euros per kilogram,” says Kilian Crone, dena Team Leader Powerfuels International. But this won't be hydrogen from Germany. Norway, with its low-cost hydropower, and sunny and windy regions such as North Africa, the Middle East and Chile have the potential to become key hydrogen exporters. “We shouldn't forget about Eastern Europe either,” says Crone, referring to the green electricity potential in territorial states such as Ukraine, Russia or even Turkey (see page 34).

Pipelines would be the ideal solution for transporting large quantities of hydrogen quickly. Transporting liquefied hydrogen by ship is another option – similar to the one already offered for liquefied natural gas – until a sufficient number of existing natural gas pipelines are fully converted to hydrogen or new ones are built in the coming decades. “Verifications of origin are also absolutely essential for the international trade of hydrogen,” says Siegemund. This is to prevent fraudulent labelling, such as hydrogen from other sources actually flowing out of the pipelines instead of the green hydrogen that had been declared. “That's why the production of green hydrogen should receive consistent funding and be supported with political frameworks in the early stages,” says dena expert Uhlig, making another recommendation. This would lay the foundation for hydrogen to play the role in a few decades' time that oil does today. ■



dena has been committed to Power-to-X for ten years. Back in 2011, it founded the Power to Gas strategy platform together with partners from the business community, industry, associations and the scientific community to develop the technologies further and prepare to enter the market. Today, dena is committed to building a green hydrogen economy through various projects, such as the Global Alliance Powerfuels (GAP), which aims to establish a global market for electricity-based, renewable fuels (powerfuels). As part of the EU's HY3 project, partners from Germany and the Netherlands are analysing how green hydrogen can be produced on an industrial scale. Plus, dena is helping with the implementation of Germany's national hydrogen strategy and plays a key role in the control centre set up for this purpose.

[www.powerfuels.org](http://www.powerfuels.org)



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In 2011, a disputed infrastructure project went into operation: the Northstream 1 gas pipeline. In this same year, dena launched two fitting projects for the future: it started looking at natural gas mobility and initiated the Power to Gas strategy platform. The year before, in 2010, dena published its Grid Study II, its analysis of infrastructure requirements for the energy transition. But 2011 as a year in terms of energy policy was not about pipes or pipelines, but about nuclear power: the nuclear disaster in Fukushima, Japan, accelerated the phase-out of nuclear energy in Germany.

## FACTS & FIGURES

You must have noticed by now that we're celebrating our anniversary! In October 2020, dena turned **20 years old**. What have we achieved in our jubilee year? What are we doing on the international stage? How has the German Energy Agency developed as a company? In **Facts & Figures**, we share the **data** that answers those questions.



# GLOBALLY ACTIVE

dena's work has become more and more international since it was founded. To date, dena has been and continues to be active in over 60 countries – here's a selection.

Learn more at  
[www.dena.de/en/international](http://www.dena.de/en/international)



## ASIA

### CHINA

dena has been active in China for over 15 years: in addition to cooperation on energy efficiency in industry and urban development, one focus has been on climate-friendly construction. The first German-Chinese pilot project kicked off in 2010. There are now 45 projects running in twelve provinces and four climate zones, including schools, office buildings and residential buildings.

### TURKEY

The German-Turkish Energy Partnership has existed since 2012. Both countries want to intensify the bilateral energy cooperation. Focal points include renewable energies, energy efficiency, energy infrastructure and sector coupling.

### UKRAINE

dena has been helping Ukraine modernise its energy system and increase energy efficiency in the building sector since 2015. The two countries entered into an official energy partnership in 2020.

### IRAN

The focus of dena's work in Iran is the creation of a National Energy Efficiency Action Plan (NEEAP). This involves recording existing tools, performing a quantitative estimate of potential and defining sector-specific measures.

### KAZAKHSTAN

dena is supporting Kazakhstan in creating the necessary frameworks for an energy efficiency market so that the country can decarbonise and modernise its economy.

### RUSSIA

The Energy and Climate Protection Management System (ECM) developed by dena has become a leading export. Russia is the latest country to start using it, joining the 75 German and 25 Chinese cities that already use it successfully. After being tested in two pilot municipalities, the ECM will be deployed in 34 other Russian cities.

## EUROPE

### GERMANY

Government representatives, entrepreneurs, experts, civil society and the start-up community come together during the Berlin Energy Week (BEW) to discuss the future of global energy supply. The main events at the BEW include the Berlin Energy Transition Dialogue (BETD), a high-level conference with around 2,100 participants from 90 countries.

dena has been helping the BMWi communicate the German energy transition abroad since 2016. Delegations of experts come from all over the world to visit dena in Berlin and learn more about the energy transition.

### FRANCE

France and Germany are close colleagues – also when it comes to climate action. In 2014, both countries' energy agencies, ADEME and dena, established the Franco-German Energy Platform.

dena is involved as a member of the Global Alliance for Buildings and Construction (GlobalABC). The network, which has its headquarters in Paris, was established as part of the COP 21 and has 130 members, including 29 states.

### REPUBLIC OF IRELAND

dena has been maintaining the German Biogas Register for a decade. This also stirred up interest in the Republic of Ireland: dena contributed its expertise to the GreenGasCert project to develop a certification system for the Emerald Isle.

### BELGIUM

As the headquarters of the European Union (EU), Brussels has international significance. dena is there on a regular basis with dialogue events, for instance with the Alliance for Building Energy Efficiency (Allianz für Gebäude-Energie-Effizienz, geea) or to discuss the topic of powerfuels.

### NETHERLANDS

The idea for the serial refurbishment of buildings comes from the Netherlands. dena has been working with the Energiesprong organisation, which successfully established this refurbishment market Germany's next-door neighbour, since 2018.



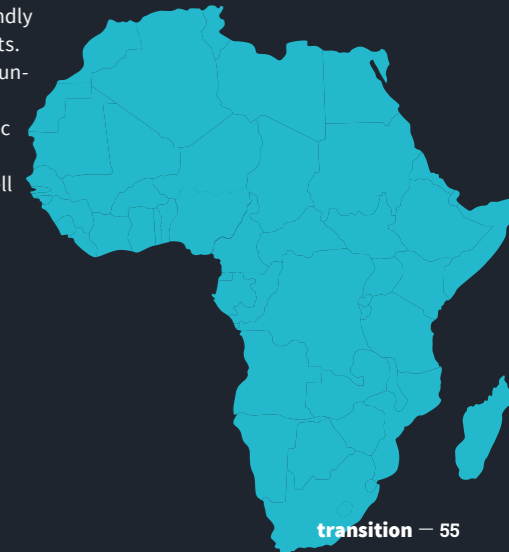
## AFRICA

### UGANDA

dena has been honouring start-ups with the SET Awards every year since 2017. 2019 saw two winners come from Uganda: Bodawerk developed the Boda Boda electric motorbike. Divine Bamboo produces sustainable fuels from bamboo.

