Dossiers

CLEW Yearbook

CLEAN ENERGY WIRE

Imprint

The Clean Energy Wire supports journalists who cover Germany's Energiewende, providing international correspondents with an overview of the key stories, experts, decision-makers and facts of Germany's landmark energy transition. Its news digest offers a daily snapshot of important energy policy reports, studies, policy decisions and current debates. The website provides in-depth background material and key contacts for journalists looking for information on Germany's energy transition and climate policy.

Our team of journalists and media professionals in Berlin is available to support journalists in their work.

Clean Energy Wire CLEW
Rosenstr. 2
10178 Berlin, Germany
info@cleanenergywire.org
+49 30 2844 90 200

Clean Energy Wire is a joint initiative of the European Climate Foundation and Stiftung Mercator under the roof of the Smart Energy for Europe Platform (SEFEP) gGmbH.

Authors: Sören Amelang, Kerstine Appunn, Lars Borchert, Peter Dinkloh, Sven Egenter, Paul Hockenos, Ruby Russell, Jakob Schlandt, Ellen Thalman

Design and typesetting: Annika Langer, Berlin
Cover and Dossier images: © [Shutter81] Fotolia; © [Thomas Lehmann] iStock; © [ArpadNagy-Bagoly] Fotolia; © [mhp] Fotolia; © [PhotoSG] Fotolia; © [Alex Kotlov] iStock; © [WEMAG AG] Batteriespeicher Schwerin Akkuhalle; © [Lulla] Fotolia; © [nullplus] iStock; © [ictor] iStock; © [anweber] Fotolia; © [Bengt Lange] Moorburg Power Plant 11, Vattenfall; © [hansenn] Fotolia; © [Gina Sanders] Fotolia; © [Sunny studio] Fotolia; © [Giso Bammel] Fotolia
Portrait photos team: © [Detlef Eden] detlefeden.com

Publication: Jan 2016

CLEAN ENERGY WIRE

Introduction

The year 2015 earned the label "historic" as it came to a close. Observers hailed the Paris Agreement on climate action as a breakthrough for efforts to limit global warming. Whether the world will live up to its pledge remains to be seen. But the year will certainly have a special place in the Clean Energy Wire's history, as our first in full operation.

The articles in this yearbook showcase the Energiewende's shifts in policy and plentiful challenges. And it's been an eventful year for the generational project of transforming Germany's energy supply.

When we went online in November 2014, just uttering the words "coal exit" was taboo among politicians. Now the debate is in full swing. This was a year in which the discussion over costs seemed to peak, and the reform of the Renewable Energy Act stoked fears of an end to the surging growth of wind and solar power. Yet at the end of 2015, cost concerns are almost as prominent as they have ever been, while Germany chalks up a new record for renewable power production. The government's struggle to meet its own climate targets has been a constant theme throughout.

The Stiftung Mercator and the European Climate Foundation initiated our project with the goal of contributing to the successful move towards a low-carbon economy by supporting quality journalism. Right from the start, the dossier articles in this yearbook formed the backbone of our work to help international journalists understand and cover the Energiewende.

The articles, each fact-checked and often re-written several times, provide context and set out the state of play on key issues of the complex Energiewende story. They do not aim to be the final word. Instead, they give a snapshot of ongoing debates. Some events unfolded so fast the articles featured in this yearbook – such as the dossier on power market reform – have been fully revised and updated. At the same time, our factsheets, news stories and press digest on cleanenergywire.org keep readers abreast of the Energiewende's twists and turns.

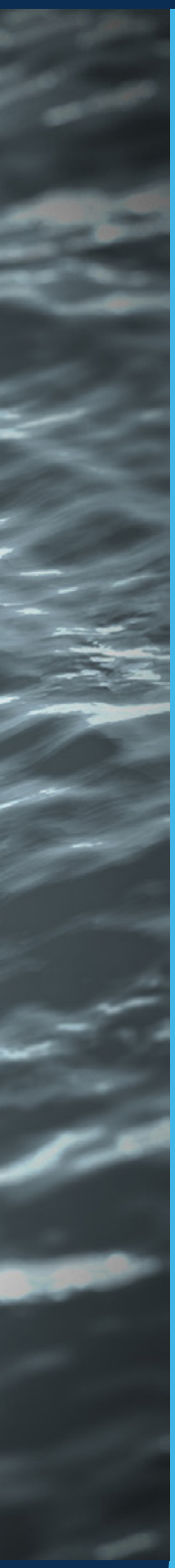
Some dossier stories – like the History of the Energiewende – will provide valuable background for some time to come. The interviews in our pre-COP21 package continue to offer insights into the hopes and concerns of Energiewende players. Our dossiers are, as one journalist put it, a "treasure trove" of story leads, contacts and, most importantly, context.

Our small team of committed staff journalists and freelance editors and writers is close to achieving the almost 360° view of the Energiewende we are ultimately aiming for. A closer look at the role of the financial industry and – putting a key piece of the puzzle in place – a first take on the mobility sector, will kick off 2016's round of dossiers, with necessary updates and new deep dives to follow.

Whatever role the events of 2015 will ultimately have played in the history of the global energy transition, we hope this dossier yearbook will be the first collection from a strong body of Energiewende coverage by the Clean Energy Wire.

Sven Egenter

Contents



Dossier

COP21 – The view from Germany

German positions on the Paris Climate Summit

7 Dec 2015 | Sören Amelang, Kerstine Appunn

Hopes for the Paris Climate Summit from 30 November to 11 December are high, but will the COP21 become a breakthrough for global efforts to reign in climate change? In this dossier, the Clean Energy Wire presents German perspectives on the summit and a new climate agreement. A series of interviews will highlight positions of activists, researchers, businesses, politicians and negotiators. The factsheet "Controversial climate summit issues – positions in Germany" gives an overview of the most disputed issues at the COP21 – e.g. climate finance and differentiation – and highlights the position of the German government and civil society on these topics. The results of the Paris summit have strong implications for the Germany's Energiewende, the move to simultaneously phase-out nuclear power and decarbonise the economy.

Interview 1

The energy transition is not a cakewalk

The final negotiations for a global climate treaty are underway in Paris. What is the German perspective on an international climate agreement and what has the energy transition (Energiewende) got to do with it? The Clean Energy Wire talks to German businesses, researchers, negotiators, politicians and activists who have stakes in the talks. Today: Frederik Moch, Head of Division for Energy Policy at the German Trade Union Association (DGB).

Frederik Moch. Photo: DGB.

CLEW: **What would you consider to be a successful outcome of the Paris climate conference?**

FREDERIK MOCH: It is important to us as trade unions that the agreement is binding. It must also have an ambition mechanism so that insufficient targets can be adjusted. Another item that is particularly important to us is the notion of "just transition". When energy production and industrial processes are transformed in order to prevent dangerous climate change, the process has to be shaped in a social way. This has to be incorporated in an agreement. We have to fight climate change in a fair fashion.

What lessons can other countries learn from Germany's approach to cutting greenhouse gas emissions?

I would say Germany is definitely an example and a model for how a country can approach a transition to a low carbon economy. Every country will possibly choose its own path but, from our point of view, the energy transition is a good example. We should remain a model for how climate action, socially responsible actions and prosperity can be achieved simultaneously. We have to do some homework on this but, generally, we should continue to show that an industrialised country like Germany can achieve a climate-friendly economy. With the energy transition, we have seen an increase in innovation in all economic sectors and we have seen new jobs emerging in the renewables industry. But we have also seen challenges: there has been no breakthrough in energy efficiency policy, there are issues with the grid expansion and we are facing major structural change in the energy sector that will impact the workforce. And looking at the renewables sector: Green jobs have to become good jobs – co-determined and well-paid! The energy transition is not a cakewalk but it is necessary.

Do all the different trade unions in Germany support the energy transition?

We have a consensus that the energy transition is necessary not only for the climate, but also to innovate the country. All unions in Germany agree that the energy transition is an opportunity. But different unions obviously see different challenges. Those who represent workers in energy-intensive industries, or the mining and power sector, will face larger challenges than others. We have seen that energy-intensive industry is staying in Germany despite the Energiewende – but we have to make sure it stays that way because the goal is to retain the full range of industrial sectors in the country. Certain exemptions from energy transition-related obligations for energy-intensive industry have to remain in place – but always in a way that the costs of the energy transition are distributed fairly. We need innovation and investment into new jobs to make sure we are actually using the opportunities that the Energiewende provides – and we have to find a socially sustainable way of doing so.

You have said that the transition to a low-carbon economy has to happen 'while retaining a high level of prosperity' – how does that agree with structural change happening in the Energiewende?

Structural change is not something new that only happens because of the energy transition. There has been structural change for as long as there have been

economic activities. Sectors emerge, sectors change, other sectors come along and some lose importance. Germany has quite a lot of experience with structural change; for example after reunification between West and East Germany, or when hard coal mining was phased-out. We have seen that the state can, and must, organise and facilitate such changes. We have learned a great deal from the experiences and we are happy to share this knowledge with our colleagues abroad. The state has to be a reliable actor which provides guidance and social back-up during structural changes. You cannot leave these things to market forces. Unions and companies also have to work together to shape change in a way that doesn't disadvantage workers.

Germany has had heated discussions about a "coal phase-out" to achieve its climate targets. The new Paris climate agreement might prescribe the decarbonisation of the world economy – will the unions fight for jobs in the coal sector?

Yes, we are always fighting for every job. This doesn't mean that we will blindly cling to the 'stoker on the electric locomotive'. It means that we will look after every job because that is our job. We obviously know that structural change is happening – it is then our obligation to see how new jobs and new opportunities for employees can be created. Our colleagues should have the potential to live a decent life - not be left hanging in mid-air.

The interview was conducted by Kerstine Appunn | 07 Dec 2015

Interview 2 Next innovation wave in economy will be "green"

Dirk Messner, Director of the German Development Institute (DIE) and Co-Chair of the German Advisory Council on Global Change (WBGU).

Professor Dirk Messner. Photo: DIE.

CLEW: **What would you consider to be a successful outcome of the Paris climate conference?**

DIRK MESSNER: There are four key elements. The first is the review and monitoring mechanism to ensure that signatory states will actually implement the pledges that they have made. The more precisely this review mechanism is constructed, the more precisely we can measure and review that everybody is heading in the right direction. If this mechanism is too loose and lets states report unsystematically and without fixed benchmarks then we will have a big problem.

The second key factor is that a long-term goal is agreed. Ideally, this would be called 'decarbonisation of the world economy', at best by 2070. But I would also be satisfied if it says 'in the second half of the 21st century', so that businesses and society know that this is the target that we are aiming for.

Thirdly, it will be very important that decisions are made on adaptation to climate change to make sure that we get developing countries on board. The fourth key element is the provision of climate finance for developing countries.

If we leave Paris, saying "now it's done. Let's meet again in 2020", this would be a failure. If we leave Paris arguing "this was the starting point to decarbonise the global economy, let's start tomorrow morning to accelerate the transformation" – then we would have a chance to stay within the 2 degrees corridor.

What do you think are the biggest challenges in the process?

We will achieve the goal of 100 billion US dollars in climate finance annually by 2020. I am not worried about that, but I am concerned about the long-term goal not getting approved. If we don't agree on a long-term target we will end up focusing solely on the pledges that countries have made so far and that is not enough. This is probably the most contentious issue. When it comes to the exact design of the review mechanism, opinions are also still very diverse.

How important is it that the long-term goal is called "decarbonisation" in the final agreement? Would it matter if it was called "climate neutrality", as the European Union phrases it?

It's important that we achieve a climate-compatible global economy. If I was to choose a term that is not 'decarbonisation' it would be 'climate-compatible economy', meaning that we have to reduce our emissions to almost zero by 2070. The problem with the term 'decarbonisation' is that a range of countries who have large coal deposits would want to solve this problem by using carbon capture and storage (CCS). This is a hotly disputed technology in Germany, but I think it would be appropriate for such countries, including Poland and India. If countries want to keep burning coal they should better do it with CCS and not without it.

If there is agreement on decarbonisation of the global economy or climate neutrality, how can Germany and the rest of the world benefit from it financially?

In the long-term, we will gain a stable energy system that will be very cheap to run. Studies show that the initial investments in such a system are high, as is the case for every new technology. But once the infrastructure is there, energy resource costs will be low or non-existent as they will be mostly wind and sun. Only the infrastructure will have to be paid for.

The second element is that the transition to a renewable energy system involves a massive investment programme for all national economies. Those countries that are now making large investments are going to be success stories when it comes to economic growth and jobs.

In an industrialised country such as Germany, where industries like car manufacturing are an important part of the national economy and have great influence, how can the state shape this transformation without alienating industry?

In the German energy system we can see large growth dynamics in the renewables sector, leading to more jobs in this area. Renewables are a very fast growing investment sector in the German economy, but also internationally.

In the car industry, it's all about inventing a new engine system. Electro mobility could be the equivalent of renewables in the energy sector. The German car industry has to make sure that it will not miss the boat in this area because others, such as China, are moving very fast. Due to its air pollution problem, China is embracing e-mobility much more quickly than Germany, which risks being left behind. Germany has a traditional, very influential and technically highly skilled industry, but with an old engine system. It has to get its act together.

In all other areas of industry, energy efficiency is key and Germany is strong when it comes to efficiency and environmental sustainability. This is down to Germany's relatively strict and progressive environmental policy over the past 40 years. Many companies at first considered this a threat but it has strengthened the resource and environmental efficiency in the German economy. And: the next innovation wave in the global economy will be "green".

You've mentioned that environmental legislation can be considered a threat by companies. This is also why energy-intensive industries in Germany, such as the power and steel sector, are calling for a 'level playing field' to make sure that climate action, for example in the form of a price on carbon, is implemented worldwide so that it doesn't disadvantage companies in certain countries. Should German companies be afraid of carbon leakage?

I don't think the German economy should be afraid of de-industrialisation. We can see that the German economy is faring well in the transformation to renewable energies. One example is the German steel industry: ThyssenKrupp is working hard to develop a low carbon business model, aiming at using CO_2 as a resource for producing chemicals in the future. But of

course the call for a level playing field is very reasonable. It doesn't help if we make strict energy efficiency rules for the steel industry in Germany or implement a price on carbon if this leads to the German industry closing down its production in Germany just to re-open it in India.

It doesn't matter to the climate where the emissions come from. That's why a global price on CO_2 emissions would be very reasonable, because it would prevent distortion of competition. We won't achieve this in Paris but we will definitely have to work on this after COP21, for example by discussing the union of emissions trading systems of large economies such as Europe and China. If we connected those two alone we would cover 60 percent of world exports. That would be a step in the right direction to shaping a common market for emissions.

The interview was conducted by
Kerstine Appunn | 03 Dec 2015

Interview 3 Old business models are challenged by the Energiewende

Rüdiger Senft, Head of Corporate Responsibility at Commerzbank.

Rüdiger Senft.
Photo: © Commerzbank

CLEW: What would you consider to be a successful outcome of the Paris climate conference?

RÜDIGER SENFT: At the Commerzbank we would like to see a binding agreement and long-term emission reduction targets. For the banking sector, the topic of carbon trading or a priceon carbon is very important. Carbon trading is not a European thing anymore. Times have changed with an increasing number of national and regional schemes, for example in China, California or South Korea. We would hope that Paris will create a signal for carbon pricing and will be a catalyst for change.

What do you think are the biggest challenges in the process?

When 195 nations sit together usually the lowest common denominator prevails. But in this case I am of the opinion, maybe a little naïvely, that politicians must work together to put forward ambitious climate action targets. We're fighting global climate change, this is about the greater good and the big picture and every country should make its contribution. So I hope that Paris will not get lost in petty skirmishes. Obviously richer countries with larger economies have to contribute more. I think Germany is accepting this role and maybe this will serve as an example for other industrial nations to contribute more to climate action than developing nations.

What lessons can other countries learn from Germany's approach to cutting greenhouse gas emissions?
It's my hope that Germany's transition to a renewable energy system is held up as an example. As a bank, we always assess the risks and chances of a transformation such as the Energiewende (energy transition). Commerzbank has seen the opportunities in the Energiewende and has been active in the renewables sector through financing renewable energy projects for years. At the same time we are closely watching the risks that climate change or the mitigation of climate change through decarbonising the economy could pose to individual companies and what loan defaults could result from it. This aspect of factoring in risks related to climate change will become more important. But it is a positive undertaking because it factors in the reality of the impact of climate change.

More and more financial institutions and insurance companies, such as Allianz, are divesting from fossil-fuel related assets. Do you see this as a trend in Germany and what are the plans of Commerzbank in this area?
One has to take into account the differences between a bank and a large institutional investor like Allianz which invests its customers' money. The latter is able to rearrange investments quite quickly. If they see that companies who are highly invested in coal might lose value they will calculate their risks and act accordingly.

Commerzbank is less involved in this investment business. We are a bank which is more focused on giving loans to corporate clients. Some of these loan relationships have evolved over decades and when you have such a close connection to your customer you can't change your involvement as quickly. Nonetheless we endeavour to find solutions for our customers that result from the energy transition.

Some business models have been challenged by the Energiewende and Commerzbank has to react to this without abandoning our customers. As a creditor we can influence our customers by asking about their medium and long-term planning and whether it takes into account low-carbon strategies. If, for example, we find that climate change related risks are not incorporated in a company's business strategy we have to question our relationship with that company. While we're trying to work together with our customers on this we also have criteria for exclusion, such as not funding companies that use mountain-top removal coal extraction. We're currently revising the method by which we decide to grant credit to customers.

The interview was conducted by
Kerstine Appunn | 01 Dec 2015

Interview 4 We must err on the side of caution

Biologist and climate researcher **Hans-Otto Pörtner** from the Alfred Wegener Institut, a Helmholtz centre for polar and marine research, who was elected co-chair of the Intergovernmental Panel on Climate Change (IPCC) Working Group II (Impacts, Adaptation, and Vulnerability) in October.

Hans-Otto Pörtner. Photo: AWI.

CLEW: What would you consider to be a successful outcome of the Paris climate conference?

HANS-OTTO-PÖRTNER: I believe many issues are on the right track in the run-up to the summit. Speaking as a citizen, rather than as a co-chair of the IPCC Working Group II, I hope that the countries' ambitions will approach more closely what climate science says should be the targets, and that they implement scientific findings.

I would also hope that countries like the US, China, Australia and Canada give up their reluctant position and energetically join this huge transformational challenge, instead of playing for time.

What do you think are the biggest challenges in the process?

Surely the largest hurdle is the fact that Paris will be a gathering of countries with hugely differing backgrounds. For example, there are many countries that have invested too much in fossil energies over recent years and decades – countries like the US, who have based their whole infrastructure largely on fossil energies. It is necessary that those countries can now understand the positive challenges that are related to the necessary transformation ahead, and show their readiness to bring the process forward, and to do justice to their position of economic leadership.

What is Germany's role in the negotiations?

Germany, with its strong economy, has an important role to play in the moderation of the talks. The country must also present its climate protection efforts as a model, without playing the know-it-all. But Germany can show that the transformation model works. It must openly contribute its successes and failures to the international discussion, so we can find a constructive basis from where to start.

Germany is also a role model when it comes to the implementation of scientific information. But I also believe that Germany could be even more ambitious at developing long-term climate targets, and could incorporate more findings from the last world climate report in detail.

What lessons can other countries learn from Germany's approach to cutting greenhouse gas emissions?

I believe many aspects of national policy are exemplary on an international level. The roll-out of renewable energies is clearly the figurehead of our country. Of course, the transformation in the car industry is a totally different question, and we also went in the wrong direction by increasing the use of cheap coal over the last decade – that has to be corrected now. So Germany is not exemplary in all areas, but the development of renewables really stands out, for which there are many obvious examples. If we take new technologies into account, for example power-to-heat or power-to-gas, then these add up to a new stepping stone, where we can show it works. Germany is proof that you don't need to sacrifice economic growth in order to protect the climate.

Are the findings of climate research fully incorporated in climate politics?

It is really important to take the risks highlighted by scientific research more into account in this process. Some risks are still neglected – this is even true for some risks related to rising sea levels, which could exceed current expectations simply because of new findings related to the behaviour of the Antarctic ice sheet. I also believe the risks for human health due to extreme

weather events are still not incorporated enough. It would really be important to further extend the precautionary principle, so we can find the right way with the help of further scientific insights – even though we will never be able to resolve the very last uncertainties.

What is the future of the IPCC after the 5th assessment report?

By evaluating research from all areas of climate science, we will continue our contribution to the development of targets, draw attention to risks and, eventually, find the right balance between adaptation and mitigation. It must be one of the most important goals to highlight possible solutions for humanity, but at the same time draw attention to the risks that might be associated with these solutions. The IPCC, in its advisory role, will be indispensable for decades to come.

The interview was conducted by Sören Amelang | 24 Nov 2015

Interview 5 Paris must send signal for global fossil fuel exit

Regine Günther, General Director Policy and Climate at WWF Germany.

Regine Günther. Photo: Lichtschwaermer.

CLEW: **What would you consider to be a successful outcome of the Paris climate conference?**

REGINE GÜNTHER: Unlike the climate summit in Copenhagen six years back, Paris will most likely deliver a climate deal. However, what determines the success of the Paris outcome is the quality of the deal – and here the devil is in the details.

For an outcome to be called successful, it must facilitate deep greenhouse gas emissions cuts down to levels that keep the global temperature rise well below 2-to-1.5 degrees Celsius. The world cannot afford global warming to exceed this critical level, which would destroy ecosystems, diminish future generations' wealth and drag the world's poor into even deeper misery.

All intended additional measures by states, which would enter into force through a Paris climate agreement, would bring down the temperature rise to around 3 degrees. That would be a substantial improvement – but it is still not enough.

In order to close the remaining emissions reduction gap, the Paris agreement must include additional mechanisms. These must enable countries to progressively improve their climate targets, to shift trillions of US dollars towards renewable energies and energy efficiency, and to improve their climate resilience. Improving climate targets and investments must of course be tracked and reviewed regularly, providing transparency and accountability of action, and scientifically measuring success against trajectories which are in line with the 2-to-1.5 degrees limit.

What do you think are the biggest challenges in the process?

Closing the emissions gap is the greatest challenge – and making states fully accountable. There are many issues involved in capping the temperature rise at 2 degrees, so the Paris agreement has to include three elements:

Firstly, we would like to see a legally binding agreement that translates the 2-degree celsius temperature limit into a longterm goal to completely decarbonise the global economy by 2050, backed by a 100 percent renewable target.

Secondly, we need a mechanism that reviews the national emission cuts every five years and we need a very robust stocktaking system that encourages states to scale up their levels of ambition.

And thirdly, the agreement needs to include a very robust system of transparency rules, making emissions of all states comparable. I don't think that Paris will deliver all the necessary details and criteria in a fully formulated text but it should include the principles.

Then there's the question of how we can support poor countries in their efforts to switch to low carbon and climate resilient development pathways. It is very important to provide support to countries that are already suffering from the impacts of climate change, which result in climate-induced economic and non-economic loss and damage. Paris must deliver a credible financial package, providing confidence that the pledges of 100 billion dollars per year by 2020 from industrialised countries will be achieved and will rise after 2020.

To be very clear: Paris must send the signal that the world is phasing out fossil energy fast and is phasing in renewable energy.

What is the German role and the German objective in the negotiations?

Germany plays a leading role because it is doing a lot at home and brings this experience to international negotiations. Within the EU, Germany faces some hurdles because there are countries that would like to put the brakes on climate protection efforts.

But Germany is certainly a beacon, even if many policies have not been particularly stringent and some of the biggest polluters here are being given a golden handshake to phase out dirty lignite plants. The fight to end coal still has to be won and the expansion of renewables has lost some of its dynamic, even though it is still proceeding.

Chancellor Merkel did a good job by negotiating decarbonisation with the G7, and her climate finance announcements to double Germany's contribution to international climate finance by 2020 was a strong push for other donors to do more and better. She is certainly very engaged and has been a driving force that is very important, despite some of the downsides of the government's policies.

What lessons can other countries learn from Germany's approach to cutting greenhouse gas emissions?

Germany has built up the share of renewables in power consumption to over 30 percent and has shown how to integrate fluctuating renewable electricity into the grid.

Not that Germany is perfect, but it is important to show that economic growth – including growth in jobs – can go hand-in-hand with climate action. This is a win-win situation and it's not just about costs. The lesson learnt: Decarbonisation, if done the right way, can bring more economic advantages than disadvantages. It also gives us independence from a volatile energy market, reduces imports and improves the national value chain.

This is a big change compared to early climate talks. Back then, moving out of fossil fuels was seen as a burden, but now we view this not as a disadvantage but as a big opportunity.

What are the top priorities for the WWF in Paris?

Making Paris another milestone in the journey towards a zero carbon, climate resilient and more equitable future. The world is coming together to prove and declare its firm will to end the age of fossil fuels within the next decades.

When I talk about the world coming together, I mean more than the conference with all the ministers and heads of state attending. I also mean all the people coming to Paris. WWF will be part of this giant mobilisation and we are proud of it. It is amazing to see how the climate movement has grown and how far things have moved in the six years since Copen-

hagen: Even China and the US are shutting down coal power plants. The signal from Paris will be: Go forward and don't stick to fossil fuels – that would be a loser strategy.

The interview was conducted by
Ellen Thalman | 19 Nov 2015

Interview 6 Paris must be starting point for carbon price talks

Ottmar Edenhofer, director of the Mercator Research Institute on Global Commons and Climate Change, chief economist at the Potsdam Institute for Climate Impact Research, and former co-chair of Working Group III of the Intergovernmental Panel on Climate Change (IPCC).


Ottmar Edenhofer. Photo: MCC.

CLEW: **What would you consider to be a successful outcome of the Paris climate conference?**

OTTMAR EDENHOFER: I am admittedly rather pessimistic about the outcome because what we have seen so far are Intended Nationally Determined Contributions (INDCs) that probably do not allow us an entry point into an effective climate policy. The current INDCs are just slightly more ambitious than what we have seen with the Cancun Agreements. Emissions will increase until 2030. This is very worrying.

The real challenge is that we are in the middle of a large coal renaissance. Countries plan to install 1,000 gigawatts of coal-fired plants around the globe. And even if we implement and install one third of this, it would lead to around 113 gigatons of CO_2. Together with existing capacities – with which we have committed to emit 730 gigatons of CO_2 – we will then almost exhaust the 1,000 gigatons consistent with a 2-degree target.

What could be an effective short-term entry point for climate policy would be negotiations for a carbon price, with climate finance transfers conditional on the cooperation of countries over a carbon price. If Paris could sort out the climate finance issue and also define the starting point for a process to negotiate on carbon pricing – even if the negotiations themselves are not within the UNFCCC – I would be happy. But this is unlikely.

