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Sustainable reading from the Oeko-Institut



The half-way stage in Germany's "energy turnaround"

An exciting time
Guest article by Dieter Seifried

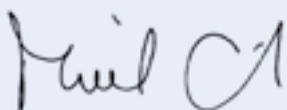
The energy turnaround: half-time, complete success?

With the publication of the book *Energiewende – Wachstum und Wohlstand ohne Erdöl und Uran* in 1980, the Oeko-Institut presented, for the first time, comprehensive scenarios for an alternative energy future. Florentin Krause, Hartmut Bossel and Karl-Friedrich Müller-Reissmann described how growth can be decoupled from the consumption of electricity and other fuels, and identified energy efficiency as the key to long-term reductions in energy demand. This ground-breaking study on energy system transformation – the first of its kind – provoked sometimes highly emotional debates. Since the Oeko-Institut opened its office in Darmstadt in 1980, much of my own work has focused on nuclear power plant safety. My colleagues and I have repeatedly pointed out the weaknesses and potential risks associated with this technology. In the past 35 years, a great many stakeholders have made their own contributions to establishing the concept of energy system transformation on a firm scientific footing, filling it with life, and proposing solutions for sustainable energy use, many of which are now accepted by society at large. In March this year, we invited representatives from politics, associations, business, academia and civil society to join us at a celebratory event to mark “the half-way stage?” in Germany’s energy turnaround.

At the same time, of course, we could not ignore one key question: how much success have we achieved, measured against the goals we set ourselves back in 1980? What still has to be done to make energy system transformation a reality? Which achievements can we celebrate, and which major obstacles lie ahead? These questions are explored in the current issue of *eco@work*. In a guest article, Dieter Seifried, who worked at the Oeko-Institut for many years, describes how he sees the half-way stage, while the other two articles look back and, above all, look forward to the challenges that are likely to arise in the next 35 years. There is no disputing that we must cut our greenhouse gas emissions to almost zero by 2050 in the interests of the climate. This will require sustained efforts in the power generation industry, together with a more intensive focus on other sectors, such as transport and buildings. In our numerous research projects here at the Oeko-Institut, we will continue to develop fresh and innovative ideas to guide this process now and in future.

I hope you enjoy reading this issue of *eco@work*.

Yours,



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Guest article by Dieter Seifried

A game of two halves?

I am proud to say that I myself had a hand in pioneering energy system transformation at the Oeko-Institut in the early days. Together with three of my colleagues, I was involved – until 1985 – in drafting the Institute's strategy on recommercialisation of the energy supply, which offered analyses and made recommendations on removing the obstacles to implementation of the blueprint for an energy turnaround, published by the Oeko-Institut in 1980. A key priority was to abolish existing economic disincentives, such as the tariff structures and legal frameworks – especially the system of concession fees – that favoured the electricity oligopolies. We also wanted to replace undemocratic decision-making structures with local, citizen-led processes. In the mid 1980s, the findings of climate research and the Chernobyl disaster gave our approach a considerable boost.

At first, very few of the municipal utility companies (Stadtwerke) were willing to embrace our ideas. Nonetheless, with a few of them, we were able to establish interesting forms of cooperation and develop new energy services. We devised a least cost planning (LCP) package for the Stadtwerke in Hanover, for example, demonstrating that action on energy efficiency pays off, not only for the municipal utilities but also for customers.

The projects generated a wealth of information that we then attempted to apply locally in Freiburg. As a member of the Freiburg Climate Action Alliance, the Oeko-Institut proposed an energy-saving scheme for Freiburg's local energy supply company FEW, which involved the distribution of low-energy light bulbs to FEW's customers free of charge. We estimated that replacing light bulbs offered the potential to save around three million deutschmarks, benefiting the municipal utilities and customers alike. After some initial scepticism on the part of the company – which we managed to overcome with

public events and discussions with local councillors – the project became reality. The "Meister Lampe kommt" (Lamp-lighter) scheme was a great success, prompting the then Lord Mayor Rolf Böhme to remark that "with this project, FEW has finally made the leap from a conventional supply company to a modern service provider".