### SOUTH AFRICA/MOROCCO

dena has launched the Global Alliance Powerfuels (GAP) together with industry partners. The aim of this alliance is to open up global markets for synthetic fuels based on renewable energies. Promising production locations include South Africa and Morocco.



## THE AMERICAS

### CANADA

dena has been cooperating with Transition énergétique Quebec (TEQ) since 2020. The state-owned company wants to promote the transition to an innovative and efficient energy system.

### UNITED STATES

Project Drawdown is a global climate action campaign based in San Francisco, California. The European offshoot Drawdown Europe was launched in 2018 by dena, EIT Climate-KIC and the European Climate Foundation.

### HONDURAS / MOZAMBIQUE

With the Renewable Energy Solutions (RES) programme, dena supports German companies that want to establish climate-friendly technologies in foreign markets. More than 90 projects in 60 countries have been created so far. These include five photovoltaic plants with intelligent storage systems in Honduras and a well with a solar-powered pump in Mozambique.





**"Happy twentieth birthday!"**

Tanja Gönner, Board Spokesperson, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)



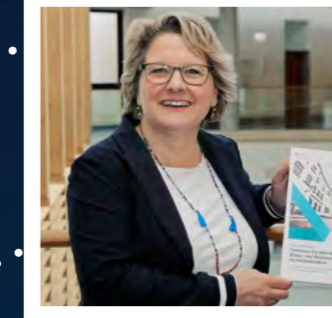
**"A source of ideas for politics and industry"**

Katherina Reiche, Chief Executive, innogy Westenergie



**"I'm looking forward to the next 20 years."**

Professor Helmut Schönenberger, Managing Director of Untefnehmertum Venture Capital Partners



**"20 years of dena have been one continuous success story. Its founding mission is more relevant today than ever before."**

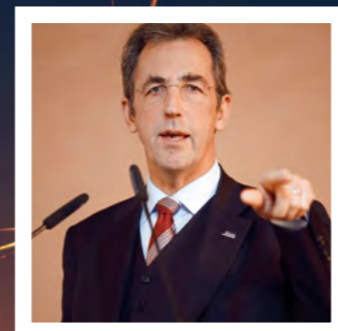
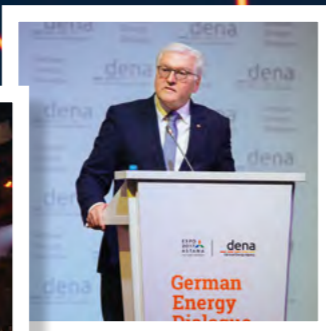
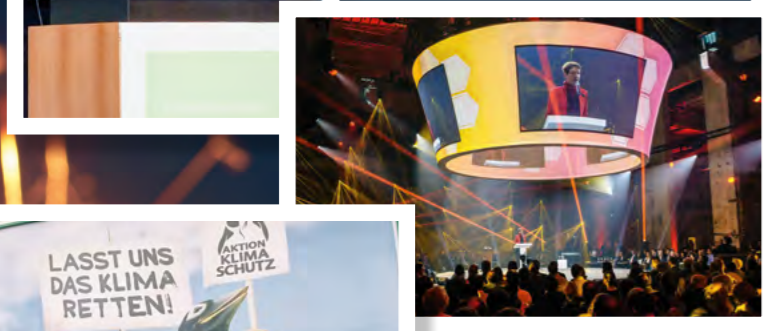
Thomas Bareiß, Parliamentary State Secretary, Ministry for Economic Affairs and Energy



**One Label**  
**Eleven** dena congresses  
**Twenty** award shows  
**Dozens** of logos  
**Hundreds** of keynotes  
**Thousands** of events  
**Tens of thousands** of tweets  
**One hundred thousand** guests  
**Millions** of brochures printed

not to mention countless networks, publications, PV plants, funding programme consultations, press releases, studies, guest articles, pages of Biogas Register, market incentive programmes, discussion papers and energy consultant database entries.

*A lot has happened in 20 years of dena. And we're far from finished!*



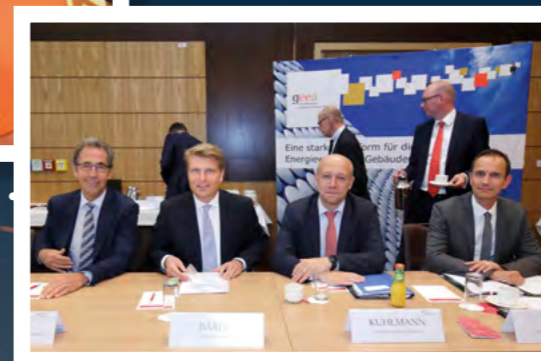
**"With its Grid Studies, dena has laid the foundations for improving the level of synchronisation between the expansion of renewable energies and the electricity grids. Today, it's a matter of course."**

Stefan Kapferer, Chief Executive, 50Hertz



**"Our cooperation with dena is the perfect example of the role France and Germany need to play for the green recovery in Europe."**

Arnaud Leroy, President, Agence de la transition écologique (ADEME)



**"A key player in making the energy transition a successful one."**

Kerstin Andreae, Managing Director of the German Association of Energy and Water Industries



Photos: dena



# New momentum creates increasing demand

2019 was another record year at dena: the company posted a revenue of €24.8 million, the highest in its history. As a result of the increasing global momentum in climate action, the services dena offers were in greater demand: a trend that is set to continue.

Dena's business is seeing extremely positive development. For example, revenue in 2019 increased by 11.2 per cent to €24.8 million – the highest in the company's history. And this trend is set to continue – figures for 2020 are also likely to show revenue growth. The new momentum in the energy transition and climate action – at national, European and global levels – means that dena's expertise and services are increasingly in demand.