What do you think are the biggest challenges in the process?

My biggest concern is that the INDCs are basically pledges, and these pledges are neither comparable nor can they be monitored, so far. This is the most important challenge for the Paris meeting. Nonetheless, to achieve something meaningful, we can't just rely on INDCs.That is why carbon pricing is so important. Without it, we cannot stop the renaissance of coal. Investments over the next ten years will determine the future emissions trajectory and it will become very hard to depart from this trajectory. It's not mainly a climate system issue – it's all about the investment cycle and these investments are already under way. We have to impose a carbon price because otherwise there is no incentive for investors to change their investment decisions.

What is Germany's role in the negotiations?

Germany is quite committed to contributing to climate finance and I hope that Germany can promote something on carbon pricing. Probably this cannot be negotiated within the UNFCCC but next year China has the leadership of the G20, and after that Germany. Germany could use that opportunity to launch a debate. At the Paris negotiations, Germany could at least make sure that climate finance can be used, or is designed, in a way that makes transfers dependent on international cooperation. It's probably not realistic to expect negotiations on carbon pricing from the UNFCCC, but Germany could make sure the Paris talks lead to negotiation on this issue at the G20.

What lessons can other countries learn from Germany's approach to cutting greenhouse gas emissions?

Other countries can learn how important a carbon price is. Germany's model of the energy transition was to subsidise renewables and reduce demand for electricity. This has led to a situation where coal-fired plants have become incredibly competitive. The German example shows that we had very good intentions and we have invested a lot in increasing the share of renewables, but meanwhile we are in a situation where coal is much more competitive than gas. This is something we predicted as economists a long time ago and we always raised the importance of carbon pricing. The EU emissions trading system is not functioning well, so now we have real problems. Carbon pricing is not the whole game, many other things have to be done, but without it climate policy cannot be effective.

Do the Paris negotiations have the potential to be a historic turning point in the fight against global warming?

I hope Paris will be remembered as a starting point for effective climate policy and not a repeat of what we have seen over the last twenty years, where we have had negotiations and conferences and in the end emissions have increased. Despite the financial crisis, and despite the Kyoto Protocol, we have had record emissions growth over the last decade. The coal renaissance hasn't stopped in China, it has continued in India and we have by no means seen the emissions peak in China. Despite the undisputed progress of renewables, the emissions they have saved have been more than cancelled out by the growth of coal.

I hope this conference is a starting point for a new framework, with carbon pricing to incentivise carbon-free technologies and penalise the use of carbon. We should also use the revenue from carbon pricing on investments like clean water and electricity that support the poor. In this way, we can design carbon pricing which is consistent with the reduction of inequality.

I think we need a new discourse along these lines. This is enormously important. Right now we are stuck, and I hope Paris can at least be the starting point for a reasonable debate. I'm not talking about making things a bit more efficient here and there – I mean real effectiveness.

The interview was conducted by
Ruby Russell | 17 Nov 2015

Interview 7 Energy sector key to cutting CO_2, cannot do job alone

Uwe Franke, President of the German Member Committee of the World Energy Council and former CEO of BP Europe.

Uwe Franke. Photo: Weltenergierat.

CLEW: **What would you consider to be a successful outcome of the Paris climate conference?**

UWE FRANKE: The establishment of a legally-binding agreement with clear long-term goals, a stable policy framework, and monitoring of progress. The lack of an international framework has created uncertainty in the energy sector, and an agreement is key to providing the certainty necessary to spur action. A successful agreement would send the appropriate policy and market signals to incentivise investment, while allowing for countries to utilise flexible instruments to achieve these goals. Furthermore, a successful agreement would include mechanisms to ensure accountability and comparability.

What do you think are the biggest challenges in the process?

The challenge is creating a comprehensive agreement while still taking into account the political, economic, and institutional differences across countries and regions. This requires managing the competing demands of the energy trilemma: environmental sustainability, energy security and energy equity. When it comes to energy security, many countries endowed with fossil fuels resources view decarbonisation as an existential threat. Other countries still struggling to provide access to electricity and lift people out of energy poverty have to balance energy equity concerns with environmental sustainability.

Enabling countries to balance these competing demands also requires the mobilisation of substantial financial investment to develop and deploy technology based solutions. Thus, formulating an agreement that sends the appropriate market signals to foster and spur investment in places where the funding can make the most impact is another major challenge.

What should the German role and the German objective in the negotiations be?

Germany should demonstrate leadership within the EU negotiating team and in its own right encourage all countries to negotiate in good faith toward an international and binding agreement. Germany should help the EU speak with one voice and urge all stakeholders to come to the table. Germany has already experienced some diplomatic success in negotiating the G7 pledge to move away from fossil fuels, and could capitalise on the goodwill this engendered to build momentum toward an agreement.

What lessons can other countries learn from Germany's approach to cutting greenhouse gas emissions?

First, countries must design incentives appropriately. Germany's experience with the feed-in tariff for renewables and charges for the electricity grid - the cost of which ballooned over time and resulted in high electricity prices - should serve as a note of caution. Countries must think carefully about the long-term implications and costs of incentive schemes and policy designs.

Second, countries should ensure any low carbon policy design is based on market principles and sends appropriate market signals to spur investment and deploy appropriate energy resources. For instance, one unintended outcome of the Energiewende is increased coal consumption while highly efficient natural gas plants sit idle, whereas it is exactly these natural gas plants which would complement renewables and help Germany achieve its climate goals.

Third, a transition must be holistic and integrated. This means encompassing all sectors, including transport, buildings, industry, heat and agriculture. Furthermore, such a transition requires investing in all parts of the system, including the grid, to assure new technologies will be integrated.

Fourth, the cost of the Energiewende may be too much to bear for many countries. However, each

country should decide what they are willing to pay and who is willing to pay it. An open and inclusive dialogue about who is responsible for these investments and how to share responsibility between the government, the private sector, and the public is crucial. To strengthen the competitiveness of the economy should be key in the Energiewende. This is the most convincing argument for other countries.

Finally, no one size fits all. While there may be components of the Energiewende that other countries could adapt and adopt, different domestic resources and supply contexts, as well as different financial means, levels of development, and geopolitical and geographic characteristics, require tailored solutions.

How would you describe the role of the energy sector in the efforts to take effective action on climate?

The energy sector is crucial to efforts to mitigate climate and must be – and indeed is ready to be – part of the solution. It is impossible to achieve the 2 degrees Celsius target without the energy sector. However, it should not be the only sector expected to shoulder the responsibility, and a huge investment in the sector will be needed to do it. The energy sector can contribute to change across all sectors by pioneering new solutions and technology that can be adopted in other areas, including on the demand side. Provided the proper incentives and policy framework, the energy industry can invest in new technologies to improve efficiency, decrease carbon emissions, and reduce energy intensity. But they cannot do the job alone.

The interview was conducted by
Sven Egenter | 13 Nov 2015

Interview 8 World expects Germany to lead way with Energiewende

Jennifer Morgan, Global Director of the Climate Program at the World Resources Institute, who also serves on the German Council on Sustainable Development.

Jennifer Morgan. Photo: © Rat für Nachhaltige Entwicklung.

CLEW: **What would you consider to be a successful outcome of the Paris climate conference?**

JENNIFER MORGAN: A successful outcome is an agreement that has clear short and long-term signals and that will accelerate the pace and scale of change to the zero-carbon, climate-resilient economy. Absolutely central for this is a support package for developing countries, to help them manage the impacts and make the transition to that zero-carbon economy.

What do you think are the biggest challenges in the process?

The biggest challenge is that you have to get all the countries to agree by consensus. It's a massive process challenge – imagine any national parliament having to agree by consensus on such a complex set of issues. Obviously, different groups of countries have different priorities.

The poorest and most vulnerable countries want to make sure that there's a package that they feel will support them in this transition. This finance package – which is not only public money, but also about shifting private investments – is definitely one of the biggest challenges as well.

Do you believe the chances for a success have substantially increased since the last summit in Copenhagen?

There's certainly a greater chance of success in Paris, for a number of reasons. Compared to the situation

before Copenhagen, renewable prices have dropped dramatically – this has created an economic situation that simply didn't exist before. It was seen very much as a choice between climate action and economic growth.

The second big shift concerns the US and China, who now act and cooperate on the highest levels, whereas before Copenhagen they were fighting with each other in the media. The announcements by those two countries have been game changers - no-one can hide behind them anymore, and they both clearly want a success in Paris.

Thirdly, there is a much greater level of understanding of what a UN agreement can do and cannot do. Before Copenhagen, everybody thought: 'This conference will be the saviour and afterwards everything will be ok.' Now we know Paris is just one important moment along the transformation, it's not the end.

This time, there is also more pressure from more players. Now you see mayors, you see investors, you see business people pushing for an agreement. Having these other voices is incredibly important.

What is the German role and the German objective in the negotiations?

The Germans are definitely respected as being leaders, even if this position makes them feel uncomfortable. The country wants to get an agreement and provides an example through the Energiewende – proving that even a highly industrialised country can decarbonise its economy and grow it at the same. They also have been leaders in providing funding for developing countries. Germany's role is to really push the EU and other countries, to try and get the most ambitious and effective agreement that's out there.

What lessons can other countries learn from Germany's approach to cutting greenhouse gas emissions?

There are all kinds of lessons, but let me give you three. One is that you need a mix of policy instruments to get there. So, it's good to put a price on carbon, but that's not going to grow you renewables. You also need additional incentives for energy efficiency, for example.

A second lesson is that you need to think about building the politics while putting in place the policies. There is now such a strong coalition for renewable energies in Germany because with the feed-in tariff, incentives were being put in place for citizens, farmers, and other constituencies. This helps to keep those policies in place through changes in government, and it's important to pay attention to this issue. The idea of just shoving through the right policies doesn't really work. But, of course, there are also mixed lessons from this in Germany – for example on coal, it has been pretty hard. If you don't build a policy package to ensure a just transition for workers, you can get a backlash if you decide to go further. So in some areas, Germany has done quite well. In others, there is definitely more work to be done.

The last point is the importance of a long-term vision, like Germany's targets to cover 80 percent of power consumption with renewables in 2050 and cut greenhouse gas emissions by 80 to 95 percent. You need to have long-term signals to be able to think systematically and to ensure you're doing enough in the early years to make sure you achieve the climate goals.

What does the world expect from Germany?

In the lead up to Paris, people expect Germany - and especially Chancellor Angela Merkel - to work carefully with other leaders to find solutions. She personally has a lot of credibility and a deeper knowledge than any other head of state out there. There is an expectation in the lead up to Paris and during the summit that she will invest a lot of her personal capital to make it a success.

After the summit, the world expects Germany to show the way, to be successful. When the Energiewende started a few years ago, many people had no idea how the country was going to do this. But they also said if anybody can do it, Germany can. Because of the 'Made in Germany' brand, and because of the successful economic role Germany plays in the EU and globally, people expect Germany to figure this out and then to work with other countries to help them. Getting Intended Nationally Determined Contributions (INDCs) implemented will be a massive challenge. The credibility Germany has from the development perspective, combined with the experience and know-how on the climate front, is something that can be a great support for other countries. Everybody

can learn from Germany's experience, technically and institutionally. We need to make this experience applicable to other countries, so they don't have to go over all of the bumps that Germany had to cross. I believe it's a huge opportunity for Germany's role in the world, but it needs to step into this more than it has been comfortable doing so far.

Do you believe Merkel's reputation as "climate chancellor" is justified?

From an international perspective, it is justified, even if domestically there is more work to be done. I have no doubt that she understands the science and what's at stake.

She managed to persuade the G7 to commit to decarbonisation by the end of the century. That was unexpected, is a big step and now one of the core options that's being negotiated. In a way, Paris is a great opportunity for Merkel. If the summit succeeds, it can provide more clarity, comfort, and certainty for the domestic debate within Germany. It will be further prove that Germany is not alone out there and nobody else is acting.

The interview was conducted by Sören Amelang | 10 Nov 2015

Interview 9 We need global deal and national efforts

Climate scientist **Daniela Jacob**, who is director of the Climate Service Center Germany (GERICS) in Hamburg which offers knowledge and advice on climate change to government, administration and businesses.

Daniela Jacob. Photo: Christian Schmid / HZG.

CLEW: **What would you consider to be a successful outcome of the Paris climate conference?**

DANIELA JACOB: It is really important that the negotiations lead to a new agreement to follow on from Kyoto, with a binding emissions goal to limit global warming to 2 degrees. But I also think that unless we successfully implement economic instruments, we will not succeed in this goal. These financial measures would probably be independent from any formal agreement and localised on a national level. I really hope that in Paris there will be representatives for each country who have the authority to make binding decisions on both emissions and finance.

What do you think are the biggest challenges in the process?

Transparency in the negotiations is very important. This will show the integration of different national interests. Dealing with conflicts of interest will be one of the biggest challenges. We are asking countries to cut back economically to reach climate mitigation goals. Finding the right compromise is a really big challenge.

Everyone benefits from emissions reduction but the costs fall on those countries making the reductions. Some countries are trying to "freeload" – to be less

active on mitigation and let others carry the burden. So I think it is important that all nations agree to a multilateral approach to protecting the climate. The emerging economies must be included – Russia and China, but also India and Brazil.

It is a question of justice between developing countries and more industrialised countries. We have to negotiate acceptable levels of emissions reduction for developing countries to balance with economic and social development. You can't really ask developing countries to slow down development. So I think this is a very difficult question. And then we come to the question of finding appropriate levels of compensation paid to the Global South by the Global North for its additional emissions.

What is Germany's role in the negotiations?

Germany is quite a rich country and so we should play a leadership role in investing in climate funds for developing countries. Germany can also play an important role in the transition to a decarbonised economy. So I think Germany should move forward on implementing nationwide economic measures – in addition to the European Emissions Trading System (EU ETS) – such as carbon taxation. Of course there are economic considerations for Germany, but also opportunities for innovation towards a decarbonised society. Germany also has an important voice within the EU, so it is very important to show that the Energiewende can succeed without a reduction in living standards – to show that it is an opportunity, not a burden.

What lessons can other countries learn from Germany's approach to cutting greenhouse gas emissions?

Germany has detailed goals on emissions reduction, which not every country has. Other countries can hopefully learn that a strong push for renewables is possible, that it is financially viable, and that the transition to renewables doesn't have to impact security of supply. This is very important. I also think others can learn that a more integrated approach to the energy transition is important – bringing in heating and mobility as well as electricity. Although we are focusing on energy, many aspects of life and society are affected, so a systemic approach is needed.

Can a climate agreement in Paris prevent catastrophic effects of climate change?

We live in a changing climate and the impacts are already very visible – storms, melting glaciers, floods and landslides. We have to reduce emissions as much as possible. If we continue to emit then climate change impacts in the second half of this century will be disastrous. If we achieve the 2-degree goal we still have negative impacts of climate change in some regions but society will probably be able to cope.

At the same time, we have to implement adaptation measures to cope with today's changes in weather brought on by climate change. This has been less strong in negotiations because of voices saying that if you talk about adaptation you reduce the need for mitigation. But both have to be done. Implementing adaptation measures on the ground – which are also good for mitigation – is really important. For this we need local and national activities.

I think if we reach an agreement to limit global warming to 2 degrees we can avoid catastrophic consequences of climate change. It is important to stress that if COP21 fails to reach a global agreement it could mean the end of globally coordinated climate protection on a political level. But I think we need many bottom-up approaches too, like nationwide carbon taxes, for example. We need both a global agreement and efficient, effective instruments within the different nations.

The interview was conducted by
Ruby Russell | 05 Nov 2015

Interview 10

Emissions trading is the key to climate protection

Katherina Reiche, managing director of the VKU German Association of Local Utilities.

Katherina Reiche. Photo: VKU.

CLEW: **What would you consider to be a successful outcome of the Paris climate conference?**

KATHERINA REICHE: We need internationally binding targets for saving greenhouse gas emissions in order to limit global warming to two degrees Celsius this century. Given the different starting points of the negotiating countries, this is an enormous challenge right from the outset. Even now, it is clear their pledges will not suffice for the two-degree goal. These targets will have to be reviewed and other mechanisms considered. As the representative of the municipal utilities and waste management in Germany, I can say that German municipal companies have accepted the political goal of climate protection. With combined heat and power, many municipal utilities have a very efficient form of energy production in their portfolios, saving nearly 11 million tonnes of CO_2 a year. Decarbonising the economy in the long term, however, can only succeed if companies have security in planning for the future. Huge investments are needed in clean technology. It is therefore important that in Paris clear and ambitious goals for climate protection are agreed.

What do you think are the biggest challenges in the process?

There are enormous differences and views on this subject. Add to this the large number of actors. Industrialised countries bear a heavier responsibility for climate change than developing countries, because they have emitted the most CO_2 in the past. Their economic growth over the last 100 years would not have been possible without fossil fuels. Of course developing countries are also striving for economic growth, which elicits more emissions. In the 1997 Kyoto Protocol, this legitimate desire for growth was acknowledged by requiring only a few industrialised countries to set mandatory savings targets. But the world has changed since then. China is now not a developing, but a newly industrialised country, and the nation with the highest emissions worldwide.

There exists the principle of common, but differently configured, responsibility. But each state decides for itself what this means. In light of this, it is very important that at least the European Union speaks with one voice.

What challenges are there at European level?

European emissions trading, which is for me the most important climate protection instrument, is a key challenge. It is market-oriented, so it adapts to the nature of markets, it offers flexibility and, in the future, the possibility of international networking with other carbon markets. That should be reason enough to strengthen this instrument. Unfortunately, the market is currently dysfunctional. Emissions rights are too cheap and they do not send adequate price signals.

What is the German role and the German objective in the negotiations?

Germany has set itself ambitious climate targets and that is a good thing. Within the positioning of the EU, Germany is also an important player. The German government has already been an important catalyst for the UN Climate Change Conference in establishing mechanisms for monitoring climate protection commitments and for climate finance. Germany also plays an important role in the area of technological development and cooperation with emerging and developing countries.

What lessons can other countries learn from Germany's approach to cutting greenhouse gas emissions?

The energy transition in Germany is like a giant laboratory which is testing how to successfully decarbonise the energy supply. This has a signalling effect. Today we have much more renewable power in the grid. This is thanks to the Renewable Energy Act. Meanwhile, the share of power from renewables in total production is 25 percent.

Because policymakers have not managed to adapt the energy-policy framework to the altered conditions, this has paradoxically caused the most efficient fossil-fuel plants, the gas-fired plants, to no longer be profitable and has even led some to close. These are precisely the power plants we need to meet Germany's own climate targets. Only the political will of the federal government will remedy this situation. We see in the example of Germany that converting the energy system in an industrialised country is a tremendous feat. It must be considered and managed in an integrated way. Power supply, heating and cooling markets and efficiency technologies require holistic concepts that are adapted to local and regional conditions. In this area, I no longer see a holistic approach, but rather a patchwork, which is fraying ever more at the seams.

How do the municipal enterprises see the future?
Municipalities think globally and act locally. The energy supply is decentralised and local actors play an increasingly important role. Municipal companies are therefore predestined to shape the energy transition. Another advantage is that municipal services in Germany enjoy a very high level of confidence among the population. Polls show this again and again. This is an advantage for projects like building pipelines or renewable energy plants. Although in principle most people support the energy transition, citizens do not always want these projects built near where they live and work. In this respect, municipal enterprises can play the role of mediator.

In addition, there are some very ambitious projects for climate protection at the local level in Germany: The highly efficient combined power and heat technology is a domain of public utilities, while municipalities are driving forward energy efficiency measures in buildings, the development of low-emission transportation and renewable energy. They will continue to do so. Last but not least, the consequences of climate change must be dealt with at the local level. In particular, flooding caused by heavy rain and storms has increased dramatically in recent years.

The interview was conducted by
Ellen Thalman | 02 Nov 2015

Interview 11 Paris deal "no guaranteed home run"

Karsten Sach, Deputy Director General "European and International Policy" in the Environment Ministry who has been Germany's chief negotiator at UNFCCC climate conferences since 1999.


Karsten Sach. Photo: IISD / ENB.

CLEW: **A last round of preparatory negotiations for the COP21 meeting has just finished in Bonn. The draft text they discussed was heavily criticised both by the EU and the group of developing nations and China (G77). What did you make of the draft and talks in Bonn?**
KARSTEN SACH: We aren't exactly where we want to be yet after this round of negotiations in Bonn. Particularly the G77 and China, representing a large number of developing nations, have proposed amendments and we can see that some nations are more interested in delaying the negotiations while others wish to see clean copy that resembles the final treaty and that can be worked with.

But the 20-page document at the centre of the negotiations in Bonn was first and foremost a great leap forward because it was brief copy in legal terminology. There were definitely passages that weren't balanced enough and it lacked a bit of 'meat on the bone', particularly when it came to clarity around a long-term climate goal, clarity regarding a mechanism for ratcheting up ambition over time, and clarity regarding accounting rules. This is where we saw room for improvement and now there are very good options for these issues in the new draft. But there are also still things that we don't like at all about the draft.

And what are those things?
The issue of differentiated responsibilities, for example, where some developing countries are trying to

further the strict separation of the world into two parts according to the status of 1992. The point of differentiated responsibilities is that everybody accepts that obligations are shared - but also that those obligations depend on the specific capabilities of each country. Industrialised countries are protesting against establishing different systems for review or transparency by differentiating only between groups of states. What we need are differentiated obligations according to the individual country's capability for climate action, but also uniform review and transparency mechanisms. In the end it is a question of equity and about a fair split of obligations. I see this as the biggest challenge at the Paris negotiations.

Another very contentious issue in Bonn was climate finance, where the G77+China made a stance that seemed to have the potential to endanger a positive outcome of negotiations in Paris. How can this issue be resolved?

I am convinced that we can also find a compromise on this issue. Industrialised countries are well on track to fulfilling their promise of mobilising jointly 100 billion US dollars annually as of 2020 for climate action measures in developing countries. This includes both public and private funds. A recent OECD (Organisation for Economic Co-operation and Development) report shows that we already reached 62 billion US dollars in 2014. Parts of the remaining gap will be closed by Germany and the UK, who announced plans to double their contributions, and by promises by financial organisations such as the World Bank to do more. So we can give a reliable commitment that we will fulfil our joint promise by 2020.

But we also have to make sure that more climate finance is available after 2020. This will go hand in hand with changing the system. It has to evolve from one of few donors and many recipients to a system where more states, also contribute to the Green Climate Fund to increase the donor base. Some states, such as Korea and Mexico, or even Mongolia, have already taken this step. At the same time, the enabling conditions in the countries which receive climate funding have to be improved. This includes making investment conditions better by getting rid of distorting subsidies. Now all these aspects need to be put into the agreement.

What has to be in the Paris agreement in order for you to deem it a success?

Firstly, we need a legally-binding treaty with a clear long-term climate target, ideally a decarbonisation target. Secondly, there has to be a mechanism for ratcheting up of ambition over time – states have to think about how they can increase their level of climate action every five years. This should include the principle of "no backtracking". And thirdly, we need clear rules on transparency and reference to ensure comparability so that we are able to see whether things are going well or not. We also need a long-term goal for climate adaptation and clear support for capacity building when it comes to the implementation of renewables or carbon emission trading in developing countries. We need more public and private climate finance by a larger group of states. That all belongs in the treaty and, for me, these are the terms of success.

Overall, we need a solid, robust and fair treaty. This treaty is supposed to last for decades. Therefore, it needs to be both modern and ambitious, so that it can account for changes in the ecologic reality without having blind spots about who in the past contributed most to climate change. And this needs to be complemented by ambitious Intended Nationally Determined Contributions (INDCs).

What lessons can other countries learn from Germany's approach to cutting greenhouse gas emissions?

Other countries can learn from Germany that it needs a wide-ranging civil society dialogue to have a transformation process like the energy transition. They can see that it needs new institutions for the transformation and instruments that bring new players into the energy market – this is the big success of the Renewable Energy Act in Germany, which helped to introduce new investors to a new form of energy. It also challenged the old energy industry establishment. They can also see that a highly industrialised country with a power system largely based on coal can, in fact, change. But another lesson learned is that it is not easy - that it needs a societal process where regions which are losing out in the process have to be supported. Germany should communicate the clear course that it has set itself with regards to climate action. But we should also openly say that not everything is perfect and that we

are organising a learning process which will inevitably include trade-offs. But we have started this process because we are firmly convinced that the opportunities are bigger than the risks.

What will be the German role in the negotiations?
We are an important part of the EU negotiating team. Germany stands for living transformation and our ambition is a good investment signal for the economy. At the G7 meeting in Elmau earlier this year we have brokered ambitious decisions, like the G7 commitment to decarbonising the global economy over the course of the century, as well as making sure that we keep our promises on climate finance. Of course we will continue to play a constructive, progressive role in the climate negotiations.

You are a climate conference veteran. What is different in the Paris negotiation compared to Copenhagen?
The difference is that the reality out there has changed. This becomes visible in the very strong climate declarations from the US and China and the agreements between Germany and India, and Germany and Brazil. The big players have invested a lot into the process and therefore want to see results. Also, economic realities have changed: renewable technologies are affordable and competitive; it makes economic sense to install them in the global south. Because of these learning curves we now have a very different situation compared to 2009 in Copenhagen. Another reason is that we have the INDCs from around 160 states covering around 90 percent of the global emissions – even if the standard of the contributions varies quite a bit. But there are obviously also still a lot of conservative elements who have been in the climate negotiation process for a long time, and changing realities also means uncertainty and things become harder to put into writing. Conditions are a lot more favourable than they were in Copenhagen but it doesn't automatically make Paris a guaranteed home run. So a lot of work and tough negotiations are ahead.

If you are not successful in Paris, will you keep following the goal of a binding climate treaty?
We will succeed.

The interview was conducted by Kerstine Appunn | 29 Oct 2015

Interview 12 Machinery makers to benefit from global climate deal

Naemi Denz, member of the executive directorate at German Engineering Federation VDMA where she is in charge of technology and environment.


Naemi Denz. Photo: VDMA.

CLEW: **What would you consider to be a successful outcome of the Paris climate conference?**
NAEMI DENZ: From the perspective of the machinery and engineering industry, which has developed climate protection technologies, but also is keeping a watchful eye on the cost burdens in its value chains, the result must have four elements. These are: to achieve sustainable progress in climate protection, to formulate clearly defined goals, to share as equally as possible the burdens and opportunities for all suppliers in our sales markets and to maintain an overview of the impact on the entire industry.