The months after the Chernobyl disaster were a turbulent time. The Oeko-Institut was inundated with hundreds of phone calls from people desperate for advice, as well as offers of help from would-be volunteers keen to make a difference. So the Institute called for the establishment of independent energy transition committees. Just a few months after the reactor disaster, the Oeko-Institut's co-ordination team was providing support for around 400 local groups, all of which were working hard to create a wind of change in their municipalities' energy policy. This citizens' movement was, in my view, a pioneering force in energy system transformation in the early days.

With energy industry deregulation in 1998, least cost planning was consigned to history. New ideas were needed, and so the focus of the debate shifted to topics such as emissions trading, green power and performance contracting. Implementing real-world projects is always the most exciting aspect of the Oeko-Institut's work, and so three of its staff launched the ECO-Watt project at a local comprehensive school, Staudinger Gesamtschule. With this performance contracting project – funded by local citizens – we were keen to show that saving energy and investing in energy efficiency and renewables pays off. This early example of crowdfunding was a resounding success: even before we could sign a contracting agreement with the City of Freiburg, the fund was already fully subscribed with contributions from teachers and other local residents. Here too, there was considerable resistance, this time from the local authority, which we were able to

overcome thanks to the Oeko-Institut's good reputation and cooperation with environmental groups and the media. The scheme's success proved that the project initiators were right and helped to promote a rollout of performance contracting.

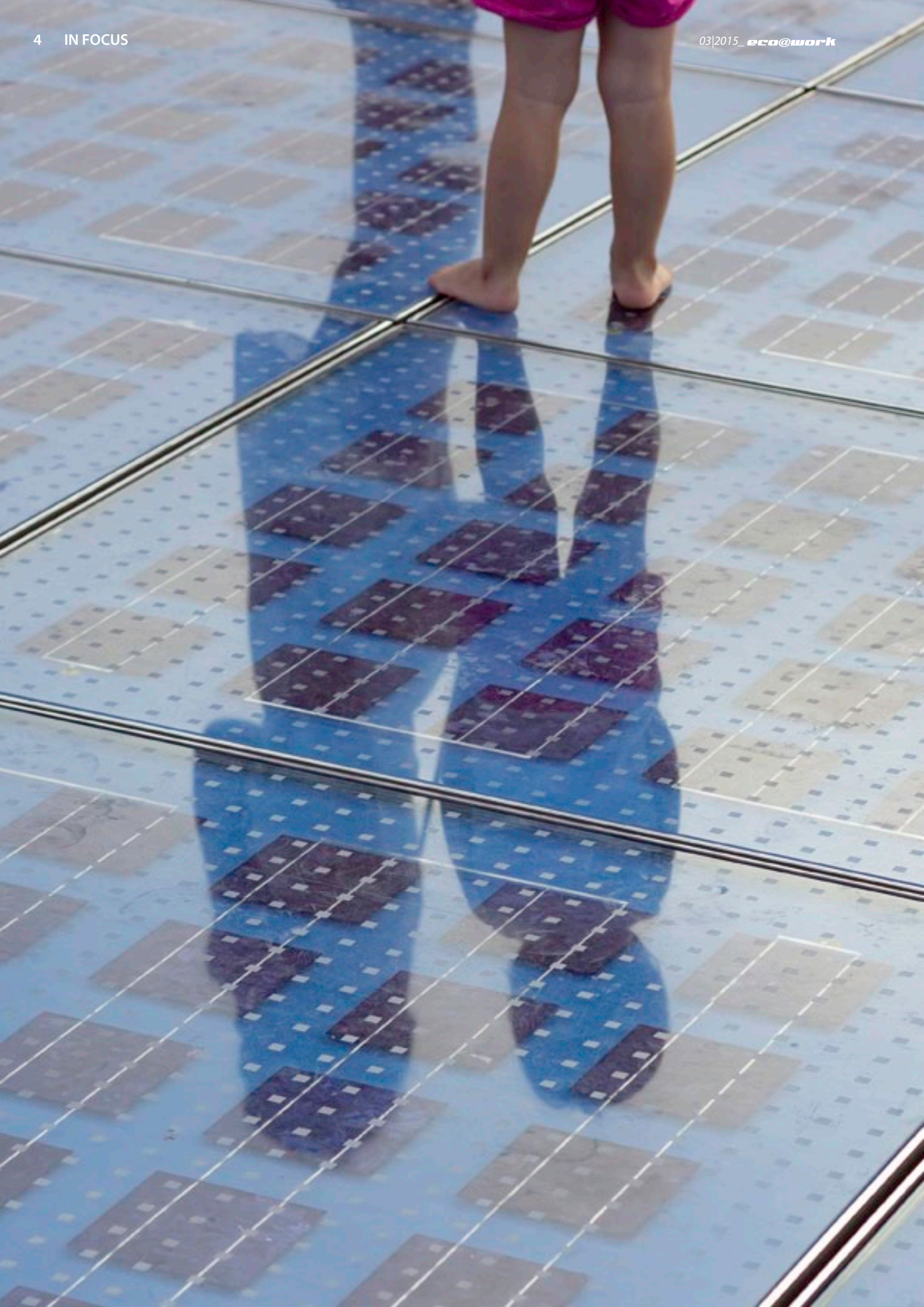
Nowadays, the need to protect the climate is widely accepted and, generally speaking, is unopposed. The only point of controversy concerns the strategies and mechanisms that should be deployed to achieve the targets. At the half-way stage, are we ahead of the game, or do we have some ground to make up? It's difficult to say. One thing has become clear in recent months, however: the mood has shifted. This is apparent from the reform of Germany's Renewable Energy Sources Act (EEG 2.0) and the media and political campaign being waged in parallel by some sections of government and industry, which aims to justify putting the brakes on the energy turnaround. The growing success of renewables is intensifying the pressure on Germany's "big 4" – and these energy corporations then put pressure on politicians.