Overall, dena recorded an operating result of €600,000 (€605,000 in the previous year) and an annual net profit of €395,000 (€38,000 in the previous year). dena employed 256 employees at the end of 2019, up from 229 the previous year. Dena's Managing Director, Kristina Haverkamp, says, "dena is growing – not only in purely economic terms, but also in terms of the many new colleagues and an increasingly international commitment. The responsibility we have been given for cross-border energy cooperation with several countries in Eastern Europe and Central Asia will enable us to work even more effectively in making the global energy transition a success."

The German federal government laid out a vital roadmap with the agreement on the phase-out of coal at the beginning of 2019 and the climate package adopted in September 2019. dena has been heavily involved in the discussions surrounding these and grappled with models for carbon pricing right from the very early stages.

One important topic area in 2019 involved gaseous and liquid energy sources based on renewable energies. This topic has been worked on from different angles across several projects. The Global Alliance Powerfuels (GAP), an alliance of several international companies initiated by dena to position climate-neutral synthetic energy sources, has generated a great deal of attention in the European and international arena.

At the same time, dena helped to draw up Germany's national hydrogen strategy. In addition to providing content analysis and consulting to the Federal Ministry for Economic Affairs and Energy

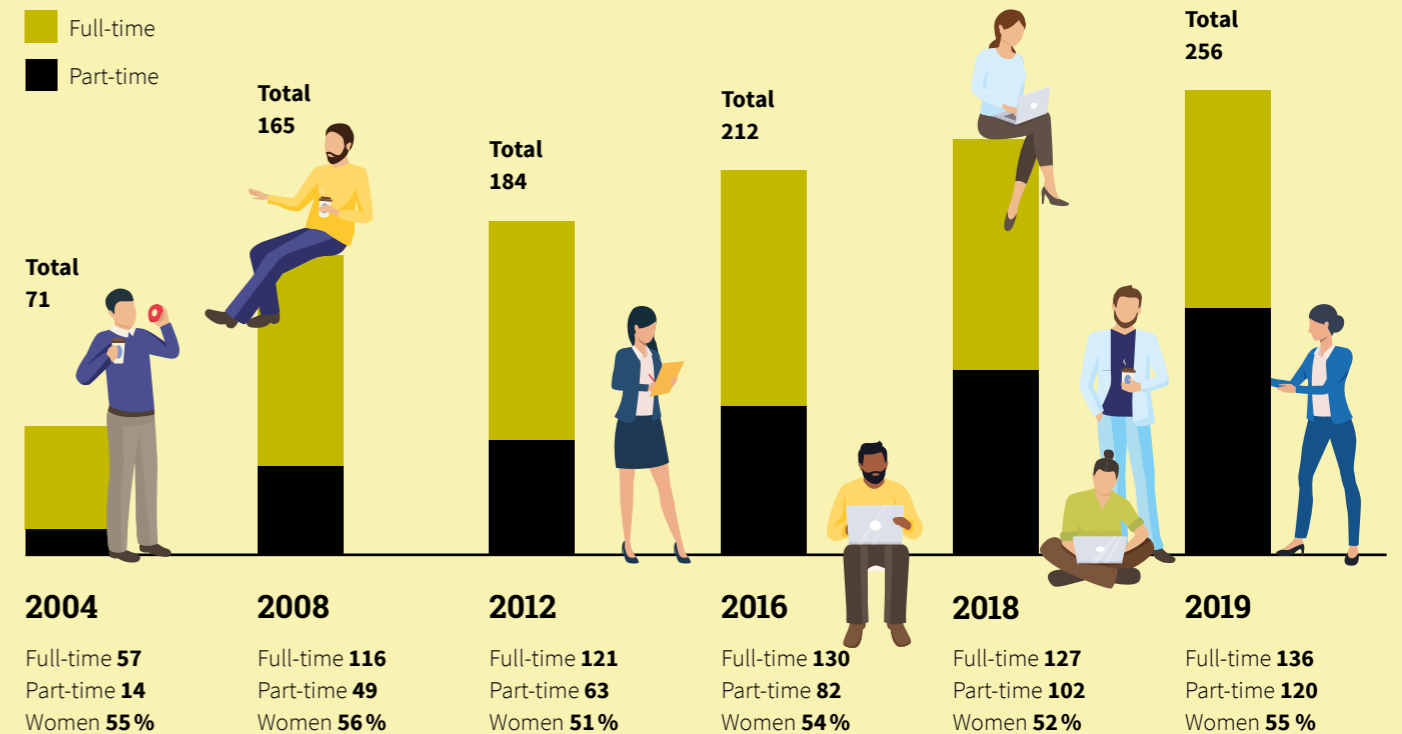
(BMWi), dena also organised and held a major stakeholder conference as part of this. At the invitation of the Federal Minister for Economic Affairs and Energy, Peter Altmaier, the Federal Minister for Transport and Digital Infrastructure, Andreas Scheuer, the Federal Minister of Research and Education, Anja Karliczek and the Federal Minister for Economic Cooperation and Development, Gerd Müller, more than 700 participants came together in Berlin to discuss the role that hydrogen has to play in the energy transition in the future.

dena investigated the potential of digital technologies for the energy transition with a blockchain study and the EnerKI project. The blockchain study has created a basic pool of knowledge on the use of blockchain in the energy industry using eleven concrete use cases as a basis. The EnerKI project, which started in 2019, is also doing important groundwork on issues relating to the use of artificial intelligence in the energy system.

The dena Energiesprong project is taking a very hands-on approach. This innovative refurbishment principle for residential buildings combines short refurbishment times with a ground-breaking implementation and financing model, which enables refurbishments to be carried out with no impact on utility costs, resulting in a net-zero standard. At the end of 2019, the planned refurbishment of over 17,000 residential units was announced (see page 32).

dena's international orientation was also strengthened in 2019 and the ground has been prepared for many more projects. In a new project launched at the beginning of 2020, dena is offering consulting and support services for international energy cooperation with several countries in Eastern Europe and Central Asia. In this way, dena is helping the BMWi and other federal ministries to implement and, on a conceptual level, further develop energy partnerships, energy dialogues and project-related energy cooperation with Turkey, Ukraine, Russia, Belarus, Kazakhstan, Uzbekistan and Iran. dena is thus continuing to pursue its approach of integrated energy transition and is increasingly working internationally, across sectors and across disciplines. ■