What do you think are the biggest challenges in the process?
As with other recent climate change negotiations, the biggest challenge is to mediate between developed and emerging markets. The industrialised countries are demanding greater engagement from the rest of the world. By contrast, the emerging economies want a fair chance for their own, self-determined growth. This is a fundamental conflict, but also one that is not insurmountable. China, for example, is already a world power on the global market, but is still aiming for significant economic growth in many regions. The Chinese government has already proven that it can invest heavily in climate protection, but is pushing back against a binding agreement. The industrialised countries also cannot agree on steps for concrete im-

plementation. Personally, I am doubtful as to whether the motto, "Everyone does what he wants and can" is the right answer for the long-term.

What is the German role and the German objective in the negotiations?

Germany has traditionally been a driver and facilitator and should remain in this role. We have a vital interest in getting as many countries as possible to participate if we want to achieve our own ambitious goals. But we also have to be realistic about this scenario. On the world stage, it is always more effective if the European Union acts in unison, and even that is not a matter of course. Therefore, Germany should use its standing to help Europe present a unified position and represent the European agreement along the lines of the climate and energy package agreed for 2030.

What lessons can other countries learn from Germany's approach to cutting greenhouse gas emissions?

The individual conditions in the various regions of the world are different. In this respect it is rather difficult to draw fundamental lessons. But some key issues are clearly evident. First, energy efficiency deserves more attention. To increase energy efficiency is always a direct form of climate protection, regardless of whether intelligent systems make buildings more efficient, precision machines operate with high efficiency or we use digitisation to optimise Industry 4.0 processes.

Second, the transition to renewable energies is not a very simple undertaking. The German Renewable Energy Act has helped greatly to organise the entry into renewable energies. But we have also seen that we failed to adjust this process quickly enough. The current transition to a competitive tendering system makes sense. For this we need – now that about one third of our electricity comes from renewables – efficient approaches to system integration and the linkages between sectors.

Thirdly, Germany has achieved a large part of its climate goals by closing and sealing landfills and reutilisation of landfill gas. Developing and emerging countries have an easier time, because their current challenge is to build a reliable energy market, and, if they want, a modern waste management system. A low-carbon economy is easier to create in an economy still in the midst of growth, than in one that is already mature.

Incidentally, it is important to stress that Germany can be proud of the fact that it has paved the way for solutions for the rest of the world, as a pioneer of climate-friendly and efficient technologies. That wind and solar power can be used in developing countries today has much to do with the learning curve in Germany. We have built a competitive industry for wind energy. For various reasons, this did not work out in photovoltaics.

Can a global climate agreement harm German industry?

From the perspective of the machinery industry, a global agreement would first of all bring great benefits! The opportunities are immense. If the interest in efficient technologies continues to rise, if production and processes are designed to be low in emissions, and if renewable energy and system solutions are required, then we may receive what we like to call the "energy revolution-dividend". Our industry would only suffer if an agreement includes heavy burdens or limitations in comparison to the regulations that apply to our direct competitors' industry. The former would come from higher costs, and the latter from restrictions such as unilateral constraints on exports, as we are seeing currently in coal power plants. For these, the OECD countries may block export credit coverage; but this does not prevent a single power plant from being built, as our competitors from China do not have to adhere to these rules.

The interview was conducted by
Ellen Thalman | 21 Oct 2015

Interview 13

Global South should be capitalised

Sabine Minninger, policy advisor on climate change for German aid agency Bread for the World. Since 2008 Minninger has followed the UNFCCC process together with partner organisations in the global south.

Sabine Minninger. Photo: Brot für die Welt.

CLEW: **What would you consider to be a successful outcome of the Paris climate conference?**

SABINE MINNINGER: A success would be a legally binding global agreement that will keep global warming well below 2 degrees Celsius until the end of the century. This must be anchored in measurable, reportable and verifiable (MRV) regulations, so that all countries have to follow the same rules, and mitigation efforts are measurable, transparent and comparable.

Of course, from the perspective of a development organisation like Bread for the World, the agreement has to respond to the needs of the poorest people in the global south who are vulnerable to climate change. There are islands in the South Pacific where resettlement programmes are already going on – this is not in 20 years, this is now. Loss and damage has to be anchored in a globally binding agreement.

What is most important for this agreement is long-term vision. And therefore there must be language on decarbonisation, close to that of the G7 agreement. At best, we need a commitment to global decarbonisation by mid-century. Or as a second best, within the century. The end of fossil energies has to be anchored in the global climate agreement. If this is not included, it will be a worthless piece of paper.

What are the biggest challenges to reaching a meaningful agreement?

We have already failed to meet the major challenge: to get legally binding commitments from all states to reduce their emissions. This chance has been missed. The INDCs (intended nationally determined contributions) will not make it into the global agreement – only into a COP decision, which remains voluntary. And these voluntary measures are not enough to keep warming below 2 degrees. The commitments on the table will allow warming of 2.7 degrees, and of course we cannot accept this. It will be a human catastrophe. If this cannot be renegotiated in the next three months then we have to have an option to keep global warming below 2 degrees and that means every five years we will have to review and ratchet up national commitments.

Low ambition means efforts must now be targeted to a five-year renegotiation cycle. What is also key is that the agreement must have a robust MRV system. So far, everyone can do what they want, when they want, and how they want. And there is no transparency, so we cannot see who still has to step up their ambition in order to keep global warming below 2 degrees.

The 2-degree limit and full decarbonisation are the vision. The concrete action is the five-year renegotiation cycle with a ratcheting-up mechanism and the MRVs. This is the architecture. The house we are building will not be finished in Paris. Actually, we are just drawing up the architectural plans. And after 20 years of negotiation, those plans look lousy. Without the proper architecture everything that follows will collapse.

Now the bargaining starts. The European Union is desperate to have the five-year cycle. But the bargaining chip will be climate finance. There must be a long-term commitment to climate finance with clear pathways and sources. There must be predictable, additional money that allows for planning and does not draw down existing development funds.This will be the trigger for countries like China, for example – which is not a big fan of a five-year cycle – to reconsider their position.

The African states have always been big friends of the European Union and have supported it on higher mitigation ambitions. But they have now shifted their emphasis away from mitigation to climate finance ad-

aptation measures because they are desperate. We need a signal to the African states: We support you on your adaptation efforts but now please come back on track and really support us on mitigation.

Is Germany doing enough on climate finance?

On a global level we have a shortfall of close to 70 billion US dollars from the 100 billion targeted, and no one knows how to close this gap by 2020. It is hard to criticise the country that has been the most ambitious. I am glad that Germany has committed more money than any other country. Germany has put what it believes to be its fair share of money on the table: 4 billion US dollars, in order to trigger 6 billion in private finance to make up a share of 10 billion. But we don't believe it works like this. We still don't know how much private finance will be triggered. On mitigation, public money will trigger investment in renewable technologies, for example. But on adaptation we won't see that effect.

The most ambitious player has a responsibility to set the benchmark. We see a danger that if Germany commits 4 billion US dollars, no other country will better that. There is a responsibility to reach the 100-billion-dollar target and we believe it must be public money. Is Germany's contribution enough? No.

What is Germany's role in the negotiations?

I can tell you what role Germany should play. I believe the EU's climate targets are not enough. Also, the German targets are miserable in that they haven't even achieved the last targets they set. What this means is that we need a very concrete announcement before Paris that Germany will exit from brown coal. Germany must stop extracting brown coal immediately to signal that it is serious about reaching its targets. The Energiewende can only be achieved if we stop using fossil fuels – and that of course goes hand-in-hand with better use of renewables.

What lessons can other countries take from Germany's approach to cutting greenhouse gas emissions?

That Germany was the first country to announce its energy transition was a remarkable step forward and deserves respect – if it is actually implemented. Germany is at the forefront of convincing other countries to reduce emissions and motivating them to follow their concept of the German Energiewende. The rest of the world is watching this process. Germany's position needs to be made clear before Paris. You can see how strong the coal lobby still is in Germany. There is a lack of political will and we have to do better. The German Energiewende has to be a success story. If Germany's energy transition fails, other countries won't be prepared to take the same path.

The interview was conducted by
Ruby Russell | 12 Oct 2015

Interview 14 EU must speak with one voice

Reimund Schwarze, professor for international environmental economics at the Helmholtz Centre for Environmental Research in Leipzig. He has done extensive research on the economy of climate change, sustainable development and climate change policy.

Reimund Schwarze. Photo: UFZ.

CLEW: **What would you consider to be a successful outcome of the Paris climate conference?**

REIMUND SCHWARZE: What we need is a basic, wide reaching climate treaty that everyone can support. The architecture of such an agreement is pretty much in place. I would measure the success of Paris in terms of agreeing on such a basic treaty and not in terms of binding emission targets. Since Lima we have the countries' climate action pledges (INDCs) which will be part of a dynamic monitoring process spread over several years. If the main targets of decarbonisation as well as reaching an emissions trend reversal by 2030 – which seems to be possible when looking at the INDCs so far – are incorporated in a global treaty, I am satisfied.

What do you think are the biggest challenges in the process?

The biggest challenges in Paris are to find a consensus for this basic treaty and to give it a strong framework of general principles that are supported by all nations. This should include – from my view as an economist – the long-term target of achieving decarbonisation with economic instruments such as a price for carbon. It is also very important that the treaty incorporates the obligation of rich nations to give 100 billion dollars or more for climate finance. I am saying "or more" because I think that more than the promised 100 billion dollars per year by 2020 will be needed. This part is essential to make the treaty acceptable also for developing countries. Apart from that, I really hope that a 'diplomatic disaster' like 2009 in Copenhagen can be avoided and that geopolitical problems such as the Russia-Ukraine conflict, IS or refugees from Syria- as well as the loss and damages issue - will be settled to a degree that they won't interfere with negotiations in Paris. If this succeeds, I am overall very optimistic that a basic treaty will be achieved in December.

You are a strong proponent of a price for carbon – where will such a price mechanism play a role in the Paris negotiations?

In order to make the national climate targets of the INDCs work, we don't only need a monitoring process - we also need a price mechanism. This is why incorporating a target for a price for carbon into the basic treaty in Paris is so important. I am obviously passionately supporting a global emissions market. But I don't believe that Paris will reach an agreement that sets one carbon price for the world which then gets implemented by the UN. However, it's important that the basic principle gets embedded and then every country can implement mechanisms like carbon trading, or a carbon tax or whatever they choose, themselves. Even if this results in different carbon prices in different countries, it would still reduce carbon leakage, compared to a world where only a few nations or groups of nations have carbon prices and others have none. And it will kick-off a dynamic process, like with the INDCs, that can lead to achieving a long-term goal such as a global carbon market.

What is the German role and the German objective in the negotiations?

I think Germany plays a minor role in the climate negotiations. The most important objective for Germany is to keep the European Union together and make sure that it acts as one and is visible as a strong negotiating partner. The real debates will be between the US, China and the developing countries - and in order for the EU to participate, it's important that it speaks with one voice.

What lessons can other countries learn from Germany's approach to cutting greenhouse gas emissions?

Germany has so far not found a way that demonstrates how climate action can be cost-efficient. As a rich country, Germany can afford to implement a costly energy transition (shift from conventional to renewable energy) but other countries in the EU and other parts of the world don't have the same economic means. The task is to find a way of building a green economy in an affordable fashion. Neither Germany's energy transition nor the European emissions trading system are convincing approaches at the moment. Germany's solo attempt at creating social and technological breakthroughs and hoping that the world will follow has not worked out because this was only possible in a rich country like Germany. The energy transition is a luxury model - what we need are broadly applicable approaches to avoid carbon leakage and this is going to be a very long process.

The interview was conducted by
Kerstine Appunn | 12 Oct 2015

Factsheets

- Controversial climate summit issues – positions in Germany
- The making of „Climate Chancellor" Angela Merkel
- COP21 - Media on Germany and the Paris Climate Summit
- Coal in Germany
- Germany's greenhouse gas emissions and climate targets
- Paris climate deal – does Germany get what it hoped for?

www.cleanenergywire.org/dossiers/cop21-view-germany

Dossier

The challenges of Germany's nuclear phase-out

Managing the nuclear legacy – a project into the next century

12 Oct 2015 | Kerstine Appunn

The question is no longer whether Germany's future will be nuclear-free – or even when, since the government is committed to completing the phase-out by 2022. But the logistics of pulling the plug on what was until recently one of the country's primary sources of power are proving an immense challenge for this part of the country's Energiewende. Legal hurdles, decommissioning technicalities and above all the question of where to store the radioactive waste and who will pay for it all, are the main issues at hand.

Germany's nuclear phase-out marks two important anniversaries next year. In 2016, it will be 30 years since the fatal nuclear meltdown in Chernobyl and five years since the catastrophe at Fukushima. These events were crucial to the motivation and timing of Germany's decision to exit nuclear power once and for all, a project that is now under way, and being played out near Rheinsberg, in a nature reserve 100km from Berlin.

Time seems to stand still between the lakes of Nemitzsee and the Großer Stechlinsee. But at the end of a long narrow road through the peaceful forest, a complex and labour-intensive operation at the Rheinsberg nuclear power plant (NPP) provides a glimpse of the future of Germany's nuclear industry. Today, engineers at NPP Rheinsberg are joined by tourists who arrive in shorts and flip-flops to learn about the operation and decommissioning of the old Russian reactor, the first to be taken into operation in the GDR. The NPP admin building is listed as a piece of original GDR architecture.

Rheinsberg operated for 24 years, before being switched off in 1990. The decommissioning works are ongoing and will continue until 2025. In other words, the process of shutting down Rheinsberg will take 11 years longer than the plant's power-producing lifetime. It will cost around 600 million euros. The reactor buildings and grounds are slowly being decontaminated but it is still unclear where Rheinsberg's radioactive waste – and that from other NPPs – will be laid to rest.

Following decades of protests against nuclear power, the government of Social Democrats and the Green Party in 2002 agreed with the big utilities to limit the lifespan of nuclear power stations in Germany to 32 years so that the last one would be closed by 2022. In 2010, a new government under chancellor Angela Merkel reversed this legislation, extending the operating time of nuclear plants for up to 14 more years (See Factsheet The history behind the nuclear phase-out). In 2011 in the wake of the Fukushima accident, parliament voted by an 80-percent majority to shut down all Germany's nuclear reactors by 2022 and Germany had its nuclear phase-out back.

> *"The technical and economical handling and storage of our radioactive waste will be the most difficult challenge of the Energiewende."*
>
> *Christian von Hirschhausen, DIW.*

The country has been coming to terms with the practical and financial implications of this ever since. Compared to the task of covering a major industrial nation's energy needs with renewable sources, switching off the 22 remaining NPPs once looked like the easy bit of Germany's ambitious energy transition (Energiewende), a project that also aims to drastically reduce CO_2-emissions. Now, the country is discovering just how laborious it is to shut down what was the country's biggest single source of electricity in 2005 – covering 26.2 percent of production.

"The technical and economical handling and storage of our radioactive waste will be the most difficult challenge of the Energiewende," predicts Christian von Hirschhausen, researcher at the German Institute for Economic Research (DIW).

Figure 1 | Situated in the middle of a nature reserve the nuclear power station Rheinsberg is currently being decommissioned to reach "greenfield" status. By 2015, this will have taken 35 years. Photo: EWN.

38 years after Germany began to decommission its first nuclear power stations, and just seven years away from becoming a nuclear power-free zone, the country is struggling with almost every aspect of the nuclear phase-out.

One issue that isn't a problem is public consent. The vast majority of Germans want to see nuclear power gone sooner rather than later. According to a 2015 poll, 81 percent of Germans back the nuclear phase-out. Among 14 to 29 year olds, that rises to 93 percent.

But one of Germany's leading newspapers, the Frankfurter Allgemeine Zeitung (FAZ) has likened the legal (or possibly illegal) process of implementing the nuclear standstill order, enacting the immediate shut-down of eight NPP after Fukushima, and the second phase-out decision in 2011 to a novel by Franz Kafka.

Shutting down a nuclear power station requires more than simply switching it off. Engineers point out that reverting the site to "greenfield" status, as the technical term goes, takes several decades and produces tonnes of radioactive waste.

One of Germany's leading newspapers likened the implementation of the nuclear phase-out after Fukushima to a novel by Franz Kafka.

What will become of this waste is a contentious issue. Storage locations both for the medium- and long-term custody of radioactive material are few and far between, and no region in Germany is keen to host the poisonous remains.

And then there are the costs. Power suppliers who operated nuclear reactors are liable to pay for their deconstruction and waste storage. In line with German law, they have made provisions of around 38 billion euros for these duties. But experts doubt if this sum will suffice. The shaky economic standing of the big utilities has triggered concerns they won't have the financial means to deal with their radioactive legacy.

The lights stay on – even without nuclear

On 28 June 2015, E.ON shut down Grafenrheinfeld NPP in Bavaria. It was the first plant to be mothballed since Angela Merkel's conservative-liberal coalition government ordered the closure of eight stations in 2011. Even though Grafenrheinfeld covered 11.5 percent of Bavarian power consumption right up to its final days of operation, alternative energy proponents and think-tank Agora Energiewende* quickly calculated that electricity supply would remain stable, since renewable power easily covered the 10 billion kilowatt-hours the plant produced annually. This was echoed by Bavaria's minister for energy and economy, Ilse Aigner, who told the press, "security of supply was not endangered in any way due to the exit of Grafenrheinfeld".

DIW published a study in May 2015 finding that the power supply would remain secure in Germany, even after the last nuclear power plant had gone offline in 2022. "Germany will even continue to export power in 2025, thanks to growth of renewable energies and the fact that we have vast overcapacities at the moment," said the DIW's Claudia Kemfert, who co-authored the study.

Bolstered by this reassurance, Grafenrheinfeld's end was a quiet one, with few protests from industry and local beneficiaries of the nuclear power plant. As with Grafenrheinfeld, most German towns in the vicinity of nuclear reactors have a love-hate relationship with the local plant. For many residents the plant provides reliable, life-long

*Agora Energiewende, like the Clean Energy Wire, is funded by Stiftung Mercator and the European Climate Foundation.

employement while taxes and revenues paid to the community are often topped up with donations to local clubs and communal facilities. Others have long campaigned for their closure, blaming NPPs for a (disputed) rise in leukaemia, and following Chernobyl and Fukushima, perceiving them as an ever-present mortal danger.

Karsten Hinrichsen, who founded the anti-nuclear group Brokdorf Akut has been campaigning against the northern German reactors at Brokdorf and Brunsbüttel for 40 years. He says the conflict is now all but over. "We are now fighting for a clean deconstruction with as little radioactive pollution as possible and we are still campaigning for the plant at Brokdorf to be taken offline earlier," he told the Clean Energy Wire.

The anti-nuclear movement has a long history in Germany, but aside from concerns over safety, many now argue that there is no useful place for nuclear power in the future German energy landscape dominated by renewables. Nina Scheer, a member of parliament for the Social Democrats (SPD), which currently forms the coalition government alongside Angela Merkel's Christian Democratic Union (CDU), says shutting down nuclear capacity is the "only logical answer" for Germany. "In an energy system made up of almost 100 percent decentralised and fluctuating renewable power sources, there is no place for large inflexible electricity plants such as nuclear stations," she told the Clean Energy Wire. According to government plans, Germany's Energiewende will see at least 80 percent of gross electricity consumption covered by renewables by 2050.

Legal hurdles

Even if the political debate about nuclear power's future is over, the early stages of the phase-out are being hotly debated in legal battles that could end up costing the state billions of euros in damages. Nuclear power station operators E.ON, RWE, EnBW and Vattenfall aren't fighting the nuclear phase-out per se, but they are claiming compensation for profits lost as a result of plants being shut down early. More than 30 lawsuits and constitutional complaints, adding up to demands of over 20 billion euros, are pending as a result of the nuclear phase-out. Even lifelong anti-nuclear campaigners like Hinrichsen say they wish Merkel had put the nuclear exit on a more solid legal footing. (See factsheet on legal issues of the nuclear phase-out).

"In an energy system made up of almost 100 percent decentralised and fluctuating renewable power sources, there is no place for large inflexible electricity plants such as nuclear stations."

Nina Scheer, MP.

Turning a nuclear power station site green

When NPP Rheinsberg was powered down in 1990 it had reached the end of its legal lifespan and all its fuel elements were still in the reactor. The same is true of the eight plants that Merkel's government shut down in 2011 in the wake of the Fukushima reactor meltdown in Japan.

"When it comes to technical and organisational challenges, the operators of the eight recently shut-down reactors face exactly the same issues that we've had," says Hartmut Gülow of Energiewerke Nord (EWN). EWN is in charge of decommissioning several nuclear power plants in Germany, among them the NPP Rheinsberg. The sudden standstill order in 2011 means the first years are being spent reorganising or selling fresh fuel elements and buying castor casks for used elements (at over 2 million euros a piece), says

Gülow. He has worked at Rheinsberg for 47 years. For more than half of that time he's been in charge of dismantling the reactor. Only after the rods have left the plant can the clean-up begin. Disposing of Rheinsberg's 74 unradiated fuel elements (they sold them to Los Alamos National Laboratory in the US in 1995) and 246 used ones took nine years.

By 2022, the last of Germany's remaining eight nuclear plants is to go offline. Between 1971 and 2011 15 power producing reactors have been shut down and so far most operators have decided to dismantle them immediately, rather than opting for so-called "safe enclosure". The latter means encasing radioactive remains to prevent leakage and only dismantling them 40 to 60 years later – once radioactivity has subsided naturally.

"We considered safe enclosure in the beginning but it paid off to undertake decommissioning with the plant's own staff because they really know the ins and outs of it."

Hartmut Gülow, EWN.

"We considered safe enclosure in the beginning but it paid off to undertake decommissioning with the plant's own staff because they really know the ins and outs of it," says Gülow. He reasons that after 50 years, no one would remember exactly where things were and how they worked, making the clean-up all the more difficult. RWE and Vattenfall, which are in the early stages of decommissioning power stations Biblis, Krümmel and Brunsbüttel, are following EWN's lead, saying their own experienced personnel will undertake most of the clean-up.

Gülow and his team are decommissioning pioneers. Since 1990 they have faced it all: long-winded bureaucracy (it took five years just to get permission to start dismantling), unpleasant surprises (there also was a hot cell for research and some radioactive waste ponds on-site), transport difficulties (a train-vehicle large enough to carry the reactor's pressure vessel had to be imported from Austria) and technical challenges. They had to buy new gear, such as a PETRA facility to dry out around 1,000 barrels of weak and medium radioactive waste before it could be sent to an interim storage facility. In 2005, they turned the reactor cooling pond into an "underwater cutting place" where highly radioactive remains could be dissembled with remotely controlled cutting devices.

Today, with the 2025 finishing line for the Rheinsberg clean-up in sight, EWN's expertise is in demand. The company, which is also decommissioning a larger GDR reactor in Greifswald and a research reactor near the west German town of Jülich, has won contracts to dismantle the EnBW reactor in Obrigheim, and since 2003 has been in charge of the technical decommissioning of the Russian nuclear submarine fleet at Murmansk. "Decommissioning knowledge and technology is one of Germany's export products and we sure have gained a lot of experience in it," says Gülow.

Germany will have more than 20 atomic power plants in various states of decommissioning in 2022, including the eight plants switched off in 2011, plus several nuclear research facilities. There will be plenty of work in nuclear decommissioning until at least 2050 as the dismantling and cleaning work required takes an average of 20 to 25 years, taking into account inevi-

"Nuclear power for a peaceful future" – the remaining employees at eastern German nuclear power station Rheinsberg near Berlin are still keeping the original calendar in the control room up to date. Photo: CLEW.

table delays. EWN, for one, is looking for new engineers and offers a trainee programme.

Other areas of research in Germany have been less fortunate in the wake of the nuclear phase-out. "Funding for nuclear waste management research has remained stable but support for reactor safety research has decreased considerably," Dirk Bosbach, professor for nuclear waste disposal at the Forschungszentrum Jülich and spokesperson of NUSAFE (Nuclear waste management, safety and radiation research) told the Clean Energy Wire. Industry funding for nuclear safety research has shrunk substantially because any kind of innovation is likely to arrive after the last German plant is shut down in 2022 – too late for power station operators.

"It's important that Germany remains competent in the field of nuclear safety," Bosbach says. Otherwise, German experts won't be tapped for international committees that set NPP standards. But to stay competent, scientists must continue participating in international research programmes. This requires domestic research on innovative reactor models, Bosbach says.

But a number of stakeholders have been critical of such research, in view of the long-fought-over legislative and public consensus to close down nuclear plants. "In the end it's a political and societal decision whether we want this kind of nuclear research or not," Bosbach says. As long as German research institutes can offer interesting projects and oppo tunities, professionals will stay and young students find it attractive. There is a lot of interest from young academics in the safe management of nuclear waste.

Where will the waste go?

A total of 342,000 tonnes of material must be removed from NPP Rheinsberg, 60,000 tonnes of which is radioactively contaminated. While some of it can be cleaned and released into the normal substance cycle, thousands of tonnes of low and medium level nuclear waste must be safely stored.

Because the lifespan of its nuclear reactors is limited and the existing amount of nuclear remains is established, Germany is in the rare position of knowing pretty much exactly how much radioactive waste it will have to store. 303,000 cubic meters (m^3) of low and medium level nuclear waste will go to a final storage facility in the retired Schacht Konrad iron ore mine near Salzgitter. The repository is currently under construction and scheduled to be loaded in 2022, a process that should take no longer than 40 years, the Ministry for Environment, which is in charge of nuclear law, says in its "national disposal programme" of August 2015.

> *"In 2050, when the final repository is ready I will be 98 years old, so I am not sure I will live to see it happen, but I certainly feel that it is my responsibility to organise this now."*
>
> *Environment minister Barbara Hendricks.*

The fate of 28,100 m^3 of high-level waste in 1,900 containers and 200,000 m^3 of low and medium level waste which has been unsafely stored in a disused salt mine in Asse, Lower Saxony is less clear. Heat-generating waste accounts for only a fraction of Germany's radioactive refuse, but it is responsible for 99 percent of the radiation. The environment ministry set up an expert commission that has until next year to come up with a plan to look for a final repository for heat-generating waste. The search itself will continue until 2031. Once a site has been found, the repository must be constructed in time for the first

Figure 2 | Location and status of Germany's nuclear power stations and year of (planned) shut down.

containers housing used fuel elements to be deposited there in 2050. The procedure of transporting and storing thousands of casks in the final repository will take until 2090 or 2100, Environment Minister Barbara Hendricks said in August. "In 2050, when the final repository is ready I will be 98 years old, so I am not sure I will live to see it happen, but I certainly feel that it is my responsibility to organise this now," Hendricks said.