It's an exciting time. The outcome will be decided in the second half!

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Dieter Seifried founded the Ö-quadrat consultancy, which focuses on energy industry and policy issues, in 1999. Before that, he worked for the Oeko-Institut for 16 years.



The half-way stage in Germany's "energy turnaround": where are we now?

35 years on ...

With the publication of the book *Energiewende – Wachstum und Wohlstand ohne Erdöl und Uran* in 1980, Oeko-Institut scientists sent a clear message: energy system transformation is within reach. Since then, a great deal has happened in Germany's energy turnaround. Climate change has entered social and political consciousness – and requires wide-scale decarbonisation by 2050. The nuclear phase-out was agreed and then delayed, and will now be implemented by 2022. Renewable energies are booming, and greenhouse gas emissions have been cut, in some sectors more than others. Germany is on track towards a sustainable energy future, but faces problems and setbacks as well as progress and success stories. The aim is to achieve a fully sustainable energy supply by 2050. 2015 marks the half-way stage. But have we really reached 50 per cent of our goals?

"Given the major challenges we face, that's difficult to measure. What is certain is that in some sectors, we could and should have achieved more in the last few years in order to stay on track," says researcher Christof Timpe, Head of the Oeko-Institut's Energy and Climate Division in Freiburg and Darmstadt. As he explains, progress on energy system transformation varies in the individual sectors – and so does the degree of optimism with which we can view its further implementation. "In the electricity sector, for example, we are well on track; here, we are much further

ahead than in other areas. There is a relatively broad political consensus on the transformation goals in this sector, and most of the technologies required are available. Decarbonisation is well within reach here." Of course, electricity generation is not without its problems. "There are some difficult decisions ahead," says Christof Timpe, "notably as regards the construction of power lines and the future role of coal-fired power plants."