## Employees



## Revenues 2001–2019

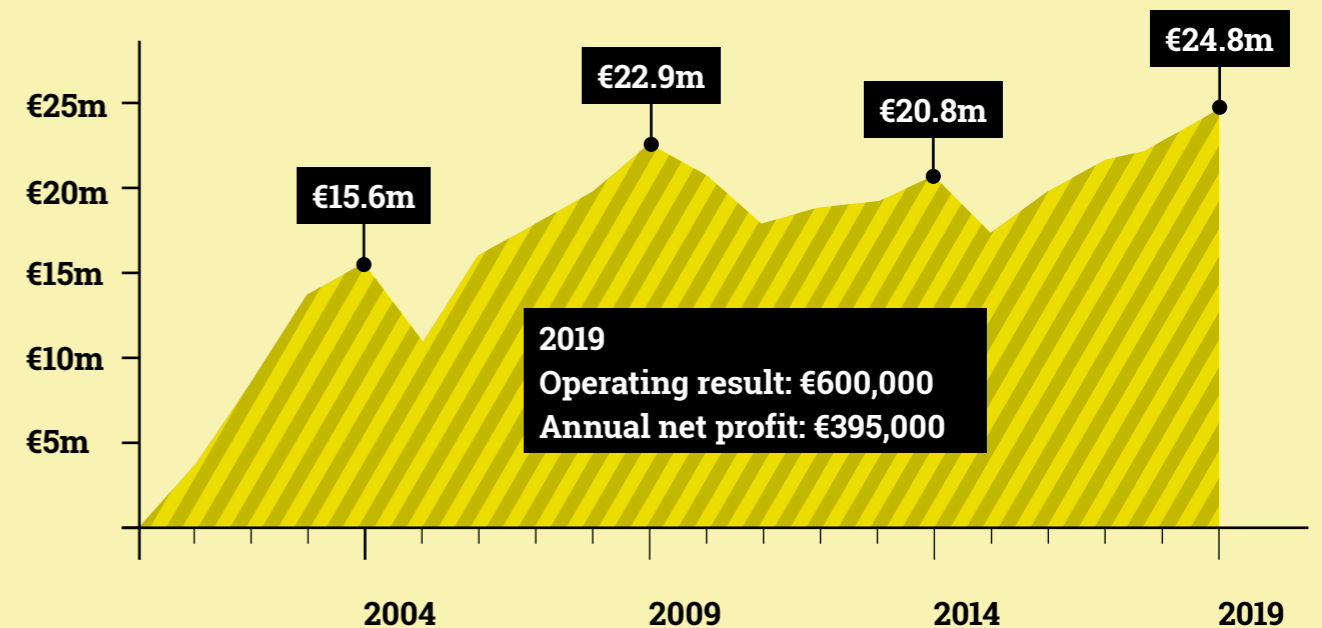
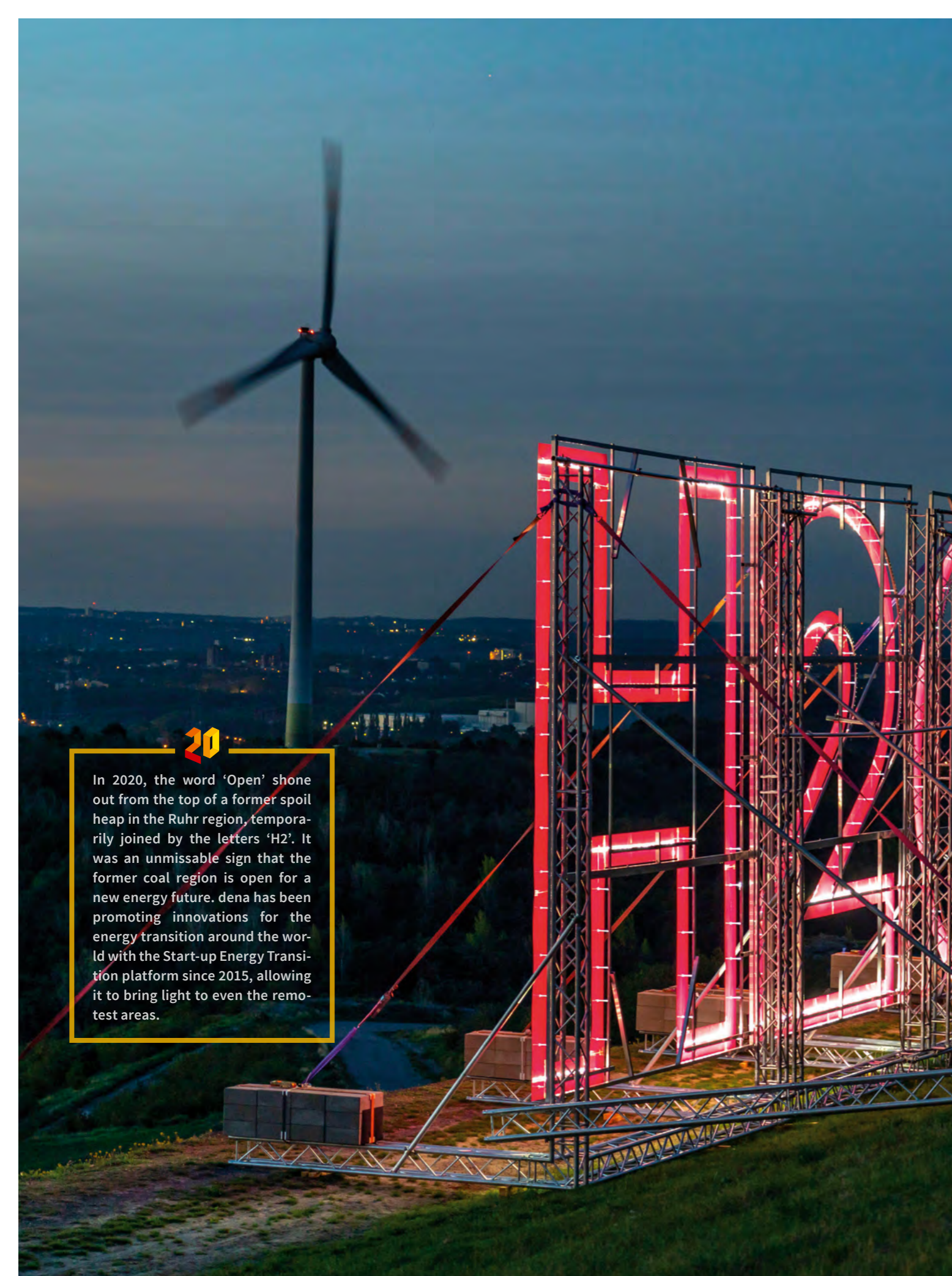


Illustration: de.freepik.com/macrovectors





20

In 2020, the word 'Open' shone out from the top of a former spoil heap in the Ruhr region, temporarily joined by the letters 'H2'. It was an unmissable sign that the former coal region is open for a new energy future. dena has been promoting innovations for the energy transition around the world with the Start-up Energy Transition platform since 2015, allowing it to bring light to even the remotest areas.