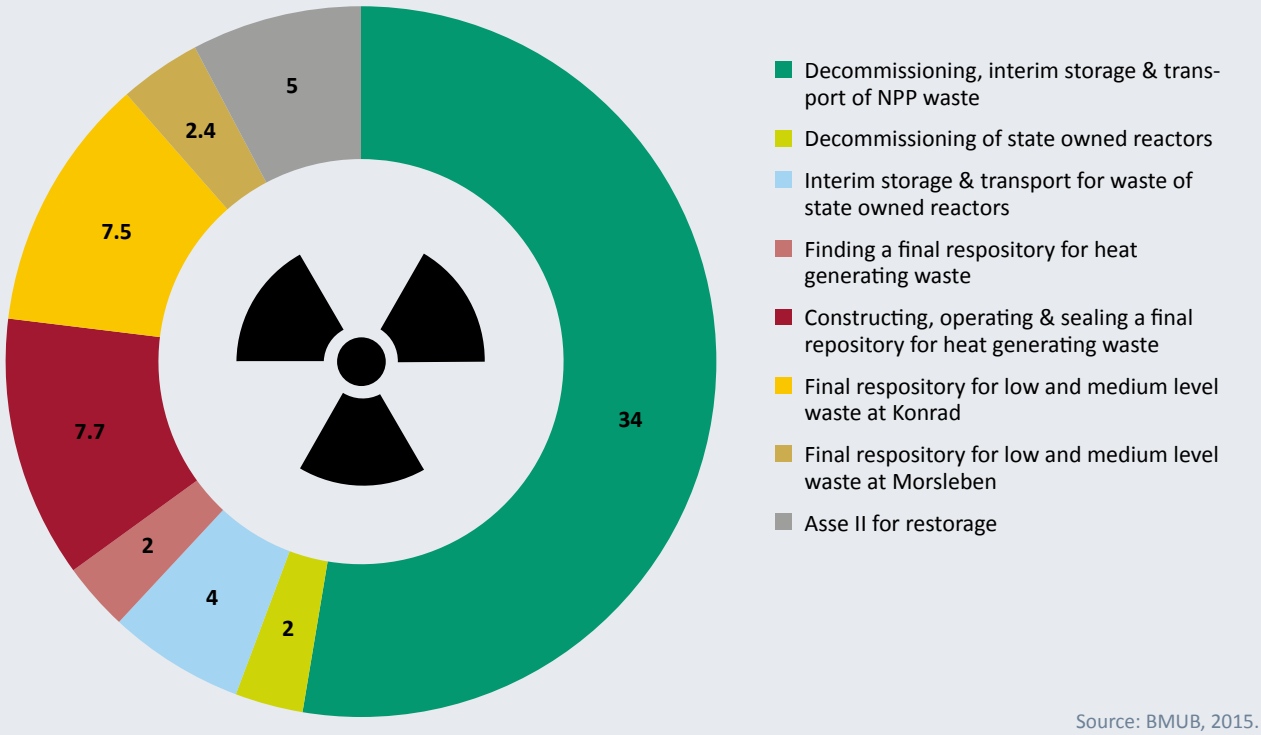
When it comes to finding a final repository for the highly radioactive waste, Germany is a "blank map", Hendricks said – anywhere with a rock formation suitable for an underground repository is a possible location. But no community in Germany is keen on living next door to a cemetery for contaminated waste.

Even finding storage for 26 containers of high-level waste now ready to return from reprocessing facilities in France and the UK has provoked a high-profile controversy. After state premiers failed to agree on who would take the casks and how many, the environment ministry had to assign them, provoking angry reactions from Bavaria (See Factsheet nuclear waste storage).

How much does it cost…

Decommissioning, storing, transporting and re-storing – ridding Germany of its nuclear heritage comes with a hefty price tag. The state will have to pay the decom-

Figure 3 | According to current environment ministry estimates, costs for nuclear decommissioning and storage to be covered by the state and/or utilities will amount to over 65 billion euros.



Source: BMUB, 2015.

missioning and storage costs for publically owned research reactors and for EWN's activities in the former GDR, since these power plants did not find private owners after Germany's reunification. The environment ministry estimates a bill of around 6 billion euros, excluding the costs for finding, building and operating a final repository, but says the figure is "afflicted with great uncertainties". The state will also pay over 5 billion euros to retrieve and re-store the unsafely stored waste from Asse, and a further 2.4 billion euros to close the facility in Morsleben (See Factsheet on nuclear clean-up costs).

Vattenfall says that from previous experience, costs for the post-operation period, and decommissioning works range from 500 million to 1 billion euros per NPP, depending on its size, age and run-time. RWE estimates that costs of decommissioning two reactor blocks at Biblis in the next 15 years will be "considerably higher than 1 billion euros".

The environment ministry expects the cost burden to peak between 2016 and 2020 but says storage will still need financing in 2080. The final repository for low and medium level waste at Schacht Konrad will cost around 7.5 billion euros, according to the ministry. Previous calculations put the locating, building and operating of a final repository for heat-generating waste at around 10 billion euros, but in August the ministry said it was impossible to pin down concrete figures, since even the site of the final repository was still unknown.

"We lack both the technical and the economic experience to assess how much the dismantling of nuclear power stations will actually cost," says DIW researcher von Hirschhausen.

In April 2015, Michael Müller, head of the parliament's final repository search commission, said costs could rise to 50 or 70 billion euros over the coming decades. Von Hirschhausen says this estimate is a reference point. "When we talk about storage, we are talking about an issue that will follow us into the 22nd century," he told journalists, pointing to a major problem with achieving any realistic estimates.

… and who pays?

The "polluter pays" principle and provisions in the nuclear power law and the German Commercial Code oblige the four big German utilities E.ON, RWE, Vattenfall and EnBW (as well as some smaller municipal utilities who have part ownership of some of the big four's NPPs) to put aside funds for dismantling and waste storage. And so they have. By the end of 2014, the utilities had set aside 38 billion euros – 22 billion for decommissioning their power plants and 16 billion for final storage (See Factsheet Securing utility payments for the nuclear clean-up).

When it comes to finding a final repository for the highly radioactive waste, Germany is a "blank map".

But with the final costs still so unclear – and potentially many times higher than the funds put aside – many fear that it will be the (future) taxpayer who foots the bill for the nuclear clean-up. Back in 2011, the German Federal Court of Auditors (Bundesrechnungshof) had already said the government lacked the expertise to judge whether provisions made by the utilities were sufficient, posing considerable risk to the federal budget.

For decades, the utilities earned handsome profits from nuclear power. But now they are struggling to adjust to a new energy world – increasingly dominated by decentralised renewable energy – and are earning less and less from their conventional plants. It's not impossible that these companies will cease to exist long before their nuclear waste is safely stored away.

These concerns have been noted by the Ministry for Economic Affairs and Energy, which had the utilities' provisions stress-tested by auditors and is working on a law to prevent nuclear power operators from shirking responsibility by restructuring their companies.

"We know how much the companies have earmarked as provisions for nuclear decommissioning and storage but we don't know how exactly they have invested these sums," Nina Scheer of the SPD told the Clean Energy Wire. "And there's the rub: the utilities are free to invest provisions in tangible assets like power stations but there is no guarantee that these assets will be worth as much in the future as they are now."

On behalf of the energy ministry, auditors at Warth & Klein Grant Thornton scrutinised the utilities for exactly this. The government and the utilities said in mid-October the calculations had shown that the provisions would be sufficient to pay for the decommissioning of nuclear reactors. But the stress-test results also revealed that the potential cost could far exceed the utilities' provisions - primarily depending on the assumption made on interest rates and future price increases for the work ahead. Professor Wolfgang Irrek, an energy expert at the Ruhr West University of Applied Sciences, told Süddeutsche Zeitung the stress test whitewashed the problems, because it didn't investigate worst-case scenarios. "Instead, it draws conclusions on the basis of risk-free expectations." He said it was problematic to say the utilities had "passed" the stress test.

"When we talk about storage, we are talking about an issue that will follow us into the 22nd century."

Christian von Hirschhausen, DIW

Bettina Meyer and Swantje Küchler, associates at Green Budget Germany (FÖS), have compared provisions made by the big four utilities by calculating how much each has put aside per kilowatt of nuclear capacity.

"What worries us is that the amount ranges from 1,300 €/kW at RWE to 1,700 €/kW at EnBW, 1,800 €/kW at E.ON and 2,000 €/kW at Vattenfall,"

Meyer told the Clean Energy Wire. She said it was also unclear why the companies came up with such different provisions assigned for decommissioning and waste storage. "There might be plausible reasons for these differences but without more transparency and information from the utilities, we cannot understand and evaluate them."

Energy and economy minister Sigmar Gabriel wants to make sure that utilities pay for the nuclear clean-up. Photo: © BMWi/Maurice Weiss.

Vattenfall and RWE deny their nuclear provisions lack transparency. "The provisions are examined and adapted annually," a Vattenfall spokesperson told the Clean Energy Wire, adding that they were based on existing contracts, external expert views and information from the Federal Office for Radiation Protection (BfS), and checked by independent auditors.

Critics remain unconvinced. Some suggest the utilities should pay their nuclear provisions into a state-administered fund, to protect them from company values losses or bankruptcy. Similar funds exist in France, Belgium, Czech Republic, Sweden, Finland and Hungary. The FÖS proposed that such a fund should contain sufficient assets to pay for the projected costs of the nuclear clean-up, and include a risk reserve or an obligation to provide further capital if needed (top-up liability) (See factsheet on nuclear funds).

When asked whether having to make cash available for a public fund would have a strangling effect on the company, RWE spokesperson Lothar Lambertz told the Clean Energy Wire that RWE's nuclear provisions were secure and would be available once needed.

The economics and energy ministry will present its own proposal for how to safeguard nuclear decommissioning and storage funding in the autumn.

The "parents are liable for their children" law

The ministry has also presented a draft law that will enforce the nuclear operators' liability in case of company restructurings. Minister Gabriel calls it the "parents are liable for their children" law, with E.ON's announcement to spin off its conventional operations in mind. Under current legislation, E.ON's liability for the new company, Uniper – which was to include nuclear operations and plant decommissioning – ends after five years. Gabriel wants to make the "parent" liable indefinitely.

E.ON's reaction came in early September. The operation and decommissioning of the company's German nuclear activities will not be transferred to the new spin-off Uniper, as previously planned, but will remain with E.ON, the board decided. CEO Teyssen explained that the government's change in law created unacceptable risks for the company's previous spin-off plans.

He reiterated that he deemed a change to the five-year liability limit to be unconstitutional, but said his company didn't have the time to wait for the outcome of a legal dispute which might take years.

Following months of heated debate and with so many lawsuits pending over the nuclear phase-out, it was time to find a common solution for decommissioning and nuclear waste storage, Teyssen said in August.

Vattenfall and RWE deny their nuclear provisions lack transparency. "The provisions are examined and adapted annually."

Vattenfall spokesperson.

> *"If we continue to source nuclear power, we will have to deal with even more nuclear waste and that will cost even more money."*
>
> *Nina Scheer, MP.*

Thorben Becker, head of the climate change group at Friends of the Earth Germany (BUND) has warned against letting utilities get off lightly on condition that they drop their legal pursuits against the nuclear phase-out. This would entangle issues that should be handled separately, Becker told an expert hearing of the economy and energy committee at the federal parliament in March 2015. Scheer says that any such deal would be dubious as long as the basic responsibilities and costs for nuclear decommissioning and storage aren't completely ascertained.

The legal, financial and logistical hassle over the nuclear phase-out won't be laid to rest any time soon. But few believe Germany could countenance a return to nuclear power – or even extend the operating times of existing plants.

"If we continue to source nuclear power, we will have to deal with even more nuclear waste and that will cost even more money," said Scheer.

Factsheets

- The history behind Germany's nuclear phase-out
- What to do with the nuclear waste – the storage question
- Nuclear clean-up costs
- Securing utility payments for the nuclear clean-up
- Legal disputes over the nuclear phase-out

www.cleanenergywire.org/dossiers/challenges-germanys-nuclear-phase-out

Dossier

The Energiewende and efficiency

Taming the appetite for energy

17 Sep 2015 | Sören Amelang

It will take more than just making the power supply green to achieve climate targets. Germany must also tackle demand and consume less energy. In the past, energy use only fell significantly when the economy took a hit. Now the country wants to prove it is possible to decouple growth and emissions by dramatically increasing efficiency. The potential is huge and so far largely untapped, which is why the issue has been dubbed the “sleeping giant” of the Energiewende. The government’s Climate Action Programme, designed to get Germany back on track for its 2020 climate goals, suggests that increasing energy efficiency can bring more emissions cuts than any other measure. But saving energy on a large scale – by insulating buildings, changing behaviours and introducing new technologies – has proven a hard sell so far.

Too good to be true?

Efficiency offers so many benefits it almost sounds too good to be true. Who could find fault with the main idea behind it: Getting more out of the energy consumed? The advantages of cutting waste and pursuing efficiency are so numerous it sounds like a no-brainer – and experts consider it essential to the success of Germany's energy transition.

> *"Germany can achieve its emission targets much faster if energy is used more efficiently."*
>
> *Robert Pörschmann, BUND.*

"Efficiency is absolutely indispensable to make the Energiewende a success. It is our most important energy resource," explains Christian Noll, managing director of the German Industry Initiative for Energy Efficiency (DENEFF). Efficiency specialist Robert Pörschmann, from Friends of the Earth Germany (BUND), agrees: "Germany can achieve its emission targets much faster if energy is used more efficiently. This buys time, which is in very short supply in the fight against climate change." Matthias Zelinger from the German Engineering Association (VDMA) says rising energy prices make efficiency a strategic factor for German industry. "Companies can gain cost advantages, and efficiency becomes a competitive advantage."

Memorable "house with hat" poster: One of many government campaigns to promote home insulation was launched in 2010. Source: BMVBS, 2010.

But at the same time, experts lament that progress in the area is disappointingly slow. "Efforts have got stuck. We're lagging behind in all areas," Noll told the Clean Energy Wire. So what is so difficult about saving energy?

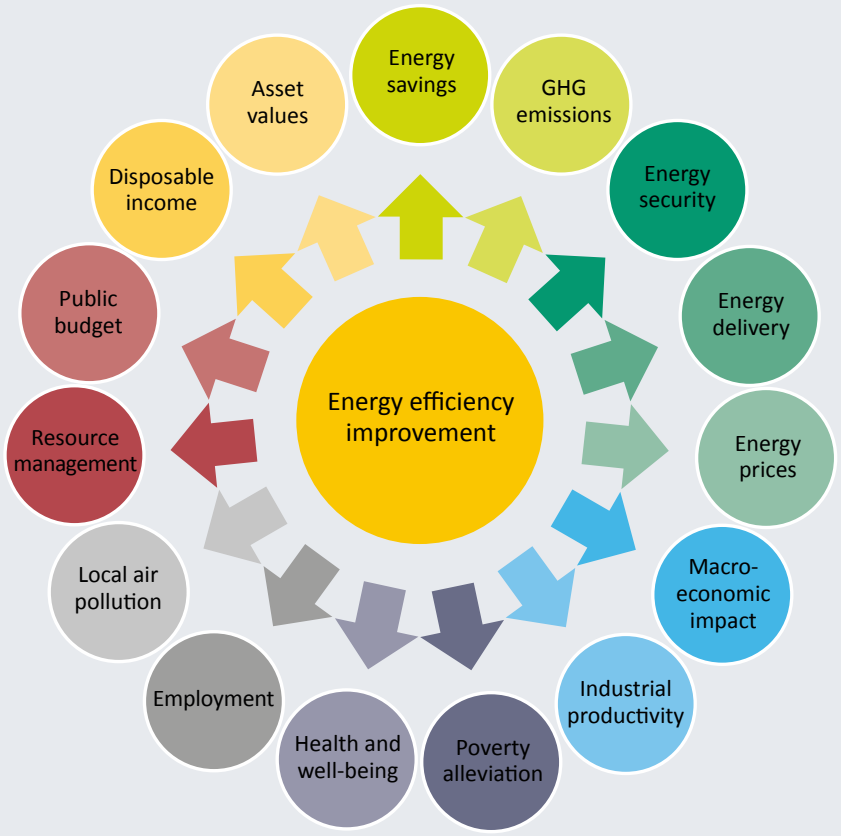
Less is more

The government gave efficiency a big push last year by publishing the National Action Plan on Energy Efficiency (NAPE). It declares energy saving the "twin pillar of the energy transition" – on a par with the roll-out of renewable energies, which has been basking in the limelight by comparison. The document argues that saving energy is so crucial because it contributes to all three main aims of German energy policy at once, making it: firstly, environmentally friendly; secondly, secure; and thirdly, affordable.

1. Efficiency and the environment: Indeed, saving energy is a fundamental and, most experts would add, neglected part of Germany's plans to cut CO_2 emissions. By 2020, the country wants to cut total energy consumption by 20 percent compared to 2008. By 2050, the target is to get by with only half the amount of energy, so CO_2 emissions can fall by at least 80 percent compared to 1990 levels (for more details, see Factsheet on Germany's climate targets). This is unchartered territory as no advanced economy has ever tried to reduce energy consumption to this extent. BUND's Pörschmann also points out that a significant cut in energy consumption means fewer wind turbines and transmission lines, which often meet local resistance, need to be built. "Efficiency can drastically reduce the need for interventions in natural habitats," he says. This also saves costs and land.

2. Efficiency and supply security: Efficiency is also seen as key to achieving a secure energy supply. Germany produces only a fraction of the energy

Figure 1 | Potential benefits of efficiency



Source: OECD/IEA

it consumes, despite all the buzz about the rise of renewables. The country imports virtually all the oil it consumes, as well as around 90 percent of hard coal and gas, with Russia being the dominant supplier. The Ukraine crisis has brought this relationship into sharp focus. "While energy trading is generally a desirable thing, energy imports also create dependencies. One way to reduce these is higher energy efficiency," states the NAPE. Stefan Thomas, from the Wuppertal Institute, told the Clean Energy Wire: "Efficiency is immensely important, because it is the biggest, fastest and most economical contribution to climate protection and to supply security."

3. Efficiency and affordability: Efficiency is key to making the Energiewende affordable, the government believes. Many experts would agree. "Countless studies have shown: A significant increase in efficiency makes the energy transition cheaper for everyone," says Patrick Graichen, head of think-tank Agora Energiewende. Graichen argues this is crucial to maintain public acceptance of the project, as rising electricity prices tend to dominate the debate about the Energiewende. In theory, efficiency can bring relief for poor households burdened by high power bills. It can also benefit companies by keeping them competitive in the global market place.

Lagging behind targets

So where does Germany stand in terms of efficiency? "Germany has undertaken big efforts, but the challenges are immense. We need to cut primary energy use by 50 percent within 35 years," says Wolfgang Eichhammer, from think-tank Fraunhofer ISI. "There is no lack of willingness to do it and a fair amount of efforts. But we must speed up the process urgently." Thomas stresses that no other country has ever taken on a com-

Table 1 | European efficiency ranking

State of energy efficiency

Country	2012 Energy Intensity*	Ranking
Malta	0.0717	1
United Kingdom	0.0746	2
Lithuania	0.0851	3
Germany	0.0884	4
Slovakia	0.0888	5
Hungary	0.0909	6
Spain	0.0925	7
Portugal	0.093	8
European Union	0.0947	
Austria	0.095	9
Poland	0.0964	10
Italy	0.101	11
Netherlands	0.1021	12
Denmark	0.1027	13
France	0.1051	14
Czech Rep.	0.1053	15
Croatia	0.106	16
Cyprus	0.1076	17
Ireland	0.1076	18
Greece	0.1096	19
Slovenia	0.1108	20
Romania	0.1135	21
Norway	0.1168	22
Latvia	0.1205	23
Bulgaria	0.1288	24
Belgium	0.1326	25
Estonia	0.1369	26
Finland	0.1488	27
Luxembourg	0.1584	28
Sweden	n.a.	

Yearly efficiency gains 2000 - 2012

Country	2000 - 2012	Ranking
Latvia	3.11 %	1
Poland	2.79 %	2
Romania	2.53 %	3
Bulgaria	2.47 %	4
Lithuania	2.02 %	5
United Kingdom	1.89 %	6
Netherlands	1.84 %	7
Norway	1.81 %	8
Slovenia	1.77 %	9
Hungary	1.60 %	10
Slovakia	1.54 %	11
EU	1.34 %	
Denmark	1.24 %	12
France	1.19 %	13
Portugal	1.15 %	14
Sweden	1.12 %	15
Croatia	1.07 %	16
Ireland	1.06 %	17
Germany	1.04 %	18
Cyprus	1.04 %	19
Czech Rep.	1.01 %	20
Austria	0.99 %	21
Belgium	0.87 %	22
Italy	0.83 %	23
Estonia	0.75 %	24
Greece	0.71 %	25
Luxembourg	0.39 %	26
Finland	0.34 %	27
Spain	0.22 %	28
Malta	0.10 %	29

* final energy intensity adjusted for differences in industry, economic structure and climate

Source: DENEFF, Fraunhofer ISI (2015)

parable challenge. "But with present policies, we can only save a quarter of energy, not half," he says.

International comparisons reveal that efficiency standards in Germany are relatively high, but recent progress is slow. The American Council for an Energy-Efficient Economy ACEEE crowned Germany a "world champion" in efficiency in a 2014 study. But an analysis by the German Industry Initiative for Energy Efficiency (DENEFF) and Fraunhofer ISI concluded: "The level of energy efficiency and efficiency policy is good, but many European countries have overtaken Germany in the past 15 years when it comes to progress in efficiency."

In 2013, the University of Stuttgart concluded a meta-analysis of more than 250 publications on effi-

ciency as follows: "With current efforts and today's regulatory framework, the government's targets will clearly be missed." The EU even started an infringement procedure in 2014 because Germany was too slow to comply with the EU Energy Efficiency Directive.

One reason for slow progress on efficiency is neglect by the previous government, which was in power until 2013. Germany adopted its central climate and efficiency targets in 2010. But the economics ministry was led by Philipp Rösler from pro-business party FDP during that time, and one of the officials in charge even publicly ridiculed the idea of efficiency, saying it reminded him of socialist planning in the former GDR. "Nothing happened on efficiency. You could have even called it a policy of efficiency prevention," says Pörschmann.

> *"With current efforts and today's regulatory framework, the government's targets will clearly be missed."* *University of Stuttgart.*

The new "Grand Coalition" government of social democrats (SPD) and conservatives (CDU) gave the subject new prominence with the publication of the NAPE in December 2014. Most experts, from both the business community and environmental NGOs, applauded the publication of the policy document, which put a lot of emphasis on creating the right conditions so efficiency can become a business opportunity and thrive without the need for financial support.

Earning money with efficiency

Volker Breisig, from consultancy PWC, said the NAPE was a turning point for energy efficiency and the companies involved. "Last year, the sombre mood in the industry left us a bit perplexed, but now we can clearly see tender shoots," he said. The German Industry Initiative for Energy Efficiency (DENEFF) estimates companies specialising in efficiency employed around 850,000 people in 2013, while sales totalled 162 billion euros. DENEFF also sees healthy growth in the sector, with sales increasing around eight percent year-on-year. Zelinger says a recent survey by his engineering association revealed an enormous potential for efficiency investments. "Almost 80 percent of companies specialising in efficiency and energy generation expect their clients to increase investments in efficient technologies."

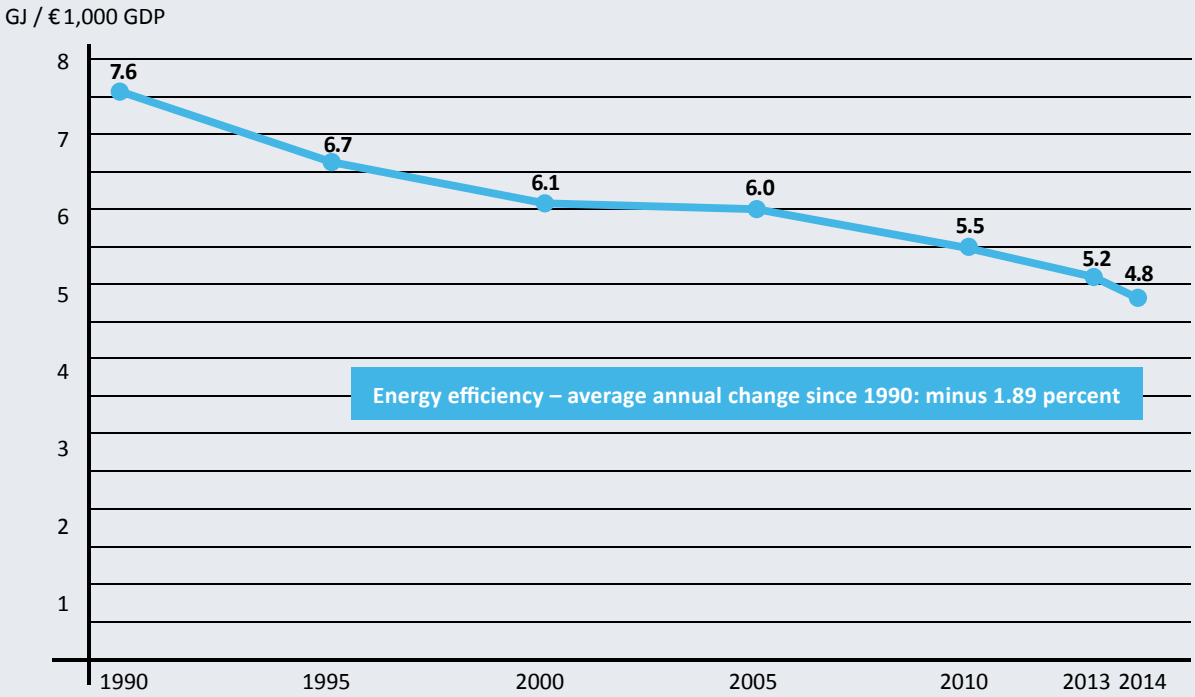
According to management consultancy PWC, efficiency is a huge business opportunity, creating many jobs in future-proof businesses. The Fraunhofer ISI's Eichhammer is convinced efficiency also offers great export potential for German companies. "Germany is in a good position. Just this morning, I had a visit from a delegation from China's National Development and Reform Commission, who wanted to find out more about efficiency," he said. "The subject is gaining traction in many countries."

There are plenty of business opportunities in the field of efficiency because many investments yield double-digit returns, while interest rates are at historic lows. Experts at the German Institute for Economic Research (DIW) even argue that efficiency investments can be an important stimulus for economic growth.