There's no disputing that much of the progress achieved in the electricity

sector is due to the successful expansion of renewable energy sources (RES). According to provisional figures from the Working Group on Renewable Energy Statistics (AGEE-Stat), the share of RES in gross electricity consumption reached 27.8 per cent in 2014. And last year, for the first time, more power was generated from renewables (161 TWh) than from lignite (156 TWh) – compared with just 36 TWh from renewables in 2000. Renewable energies feature prominently in many of the Oeko-Institut's projects, and a key issue is how they can best be promoted in future. Since

2000, guaranteed feed-in payments for RES electricity (RES-E) have been regulated by Germany's Renewable Energy Sources Act (EEG), but the law will change yet again in 2016. "At present, installation operators receive a more or less fixed payment per kilowatt hour, comprising income from electricity sales and a floating market premium – irrespective of demand," says Christof Timpe. "So if there is a surge in supply, even for a few hours, this can contribute to the formation of negative prices on the electricity exchanges." A reform model – known as EEG 3.0 – developed by the Oeko-Institut on behalf of Agora Energiewende is therefore based on a fixed premium (capacity payment), among other things. "The key question is this: which system services does the plant provide? The premium should be calculated on that basis so that the producers of RES electricity share the risk posed by price fluctuations on the electricity exchanges," says Christof Timpe. The model aims to smooth out fluctuations in power production as far as possible and thus reduce the need for flexibility. "But with the present model, maximising electricity production, not systemic gains, is the key focus of interest."

New Grids

Restructuring the transmission grids is also important in making energy system transformation a reality. "If the transition to an RES-based electricity supply is to be successful, grid adaptation is a must. At present, the grids are optimised for electricity generation in large power plants, but the energy turnaround will cause more fluctuations in power generation and create a multitude of local producers," says Christof Timpe. "Flexibility is also needed, for example through load management at the level of consumers, as well as more heat and power storage." But which specific flexibility options at which times and, above all, how much grid expansion will be needed? These are highly contentious issues. "There is considerable opposi-

tion to grid expansion. In our view, that's partly due to the very complex process involved in producing the Grid Development Plan, which the public finds difficult to follow," says Christof Timpe. "The plan is produced annually and describes grid expansion for the next 10 years." An Oeko-Institut project on Grid Transparency – Ensuring Greater Transparency on the Need for Grid Expansion, funded by the German Federal Ministry of Education and Research (BMBF), therefore looks at ways of making demand planning more transparent, thus enhancing understanding of the required measures. "The aim is also to improve the scenarios for grid expansion planning," says Christof Timpe. "So we are holding scenario development workshops with stakeholders such as citizens' action groups and environmental organisations, focusing on the electricity sector and the scenarios' potential impacts on grid expansion."

So far, the project's findings suggest that the scenarios on which the Grid Development Plan is currently based should be enhanced with additional options, with substantially reduced deployment of coal-fired power plants and regionally optimised distribution of renewable energies. "It is quite conceivable that redefining the scenarios for grid development will present a different picture of the need for specific transmission projects," says Timpe. "However, the basic requirement for grid expansion – for example, along the north-south axis – is not called into question."

Buildings: a problem sector

On the issue of power grid expansion, there is still considerable disagreement on the right approach. For the Oeko-Institut's experts, however, it is the buildings sector that gives real cause for concern in the context of the ener-



gy turnaround. According to Christof Timpe's colleague Veit Bürger, this is a "major black spot", with problems including outdated heating systems and poorly insulated buildings. "For decades, we have heard lip service being paid to the substantial need for action here, but no policy decisions are being taken," says the Deputy Head of the Energy and Climate Division. He finds it especially vexing that tax relief for energy upgrading of buildings has failed to come about, "although this would have been no more than a tiny element of the energy transformation mosaic". He admits that this is not a straightforward sector, partly because it is far more fragmented than, say, the electricity industry. "You're dealing with millions of householders, so of course it is more difficult to make rapid progress." Nonetheless, effective action is possible, such as the introduction of a climate levy, payable by householders depending on the energy status of their property, and the long-term obligation to carry out upgrading. "We also need better enforcement of the existing rules. And that means more municipal staff, for example, to ensure that building standards are genuinely being complied with."