## NEXT

The long-term project of climate neutrality needs **innovations** and committed **innovators**. What is our vision? Which solutions are helping us reach our goal faster? What new technologies are on the horizon? In **Next**, we focus our attention on what's coming up.



# A LABORATORY FOR THE ENERGY WORLD OF TOMORROW

Networking platform and workshop: in the Future Energy Lab, companies, municipalities and scientists come together to test technologies for a digitalised, decentralised energy supply.

TEXT Katharina Wolf

Right in the middle of a structural change: the city of Bottrop is receiving a platform to analyse carbon and simulate climate action measures.

“Most mayors have no idea what their city’s carbon footprint is,” says Thomas Koller, CEO of software company enersis. This might sound astonishing at first, but on closer inspection, it’s really no surprise at all. After all, drawing up a carbon footprint requires you to evaluate a wide variety of data from agriculture, industry, transportation and buildings. This data isn’t always easy to get hold of – and you can forget about any sort of standardised format.

Anyone aiming to reduce carbon emissions, however, needs this data as a starting point if they are to develop an effective strategy. One of the three pilot projects launched by dena’s Future Energy Lab in August 2020 aims to show how this data can be better collected and analysed.

## The stakeholders come together at the workshop

The Future Energy Lab is home to interdisciplinary collaborations between companies, municipalities and the scientific community. As part of these collaborations, joint practical tests are carried out to see how digital technologies can be used in concrete applications for the energy transition. Artificial intelligence (AI), blockchain (BC) and

the Internet of Things (IoT) are of particular interest for the energy sector.

The various stakeholders communicate directly via a digital platform solution. The participants log into the platform, where they can then access the project data and work together in the lab at the virtual workbench.

“The Future Energy Lab is designed to be both a networking platform and a workshop at the same time,” explains Andreas Kuhlmann, dena’s Chief Executive. “We first bring the various stakeholders in the energy transition together – large energy suppliers, small start-ups, municipalities, wind farm operators – and then enable them to work together on specific projects. This allows us to test whether new digital methods are suitable for the energy world of tomorrow.”

## Carbon footprints for municipalities

The carbon data demonstrator project is working on drawing up the municipal carbon balances that we mentioned in the opening paragraph. Municipalities will be able to use a software program to simulate their energy transition and the climate action measures. “We need cities to be transparent about their carbon emissions to be able to map their current progress in terms

of climate action. The only way we can develop effective measures is with a reliable database,” explains Lisa Kratochwill, an expert in dena’s Digitalisation Team.

“We collate data from public administrations, clean it up in our software program and then analyse it,” says Koller, describing the process. “This allows us to enable municipalities to see where they stand with their carbon emissions in general.” Carbon reduction measures can then be derived based on this analysis and the impact of these measures can be simulated at the same time. “While it may make sense for one municipality that has a lot of detached houses to promote solar rooftop panels, another may get more benefit from a new wind farm,” he explains.

There was a lot of interest in the project, and eight municipalities were chosen. They will have a simulation platform when the project ends in 2021. One of the municipalities is Bottrop in the Ruhr region – a city that Climate Manager Katrin Knur describes as “right in the middle of a structural change.” Formerly dominated by coal mining, the city is deeply committed to reducing its emissions. Knur also hopes that the clear presentation of the data in the carbon demonstrator will improve communication

about the climate action measures – not just with citizens, but with other municipalities, too. For enersis, Koller continues, the project is an opportunity to further develop the existing software.

## Trusted identity

The Future Energy Lab’s ‘Blockchain-Based Device Identity Database’ project is testing whether blockchain technology is suitable for organising the decentralised energy system. In the past, a few large power plants determined the energy market; today, millions of generation and consumption plants are involved. And the number of these networked stakeholders will continue to increase significantly.

The basis for this increasingly complex, decentralised energy system is operational and secure communication between devices. To create this basis, each device needs a unique and trusted identity, which in turn is linked to certain properties such as access rights. Blockchain lends itself to storing all these identities complete with their assigned properties in a tamper-proof and transparent way.

“Security is crucial for any network. But when the energy supplies depend on it, ‘crucial’ takes on a whole new meaning.

Our energy system requires the highest level of protection possible against tampering and must operate smoothly. We’re testing whether blockchain technology might be good solution for this in the Future Energy Lab,” explains Philipp Richard, Team Leader Digitalisation and Energy Systems at dena.

The aim of the project is to develop a database in which millions of decentralised generation plants and consumption units such as photovoltaic plants, storage facilities, electric vehicles and electrolyzers are not only listed as active market stakeholders in a clearly identifiable way, but in which they register and deregister in as automated a way as possible.

## From a start-up to a DAX-listed company

A total of more than 20 partners, ranging from a start-up to a DAX-listed company, are involved in the development of this blockchain-based database. One of these partners is OLI Systems, based in Stuttgart, Germany. The start-up offers blockchain-supported services for the decentralised energy world, such as linking decentralised generators and consumers to enable direct trading. “Automated registration in a database is the basic requirement for many modern business ideas,” emphasises founder Ole Langniß: “We can no longer control an energy landscape with a projected four million small power plants and flexible consumers the way we used to be able to with 6,000 large power plants.” ■



The Future Energy Lab is a part of the German federal government’s blockchain strategy. The German Federal Ministry for Economic Affairs and Energy (BMWi) has commissioned dena to investigate the potential of digital technologies for the energy transition. Companies that would like to get involved with the Future Energy Lab can get in touch with dena.