Optimists also point to encouraging signs that efficiency efforts are finally showing up in macroeconomic statistics. According to energy market research group AG Energiebilanzen (AGEB), German households and industry made great strides last year to use energy more efficiently. Just 4.8 gigajoules of energy were needed to produce goods worth 1,000 euros, in 2014. This is a drop from 5.2 gigajoules needed in 2013 and 7.6 gigajoules in 1990, according to an AGEB press release. The group said the results were "excellent" compared to other countries.

"This means Germany has increased efficiency by more than a third within the last 24 years," said

Figure 2 | Development of efficiency in Germany



Source: AGEB (2015)

Hans-Joachim Ziesing, a member of AGEB's managing board. Energy efficiency increased on average by 1.9 percent per year since 1990. Private households increased efficiency by almost six percent last year, while industry used 3.3 percent less energy to produce goods worth 1,000 euros, according to the AGEB results.

But most experts still complain the government is slow to turn the National Action Plan into reality. Many say the issue was dealt a massive setback when planned tax incentives for the insulation of buildings were blocked by Bavaria in early 2015.

The EU also believes Germany is not keeping pace on efficiency: The European Commission gave Germany a final warning in June regarding the transposition of the Energy Efficiency Directive.

> *"This means Germany has increased efficiency by more than a third within the last 24 years."*
>
> *Hans-Joachim Ziesing, AGEB.*

Can efficiency ever become "sexy"?

Given the numerous benefits of efficiency, how is it possible that progress on the issue is so slow? The reasons given for this paradox are at least as numerous as the benefits of saving energy, and they range from psychological hurdles to financing problems and technical issues.

The most often heard complaint – be it at conferences or in discussions with individuals - is that "efficiency is simply not a sexy topic".

"It's a well-known saying that efficiency is not as 'sexy' as renewable energies," reports the Wuppertal Institute's Thomas. Fraunhofer ISI'S Eich-

hammer told the Clean Energy Wire: "If efficiency could get as much attention as wind and solar energy, we would be miles ahead."

The German parliament's "Working Group Efficiency" was so frustrated with public perceptions they invited journalists to quiz them about possibilities to "sex up" efficiency in the eyes of constituents. The lawmakers were told many people were simply not interested because they thought the subject was too complicated, too multi-faceted and too diffuse. Journalists agreed efficiency was a hard sell, even in the newsroom, because few readers get passionate about building insulations and new heating systems hidden away in dark cellars – which are also a bad location for photo opportunities.

The German parliament's "Working Group Efficiency" was so frustrated with public perceptions they invited journalists to quiz them about possibilities to "sex up" efficiency.

In the eyes of most people, efficiency also has little to offer in terms of social prestige – who wants to boast about a new heating pump? "Efficiency is hidden in hundreds of appliances, machines, components, so it's difficult to get an overview. Very often, it is even invisible, so no-one can boast with it," says Thomas. Many people also associate efficiency with restraint and abstinence, which does not fit well into the dominant consumer culture.

Too poor to save

A central hurdle for many efficiency efforts is the associated cost. In most cases, efficiency gains require an initial investment.

This is why many poor households simply can't afford to save energy. A more efficient washing machine or LED bulb, both of which would cut electricity bills, are often out of reach financially.

To help people realise how much energy they can save, the German government offers a service in association with the Federation of German Consumer Organisations (VZBV). Thanks to public subsidies, consumers can book a session with an energy specialist at their home to look at ways to increase efficiency in power and heat consumption. But an advisor in Berlin, who did not want to be named, said even the nominal fee of ten euros puts poorer people off – despite average annual saving options identified in one session reaching hundreds of euros. "Most people who book this service are academics who are very energy conscious anyway," reported the advisor. Another problem is that most people vastly underestimated the significance of the topic for their wallets. Many know exactly how much petrol their car needs but few can name their home's energy consumption.

The initial investment is also a large hurdle in industry, where efficiency progress is particularly slow. "Final energy productivity is meant to increase 2.1 percent per year. But over the last five years, it only increased by 0.2 percent. So, basically, efforts need to be increased ten-fold," Noll told the Clean Energy Wire. "Companies just don't consider efficiency as part of their core business, and they demand unrealistic returns on investment." The VDMA's Zelinger says many companies will only spend money on efficiency measures if the investment pays for itself within two or three years. "This often translates into the exclusion of economically viably investments, which would yield high returns in terms of their life cycle."

A simple lack of knowledge is also often a factor in the slow progress of efficiency in industry. The government hopes to overcome this with the establishment of industry efficiency networks, where industry representatives can exchange ideas and experiences.

"These are very important to overcome non-economic hurdles to investments," explains Eichhammer.

Investors vs users

In the area of building insulation, the official aim is to renovate around two percent of buildings per year. But progress is far too slow. "The renovation rate is now probably below one percent," says Noll. Almost 40 percent of total final energy in Germany is consumed in buildings, the largest part of which is used for heating. More extensive building insulations could, in theory, also relieve consumers burdened with high energy costs. But because most Germans are tenants, efforts in this area are hampered by the so-called investor/user dilemma: Tenants are not prepared to shoulder the costs of renovations because they do not know for how long they will stay in a flat or house. Landlords, on the other hand, don't reap the benefits of lower energy bills. "The rate of renovations must increase rapidly and the issue of financing is crucial," says Eichhammer. At the Wuppertal Institute, Thomas believes the state has to double financial support to get insulation rates up to speed. Experts at think tank DIW believe it would require an additional annual investment in energy upgrades of ten to 12 billion euros to achieve an annual refurbishment rate of around two percent of buildings, which is necessary to achieve efficiency targets. Efficiency also gets neglected during the construction of new homes because many future homeowners look only at building costs, rather than long-term maintenance costs.

The issue of financing is considered a central obstacle for efficiency investments in both housing and industry. Insecurity about future energy prices and how much energy can be saved creates insecurity about amortisation times, which is why many experts believe new financing models are required to kick-start the process.

Efficiency is also making little headway in transport. One reason is that this area has been neglected by politics, according to Thomas. "Also, progress in engine efficiency has been counterbalanced by a trend to larger cars," he adds. "Transport is a hard nut to crack for politics, because it is in the interests of Germany's car manufacturers to sell large cars, which are also status symbols for their customers."

Carrots or sticks?

These problems are the reason why many proponents of efficiency make the case for binding efficiency targets, a stringent efficiency law, and new financing models to force the hand of investors. They point to the rapid rise of renewable energies due to the system of feed-in tariffs, which guarantee a steady income stream for 20 years. New building efficiency standards are a further example often cited to show that binding targets might be more effective than voluntary incentives.

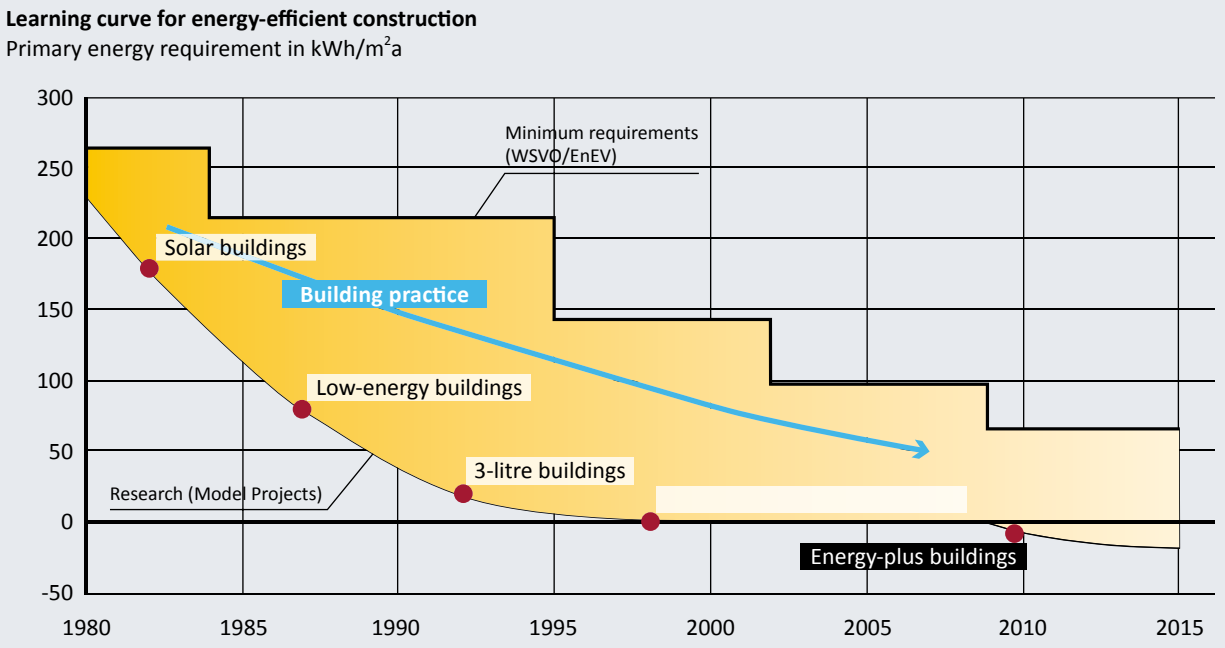
"It would be a huge progress to introduce binding targets, just like France and Denmark," argues Noll. Pörschmann agrees: "Firstly, efficiency targets are not anchored in law. Secondly, the efficiency budget is too small and not secured permanently. Thirdly, we lack an independent coordinating body which can ensure all efforts point in the right direction."

The government, however, is reluctant to introduce obligatory targets. "A culture of energy efficiency cannot be prescribed by legislative authorities," said energy minister Sigmar Gabriel (in FAZ).

Critics also insist the government must add an "efficiency first" organising principle for major investment decisions. Many infrastructure projects, such as electricity grids, are planned without ever raising the question of whether the project could become superfluous by investing the same amount of money in efficiency measures. Whenever there is a shortfall in energy provision, policymakers immediately believe generation must be increased, instead of looking for saving potentials.

> *"The rate of renovations must increase rapidly and the issue of financing is crucial."*
>
> *Wolfgang Eichhammer, Fraunhofer ISI.*

Figure 3 | Building regulations push efficiency



Source: Fraunhofer IBP, BMWi (2014)

Factsheets

- Combined heat and power – an Energiewende cornerstone?
- Details of new Climate Action Programme

www.cleanenergywire.org/dossiers/energiewende-and-efficiency

Dossier

The power market and the energy transition

The country of the Energiewende strengthens competition and flexibility

26 Aug 2015 | Jakob Schlandt

The Energiewende involves tough choices for politicians: How will Germany organise the market around the ever-increasing share of renewable energy? What happens if the sun does not shine and there is no wind?
A decision by the German government to put their trust in the free market will have long-lasting implications. Most experts agree there will be little or no investment in fossil power plants in the future, but disagree if this really matters.

Germany's green energy production is going from strength to strength. Renewable energies, driven by increases in wind and solar, contributed one third of electricity consumed in the first half of 2015. Yet the "Energiewende" is not just about producing an endless supply of green electricity, as Germans have discovered in recent years. The power grid as a whole is challenged by fluctuating production from these sources. How then will Germany keep the lights on at all times? Where will the power come from when the wind subsides and the skies are overcast on a winter day with high consumption? And, finally, what will happen to the many coal- and lignite-fired power plants that are still in service?

The German government is trying to solve these problems with a complete overhaul of the energy market design, which was outlined in a white paper in early July 2015, and has opted for a market- based rather than a state-sponsored approach. Foreigners are surprised. For Gerard Reid, Co-Founder of London-based consultancy Alexa Capital, "it is a big decision by the government to assume that the market will solve all the problems – and not one that is very typical of the German stereotype in the Anglo-Saxon world."

Rainer Baake, the Green State Secretary of the German Ministry for Economic Affairs and Energy, presented the market design at a press conference where he talked about a power market driven by prices rather than state intervention and built around the expanding share of green but fluctuating renewable energy in Germany. The theme was repeated in the white paper his government published the same day. Baake claims that his government made a fundamental decision that will influence the German market for perhaps decades. In essence, Germany's way forward is that fossil power plants will not receive systematic support for providing security of supply – even though the remaining eight nuclear power plants will shut down, one after the next, by 2022. Germany is taking a different approach than, most notably, the UK and France, who recently introduced so-called capacity market schemes. Instead, the free electricity market, where power is traded by the megawatt hour (MWh), will be updated and the focus will be on letting prices reign freely. The name of the project: Energy-Only-Market (EOM) 2.0.

Competing flexibility options – the market will pick the winners

The basic idea of the new power market design is that all options for flexibility in the system will compete to provide the cheapest solution to this problem – be it storage providers, gas power plants or demand-side management. The market will pick the winners. At the same time, electricity retailers will be bound by stricter rules to fulfil their obligations to deliver power to their customers. The state, at the same time, will guarantee that it will not mingle with prices, to ensure flexibility for investors of power plants. Baake likened this to a "constitution" for the power market. However, should the EOM fail, there will be a safety net in place. A capacity reserve of approximately four gigawatts (GW) will pick up the slack according to the plan. Importantly, these power plants will only spring into action should the free market fail completely and not be allowed to compete under normal conditions – different to a general capacity market like in the UK and France. The German government calls this "suspenders in addition to a belt."

> *"It is a big decision by the government to assume that the market will solve all the problems."*
>
> *Gerard Reid, Alexa Capital.*

A number of laws and regulations will have to be amended in the coming months – most importantly, the Energy Industry Act (Energiewirtschaftsgesetz, EnWG), the central law of the energy market other than the Renewable Energy Act (EEG). The changes are scheduled to be approved by the cabinet in the fourth quarter,

according to the timetable attached to the white paper – after talks with experts and stakeholders and a consultation have been concluded.

In early 2016, the new EnWG should be adopted by parliament. Even though it is a law that needs to be approved just by the federal parliament, the Bundestag, and not by the federal assembly of representatives of Germany's states, there might be some resistance by state governments over details of the law. But overall, Baake's claim that there is mostly agreement on the objectives of the reform is justified. Angela Merkel's coalition of Conservatives and Social Democrats has a solid majority in the Bundestag. So far, parliamentarians have not openly criticised the proposal. Even the political opposition in parliament voiced only muted disapproval. Oliver Krischer, parliamentary energy expert of the Green Party, said in a statement that the white paper lacked details. For example, projects like a reform of the grid tariffs and the regulation of smart meters had been announced a long time ago, but even the white paper could not offer detailed proposals.

> *"We don't believe that there will be incentives for investors to build new, flexible power plants that will be needed in Germany to accompany the expansion of renewable energy."*
>
> *Frank Brachvogel, BDEW.*

Power station operators: the EOM won't trigger enough investment

Owners of fossil fuel power plants lobbied hard for the introduction of a capacity market, even though the odds were never in their favour after the German government had commissioned studies, which argued in favour of the EOM, and published a green paper on the issue last year. Now, their largest lobby organisation, the German Association of Energy and Water Industries (BDEW), is less than thrilled with the results. "We don't believe that there will be incentives for investors to build new, flexible power plants that will be needed in Germany to accompany the expansion of renewable energy," says Frank Brachvogel, BDEW spokesman. BDEW reckons that even though almost ten gigawatts (GW) of fossil capacity will be added to the German grid over the next ten years, because of investment decisions taken when power prices were much higher, total capacity, which can operate independent of weather conditions, will fall by five GW by 2020 and drop fast thereafter. Market prices, however, do not reflect a shortage at the moment. On the EEX, the German energy exchange, a megawatt hour of electricity trades at around 33 euros for 2020, just slightly above the market price of today. In the view of the BDEW, it would nevertheless be only a matter of time until peak consumption of 80 GW could no longer be met and prices could spike.

The reform proposal includes some benefits for fossil power plant operators. For example, 2.7 gigawatts of lignite power plants, approximately the size of three very large power stations, will be kept on the above-mentioned emergency reserve for four years, and paid for by German consumers. Additionally, mothballed power stations in the south of Germany that cannot close down because regional generation capacity is not sufficient will receive higher compensation, including investment costs. Some economists, however, think that capacity markets are ultimately necessary. Felix Matthes, an energy

expert at the Öko-Institut Berlin, an ecological think tank, proposed an alternative capacity market design, which would have given preferential treatment to greener power plants. He says: "There is absolutely no question about the basic problem that Germany faces a power-generation shortage in the mid- to long-term." Matthes also doubts that investors will trust the political promises in the energy-only-market and calls the plans a "gigantic market experiment in Germany with potentially high volatility." Prices, according to research commissioned by the energy ministry, could go as high as several thousand euros per megawatt hour – and if necessary, this is welcomed in order to encourage investment.

"The plans are a gigantic market experiment in Germany with potentially high volatility."

Felix Matthes, Öko-Institut.

The Arrhenius Institute for Energy and Climate Policy argues in a research paper that revenues from the electricity markets are not high enough to finance the fixed cost of building and maintaining a new power plant, because prices are based on the variable cost of power stations, mostly for fuel and carbon emission certificates.

André Wolf, an economist from Hamburgisches WeltWirtschafts-Institut (HWWI), one of the leading economic research institutes in Germany, sees clear disadvantages in support schemes for fossil power plants. "A capacity market puts a lid on energy prices and ensures security of supply at a very high level, but it is potentially very costly." Nevertheless, there would be a substantial risk in sticking to an energy-only market. "Market failure can happen for a lot of reasons, such as collusion of utilities or the inability of the market to foresee capacity tightening."

"Market failure can happen for a lot of reasons, such as collusion of utilities or the inability of the market to foresee capacity tightening."

André Wolf, HWWI.

Will the state really never mingle with the power market?

Germany's largest utility, E.ON, which will be split into two companies early next year – a conventional power in one and renewables, power grids and energy services in the other – had always argued for a capacity mechanism. Nina Scholz, who oversees regulatory affairs for the Düsseldorf based company, says that the new market design "falls well short of what we expected and think is necessary to ensure security of supply". In her view, the German government declined the introduction of a capacity market by referring to regulatory risks and government intervention.

But for Scholz, the problem of government intervention could not only occur by introducing a poorly designed capacity market, but also in an energy-only market by supporting or discriminating specific technologies or types of capacity: "A gas power plant is a flexibility option for the system. But so is, for example, battery storage. Any government support scheme for battery storage would influence the margins of new gas power plants." Additionally, the question is if the German government can really stick to its promise not to mingle with the power market in the future – which would deter investors further. Ines Zenke, energy market expert at law firm Becker Büttner Held says that "from a formal point of view, it is not possible for the German government – or any other democracy – to guarantee investors that there will be no changes to the regulation of the new power market design."

Utility representatives are worried that the new energy only market won't trigger enough investment into modern power stations – like this one in Hamburg Moorburg. Photo: Vattenfall.

Future legislation could change the power market design. Nevertheless, the German government could raise the credibility of their intentions by granting investors the protection of their legitimate expectations. In her opinion Germany should do that to entice investments. Although relying on the concept of legitimate expectation could be tricky, this would at least attach a higher political price for future changes because investors could argue, in the political discourse as well as the courts that they had good faith in the German state as a whole not to interfere with high power prices.

Based on worries about the long-term legal stability of the design, BDEW questions the new power market design as a whole. "We are not convinced that the German government will stick to this approach, and eventually will change their policies when the pressure rises. There is a reason why the UK and France have opted for capacity payments," BDEW expert Brachvogel adds.

The majority of organisations welcome the EOM

Despite some pinching criticism, the decision by the government is broadly welcomed in Germany. Overall only 25 of 142 organisations that participated in the public consultation of the market design proposals, according to the economics ministry, argued in favour of the introduction of capacity payments.

Take Robert Busch for example, CEO of Germany's energy association BNE, which lobbies for the interests of challengers to the incumbent utilities. Busch said in a statement that for companies of the new and digital energy economy, the white paper would be "an important signal that shows once more that the energy transition cannot be successful with the ideas of yesterday."

Neither can the renewable energy lobby be unhappy about the result. The green energy industry feared for a while that Energy Minister Sigmar Gabriel, a Social Democrat who has spoken in support of the employees of power stations, might be inclined to make sure fossil fuel power plants receive long-term subsidies. Carsten Pfeiffer, the chief political lobbyist of the German Renewable Energy Federation (BEE), fretted last year that the "patient is obese, but somehow it gets diagnosed with anorexia and is force-fed public money." Now, he says that new flexibility options will render any support of fossil power plants superfluous. "There will be no shortage of capacity in Germany in either the short or in the long run, because new flexibility options will flood the market," he says.

"There will be no shortage of capacity in Germany in either the short or in the long run, because new flexibility options will flood the market."

Carsten Pfeiffer, BEE.

As an example, he cites that large capacities of emergency power systems run by companies could jump in if electricity shortages occur. Pfeiffer adds that in order to harness the full potential of available and future flexibility in Germany, the legislative details that will be negotiated during the coming months could be crucial. "For example, the grid operators in Germany want to stick to their old ways and are not welcome to opening the market for balancing power. But I am convinced that this is mostly a temporary problem," he says.

Holger Krawinkel, who develops and implements end-consumer business models at MVV Energie, one of the largest German municipal energy companies, is clearly convinced of the reform, too. "The EOM 2.0 is the right solution," he says. "It will help unleash most flexibility options that are existent in the current system." In the medium term, he thinks, there will be no shortage of flexibility. On the contrary: "Prices will go down, because options like home batteries or demand-side management of industries will compete with gas power stations. For fossil fuel power plant operators, this poses a problem, but not for security of supply."

However, Krawinkel thinks that the white paper and the ensuing reforms will only constitute an intermediate step. In the long run, the centrally controlled electricity system as we know it would cease to exist. Millions of producers and consumers could participate in the market, enabled by modern IT solutions, in combination with distributed production, mostly from photovoltaics, and storage. "In my view, politicians, the central government and most lobby groups have not yet realised what this will entail: A consumer-driven, fragmented market cannot be under tight state control and has very different political dynamics. Perhaps the current reform is the last reform that will see politicians in central government being in the driving seat."

What about the perspective from abroad?

Germany's neighbours support the market reform via an agreement that they would not interfere with power prices. And, according to state secretary Baake, the European Commission, too, is in favour of the new market design. "I am glad that the Commission's communication places a clear focus on the market and advocates for the flexibilisation of supply and demand and the use of price signals," he said recently in a statement. Germany, which for years mostly ignored the effects of the Energiewende abroad, is now much more keen to act in accord with Brussels and its neighbour states.

Gerard Reid from Alexa Capital sees the reform as a defeat for the incumbent fossil energy industry. In the UK, he argues, big utilities lobbied hard and eventually successfully for a capacity market – "which is nothing else than a bailout." He agrees with most commentators that no one will invest in new fossil generation capacity, but just like the renewable industry, this will not matter if other flexibility options are fully utilised. "What the EOM really needs in order to function well is even deeper markets than proposed by the German government," he says. To free all flexibility options, he proposes that electricity, like stocks, should be traded not in 15-minute intervals, but rather by the minute, or even the second. "This would encourage all possible flexibility options to enter the market. At the moment, long intervals in trading and balancing power favour big conventional power stations, which are slow to react."

Jakob Schlandt is a freelance contributor to the Clean Energy Wire. He also writes for Europolitics and BIZZ energy today and his own blog http://phasenpruefer.info.

Factsheets

- Capacity markets around the world
- Germany's power market reform: the options on the table
- Germany mulls support for fossil fuel power plants

www.cleanenergywire.org/dossiers/power-market-and-energy-transition

Dossier

Energiewende effects on power prices, costs and industry

German industry and its competitive edge in times of the Energiewende

6 Aug 2015 | Ellen Thalman

Industrial competitiveness in times of an energy transition: few issues have been watched as closely as this. So far, German manufacturers have kept their competitive edge, backed by strong exports, despite concerns about rising electricity costs. Some of the most energy-thirsty companies are actually benefitting from the lowest wholesale prices in Europe. Many are exempted from levies that fund the Energiewende. As consumers shoulder the bulk of these costs and some firms don't qualify for such privileges, the topic of competitiveness is likely to persist as the Energiewende progresses.

Is the Energiewende putting a dent in Germany's highly prized industry and driving production overseas? This question has been at the heart of many heated debates over the cost of the transition to a low-carbon economy and about who pays how much for the shift to renewable power sources like wind and solar.

The public debate has been sparked by a spate of high electricity prices for households and smaller business consumers, which rose partly with the "surcharge" on power bills that funds the expansion of renewables. That trend recently ebbed. Meanwhile, wholesale power prices have dropped dramatically, largely due to a plentiful supply of renewable power, while much of Germany's energy-intensive industry is exempted from the surcharge on retail power.

Energiewende-related costs are, of course, not limited to the price of electricity. They include building new power lines from Germany's windy north to the industrial south, dismantling nuclear power plants and investing in energy-efficiency measures like building insulation. After tough battles in 2014 among government, industry, unions and green interest groups to cut costs by reforming Germany's renewable energy law, and wrangling over new measures to cut emissions, the country now faces a power market reform. The latest government proposal to cut emissions opts to keep some old, coal-fired plants on stand-by in an emergency reserve, before eventually decommissioning them. This has also stoked concerns over future cost burdens.

At the same time, the German government has made "competitiveness" an explicit policy goal of its Energiewende, an objective some fear could hamper the big push for green power. Critics of the project claim that cutting emissions and casting off fossil fuels and nuclear power – its long-term ambitions – are too much for the economy to bear all at once. They also cite worries over the changing regulatory environment and fears about the security of supply through wind and solar power that fluctuates with the weather. This, they warn, could induce companies to set up shop elsewhere – like in the US, where they can benefit from cheap shale gas and what they see as a more business-friendly regulatory environment.

"The Energiewende has to become an economic success story," said Rainer Baake, state secretary for energy in the economics ministry at a recent event in Berlin. "If energy intensive industry leaves, nobody will follow suit." Germany hopes to be an ecological and economic role model for other countries – it emits just 3 percent of the world's CO_2 – leveraging its impact as a standard bearer is an important aspect of the project.

No sign of losing competitive edge so far

The German government is confident it can uphold its green energy goals without compromising competitiveness. By 2020, it aims to garner 35 percent of the power the country consumes from renewables, up from around 27.8 percent in 2014 and around 33 percent in the first half of 2015. So far, economic data show a country that is neither losing its manufacturing base nor its competitive edge. Germany currently enjoys record employment, a growing economy and rising exports despite the crisis of some of its key markets in the euro zone. Protests from an unlikely alliance of industry and workers' representatives who say the Energiewende is a threat are countered by those who say the economy remains unscathed or is even thriving, thanks to the transition. That is because renewables have created jobs and spurred innovation, and brought down wholesale prices.