More energy efficiency in the buildings sector was also the theme of the Entranze project, which ended in autumn 2014 and aimed to support policy-makers in developing measures to increase efficiency. The Oeko-Institut was a member of the research consortium which implemented the project. "For Entranze, we analysed the European building stock and owner behaviour and investigated technology acceptance and least-cost upgrading technologies," explains Veit Bürger. On this basis, the researchers then estimated the effectiveness of policy tools to 2030 and developed policy recommendations for the EU building sector. "We found that with ambitious targets and innovative support mechanisms, there is potential to cut the EU's greenhouse gas emissions by as much as 50 per cent by 2030." Key measures include refurbishing buildings to a high energy standard, gradually phasing out coal- and oil-fired heating, and using more low-energy lighting. In the experts' view, this will require consistent and appropriate updating of Germany's

Energy Saving Ordinance, for example. "Owners also need better information about energy upgrading and support schemes. And we need stringent quality standards so that energy upgrading genuinely produces the savings that we can expect to achieve if these measures are implemented correctly."


A beacon in a complex world

So what is Christof Timpe's view of the public debate about the energy turnaround? His message is clear: "In the last 10 years, the issues have become far more complex and therefore more difficult to address, largely because classic black and white thinking is simply no longer possible in many cases." The continued expansion of renewable energies is a case in point: as they now ac-

count for a significant proportion of the power supply, the system as a whole must be adapted to facilitate further renewables growth. "And that's a far more complex task than simply building as many new wind or solar plants as possible."

Although 35 years have passed since the first study on energy system transformation, Christof Timpe believes that the Oeko-Institut still has a crucial role to play. "We have become a kind of beacon. What we are trying to do with our analyses, in this complex situation, is to chart the right way forward. And that is sometimes a painful process; the future of the European and German coal-fired power plants is such a case." Will the energy turnaround be brought to a successful conclusion within the next 35 years? Christof Timpe isn't sure. But he does know that it is possible. "It is entirely feasible to cut our greenhouse gas emissions by 95 per cent before 2050. But that will require consistent and courageous policy decisions."

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What needs to be done to make the “energy turnaround” a reality?

And 35 years to go ...

Germany has set itself clear targets for the coming years and decades: a 40 per cent reduction in greenhouse gas emissions by 2020 compared with the 1990 baseline, with further goals set for 2030 (55 per cent), 2040 (70 per cent) and 2050 (80-95 per cent). There are 35 years left to make energy system transformation a reality. Its success will depend on implementation of the agreed measures, the adoption of new policy instruments, and continuous monitoring of progress.

Every two years, the German Government – like all the EU Member States – is required to assess greenhouse gas emissions trends for the coming 20 years or so in a projections report, which is prepared by a research consortium involving the Oeko-Institut. “The projections report for 2015 charts greenhouse gas emissions trends to 2035,” explains researcher Julia Repenning, Deputy Head of the Energy and Climate Division at the Oeko-Institut’s Berlin office. “It covers all the measures introduced before the end of August 2014.” It is already apparent that even for the period to 2020, the targets cannot be met without additional efforts: the report predicts emissions reductions of just 32.7 per cent by 2020 – a clear shortfall compared with the 40 per cent climate target. The experts are also forecasting a reduction of around 43 per cent (instead of the required 55 per cent) by 2030 and around 48 per cent by 2035. “These figures are dependent on a number of variables, so sensitivity analyses were also carried out,” as Julia Repenning explains. “If fuel prices and population growth increase, we expect emissions to fall by 31.9 per cent. With a smaller electricity export balance and lower economic growth, a 35 per cent reduction may be within reach.”

In its National Energy Efficiency Action Plan and Climate Action Programme 2020, adopted at the end of 2014, the German Government sets out a package of measures aimed at achieving