Learn more (in German) at [www.future-energy-lab.de](http://www.future-energy-lab.de)

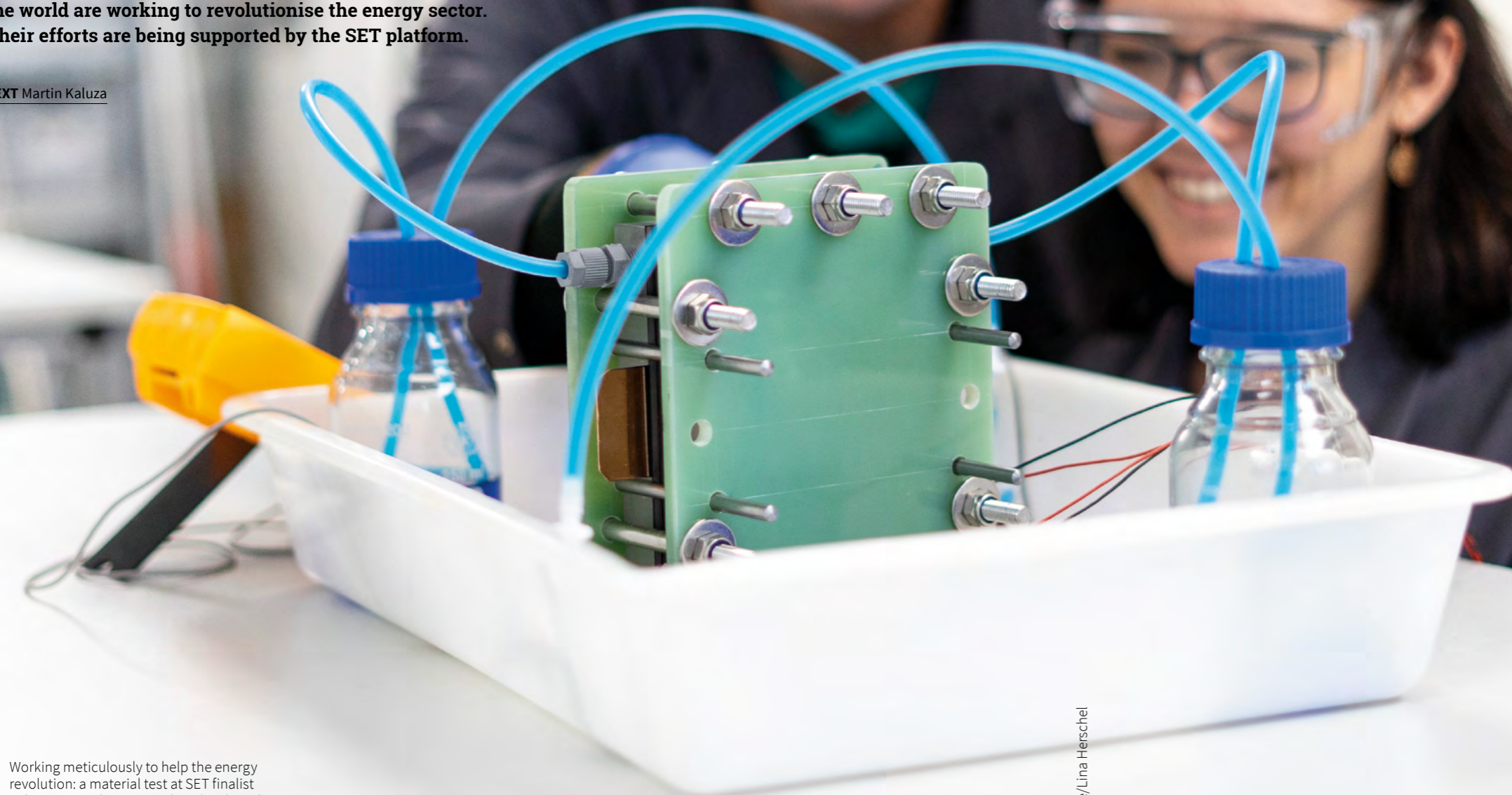
Photo: shutterstock/mekcar, shutterstock/whiteMocca (M)



# Innovations to help climate action

**A flywheel energy storage system for renewables, a light for shelters accommodating those most in need, managing smart grids using artificial intelligence – start-ups around the world are working to revolutionise the energy sector. Their efforts are being supported by the SET platform.**

**TEXT** Martin Kaluza



Working meticulously to help the energy revolution: a material test at SET finalist VoltStorage – the start-up has developed an electricity storage system for home use based on vanadium redox flow technology.

Photo: VoltStorage/Lina Herschel

Founders of energy transition start-ups face additional challenges beyond the development of their innovations. They need to find investors and partners, garner attention and develop suitable business models. This is where the SET platform steps in. It uses its high-level network in the fields of innovation, energy and politics to garner international attention for start-ups and their solutions.

The SET Global Innovation Platform established for this purpose includes SET Week, the SET Tech Festival and the SET Award presented at the festival, as well as the Top 100 List. The success can be seen in the SET Awards, which are presented every year and span five categories. “We had 570 applications from 88 countries for the 2020 Awards,” says Pia Dorfinger, dena Team Leader for Start-ups and Innovations. “The quality of the applications is also extremely high.”

In years gone by, the 15 finalists have met in Berlin each spring for a major exchange with 200 other start-ups at the SET Tech Festival and the awards ceremony. “This year we had to hold the entire SET Tech Festival and the SET Awards ceremony virtually due to the coronavirus crisis,” says Dorfinger. The SET Week was an online-only event and took place between 19 and 22 October 2020.



The Start-up Energy Transition (SET) Global Innovation Platform increases the pace of innovation in the global energy transition by identifying international start-ups in the areas of energy transition and climate action, supporting them and guiding them to success.

**Learn more at**  
[www.startup-energy-transition.com](http://www.startup-energy-transition.com)



## BluWave-ai

**Registered office:** Ottawa, Canada  
**Product:** Artificial intelligence platform  
**Aim:** Intelligent management to ensure efficient electricity grids

### Efficient grid management with artificial intelligence

This year's finalists in the Digital Energy Systems category included BluWave-ai. Founded in 2017, the Canadian start-up has set its sights on becoming nothing less than the world's leading AI company for renewable energies. The basic idea is that the company uses artificial intelligence to manage smart electricity grids more efficiently. BluWave-ai does this using live data from wind turbines and solar power systems, which the company combines with weather data, enabling it to forecast how much electricity a certain point in the grid will produce in the next few minutes with much greater precision. "This allows us to better manage production and storage in the grid and, for instance, help to alleviate load or production peaks in grids with a high share of renewable energy," says BluWave-ai founder Devashish Paul. "The result is lower net energy costs, better integration of renewable energies and lower emissions," he continues.