Lower wholesale prices and exemptions from levies that fund investment in renewables have buffered large users of electricity, says Jürgen Weiss, energy economist at The Brattle Group in Boston. Weiss told the Clean Energy Wire: "My sense is that the impact of the Energiewende on competitiveness has been exaggerated."

> *"The Energiewende has to become an economic success story."*
>
> *State secretary Rainer Baake.*

And since Germany's renewed commitment to phase out nuclear power after the disaster in Fukushima, Japan, its exports have increased by 17 percent in real terms. Output from manufacturing rose by around 10 percent between the end of 2010 and 2014, employment in the manufacturing industry was up 7 percent and overall more people are in work in Germany than ever before and unemployment is falling despite strong immigration.

The energy-thirsty manufacturing sector makes up about 22 percent of gross domestic product, compared to 15 percent in the EU on average. Around 15 percent of Germany's workforce is employed in sectors that export products as diverse as automobiles, chemicals, machine tools, electronics or steel. These exports are a big driver of economic growth in a country that is the world's fourth-largest exporter, not to mention the fourth-largest economy. Thus, much is staked on industrial competitiveness.

> *"The goals of the government are much too ambitious. Everything is meant to happen far too quickly: The nuclear exit, the roll-back of CO_2 emissions."*
>
> *Marijn Dekkers, VCI.*

Indeed, Germany has long ranked among the top five in key global competitiveness indices. According to the World Economic Forum's 2014 European Competitiveness Report, "German companies are among the most innovative in the world, with heavy spending on R&D (ranked 4th)—notably with an increase from 2.5 to 2.8 percent of GDP in both public and private sectors between 2010 and 2012—and displaying a high capacity for innovation (2nd)."

The Energiewende is frequently cited as a driver of that innovation. Germany's machinery industry, for example, is home to many energy intensive companies that also produce the moving parts for the renewables industry. Many of these outfits belong to the "Mittelstand," typically family-owned businesses that are often described as the backbone of the economy. The German Engineering Association VDMA, comprised of around 3,000 manufacturers, walks a tightrope between supporting the energy transition and ensuring that the regulatory environment – like exemptions from levies - remains favourable to its businesses.

"The machinery industry is developing the technology that is making the Energiewende economically possible," said VDMA Executive Director Thilo Brodtmann. "The Energiewende 'made in Germany' will only be attractive globally if it is economically successful. Today already, the machinery industry exports around two-thirds of its goods to other European countries and around the world. We have the key technologies that will be in demand in the future."

Mixed view of the Energiewende among industry branches

The intensity of criticism differs widely among industry branches. But while these may diverge, nearly all are adamant about one thing: exemptions from the renewables surcharge must remain in place to protect certain sectors and thus the economy in general. This surcharge is added to electricity bills and pays the difference between the wholesale market price and a state-guaranteed price to investors in renewable facilities like wind or solar parks.

A 2014 study by the research group IHS, which was sponsored by the Chemicals Industry Association (VCI), said that if exemptions were phased out, GDP in Germany would be nearly 5 percent lower by 2020.

Large users with significant power costs (those who use about a sixth of all power consumed in Germany) are partially or wholly relieved from the surcharge. These include companies like chemicals maker BASF or steel and technology company ThyssenKrupp. Business is eager to hang on to these exemptions, and executives are vocal about the need to maintain these policies in the future.

Weiss of the Brattle Group says: "The general concept of exempting companies in energy intensive and trade-exposed sectors, while unpopular among individual ratepayers, has likely helped shield those companies from the effects of higher domestic prices." At the same time, "This does not mean that certain companies in certain industries are not negatively impacted."

> *"There is currently a "high level of political insecurity in the business sector."*
>
> *Holger Lösch, BDI.*

Among the loudest voices arguing against the Energiewende has been the VCI chemicals industry association, home to some of Germany's most energy-intensive companies, and also to a number of medium-sized "Mittelstand" companies.

Marijn Dekkers, VCI President and CEO of big German chemicals and pharmaceuticals company Bayer, told the mass-market Bild newspaper in June: "The goals of the government are much too ambitious. Everything is meant to happen far too quickly: The nuclear exit, the roll-back of CO_2 emissions." According to Dekkers, this policy has caused a rapid rise in prices, which has been most damaging to medium-sized chemicals companies. "This (segment) is very energy intensive and can't just move production abroad."

In 2015, the number of companies eligible for exemption from the renewables surcharge rose by 5.3 percent to 2,461 in total, including 280 off-takers in the chemicals and pharma industry, according to the Economics and Energy Ministry. Chemicals was the third-largest industrial group exempted, with by far the largest amount of power at 27,600 gigawatt-hours, compared to the next highest, the steel and iron ore industry at 10,700 gigawatt-hours. There are around 2,000 chemicals companies in Germany, according to the Chemicals Industry Association VCI.

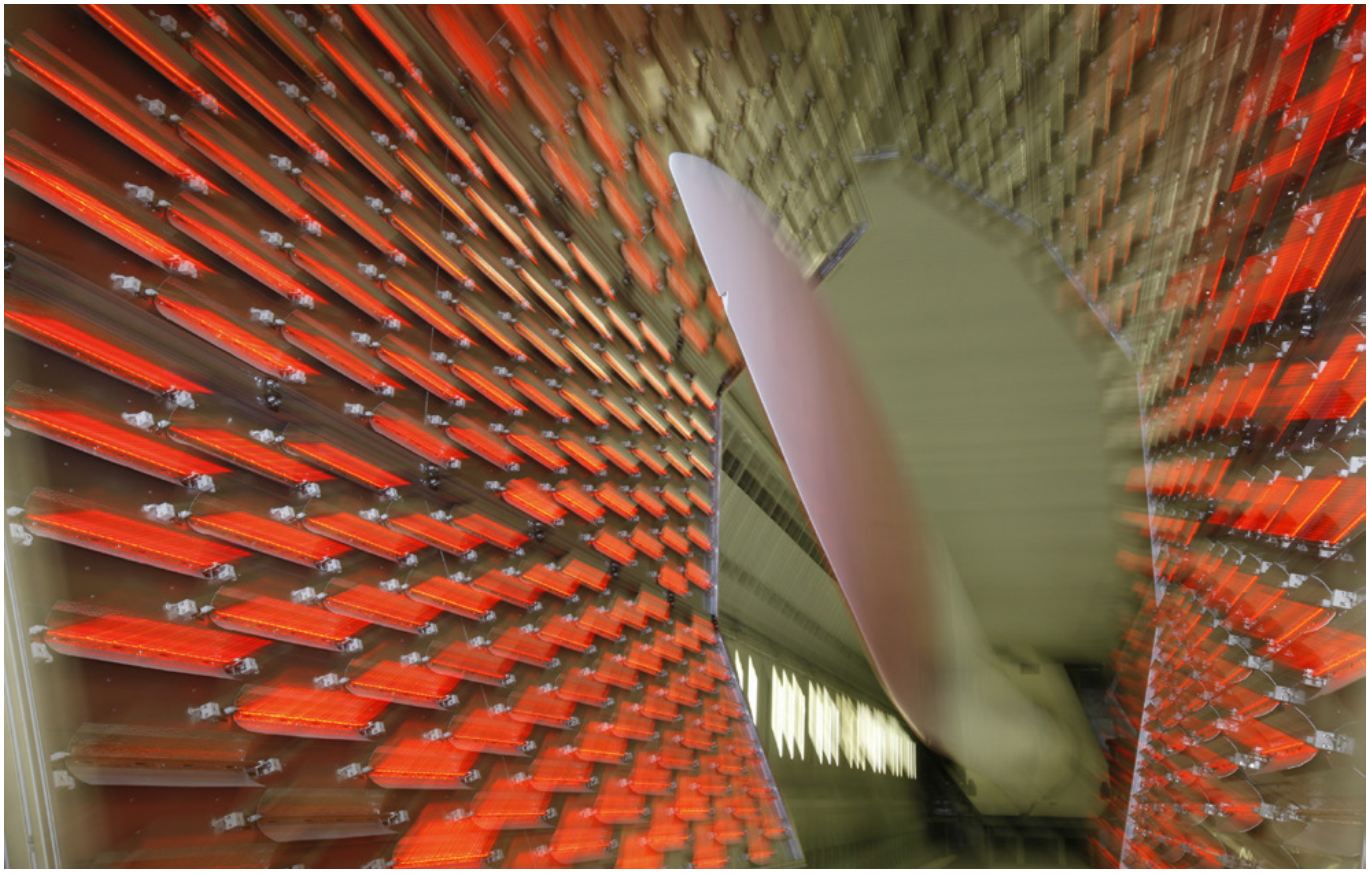
For all its worry mongering, the chemicals industry said in December that it had invested 7 billion euros in Germany in 2014, up 2 percent from 2013, half of which was spent on expansion of production capacities. For 2015, it said it was "cautiously optimistic."

Indeed, a 2015 Ecofys and Fraunhofer ISI study comparing electricity prices, network charges and privileging criteria for companies in 10 countries showed that, across the board, "Energy-intensive, large-scale consumers from the metalworking industry and the chemical industry pay the lowest electricity prices.Furthermore, Aluminium and copper producers, and also electric arc furnace operators, pay no or significantly reduced taxes and levies and low network charges." Stressing the importance of exemptions, the think tanks said, "the German price without privileges would be much higher than electricity prices in other countries."

Industry has policy jitters

Industry leaders from many branches have repeatedly said they want more certainty on future energy policy. This is not limited to exemptions on the surcharge. A number of political decisions are slated for the next few years – from reforming the German and EU power markets to the question of ensuring reliable power supply as the share of fluctuating renewable electricity grows in the power mix.

"Especially mid-sized companies must find their way in the Energiewende," VDMA President Reinhold Festge said recently. "Reliable regulatory conditions and security of supply are for them the most important thing."



German Engineering Federation VDMA sees the positive effects for new industries such as wind turbine manufacturing but asks for improvements in policy making. Photo: Nordex SE via VDMA.

Holger Lösch, a member of the executive board at the BDI Federation of German Industries, also warned at an Energiewende event in Berlin that there is currently a "high level of political insecurity in the business sector."

That mood is unsurprising against a backdrop of reports like the chemicals industry-sponsored IHS study, which ominously predicted that "the current high-cost energy path will make Germany less competitive in the world economy, penalize Germany in terms of jobs and industrial investment and impose a cost on the overall economy and household income."

But industry has recently toned down its criticism of moving the economy to a low-carbon future, focusing more on improvements in policy than on rolling back the project altogether.

> *"We are seeing a creeping exodus of energy intensive industries."*
>
> *Jochen Leonhardt, BVMW.*

In its 2014 Energiewendebarometer, the VDMA said that while 85 percent of its companies surveyed were unhappy with the political implementation of the project, saying improvements were necessary, 63 percent saw the Energiewende as an opportunity, expecting "positive effects," although this figure was down from 65 percent in 2013.

And there is broad agreement in German society that the Energiewende is worth the cost, compared to the high price of climate change and the often hidden costs of the old energy system – subsidies for coal, renovation of old, coal-fired plants, nuclear waste disposal, or the risk of relying on Russia for gas, to name a few.

According to a 2012 study by Joachim Nitsch at the German Aerospace Centre,

the extra costs for the Energiewende "are clearly below the as yet unaccrued costs of damage to the climate, and below the costs for subsidising the fossil fuel energy sector." To enhance the security of supply and lower expenses over the long term, the government aims to cut fossil fuel consumption to 40 percent of overall energy (not just electricity) consumption by 2050.

The fly in the ointment: Investment

One sticky issue for the German economy is sluggish private investment. Critics, such as the DIHK German Chamber of Commerce, argue that this is a sign of a slow, grinding process in which companies scale back investment due to uncertainties in the business environment. Over the long run, this hurts growth prospects and jobs.

The country's overall sluggish private investment has long been a concern and possible explanations are heatedly debated. According to Marcel Fratzscher, president of the DIW German Institute for Economic Research, who headed a group of experts looking into possible solutions: "Since 1999, Germany has amassed an investment deficit of around a trillion euros and thus has missed out on considerable growth potential." The DIW estimates that Germany should be investing around 3 percent more of GDP, or about 75 billion euros a year.

In its 2014 annual Energiewende-Barometer, the DIHK said companies were hesitant about new investment projects, citing uncertainty over the surcharge exemption for self-produced power, and worries about the reliability of supply due to the nuclear phase-out and the slow expansion of the network, especially in southern Germany.

> *"A hesitancy to invest is likely mainly related to high energy prices and insecurities about the future direction of energy policy."*
>
> *Deutsche Bank Research.*

Jochen Leonhardt, member of the board of the BVMW German Association of Small and Medium-sized Businesses said recently that, "we are seeing a creeping exodus of energy intensive industries." It was not that plants or production that were being shut down in Germany, instead "new investment is often carried out abroad, where energy costs are lower."

Deutsche Bank Research says that the real capital stock of the chemicals industry has even decreased in recent years – the only export sector in which this has occurred. "A hesitancy to invest is likely mainly related to high energy prices and insecurities about the future direction of energy policy," the researchers said in a report in March.

Prices are a bugbear, but may not reveal much about competitiveness

Just how much are these costs affecting business? Of the some 24 billion euros consumers paid in levies to finance renewables in 2014, private households paid 8.3 billion euros, while industry paid 7.4 billion (with commercial enterprises, including services, paying 12.5 billion euros in total), according to the BDEW Association of Energy and Water Industries.

While commercial customers are the largest power user in Germany, consuming almost 70 percent of overall production, (followed by households with 28 percent), big, energy intensive industry benefits from over 20 different exemptions from taxes, levies and surcharges. Those apply to certain, but not all, industrial power customers, but not to households. This has meant retail consumers and less energy-intensive – often smaller - businesses have been footing the bill.

The exemptions, along with a broad range of wholesale and retail electricity prices, which depend on how companies source their power, have created huge differences in what buyers pay for power.

The steep rise in power prices in the years after renewables subsidies began has been the source of much criticism. But Andreas Löschel, energy economist at the Centre for European Economic Research (ZEW) and part of the independent group that evaluates the government's annual Energiewende progress report, says prices are not a good indicator of competitiveness. Instead, "unit energy cost" - how much energy it takes to create one unit of gross domestic product (GDP) - could provide clues as to how Energiewende costs are affecting the economy. This is also known as energy intensity - the higher the unit cost, the higher the price of energy for generating economic growth.

Löschel says a big problem is that cost comparisons by industry sector and country are hampered by a lack of data. This is especially true of the manufacturing sector – the very sector that has been the subject of the most heated debates.

Nevertheless, Löschel does not see indications that Germany is losing competitiveness. "All in all, the problems do not appear to be very big," Löschel told Clean Energy Wire. While electricity expenditures for end users rose from 2010 to 2013 – by around 10 billion euros, or 16 percent – these ticked only up to 2.6 percent in relation to GDP in 2013 from 2.5 percent in 2012 and were bearly higher than at the beginning of the 1990s, Löschel said in a recent report. "But this is not to say that problems don't exist when the data is broken down by sector," he added.

> *"Competitiveness problems do not appear to be very big."*
>
> *Andreas Löschel, ZEW.*

Unit energy costs for the chemicals industry, for example – outspoken critics of the transition – have remained steady over the years, according to Löschel's data. The trick is to pinpoint specific segments of the chemicals industry that may be under pressure. "Finer data is needed," Löschel said.

Big, industrial users largely exempt from renewables surcharge

The renewables surcharge has risen more than fivefold since 2009. For smaller industrial users, power prices rose some 12 percent between 2008 and 2014, according to the German Statistics Office. Before 2008, higher prices for generating power were the main driver, but that has since been replaced by levies. Companies that aren't exempted from levies have had to pay an ever-increasing surcharge for renewable energy, which is the "main reason" for rising power prices, according to energy statistics provider AG Energiebilanzen.

Exempting energy-intense users from the renewables surcharge means others have to pay more for the move to renewables. This raises the surcharge by 1.36 cents, or some 28 percent, according to the BDEW Association of German Water and Energy Industries. And this is unlikely to change as the new renewable energy law of 2014 – designed to cut costs through market reforms for new renewables installations – kept subsidies for large users stable at 5 billion euros a year, according to Economy Minister Sigmar Gabriel.

For the first time in years, the levy fell in 2015, by 1.1 percent to 6.17 cents per kilowatt hour. Germany's four grid operators set the levy each year by estimating how much money they will have to pay renewables producers to cover the cost of the "feed-in tariff." The jury is out as to whether this is a shift in the 15-year trend of rising surcharges, or whether it is a one-off effect because operators paid too much to green power producers last year. As new renewable energy facilities come onto the grid, more money must be paid out in fees.

Energy think-tank Agora Energiewende said in 2015 that it expected the surcharge to fall steadily starting in 2023, while the share of renewables in the power mix will rise to 60 percent by 2035.

> *"There is no very good argument why only companies above a certain size should benefit from these exemptions."*
>
> *Jürgen Weiss, Brattle Group.*

Wholesale prices have fallen

Perhaps surprisingly, the energy transition has actually pushed some power prices lower: The wholesale price for electricity on the power exchange has fallen by more than half since reaching its ten-year peak in 2008. While this was in part due to the global financial crisis that began the same year, a larger supply of cheap green power is also driving more expensive conventional power out of the market.

Wholesale prices in Germany were among the lowest in Europe in the fourth quarter of 2014, due in part to renewables generation, a report from the EU Commission shows. For example, Dutch aluminium smelter Aldel last year filed for insolvency, blaming uncompetitive production costs on the big difference in power prices between the Netherlands and surrounding countries. The power price can make up as much as 40 percent of the production cost for aluminium.

But wholesale prices are only one way to compare industrial end-user prices, and they do not always reflect what customers pay. Large users may make their own power, have long-term power purchase agreements independent of the market, or they may lease entire power plants from utilities. That can make the average price for these users intransparent and means it is only partially governed by regulatory and market developments.

Wholesale prices can help compare energy costs for industry, because they do not include levy exemptions. But even this is difficult. The BDEW gives a wholesale price range of 4.5 cents per kilowatt-hour (kwh), the lowest level in 17 years, to 15 cents, the highest in the period.

Internationally, a study by think tanks Ecofys and Fraunhofer-ISI, commissioned by the German government, estimated industrial power prices in Germany to be somewhat higher than those in the large US state of Texas. In an example, a company in the metals industry using 1,000 gigawatt-hours of power and a 20 percent share of electricity paid around 4.95 cents per kilowatt-hour in Germany in 2013 and 3.91 cents per kilowatt-hour in Texas in 2012. Those included subsidies, taxes, fees and exemptions. Cheaper power in the US, largely due to the rise in shale gas production, has been cited as one reason companies were considering moving production there.

Indicators needed to guide policy

Even staunch proponents of the Energiewende agree that some companies do fall through the cracks: businesses that need a lot of energy for production, but whose overall consumption is not high enough to qualify for relief. It is very hard to evaluate how these companies are faring because "there is no data," Ralf Wiegert from IHS told the Clean Energy Wire.

The Brattle Group's Weiss notes the importance of some of these companies to the German economy. "Germany's success is built on small and medium sized companies. It is certainly possible that many of those are exposed to international trade and are also relatively energy intensive," he says.

The exemption system should be evaluated to ensure it benefits energy-intensive companies that are important contributors to the economy. "There is no very good argument why only companies above a certain size should benefit from these exemptions," he says.

Looking ahead, the government will have to find a way to assess how the Energiewende affects the different sectors of industry, including improving data breakdowns within sectors to evaluate which areas are suffering.

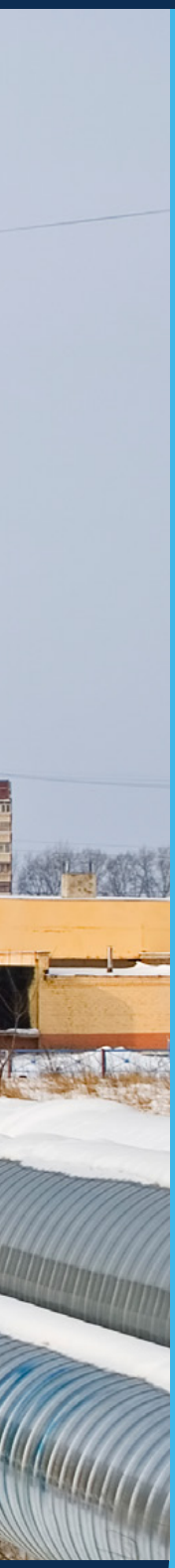
Making competitiveness a goal of the Energiewende should be accompanied by indicators – like energy unit costs – that help guide policy decisions, said the independent group of experts asked to examine the government's progress report in December. Without quantitative goals for competitiveness – like the government has for emissions or the share of renewables in the power mix – political conflicts could arise that whittle away at the very foundation of the Energiewende. According to the experts, this could "lead to an implicit revision of climate targets and the nuclear exit, through an intransparent process of weighing up advantages and disadvantages of political goals."

Ellen Thalman is a freelance contributor to the Clean Energy Wire. She has also written for The Wall Street Journal, Dow Jones Newswires and Development + Cooperation (E+Z/D+C) magazine, among others.

Factsheets

- Industrial power prices and the Energiewende
- Setting the power price: the merit order effect
- Balancing the books: Germany's "green energy account"
- Where the Energiewende creates jobs
- What German households pay for power

www.cleanenergywire.org/dossiers/energiewende-effects-power-prices-costs-and-industry



Dossier

The Energiewende and its implications for international security

Energy transition shapes foreign policy in Germany and beyond

8 Jul 2015 | Sören Amelang

Energy supply is inseparable from German foreign policy, as the country relies on imports to feed its energy appetite. The Ukraine crisis has brought the risks of Germany's dependence on oil, gas and coal from Russia into focus. While some experts warn against cutting these energy ties, others argue for an accelerated shift to renewables in order to boost international security. At the same time, the implications of a low-carbon future for foreign and security policy are hardly limited to energy supply security. If Germany manages to make its energy transition a success story, it can have profound geopolitical repercussions, and its impact might be felt across the globe.

Germany's transition to a low-carbon and nuclear-free economy has largely been a domestic environmental project, whose impact on international relations was only peripherally on the public agenda. But this has begun to change, as issues like the Ukraine crisis or integrating the EU power market have highlighted the links between the Energiewende and foreign policy. According to Wolfgang Ischinger, chairman of the Munich Security Conference, the world's largest gathering of its kind, energy and diplomacy have always been closely connected: "Energy policy is European security policy".

When tensions between Ukraine and Russia – and subsequently with Russia's European partners – erupted in 2014, there was much talk about Germany's reliance on energy imports. Russia is the country's largest supplier of oil, gas and coal. Government officials have highlighted that the Energiewende can play a significant role in mitigating such risks. The German Minister for Economic Affairs and Energy (BMWi), Sigmar Gabriel, told representatives from 60 countries at an event showcasing the energy transition as a global project in March that the Energiewende "will enable us to reduce our dependence on oil and gas imports while reaching our climate protection targets and, not least of all, advancing the development and use of new and promising technologies in global markets." Germany's exit from nuclear power, and the depletion of already limited domestic resources, will maintain its reliance on fossil fuels from abroad for some time to come, according to experts. But in the longer term, the expansion of renewables and rising efficiency to meet climate targets can reduce the need for imports.

At the same time, the impact of the Energiewende on international relations reaches far beyond energy supply security. While more renewable power may help defuse global conflicts over fossil fuels like oil, it could also weaken longstanding trading partnerships that have been a bulwark against conflict, some security analysts argue. Russia needs buyers as much as its trading partners need gas. Such mutual dependencies have provided an incentive for maintaining diplomatic stability, they say. If Germany shifts successfully towards a low-carbon future, many countries may well follow suit. Foreign policy experts say this would profoundly alter global power relations, currently heavily influenced by fossil fuel dependency. Security experts also warn that climate change starts to have grave implications for international security – for example, by destabilising fragile nation states – which adds to the importance of cutting carbon emissions through projects like the Energiewende. Lastly, the Energiewende's success has become important to Germany's credibility on the global stage, analysts say.

Germany is powered by vast amounts of fossil fuels from abroad

Despite the rapid rise of renewables, Germany remains dependent on fossil fuel imports. The share of renewables in gross power consumption rose to 27.8 percent in 2014, with first estimates showing a rise to nearly one third in the first half of 2015. But because the Energiewende has focused on electricity, mostly bypassing other energy-hungry sectors such as heating and transport, green energy's share in primary energy consumption was only 11.1 percent.

As one of the world's largest energy consumers, Germany has to import most of its energy fuel. "Although energy demand in Germany has been falling for years, the country's dependency on imported energy sources will increase with the continuing decline in domestic production," predicts the Federal Institute for Geosciences and Natural Resources (BGR). According to this institute, Germany imports about 98 percent of its crude oil, 88 percent of natural gas, about 87 percent of (hard) coal, and 100 percent of uranium.

> *"Energy policy is European security policy."*
>
> *Wolfgang Irschinger, Munich Security Conference.*

Tensions in Ukraine have highlighted that Russia supplies 35 percent of the oil Germany needs, 39 percent of the gas, and 29 percent of hard coal.

Medium- and long-term effects of the Energiewende

Until recently, there was little discussion of how the Energiewende could affect supply security in terms of foreign policy. "Up until 2014, there was no such debate in Germany," says Christian Hübner from the Konrad Adenauer Stiftung, where he has built up the renewable energy department. The Ukraine crisis has catapulted the topic into the mainstream. "The Ukraine/Russia crisis suddenly put the import dependency on fossil energies in the limelight of the political discussion," writes Matthias Ruchser from the German Development Institute (DIE).

"The Ukraine/Russia crisis suddenly put the import dependency on fossil energies in the limelight of the political discussion."

Matthias Ruchser, DIE.

This trend was reflected at this year's high-level Energy Security Summit. The implications of the Energiewende for supply security took centre stage on the agenda of the meeting of researchers, international policy makers and industry representatives hosted by Munich Security Conference in Berlin. Among others, state

Renewable power plants in northern Germany: Self-sufficiency with wind and solar instead of dependency on imported energy? Photo: CLEW.

secretary Stephan Steinlein from the foreign ministry argued that renewables and efficiency should provide a springboard for thinking about future supply security.

Energy experts Hanns Günther Hilpert and Kirsten Westphal from the German Institute for International and Security Affairs (SWP), concluded a recent analysis, saying that "Given volatile price developments and growing geopolitical risks, the Energiewende is the most important pillar for Germany's supply security, because it is the most reliable part of energy policy." Westphal has said expanding renewables is a "strategic imperative" for Germany that can increase policy leeway and negotiating clout.