further emission reductions; however, these are not covered in the latest projections report. “The aim is to utilise a variety of instruments – such as better energy efficiency in commercial vehicles, and methane emission reductions from landfill – in order to close the climate mitigation gap of 62.5 to 100 million tonnes CO₂ equivalent by 2020,” says Julia Repenning. For the measures envisaged in the Climate Action Programme, the Oeko-Institut has calculated the emissions savings that can be achieved. One example is KfW’s urban energy modernisation programme, which should be developed and expanded. “The calculations show that this could save 1.2 million tonnes of CO₂ by 2020 if the programme budget is increased to 100 million euros a year from 2016,” says Julia Repenning. Another option is to expand the road user charge scheme for heavy goods vehicles. Extending the scheme to goods vehicles weighing more than 7.5 tonnes and introducing it on Germany’s federal highways, according to the calculations, would yield a CO₂ reduction potential of half a million tonnes. And these are just two examples – there are many more, such as expanding the CO₂ Building Modernisation Programme, promoting a modal shift to rail, and encouraging resource efficiency. The Oeko-Institut’s experts have produced detailed calculations showing how the 2020 climate targets can be achieved in the various sectors.

The 2015 target

But 2020 is just a staging post: the main focus is on 2050, the target year for the energy turnaround. The second round of modelling looks at the 2050 climate scenario and investigates where there is potential to work towards the final goal. In this project, commissioned by the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, the Oeko-Institut – in collaboration with the Fraunhofer Institute for Systems and Innovation Research – is analysing the level of emission reductions that can be achieved with Germany’s current energy and climate policies and which strategies and actions are needed to achieve the targets set. “With that aim in mind, in the second of the three rounds of modelling, lasting until autumn 2015, we are developing two separate scenarios with differing levels of ambition,” explains Julia Repenning. “The most ambitious would achieve a 95 per cent



reduction in greenhouse gas emissions." As the first round of modelling in 2014 showed, the pathway for 2020-2040 described in the German Government's Energy Concept is sufficient to achieve an 80 per cent drop in emissions by 2050. However, if the aim is to achieve 95 per cent by 2050, more ambitious interim targets are needed. As the Oeko-Institut's expert makes clear: "The interim emission reduction targets should really be 45-50 per cent for 2020 and 85 per cent for 2040 if Germany is to avoid having to achieve disproportionately large cuts in its emissions in the final decade to 2050."

The first climate scenario models show that in the coming years, significant emission reductions will have to be made as quickly as possible. "This can be achieved by applying a simple formula: energy efficiency first, then coal-free power generation and more efficiency in the transport sector," says Julia Repenning. Firstly, energy efficiency – in all sectors of the economy – has a crucial role to play in mitigating climate change. In trade and industry, for example, this means using highly efficient LED lighting and light- and motion-sensitive controls. In the buildings sector, energy consumption must

be reduced by 80 per cent by 2050, with the remaining energy needs being met by renewables in future. Secondly, full decarbonisation of power generation is essential. This will require the ongoing expansion of renewable power generation capacities, especially wind and solar. "In this way, the renewables share of power generation can be increased to more than 90 per cent by 2050," Julia Repenning concludes. And thirdly, the transport sector must cut its emissions substantially in the next 10 to 15 years. This can be achieved, for example, by promoting a modal shift of freight from road to rail and by encouraging people to leave their cars at home and use an expanded local public transport network. A package of measures to further improve vehicles' fuel efficiency is also needed.

If greenhouse gas emissions are to be cut by 95 per cent by 2050, substantial reductions are needed in every sector. "But the non-energy sectors have only limited potential to reduce emissions – and this applies especially to agriculture. Disproportionately high mitigation efforts will therefore be required from all the other sectors," explains Julia Repenning. In her view, it is particularly important to keep a close eye on agricul-

ture. "Nitrous oxide (N₂O) will replace CO₂ as the dominant greenhouse gas by 2050, and farming will be the main source of these emissions," she explains. The emissions cuts needed here can only be achieved with a transformation of our food systems – "in other words, a drastic reduction in our consumption of animal products, especially meat".

As Julia Repenning points out, when exploring the potential for emission reductions, a broad view is essential. "At present, efforts to protect the climate have focused mainly on the energy sector," she says. "But to achieve ambitious climate targets, substantial mitigation efforts are needed in other sectors as well. No sector should be hiding behind the others. That's an issue which we should be discussing too." For this climate scientist, mitigation measures in every sector, according to its specific capacities, are important in moving towards the 95 per cent target – and therefore towards a society that has become genuinely sustainable by 2050.

Christiane Weihe