What's new about BluWave-ai's approach is the high frequency with which the system collects and processes data. Until now, most electricity producers and grid operators have only called up the amount of electricity the individual plants are currently producing once to four times an hour, Paul explains. But the more precision with which the data is determined, the more precisely you can predict which plant in the grid will supply how much electricity and when. And the more precise the forecast is, the more efficiently it can be managed.

Paul has worked in the semiconductor industry for 20 years. He specialises in artificial intelligence and has founded several companies. With BluWave-ai, he is in a sense mining a treasure trove of data that already exists. "We don't build sensors into hardware," Paul explains. "We use artificial intelligence to make the most of the existing hardware," he adds.

Three years ago, Paul faced the challenge of winning his first customers. "It's a typical problem for start-ups. Basically nobody wants to be the first to take the risk," says the founder. To overcome this issue, BluWave-ai entered into research projects with government laboratories. With the credibility of the research institutions behind it, the company initially found smaller suppliers in Canada as partners. Finally, BluWave-ai made contact with potential customers abroad through the Chamber of Commerce and now works for the Indian energy supplier Tata Power. Paul hopes that being part of the SET Award will garner even more international attention.

## Liter of Light

**Registered office:** Makati City, Philippines  
**Product:** Solar lamp  
**Aim:** A sustainable light source for those most in need

### A light in the dark of the slums

The SET Awards are presented in five categories. As well as digital energy systems, there is also a category for renewable energies and materials, for energy efficiency solutions and for smart mobility. A special prize is dedicated to UN Sustainable Development Goal 7: it recognises companies that help secure sustainable and modern energy for all.

This special award was won by the Manila-based Liter of Light Foundation in October 2020. Founder Illac Diaz's goal is to provide light to the inhabitants of the world's poorest districts and remotest villages. In many slums, the shacks are built close together and don't even have a window. It's also dark even during the day. Diaz took up an idea from Brazilian inventor Alfredo Moser from 2002 and showed the local residents how to build a ceiling light from a plastic bottle filled with water, which is simply embedded and glued into the corrugated iron roof. A dash of bleach prevents algae from forming in the water. The bottle directs daylight into the living area and shines as brightly as a conventional 55-watt bulb.

The idea went viral on social media. But Diaz wanted more. The slums should have light at night, too. "The bottle ceiling lights were the first phase of a larger plan," he explains. "The bottles enable people living in the slums to save on electricity costs during the day. They can then invest the money that they've saved into small solar lights so that they also have light at night."

The solar lights are now Liter of Light's flagship product. For the past six years, Diaz and his team have been running workshops in the cities and villages of 15 different countries to show residents how to build cheap solar lamps from plastic bottles and cheap individual parts. They provide some parts from donations. Since the solar lamps are still too expensive for many people to buy at \$20 to \$25, the foundation came up with its next idea: it is now training cooperatives on how to build a sustainable rental business with the cheaply built lamps. The rent for the lamps is much cheaper than electricity from the generator, for instance. This way, even the poorest inhabitants of the slums can afford the light for the night. The idea has enormous potential. According to estimates by the International Energy Agency, 840 million people worldwide have no electricity – and thus no light.



## Adaptive Balancing Power

**Registered office:** Darmstadt, Germany  
**Product:** Flywheel energy storage system  
**Aim:** Stable electricity grids with high proportions of renewable energies

### Fast storage for renewable energies

The SET Platform's latest offering is the national SET Hub. dena is working on behalf of the German Federal Ministry for Economic Affairs and Energy to provide mentoring and support energy transition start-ups in aligning their business model with the complex energy regulatory framework in Germany.

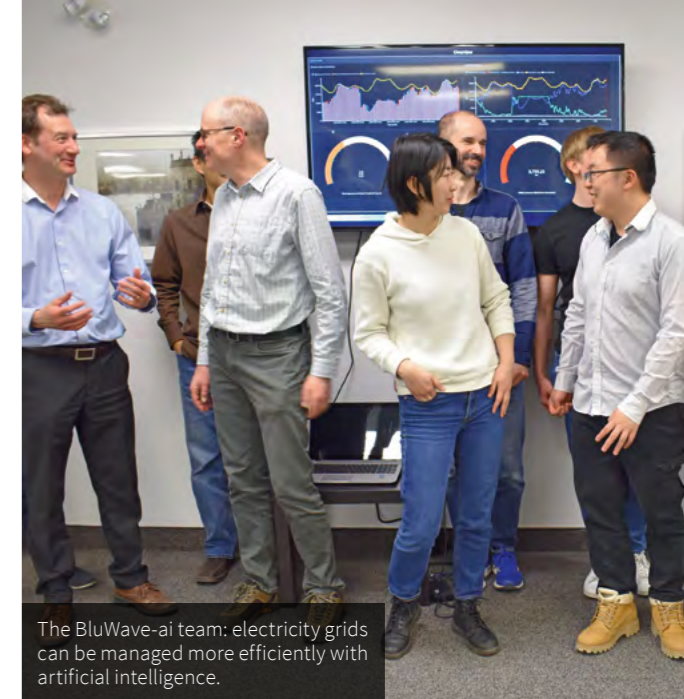
Adaptive Balancing Power GmbH, based in Darmstadt, Germany, is taking part in the first round of SET's mentoring initiative. The company, a spin-off of the TU Darmstadt, builds systems based on the principle of flywheel energy storage systems that can store surplus electricity very quickly and release it again when needed. "Flywheel energy storage systems are the oldest form of energy storage," says Dr Hendrik Schaede, the company's CEO. "It's the same principle as a pottery wheel or a spinning top."

Schaede and fellow co-founder Nicolai Meder have been working on the technology since 2008 and have developed it into an alternative for lithium-ion energy storage. "NASA patented the outrunner design concept we use back in 1975. But we were the first to master this technology in 2013 – and at competitive costs," says Schaede. The flywheel storage system is based on a hollow cylinder made of carbon fibre that rotates around a solid core in a vacuum. It is rotated by an integrated electric motor. To retrieve the stored energy, the cylinder is stopped and the engine then operates as a generator.