How exactly will the Energiewende impact Germany's energy supply dependencies? The long-term goals are spelled out in the country's long-term climate targets. By 2050, Germany aims to cut CO_2 emissions by 80 to 95 percent. This is to be achieved by halving gross energy consumption over 2008 levels, while increasing the share of renewable energies to 60 percent. These targets imply that by 2050, Germany will make great strides towards energy independence.

But in the short and medium term, the effects of the Energiewende on supply security are much less clear-cut. The limited domestic production of oil and gas will decrease even further in coming years because of depleting resources, rising the share of imports even further. Mining of hard coal within Germany will be phased out in a few years' time because it is too expensive. And the government plans to reign in production of brown coal to keep emission targets within reach. But experts agree that weaning Germany off imported energy will be a long and arduous process. Germany's phase-out of nuclear energy by 2022 adds to this challenge, because fossil-generated power will remain part of the energy mix for quite a while. Additionally, the Energiewende has so far been focused mainly on the power sector. If Germany wants to reduce oil imports, it has to cut consumption in the transport sector, for example with e-cars. Because gas is mainly burned in homes to produce heat, the insulation of buildings is key to reducing imports.

> *"Expanding renewables is a 'strategic imperative' for Germany."* *Kirsten Westphal, SWP.*

The case of Russia: Who is dependent on whom?

Foreign policy experts stress that simply loosening Germany's particular dependence on Russia is not without risks from a security policy point of view and might even backfire. Friedberg Pflüger, former state secretary in the Ministry of Defence and now Director of the European Centre for Energy and Resource Security at London's Kings College, laments that Europeans only think in terms of supply security. He stresses that security is also vital to producers, because those must shoulder massive investments to extract and transport fossil fuels. The Economist also argues that greater efficiency and the roll-out of renewables "will shift the balance of power, because it will signal a fundamental truth: in the end, the Kremlin needs its European customers at least as much as they need Russian imports."

This mutual dependence is underscored by Russia's perception of the Energiewende. "Experts from Russia clearly see the changeover to renewable energy as a threat. A threat to their economy," says the Konrad Adenauer Stiftung's Hübner. In 2014, the conservative think tank asked companies, NGOs, government officials and science experts from the BRICS countries – Brazil, Russia, India, China and South Africa - about their perceptions of the Energiewende. In contrast to experts from other countries, the Russians interpreted the Energiewende foremost as Germany's effort to become more independent of Russia. According to Hübner, the Russians believed "that a successful Energiewende in Germany poses

a threat to Russia: namely, that it would lose an export market in the long term."

Many foreign policy experts also argue that breaking down this interdependence might not make the world a safer place – and could even do harm. Ever since a ground-breaking deal in the 1970s, enabling German companies to provide pipelines for transporting Russian gas to Germany, the commodity has been a cornerstone of the diplomatic relationship between Germany and Russia. Russia and West Germany "managed to establish a reliable energy partnership," explains Pflüger. "It worked because it was not a one-sided dependence. Just as Germany needed an affordable and stable flow of gas, Russia needed stable demand. Over decades, this interdependence has proved to be a stabilising factor in foreign policy."

"Experts from Russia clearly see the changeover to renewable energy as a threat. A threat to their economy."

Christian Hübner, KAS.

Speeding up the Energiewende

Reducing Germany's dependence on Russia may also merely shift its reliance to other sources. "The lesson we should learn from the Russian dependency is not to diversify the origins of fossil energy forms by entering into new dependencies with other autocratic states," argues Ruchser from the German Development Institute. Instead, he wants to speed up the implementation of the Energiewende and to focus more on the heat and transport sector. A study for Germany's Armed Forces (the Bundeswehr) from 2011 reaches a similar conclusion: The authors recommend a quick rollout of renewable energy for more leeway in foreign policy. But Russia's role as an energy supplier might still increase, they say, and Germany should continue to deepen its interdependence with Russia.

The German government is also working to portray the Energiewende as a role model for other countries. Because its greenhouse gas emissions only amount to little more than two percent of global output, Germany's energy transition can only help mitigate climate change if other countries join in. This also explains why the government made energy supply a central theme of its G7 presidency, hoping to pave the way to a successful climate summit in Paris at the end of the year. At the June G7 summit in Elmau in the South of Germany, chancellor Angela Merkel successfully pushed the other industrialised countries to a committment to decarbonise their economies this century – in effect subscribing to a G7 energy transition.

State secretary Steinlein insists the Energiewende must become a global project in order to have an impact on climate change. "We are the world's laboratory," he says. "Whatever succeeds here will inspire hope and courage; whatever fails might not even be attempted elsewhere. We are the pioneers and the world is watching us."

Many experts agree. "With its energy transition Germany plays a global pioneering role, both for the shape of the transformation and for the terms of the transitional period," says foreign policy expert Westphal. According to her, this makes the energy transition one of Germany's most important political projects. If it fails, Westphal argues, "there would be good reason to doubt that any other country would be able to assemble the arguments and resources for a complete conversion of its energy system."

Matthias Ruchser from the German Development Institute notes that this is particularly important for the developing world. "If Germany successfully achieves the energy transition and shows that competitiveness, employment and climate protection can all be achieved at the same time, then this model will be copied, including in many developing and

emerging countries," he argues, noting that many developing countries are also dependent on fossil fuel imports.

Making solar competitive

According to Felix Matthes from the Institute for Applied Ecology, the Energiewende has already fostered this global transformation by making solar power competitive. Matthes argues the German system of financial support for renewable energy through feed-in tariffs put solar technology on track to become the world's most important energy source, according to IEA forecasts. The International Renewable Energy Agency (IRENA) reached the same conclusion in a report on global renewable energy targets: "If all countries had adopted a technology-neutral approach, it is unlikely that the dramatic cost declines in solar PV would have occurred when they did, as these were supported by the presence of large markets (most notably, Germany) that drove competition, cost reduction (in both hard and soft costs) and private-sector led investments in R&D."

Making renewables competitive "is a world-saving achievement."

Thomas Friedman, New York Times.

So it's at least partly due to the Energiewende that financial markets expect a spectacular global rise in solar power. Deutsche Bank, for example, predicted a "second gold rush" thanks to rapidly declining costs, which are set to fall further, according to a study by Fraunhofer ISE for think tank Agora Energiewende.

New York Times columnist Thomas Friedman went as far as suggesting the Energiewende should earn Germany a Nobel Peace Prize. Making renewables competitive "is a world-saving achievement," writes Friedman. "What the Germans have done in converting almost 30 percent of their electric grid to solar and wind energy from near zero in about 15 years has been a great contribution to the stability of our planet and its climate."

A policy for peace?

If solar energy is truly about to take off on a global scale, many of the world's current energy interdependencies, and thus the global political landscape will be altered. Policy advisor Westphal writes the Energiewende's contribution to international security and conflict prevention should not be underestimated: "In the medium term, cheaper and more efficient renewables could help to reduce energy poverty and defuse national and international access and distribution conflicts over expensive fossil fuels."

The Nobel Peace Prize recipient, International Physicians for the Prevention of Nuclear War, in 2013 started the campaign "Local Power for Peace". Pointing out that most military conflicts were partly about access to oil and other energy resources, the group said, "the local production of renewable energies is the central key to a more peaceful world."

Some experts also argue the Energiewende could become essential to avoiding conflicts related to climate change. State secretary Steinlein said climate change already had "dramatic implications for international security policy," naming refugees and tensions due to degrading environments as examples. "Climate change transforms conflicts and crises on a global scale", he said. A recent G7 study also concluded that "climate change is a global threat to security in the 21st century".

Nevertheless, the project is not without conflict. Some of Germany's neighbours have criticised the Energiewende's damaging effects on their power grids, calling

the project a unilateral initiative in an integrated European market. The rapid expansion of renewables and the malfunctioning EU emissions trading scheme have meant cheap German electricity from coal and renewables regularly floods neighbouring countries like Poland and the Czech Republic.

Germany bets its future on Energiewende's success

Frequently defining the Energiewende as Germany's "Man to the Moon" project, the government has staked the country's international reputation on the success of the energy transition. It is actively marketing the Energiewende abroad in order to "pave the way, through a process of dialogue with its international partners, towards a global energy transition".

The government also hopes a global Energiewende will increase demand for technology "made in Germany" and cement the country's export prowess in years to come. Chancellor Angela Merkel said at this year's industry trade show Hannover Messe that Germany needed to defend its world leadership in renewable energies. "There are 130, 140 countries that support their production of renewable energies, that make the transition step by step. Here also, Germany should extend its leading position," Merkel said according to a Reuters report.

According to Westphal, Germany is betting part of its economic success, and also its future international standing, on the Energiewende. "The energy transition is one of Germany's most important political projects, and both resource and challenge for German foreign and trade policy…If the energy transition is successful, it will raise Germany's international profile, while failure would have significant international repercussions."

Material from freelance contributor Sönke Gäthke has been used for this story.

Factsheets

- Germany's dependence on imported fossil fuels
- Germany's greenhouse gas emissions and climate targets
- Coal in Germany

www.cleanenergywire.org/dossiers/energiewende-and-its-implications-international-security

Dossier

New technologies for the Energiewende

Technology to transform the energy sector – made in Germany

1 Jul 2015 | Ruby Russell

Germany's energy transition anticipates a vastly more efficient and interconnected energy system in the future. It also poses huge technological challenges – and challenges for legislation and business models keep pace. But German scientists say their work has already made important contributions to the global goal of decarbonisation.

On a warehouse door on the outskirts of Berlin, a sign recalling the city's period of post-war division reads: "You are now leaving the CO_2 producing sector." Inside, thousands of lithium-ion and sodium sulphur batteries buzz away in gleaming steel racks. The space, a test facility of energy storage company Younicos, is pristinely high-tech.

In one corner, a small area containing a diesel power generator is closed off. Here, fuel is burned, water is heated, and steam passes through a vent to turn a mast 50 times a second. Simple but incredibly powerful, this is the technology that has powered industry for the last two centuries. But, as Younicos spokesman Philip Alexander Hiersemenzel explains, when it comes to regulating the frequency of the grid, this steam age technology is far from precise. Conventional fossil-fuelled power takes around 30 seconds to ramp up and down generation, and then only reaches a fuzzy approximation of the desired output required to stabilise the frequency. Batteries, on the other hand, perform the task in milliseconds, and with complete accuracy.

Younicos, whose 120 employees are mainly software engineers, completed Europe's first commercial battery power plant for German local utility WEMAG last year, in Schwerin, Mecklenburg-Vorpommern (about 200 kilometres northwest of Berlin). The windy north German state now generates more renewable power than it consumes – offering a taste of the future of the German energy system.

The German Energiewende – or energy transition – is a generational project aimed at decarbonising the economy and at the same time phasing out nuclear power. Since Germany began its high-profile transition in earnest in 2000, photovoltaic (PV) cells have become more efficient, while wind turbines have been repowered to soar to great heights and operate in inland areas previously considered unsuitable for wind power generation. Last year, the country covered 28 percent of its energy consumption from renewables. Now, the Energiewende is hailed as entering a new phase.

"What we will have is an electricity system that is very cheap in terms of getting fuel for free," said Hans Schäfers, an expert in smart grids at the Hamburg University of Applied Sciences. "The next stage of the Energiewende is that we really have energy in abundance and we think of new ways to use it."

Solutions for flexibility and integration

The technological challenges of volatile, fluctuating and decentralised renewable production envision a vastly more flexible and integrated energy system. Converting renewable power into other forms of energy isn't only about greening other areas of the energy system, it is also key to keeping the grid stable – too much power being as disruptive as too little. Scientists are now converting electricity into methane, with the aim of using the gas grid as a form of storage and reducing dependency on carbon-emitting natural gas imports. E-mobility and fuel cells not only offer the prospect of low-CO_2 transport, but could also contribute to stabilising the grid as excess power is channelled into the transport sector. Solutions are also needed for a more intelligent grid to cope with power fed in by "prosumers" with home PV systems, as well as utilising the flexibility of large power consumers that could deliver services such as voltage control.

> *"What we will have is an electricity system that is very cheap in terms of getting fuel for free."*
>
> *Hans Schäfers, Hamburg University of Applied Sciences.*

Optimising the entire system for maximum efficiency is also a major field of research. Across the three major en-

ergy sectors of electricity, heat and transport – but particularly in the latter two – experts say there is much to be done to reduce the amount of energy used. There are also savings to be made in homes, businesses, and industrial processes.

"Germany's steady and strong commitment to energy R&D will benefit not only Germany, but the global energy sector." IEA

To meet these challenges, the Ministry of Economics and Energy's (BMWi) Energy Research Programme has almost doubled research and development (R&D) funds in under a decade, from 400 million euros in 2006 to over 819 million euros in 2014, with renewable energy and energy efficiency research receiving 73 percent of that funding. Funds are focused on public-private partnerships, with industry usually required to match public funds. Small and medium-sized enterprises (SMEs) are sometimes eligible for up to 100 percent funding. Since 2008, the government has invested over 200 million euros in energy technology research and innovation (R&I) by SMEs, under the Central Innovation Program SME (ZIM).

Mixed reviews of German R&D efforts

"SMEs are quite strong in Germany and there are many Energiewende products that come from SMEs," Alexander Knebel of the German Renewable Energies Agency told the Clean Energy Wire. Knebel points to companies like Enercon, Germany's market leader in renewable wind, and solar firm SMA, which started as an offshoot of R&D activities at the University of Kassel. "These are start-ups that have evolved into companies with thousands of highly qualified employees," he told the Clean Energy Wire.

But it's not a straightforward picture. In the summary of its 2015 report on Research, Innovation and Technological Performance in Germany, the Commission of Experts (EFI) notes (p. 5) that, "between 1995 and 2012, innovation expenditures in relation to turnover decreased considerably among SMEs." The EFI also said (p. 4) that Germany needs to increase its overall R&D spending – which is currently just under the EU target of 3 percent of GDP on research and development.

Still, the EU's Directorate-General for Research and Innovation reports that Germany's economic impact through innovation was among the best in Europe (p. 7), reflected in part through the activities of SMEs, and that patenting levels in Germany are high, particularly in the environment and energy sectors (p. 5). Patent applications in Germany's renewables sector more than doubled between 2008 and 2014. According to the OECD, business expenditure on overall R&D in 2012 was 2.02 percent of GDP.

The International Energy Agency (IEA) acknowledged (p. 190) in its 2013 report on German energy policy that the government has made "significant" funding available for R&D linked to the energy transition and concluded that, "Germany's steady and strong commitment to energy R&D will benefit not only Germany, but the global energy sector."

But the EU Directorate-General for Research and Innovation notes (p. 126) that Germany's performance regarding new science and technology graduates has only just surpassed the EU average but new university programmes are springing up across the country, focused on the technological challenges of the energy transition. By 2013 there were over 380 renewable energy-related programmes at German universities.

Some of them at major new facilities like the Hamburg University of Applied Science's Competence Centre for Renewable Energies and Energy Efficiency (CC4E), which opened this year, with its own wind farm and demand-side integration laboratory, which combines research with interdisciplinary educational programmes.

The right industry partners

As well as funding via the Economy Ministry, energy and climate-related R&D are publically funded via the Environment (BMUB) Education and Research (BMBF) and Food and Agriculture and Education (BMEL) ministries, with the latter particularly focused on bioenergy.One of the major recipients of public funding via the BMBF is the Karlsruhe Institute of Technology (KIT), one of Europe's most renowned research and teaching institutions. KIT is coordinating a 310 million-euro, five-year Helmholtz Association project exploring the integration of renewables into the grid. Its main research areas represent the upcoming challenges of the Energiewende: new grid structures and storing or converting renewable power into other forms of energy – electrochemically (in batteries), as synthetic hydrocarbons, fuel cells, and thermal energy.

"I have been in this field for more than 20 years, and I have never seen such a change in energy before," Mathias Noe, director of the Institute for Technical Physics at KIT told the Clean Energy Wire. "Of course, that puts a lot more pressure on industry and on research. We have to find solutions fast. It is certainly exciting – the possibility to develop new technological solutions that you could not have dreamed of 10 years or 20 years ago."

This is being achieved by working closely with industry. But abandoning the models that have supported Germany's growth as a major industrial economy raises a whole host of challenges. Kurt Rohrig, deputy director the Fraunhofer Institute for Wind Energy and Energy System Technology in Kassel, which works on application and industrially orientated research and development, says the reluctance of major energy companies to shift away from conventional power has been a stumbling block. "This hampers our power development," Rohrig told the Clean Energy Wire. "We need money from industry and we need to sell our R&D results. When industry is too slow, this is a problem."

This year the government is launching Schaufenster Energiewende, a major demonstration project aimed at providing data to inform legislation. Regions are competing for 40 million euros in government funding over four years for projects. Hamburg and Schleswig-Holstein – another northern German state where renewable power supply often outstrips demand – are jointly bidding for the wind section of the project, which will show how information and communication technology (ICT) and market integration can provide solutions for a 100 percent renewable energy supply. Industry partners must match public funds, and the New 4.0 proposal includes Vattenfall, Siemens and Bayer Material Science among its 50 partners. But Schäfers says raising the private sector funding was a challenge.

"I have had a lot of talks for our Schaufenster application where I had industry saying this is what we could do – we will do it as soon as it pays off," said Schäfers. "You have to justify it in front of your stakeholders and if the return is not high enough they hold off. Where it gets interesting, the needed investment is an issue."

> *"I have been in this field for more than 20 years, and I have never seen such a change in energy before."*
>
> *Mathias Noe, KIT.*

Schäfers says that energy systems are still not an attractive investment for private investors outside the energy sector, and the big energy companies are used to very high returns of investment. But smaller energy companies and local utilities (known as Stadtwerke) – like WEMAG – are more enthusiastic about development in this field.

"In many cases the Stadtwerke have lower revenue expectations. The re-flowering of the Stadtwerke is a nice tendency," Schäfers told the Clean Energy Wire. "When there is

not enough return to be made for the big companies, there's a gap opening up for other players and that's what we see happening."

Municipal utilities also make good partners because they are less wedded to the old power system. Siemens collaborated with Allgäuer Überlandwerk (AÜW), as well as university and ICT company partners on the publically funded IRENE and IREN2 smart grid projects in the southern German village of Wildpoldsried, which explored systems for integrating the region's high share of PV power into the grid. AÜW is a local energy supplier but also operates the municipal distribution grid.

"What we needed was a partner that takes the challenges as opportunities," Siemens project manager Michael Metzger told the Clean Energy Wire. "It doesn't matter if they are a Stadtwerke or a big energy company, but they must see these new developments as challenges rather than threats. Both sides of Allgäuer Überlandwerk were interested in new business opportunities."

"We need money from industry and we need to sell our R&D results. When industry is too slow, this is a problem."

Kurt Rohrig, Fraunhofer IWES.

"Technologiefeindlichkeit" and Germany's love of the combustion engine

While the German power system has gone through radical changes with the uptake of new technologies, other sectors have dragged their feet. There are huge opportunities for the transport sector to play a major role in the new energy system, but that means turning away from the traditional combustion engine – a technology in which Germany is a proud world leader. "E-mobility is happening way slower than we thought," says Schäfers.

Yet it's not just Germany's car-manufacturing sector that is wedded to the fossil fuel-powered vehicle. "There's a lack of acceptance to buying a car that would get you only 150 or 200 kilometres," said Schäfers, who works at CC4E. "We are not used to cars that work like that. We have an e-car connected to the e-campus here which we use to visit the companies we work with and we often wonder if we are going to reach the next destination."

And observers point to "German angst" and "Technologiefeindlichkeit" – technophobia – as an obstacle to potentially cleaner options for conventional power production. Carbon capture and storage has met resistance in Germany, as has hydraulic fracturing, and of course, nuclear power. Opposition to nuclear power engendered the Energiewende, but some still believe nuclear could make an ideal, low-carbon back-up partner to renewables.

Still, if Germany is shy of developing new ways to use conventional energy sources, renewables are another story. The government's Energy Concept, launched in 2010 to outline the transformation of the energy system by 2050, has broad support among the public and politicians. But getting the legislative environment to support the technology needed along the way can be tricky.

Battery company Younicos argues that the way the power market is structured in Germany isn't always conducive to the technological solutions his company provides. The WEMAG battery park earns its keep by providing frequency control services. But the market does not reward suppliers for speed and accuracy, one of the major advantages of batteries compared to a conventional power plant.

Keeping the market in step with the new energy landscape

Another problem of conventional power plants is that though generation can be ramped up and down, most have to be kept running the whole time. When there is an excess of power in the grid, it is renewable production that must be curtailed, and that comes at an expense, because the operators of renewable facilities still receive their guaranteed feed-in tariffs and there are substantial costs for redistribution.

"Batteries make the system more efficient," Hiersemenzel of Younicos told the Clean Energy Wire. "The question is, who gets that efficiency right now? We (consumers) all have to pay for that excess power – not the conventional power plant operators. Storage can prevent that, but storage doesn't get any of that money. Batteries are commercially viable but the profit they get doesn't reflect the profit they bring to the entire system."

Storage is one of the few key areas where technology still needs to be developed. Facilities like the WEMAG battery park in Schwerin currently focus on the frequency control market. In May, a new player announced a different, decentralised approach to entering the utility storage market – combining it with the fast-growing market for home storage systems. Tesla has joined forces with German energy IT firm LichtBlick to offer Powerwall Home Batteries that will integrate with the energy market to charge when renewable power is abundant and feed into the grid during times of lower generation. "Consumers who integrate their batteries into the cluster will benefit from energy market revenues through LichtBlick," the companies announced.

> *"There's a lack of acceptance to buying a car that would get you only 150 or 200 kilometres."*
>
> *Hans Schäfers, CC4E.*

How much renewable power the grid can handle before such facilities are needed to provide actual storage is debated, with some experts saying that by the time their share reaches beyond current levels, it will be essential. Others argue that alternative solutions – such as better grid connections across the country and internationally – can hold off the need for commercial storage until close to 90 percent of the country's power is derived from renewables.

But now that the focus has shifted – or at least broadened – from power generation to systems management, Schäfers at the Hamburg University of Applied Sciences says the market needs to catch up with the technological needs of the Energiewende.

"Do you earn money running energy storage? Is supplying flexibility to the system rewarded or hindered? Neighbouring countries – like Denmark, the Netherlands, and Switzerland – are way ahead of us on this. They have market rules that actually encourage flexibility. Traditionally, we've just relied on the big conventional power producers and not penalised inflexibility."

Still, progress is being made. Currently, demand-side integration is discouraged by regulations that see large energy consumers rewarded for evening out their load on the grid, even though, with an increasingly fluctuating power supply, the opposite is needed. But based on proposed legislation by Germany's energy minister Sigmar Gabriel (Social Democrats) on the future design of the energy market, these obstacles are expected to be removed, providing economic incentives for much-needed smart grids that provide information to trigger demand-side responses.

"We are currently throwing away the possibilities for demand-side management with stupid regulations," said Schäfers. "This new legislation is a big step away from that."

Germany's gift to the global Energiewende

> *"Batteries make the system more efficient."*
>
> *Philip Alexander Hiersemenzel, Younicos.*

At the core of the Energiewende, the Renewable Energy Act has revolutionised the energy system through feed-in tariffs that have given renewable power facility operators guaranteed returns on investment, fuelling demand for the technology and bringing down its costs. But the role of the feed-in tariffs in R&D is disputed. The EFI says in its 2014 report (p. 52) that the levy for renewable power has had no "measurable innovation impact," arguing that it creates a stronger incentive to exploit existing technology than to invest in R&D.

Others say that the gradual reduction in feed-in tariffs means that technology has had to become more efficient to keep pace. "The feed-in tariff constantly dropped, so if you wanted to get the same output you'd better get some innovation going – at least so that you get the same amount of energy from your PV set with less investment," said Schäfers.

Still, reduction in feed-in tariffs has not gone smoothly. A series of sharp reductions beginning in 2012, combined with competition from China, caused a collapse in the German PV industry. Yet Schäfers argues that while it was a disaster for the many German companies put out of business, the process made a vital contribution to the world.

"Germany shouldered the development costs of PV," Schäfers told the Clean Energy Wire. "It reached a technological level where China could copy it for 10 percent of the price, and therefore it is available for everybody because now the price is low. Somebody needs to be there, and it has to be a country like Germany that is rich enough and has enough technology resources, science resources, to get the technology there and make it available for the rest to follow - and I don't mean walk behind but pick it up and carry it further. So that's the role that we accepted and that we are playing here."

Ruby Russell is a freelance contributor to the Clean Energy Wire. She has also written for Deutsche Welle, The Guardian, The Washington Times and The Telegraph, among others.

Factsheets

- Technologies "of the Energiewende"
- Combined heat and power - an Energiewende cornerstone?
- Where the Energiewende creates jobs

www.cleanenergywire.org/dossiers/new-technologies-energiewende

Dossier

Germany’s energy transition in the European context

The solo draws to a close

25 Jun 2015 | Jakob Schlandt

Germany’s energy transition began as a lonely expedition. Expanding green energy rapidly and switching off its nuclear power stations antagonised some neighbours and the European Commission. Germany has now learned that it cannot reach its goals independently and is investing in cooperation. But while many European countries are following in Germany’s footsteps, a European consensus does not appear within easy reach.

In a recent speech to an international audience in Berlin, the influential state secretary of the German energy ministry Rainer Baake explicitly addressed critics of Germany's energy transition (Energiewende), saying, "People in this country and also outside of Germany who believe this must be some kind of act of renationalisation of energy policy [...] could not be more wrong." Germany, Baake insisted, wanted to develop the transformation of the energy system – replacing fossil and nuclear power with renewables – in close cooperation with its neighbours. A Green Party member and one of the architects of the Energiewende, Baake pointed to Germany's history of largely ignoring its neighbours on energy policy, and its current, more cooperative intentions.

"Until two to three years ago, the Energiewende was mostly a solo project of Germany," says Markus Steigenberger, head of European Energy Cooperation at the German energy think-tank Agora Energiewende. "Now, the European dimension is very present at the top political level, not only among experts."

The energy transition began in earnest in 2000, when the Renewable Energy Act (EEG – co-authored by Baake), introduced feed-in tariffs to support investment in green energy, while the government reached a consensus with utilities on quitting nuclear power. At first, it went largely unnoticed. But the share of Germany's electricity consumption covered by renewable energy trebled from below 10 percent in 2004 to nearly 28 percent in 2014. And in 2011, following the Fukushima accident, the German government decided to switch off the older half of its nuclear power station fleet immediately, and to shut down the rest by 2022. This was done without thoroughly consulting its neighbours. Very few European countries – most notably Denmark and Italy – have kept pace with this radical transformation. The United Kingdom, in comparison, increased renewable energy from 3.5 percent to 13.9 percent between 2004 and 2013, in France the share went up by just over two percentage points during the same period to 16.9, while in Poland it rose from 2.1 to 10.7 percent, according to the Eurostat database.