The hollow cylinder is mounted using magnets so there are no mechanical friction losses. Air friction is also extremely low thanks to the vacuum. This makes the storage systems efficient, low wear and durable.

The flywheel energy storage system reacts especially quickly. The storage system can absorb power from the grid or start delivering it within a few milliseconds, even with full load reversal. This property also allows the storage technology to contribute to stabilising electricity grids that use high proportions of renewable energies. But there are still some hurdles to clear. "Germany wants to be a pioneer in storage technologies. But we're still lacking the regulatory framework that makes it profitable," says Schaede.

The start-up therefore has very specific hopes for the SET mentoring initiative. "We hope to gain insights into how the regulations for the German energy market are created and in which bodies we need to be active to explain what the problem is," says Schaede. "In the past, conventional energies were given regulatory preference. We hope that we don't now face the same problem with lithium-ion batteries being preferred when it comes to storage technologies. The best thing would be for future regulations to be technology neutral. That would allow the best technology to prevail." Adaptive operates pilot plants in Ireland and the UK, where it already uses the flywheel energy storage system. ■



The BluWave-ai team: electricity grids can be managed more efficiently with artificial intelligence.



A plastic bottle repurposed into a solar lamp: Liter of Light is bringing light to disadvantaged communities.



Container delivery: the high-performance flywheel electricity storage system from Adaptive Balancing Power.

Photos: BluWave-ai, Liter of Light, Adaptive Balancing Power; Illustration: de.freepik.com



# “I dream of providing people with electricity they can afford”

For Olugbenga Olubanjo, founder and head of start-up Reeddi, access to affordable electricity in energy-poor regions not only promotes environmental protection, it also boosts social and economic progress.

“I grew up in an area in Nigeria where it was always incredibly difficult to get electricity at all. I often went home late at night when I was at school. I did my homework at school and, when I was older, my assignments at the university because we didn't have any electricity at home. I know that this is something that affects a lot of children.



**OLUGBENGA OLUBANJO, 27,** studied civil engineering in Ibadan, a city of six million people in southwestern Nigeria, and in Toronto. In 2018, he founded the start-up Reeddi. The company rents portable rechargeable batteries with an integrated socket to private households and small businesses that are not connected to the power grid. Reeddi was one of the finalists of the Start Up Energy Transition Award 2020, hosted by dena and the World Energy Council.

Energy is fundamental to any society that wants to make progress. I've experienced it myself. And that's precisely why I have the vision of providing people with electricity they can afford. Incomes in Nigeria and many other African countries are low. Many people only earn three or four dollars a day.

Until now, most people have been dependent on diesel generators. These cost a household between one and five dollars every day, even if they only generate light. The generators are harmful to the environment. Unfortunately, sometimes people even suffocate from the exhaust fumes. Solar panels are more environmentally friendly, but they cost around \$300 dollars to buy – hardly anyone can afford that. You can also rent them. But you have to sign long-term contracts for that, and many people shy away from it.

I wanted to offer a solution that only costs a household 50 cents per day. That's how I came up with Reeddi: We rent out battery units by the day, which have a socket for normal mains plugs. We charge the batteries in central charging stations. The system is mobile; you can take it anywhere and it is very easy to use. Everyone can afford this electricity. We want to supply individuals and small companies, such as hairdressers, shops and workshops. Our customers don't have to purchase any technology themselves. This makes them flexible and they can use the energy when they need it.

“Energy is fundamental to any society that wants to make progress.”

We already have our first charging station and over 20 batteries here in Nigeria, and the next 100 are on the way. Our expenses for the batteries will pay for themselves after five years. We want to set up more charging stations and hope that the unit prices of the stations and batteries will come down as soon as we can mass produce them. We have requests from India, Zimbabwe, Kenya, Nigeria and Tanzania. I also see potential in the Philippines.

Whenever I talk to our customers in Nigeria, they tell me what progress Reeddi's electricity has meant for them. It's so fulfilling! Reeddi brings sustainable social, economic and environmental progress to people. ”

Photos: Rahul Kalvapalle, dena

## We bid farewell to Stephan Kohler (1952 – 2020)



Stephan Kohler has passed away. He was a co-founder, and for many years Chief Executive, of the German Energy Agency (dena). His name is inextricably linked with the 15 years he spent at the helm of our company. He had a decisive influence on dena during this long period, the longest time he spent in any one role throughout his eventful life. dena would not exist in its current form without his tireless commitment – in the range of issues it deals with, its national and international positioning at the interface between business and policymakers. In his role as dena Chief Executive, he drove so many issues related to the energy transition forward and sought out solutions: these included, but were not limited to, energy efficiency in all its facets, energy infrastructure and grid expansion, as well as innovation topics such as Power-to-Gas in the early days. In international terms, he was particularly interested in the cooperation with Russia and China, which he initiated and drove forward with great personal commitment.

Stephan Kohler was a pioneer in the energy transition. The Augsburg-born mechanical engineer made his mark as early as the beginning of the 1980s at the

Freiburg-based Oeko-Institut, the Energy department of which he led from 1983. In 1991, he became Managing Director of the Lower Saxony Energy Agency (Niedersächsische Energie-Agentur) and then took over as Chief Executive of the newly founded dena in October 2000. When he left at the end of 2014, the two-person start-up consisting of himself and a secretary had become a company with 200 employees.

Even after his time at dena, he remained connected to us. He worked in the EUREF campus in Berlin, for instance, and was active there as a founder and investor. This location has also been dena's second Berlin site since the end of 2020.

Stephan Kohler was a passionate and valiant campaigner for the energy transition and climate action. He devoted his energy to this for decades, always curious, full of ideas and verve. He was able to get to the point, never shied away from discussion, but was also a fount of knowledge and a fair moderator.

Many of those who work at dena today have worked closely with him. Many got to know 'sk' – his internal dena acronym – personally from day one. For years, he never missed the opportunity to welcome

new employees to his office.

We would like to thank Stephan Kohler for his incredible commitment and his unparalleled service to dena, the energy transition and climate action. He passed away shortly before his 68th birthday and shortly after the 20th anniversary of dena. Sadly, he wasn't able to celebrate dena turning 20 with us. We would have loved to enjoy, discuss and share the occasion with him. We're sad that we couldn't.

On behalf of the entire dena staff  
Andreas Kuhlmann  
Chief Executive  
Kristina Haverkamp  
Managing Director





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