What was the reaction abroad?

As green power expanded rapidly in Germany, and newspaper front pages began to regularly feature climate change – a particularly hot topic a decade ago – curiosity grew. Experts from the US were quick to call it an "experiment" and even a "failure of public policy". Others, including the International Energy Agency (IEA), applauded.

But initially, because renewable sources still had a relatively low share in electricity generation, the transition had little direct impact on Germany's neighbours. The Energiewende was seen as a German issue. On the European level, all was quiet following a ruling by the European Court of Justice in 2001 that the EEG was, after all, not illegal state help.

Over recent years, however, this has changed dramatically. The huge rise in Germany's production of fluctuating green energy has led to a surge in exports. When electricity is generated from wind and solar power plants, German power prices fall and imports from Germany become an attractive alternative to local production. Recent analysis by Dutch grid operator TenneT clearly shows that high renewable energy production leads to high exports. With over 20 gigawatts (GW) of interconnector

"People in this country and also outside of Germany who believe this must be some kind of act of renationalisation of energy policy [...] could not be more wrong."

State secretary Rainer Baake.

capacity (a quarter of the country's peak consumption), the German electricity market is now relatively well connected to its neighbours. And for the most part, electricity flows in one direction – out of Germany. According to analyses by the Clean Energy Wire of the database of the Federal Statistical Office (Destatis), the surplus in the electricity trade reached a record high in 2014 with 74 terawatt-hours (TWh) exported and only 36 TWh imported.

> *"Without its neighbours, the Energiewende would probably have collapsed already or at least be in much more trouble."*
>
> *Nikolas Wölfing, ZEW.*

Some of Germany's neighbours have had to cope with an enormous influx of German electricity over recent years. Polish imports of German electricity rose from 5.3 TWh in 2010 to 9.2 TWh in 2014, while the trickle of exports was reduced to just 0.051 TWh (down from 0.167 TWh in 2010). Dutch imports of German power quadrupled to 24.3 TWh over the same period – an astonishing fifth of overall consumption in the Netherlands.

Fluctuating renewables at the heart of the European power system

In short, Germany's Energiewende has led to a surge of fluctuating production in the heart of the European power grid. Some aspects sound like a win-win situation. For Germany, the Energiewende is much easier, because when renewable production peaks, interconnections to its neighbours provide a buffer so that the domestic grid is not overloaded.

Nikolas Wölfing of the Centre for European Economic Research (ZEW) in Mannheim, says that without its neighbours, the Energiewende would "probably have collapsed already or at least be in much more trouble." Not only can Germany export excess electricity, it can also import power in times of need. "Basically, being at the heart of Europe means that Germany has a gigantic battery at its disposal, in the form of foreign electricity networks." Tellingly, the current emergency reserve for electricity shortages in Southern Germany is based largely on Austrian power plants.

In some aspects, the effects of the Energiewende on markets are a welcome development outside Germany, too. All across central Europe, power prices have fallen. "That's a boon to all consumers, be they private households or industry," says Wölfing. Even Hungary, which does not share a border with Germany, enjoys lower power prices as a result of German exports, say government officials.

Some countries see the Energiewende in Germany as nothing less than a business opportunity. Embracing the German transition, Norway's Foreign Minister Børge Brende has said his country would be happy to become a "green battery for Europe and the world."

Others are less thrilled. Recently, the Czech Minister of Industry and Trade, Jan Mládek, complained publicly that his country would have to "live with the Energiewende," but voiced fears that so-called "loop flows" could lead to blackouts in the Czech Republic. In times of overproduction in Germany's windy north, uncontrolled currents from the German network first flow abroad and then re-enter Germany further south. As a result, exports to the Czech Republic rose from 0.56 TWh in 2010 to 3.83 TWh last year. Worried about grid stability and the economics of their power plant fleets, Poland and the Czech Republic pressed hard for the installation of phase-shifters at their borders. Once construction is completed in 2016 and 2017, they will in effect be

Grid connections across mountain ranges and national borders: Europe's electricity network is expected to get ever more interconnected. Photo: Fotolia © spuno.

able to block electricity flows. The project – which runs against the goal of market integration – will cost 300 million euros, shared equally between the German, Polish and Czech grid operators.

The German electricity grid agency Bundesnetzagentur is even considering splitting the Austrian-German common power market for electricity. The only "bidding zone" shared between two larger EU countries currently makes it possible to trade electricity at uniform prices and without having to buy grid capacity. But the integration of these two markets, which began in 2002, could be reversed as early as 2018, says Bundesnetzagentur. The reason: Worries about security of supply not only in the above mentioned central eastern European countries, but also in Germany. The need for an emergency reserve of power stations for the southern German electricity market could be substantially reduced if Austria was split from the German market. At the moment, trade volumes to Austria often exceed the physical connection capacity, resulting in additional power shortages in the south of Germany.

"It is a worrying development that Germany's Energiewende can have a disintegrative effect on the European energy market," says Wölfing from ZEW.

Brussels alerted by feed-in tariffs and industry reliefs

It is not only the expansion of green energy that has caused irritation abroad. France, Wölfing says, depends on Germany to provide reliable electricity exports to cover its peak winter consumption, caused by electric heating. Germany's decision to switch off its nuclear power stations had the French deeply worried, he says. "Germany has basically acted for years with very little or no regard for its neighbours."

The Energiewende has not only alerted neighbours, but Brussels, too. European Union treaties state that member states can make independent decisions on

their energy mix. But energy policies have to be in accordance with competition laws. After more than a decade of little interference with the Energiewende, the European Commission opened an investigation in 2013 into exemptions from the EEG surcharge for Germany's energy-intensive industry. After months of haggling, the German government was able to keep the rebates at a similar level, but changed the awarding procedure for the exemptions. More importantly, it was forced to commit to largely replacing feed-in-tariffs with an auction system by 2017. A lawsuit by the German government that is still underway will eventually clarify if the EEG constitutes state aid or not.

"Germany has basically acted for years with very little or no regard for its neighbours."

Nikolas Wölfing, ZEW.

Steigenberger of Agora Energiewende concludes that over recent years, the Energiewende has begun to feature prominently on the agenda of Germany's neighbours due to a "perfect storm" of interlinked factors. "The exit from nuclear energy, rising production of variable renewable energy, increasing German electricity exports, stagnant demand due to the financial crisis and efficiency measures, and depressed power prices across Europe, have alarmed European policy makers." In 2014, large European utilities like E.ON (Germany) and GDF Suez (France) prompted further concern when they announced that low energy prices had hit their profits hard, pushing them deep into the red. Germany has been repeatedly lambasted for its state interference to promote green energy and shape the Energiewende on its own terms, without taking into account the impact on European markets.

"A wild variety of different market systems does not make any sense, because power plant operators will not be able to operate in comparable environments."

Rolf Martin Schmitz, RWE COO.

Germany's future power market design – more pro-market than the neighbours?

However, on a key aspect of energy market design, Germany is likely to opt for a more a pro-market approach than its neighbours. France and the UK recently adopted capacity mechanisms to support investment in power stations and ensure that even with a rising share of renewable energy in the power system, there will always be enough conventional capacity to provide backup. A final decision has yet to be taken, but the German government has made it clear that it is not likely to introduce such a capacity market in Germany. Instead, only an emergency reserve will flank the market.

Felix Matthes, an energy expert at the Öko-Institut, an ecological think-tank in Berlin that produced its own proposal for a "focused capacity market", says this is "an extremely inconsistent position". On the one hand, Germany provides green energy with a support scheme that creates robust, low-risk revenue streams, to enable return on investment. But when it comes to fossil power stations, Germany is in a state of denial that similar measures are necessary, Matthes says.

However, the future of the European energy framework will be decided quite soon. The European Commission has started a sector inquiry looking at capacity mechanisms in 11 member states (Germany is among them because of its emergency reserve).

This summer it will publish preliminary findings and begin a public consultation. RWE, Germany's second largest utility, fears that a patchwork will emerge: "A wild variety of different market systems does not make any sense, because power plant operators will not be able to operate in comparable environments and cannot sell across boarders," says RWE's Chief Operating Officer (COO) Rolf Martin Schmitz. He argues that there is an urgent need for the EU to provide strict European guidelines.

There are many signs that the European energy system is partially disintegrating – and Germany is one of the main actors in this development. But Germany has also been at the helm of European moves to better link up its energy markets. The European Agency for the Cooperation of Energy Regulators (ACER), which plays a key role in synchronising power grid regulations so that energy can flow more easily across borders, has had wholehearted support from Germany and its national regulator, the Bundesnetzagentur. On the EU level, the technical and economic integration of energy markets is progressing.

> *"The member states are as keen as ever to keep control over their national energy mix, even when it clearly hurts common European interests."*
>
> *Severin Fischer, SWP.*

Grid extension and "electrical neighbours"

Severin Fischer of the German institute for International and Security Affairs (SWP) says "market coupling is well under way. European grids are being extended and will be better connected in a few years," thanks to a 10-year development plan and financial support from the EU.

Grid extension in Germany, as in many other countries, is politically controversial and notoriously delayed.

But some progress is being made. Earlier this year the final investment decision for NordLink was taken. If everything goes according to plan, the 1.4-gigawatt (GW) sea cable will connect north Germany to Norway by 2020. The latest grid development plan includes a total of six interconnections.

Regional initiatives are helping to coordinate and implement grid extensions across Europe. The most prominent is probably the North Seas Countries' Offshore Grid Initiative (NSCOGI), which, among other things, helps allocate the cost of new connections to individual countries.

Most recently, 12 countries around Germany signed a declaration for regional cooperation. The document epitomises the current state of affairs, leaving individual countries full control of their energy mix and instead focusing on "no regrets" measures regarding market flexibility. Signatories, led by Germany, have vowed to "allow flexible prices; we will particularly not introduce legal price caps and we will avoid that national measures have the effect of indirect price caps". Under the agreement, cross-border trade should not be inhibited.

Germany's energy transition is, in principle, supported by the top levels of the European Union. Prime ministers and presidents agreed last October to new targets for 2030: greenhouse gas emissions should fall by 40 percent (compared to 1990), renewables should reach 27 percent of energy consumption (though through binding national targets) and energy savings are set to rise by the same token. Additionally, the EU's Emissions Trading System (ETS) is being reformed with the goal of reducing a surplus of emissions certificates. Even though energy companies are currently sceptical about the real impact, a re-

vived ETS has the potential to boost the profitability of greener investments in Germany, and hence contribute to reaching the goals of the Energiewende.

Could there be even more support coming?

The new EU Commission, inaugurated last October, has put energy centre stage and is pursuing an "Energy Union", aiming to become the global leader in renewable energy. The Commission's vice president Maroš Šefovi has even been put in charge of the issue. But its initial focus is largely on natural gas and security of supply. And the Commission itself is unclear on Germany's role. In a recent interview with the magazine BIZZ energy today, Šefovi said that while Germany could be seen as a blueprint for Europe, the Energiewende has "far-reaching effects on the profitability of conventional power plants and fluctuating electricity is a challenge for grid stability".

Some experts expect very little from the Energy Union. The political aim of creating "coherence" in Europe's energy markets is unrealistic, says Fischer of SWP, and the number of measurable targets very limited. At the same time, "the member states are as keen as ever to keep control over their national energy mix, even when it clearly hurts common European interests," says Fischer, citing Hungary's deal with Russia to install new nuclear power plants. The Energy Union would nevertheless be useful to support small but important steps, he added.

The relationship between France and Germany, who can still decisively shape the European Union if acting in accord, epitomises this development. Some "rapprochement" in energy policies is visible, argues a recent study. France adopted a renewable energy target of 40 percent of electricity consumption by 2030, while reducing nuclear's share from 75 to 50 percent by 2025, initiating its own, smaller scale "transition énergétique". But there remain "immense differences," according to a paper by the Jacques Delors Institute, and introduction of a capacity market by France "has the potential to drive a wedge between the two countries, especially considering their very different electricity market designs." Closer cooperation would pay off, the Delors Institute argues. Bringing the two markets into sync could save up to 4 billion euros per year. But both countries would still consider energy policy as a national prerogative.

Wölfing from ZEW, too, believes this is a common theme in Europe. "Germany did not consult its neighbours on the Energiewende. But the unilateral introduction of capacity markets across Europe shows that they are not the sole perpetrator of largely nationalistic energy policy." He expects the EU Commission's role to be reigning in such excesses.

Matthes of the Öko-Institut sees the EU's upcoming decision on capacity mechanisms as pivotal, because the Commission could start to develop a consistent framework for different kinds of revenue streams in the electricity sector. "It is probably too late for harmonisation," he says, "but a push for convergence would be an important starting point."

Overall, says Wölfing, Germany's Energiewende will remain both an inspiration and a challenge for Europe. "An ultimate solution to all problems is just not feasible," he says. But the unequivocal acknowledgement of top officials like Baake that the Energiewende cannot succeed in isolation is a step in the right direction.

Jakob Schlandt is a freelance contributor to the Clean Energy Wire. He also writes for Europolitics and BIZZ energy today and his own blog http://phasenpruefer.info.

Factsheets

- Energiewende – Germany is not alone
- Germany's energy consumption and power mix in charts
- Capacity markets around the world

www.cleanenergywire.org/dossiers/germanys-energy-transition-european-context


ATOMKRAFT SCHADET
DEM LÄNDLE!
GREENPEACE

Dossier

The history of the Energiewende

Energiewende – the first four decades

22 Jun 2015 | Paul Hockenos

For many observers, the energy transition in Germany began with Chancellor Angela Merkel's decision to phase out nuclear power, following the accident at the nuclear plant in Fukushima, Japan. But the Energiewende pre-dates the government's decision to return to earlier plans to phase out nuclear power. A long process deeply rooted in German history and society led to policies that triggered a strong increase in renewable energy sources and are now at the heart of a move to a low-carbon economy.

"Half-time Energiewende": The confident title of environment think-tank Institute for Applied Ecology's celebration in March wrapped up what many have forgotten about Chancellor Angela Merkel's spectacular post-Fukushima decision in 2011. The societal project, which now aims to decarbonize the economy by 2050, started decades before the Merkel government re-instated plans to exit nuclear power.

The Energiewende – a full-scale transformation of society and economy – arose out of enduring grassroots movements, an evidence-based discourse, concern about climate change, and key technological advances, as well as hands-on experience garnered along the way in Germany and elsewhere (see Timeline).

Grassroots Resistance

The origins of the Energiewende are diverse, but one potent stimulus was West Germany's powerful movements – known as the New Social Movements (NSM) – that gathered steam across the 1970s in the wake of the late 1960s' student rebellion.

The anti-nuclear energy campaign was the most important NSM for what years later would be called the Energiewende. The anti-nuke campaign came to life with a bang in 1973 in Germany's southwestern-most corner in the wine-growing region near the Black Forest that abuts Switzerland and France. There, in the hamlet of Wyhl, the area's wine farmers, joined by activists from the nearby university city of Freiburg, as well as concerned French and Swiss citizens, organized to stop the construction of a planned nuclear reactor. They first occupied the construction site and then – after police used excessive force to remove them, a spectacle watched on TV across the country – took the utility to court, where it eventually backed down.

Until then, the West German utilities, with the full support of the Federal Republic's political elite, had been gradually putting plans into motion to make nuclear power a cornerstone of the country's energy supply. Both of the major political parties – the Christian Democrats and Social Democrats – were on board, some of their ranks claiming that the safe, clean technology might one day even eliminate energy bills. "Nuclear energy can be a blessing for hundreds of millions of people who today still live in the dark," read a 1956 SPD party resolution.

Yet there was a critical strand of postwar West Germans who had already been sensitized to issues around the splitting of the atom (nuclear fission). In the 1950s and early 1960s, several nationwide peace movements emerged in the Federal Republic in opposition to the Cold War and the stationing of NATO-administered nuclear weapons on West German territory. The Protestant church, some trade unions, many war veterans, and assorted leftists rallied in moral protest against the build-up of nuclear weapons worldwide and in particular in the two Germanies, which had become the militarized frontline of the East-West conflict. One explanation for Germany's sensitivity to nuclear power is that early on, the postwar critique of nuclear weapons was linked to the civilian use of nuclear fission. (A second wave of the German peace movement in the 1980s would also bolster a younger generation's resistance to nuclear power.)

> *"The protests at Wyhl shaped the anti-nuclear movement and even the Energiewende."*
>
> *Eva Quistorp, activist.*

"The protests at Wyhl shaped the anti-nuclear movement and even the Energiewende," says Eva Quistorp, an activist and leading figure in the NSMs. "It began locally, as the whole movement would, in places directly affected. At the heart of the movement were the farmers, vintners, families, housewives, and parish pastors. Students and experts contributed too, but the movement's force came from self-organized, citizens' initiatives," she says, explaining the tenacity of the protests over decades. Unlike the elitist, male-dominated student movement,

notes Quistorp, the NSMs reached out across gender, age and ideological boundaries.

Beyond Wyhl, West Germans near other nuclear-power-related sites in places with names like Gorleben, Gundremmingen, Wackersdorf, Grohnde, and Brokdorf, began informing themselves about the dangers of nuclear energy – and possibilities to block its expansion.

In the past, energy wasn't an issue that ordinary Germans were supposed to know anything about, says Quistorp. "But ordinary people began reading up and talking about technical issues like nuclear waste disposal, the warming of rivers through discharge from reactor cooling towers, the relationship between radiation and cancer, and the consequences of a meltdown or other kinds of accidents."

With the concerns about nuclear energy, academic scholars and others with expertise began evidence-based research, and started up alternative-minded working groups, institutes and think tanks, like the 1977-founded Öko-Institut (Institute for Applied Ecology) in Freiburg. Among its founders were figures like Michael Sailer and Rainer Grießhammer, both of whom came from the movement's ranks. (Today the Öko-Institut is just one of many dozen green think tanks in Germany. It employs more than 155 staff, including around 100 researchers at three locations in the country.)

In Germany there were bona fide experts among the dissidents from Day One. Holger Strohm, for example, was a prolific science writer whose 1971 Friedlich in die Katastrophe: Eine Dokumentation über Atomkraftwerke (Heading Peacefully to Catastrophe: A Documentation of Nuclear Power Plants) was a detailed, technical 1,300-page study on civilian nuclear facilities that sold 640,000 copies in West Germany. The best-seller Der Atom-Staat (The Nuclear State) by Robert Jungk, one of the world's first "future researchers," examined the relationship between the military and civil use of uranium.

> *"Other anti-nuclear movements in Europe [...] were always impressed at how well the German activists knew their stuff."*
>
> *Lutz Mez, political scientist.*

The nuclear engineer Klaus Traube had worked in top posts in German and U.S. nuclear installations in the 60s and 70s. On the job, he had witnessed human error cause an accident, which alerted him to dangers that the industry wouldn't admit to. After the Three Mile Island disaster in 1979 in the U.S., Traube switched sides and delivered the movement – as well as his party, the until-then pro-nuclear SPD – invaluable information about technical aspects of nuclear power.

"Other anti-nuclear movements in Europe," explains Lutz Mez, a political scientist at the Free University Berlin and former director of an ecological think tank, "didn't have someone like Traube who came from the industry itself. And they were always impressed at how well the German activists knew their stuff. Traube's books and others like them were widely read in Germany, even discussed on Sunday TV talk shows."

The Energy Crises

The phenomena that focused the 1970's debate on the world's energy future was not climate change, which had not yet emerged as a public issue, but rather the energy crises.

The world's leading industrial economies, including West Germany, were hit hard when the oil producing states of the Middle East drove up oil prices dramatically and cut back their supply in response to Western support for Israel in the Yom Kippur War (1973) and then in the wake of the Iranian Revolution (1979). The decade witnessed stunted economic growth and prolonged recessions in part, as a result of the energy

crises. West Germany, as did other countries, banned flying, driving and boating on Sundays. An iconic image from the time was a 1973 photograph of a horse pulling a Volkswagen van on an empty city street in southern Germany.

The energy crises seemed to confirm the findings of the widely read 1972 report "The Limits to Growth," issued by the Club of Rome, a global think tank. The report, which was translated into German and many other languages, sparked a rich debate arguing that the growing world population was using up its resources at a dangerous pace and soon could encounter crippling shortages that would bring the world economy to its knees.

The report and the energy crises were wake-up calls that countries answered in different ways. Denmark, in response, began its conversion to renewable energy. The U.S., behind the Democrat president Jimmy Carter, devoted significant research funds to promote renewable energies – and Carter even put solar panels on the White House. U.S. research conducted by the National Aeronautics and Space Administration contributed greatly to pioneering technological improvements to create the world's first multi-megawatt wind turbine. (Basically, this is the model of turbine used worldwide today.) Also, independent U.S. researchers like Amory Lovins began formulating "soft energy" alternatives to conventional energies and grow-at-any-cost logic.

But West Germany, like France, opted to shift ever more energy production from fossil fuels to nuclear power. "The idea was 'out of oil and into nuclear' for the sake of energy security," says Mez.

The shift, however, had a paradoxical impact on Germany's energy future. "It caused a lot of Germany's best energy specialists to leave the conventional energy sector where they had worked in gas and oil," says Mez. "They opted to try their luck experimenting with renewables. This is how a lot of important innovation in solar PV and onshore wind happened in Germany."

"Renewable energy wasn't initially high on the NSMs' agenda but they realised they had to pose an alternative to nuclear power other than dirty fossil fuels."

Dieter Rucht, sociologist.

Over the course of the 1970s, West Germany's anti-nuclear energy movement grew dramatically. Activists from the other NSMs, like the women's, the peace and the environmental movements, found common cause with it and one another. The environmental movement, while much more varied and loosely organized than the anti-nuke campaign, addressed many issues that would later be part of the Energiewende and climate-protection rubric such as pollution, conservation, recycling, economic growth, biodiversity, sustainable development, low-impact lifestyles, and organic farming, among others.

"Renewable energy wasn't initially high on the NSMs' agenda but they realised they had to pose an alternative to nuclear power other than dirty fossil fuels," explains the German sociologist Dieter Rucht. Yet, he says, from the start they endorsed a general vision of an alternative society in which renewable energy fit in neatly. This vision, he says, saw "a different kind of society based on decentralised structures, bottom-up processes, participatory democracy, and environmentally conscious economies. Energy was one application," he says.

In 1980, three Freiburg-based activists who had worked with the renewable energy pioneer Lovins in the U.S. authored a book entitled Energie-Wende: Growth and Prosperity Without Oil and Uranium (Energie-Wende – Wachstum und Wohlstand ohne Erdöl und Uran), coining a term that would be used in Green and left-

> *"Among the early Greens were a lot of backyard tinkerers."*
>
> *Christoph Becker-Schaum, Heinrich Böll Stiftung.*

wing circles for thirty years before Angela Merkel made it popular in the aftermath of the Fukushima disaster. The book, which sparked study groups across the country on the topic of "Energiewende," relied mostly on energy savings as the means to reduce Germany's need for petroleum und nuclear energy.

The big anti-nuke demonstrations in the late 1970s in Gorleben, Brokdorf, Kalkar and elsewhere attracted tens of thousands of concerned citizens and triggered a nationwide debate that raged in public forums. Yet the movement was not able to duplicate its spectacular success in Wyhl.

"Mostly defeats," responds Christoph Becker-Schaum, director of the Heinrich Böll Stiftung archives in Berlin, to the question of ineffective battles of the anti-nuclear movement in the years after Wyhl. "The movement could get huge numbers onto the street but, for the most part, it couldn't beat the nuclear industry in the halls of power and before the law." The activists, says Becker-Schaum, simply weren't trained to go head-to-head with professionals whose job it was to impact policy, win over politicians, and negotiate complex legal terrain.

An Environmental Party for Germany

The activists of the mass social movements, a wide array of citizens' initiatives, as well as intellectuals like artist Josef Beuys, former student leader Rudi Dutschke, and writer Heinrich Böll, concluded that what they needed to make an impact where it counted – in the arenas of politics and policymaking – was a parliamentary party of their own. Over the course of the late seventies, the activists drew up "green" and "alternative" slates to run in local elections – and they won seats. In 1979/1980, they called to life a nation-wide party and named it the Greens. Its symbol was the sunflower. Its strategy was to have one leg firmly planted in the social movements, the other in the field of politics.

With the Greens, the anti-nuclear movement and proponents of renewable energy had their own in legislatures across the country – and, as of 1983, in the Bundestag, too. The Greens wrote Germany's exit from nuclear energy high on their banner and pushed at every level of government, and internationally too, to halt the construction of new nuclear plants, to clarify the issue of waste storage, to increase reactor safety, and to offer alternatives to nuclear power and fossil fuels.

Issues like renewables, energy savings, low-impact lifestyles, sustainable development, mobility alternatives, and smart urban design, grew in importance– and became more concrete – as the Greens and the NSMs matured. The Greens, academic experts, and think tanks devoted themselves to turning visions into realistic policy proposals.

According to Becker-Schaum, the Greens' first program was full of innovative and quirky proposals to encourage energy production from renewable, natural sources. "Among the early Greens were a lot of backyard tinkerers. They were experimenting with electricity and heating, storage and combined heat and power. Some thought hydrogen might be the answer," he says, and had already struck out on their own to try it and other alternatives to conventional energy. Becker-Schaum notes that the early Greens employed the slogan "small is beautiful" for energy as well as other fields, presaging a decentralised, renewable power supply with many smaller, localised producers.

Chernobyl and Climate Change

The grassroots movements may have opened the debate on nuclear energy and alternatives to it, but the April 1986 meltdown of the nuclear power station

in Chernobyl, Ukraine, then in the Soviet Union, shifted the discussion and its urgency to an entirely new level. The disaster sent a radioactive cloud across Central Europe, including much of northern Germany. The Soviets' failure to announce the accident, the German government's initial soft-pedaling of it, and the uncertainties of the health risks set the country in panic. West Germans were glued to their television sets, hungry for tips on how to deal with contamination and the weather forecasts. Pregnant women were advised to stay indoors.

> *"[After Chernobyl] many people wouldn't leave their houses for days. It was like there was war again and they were in bunkers."*
>
> *Lars Jessen, film director.*

"Germans were completely shocked," says Lars Jessen, a German film director whose "The Day Bobby Ewing Died" is set in the aftermath of Chernobyl. "Many people wouldn't leave their houses for days. It was like there was war again and they were in bunkers. The news was on all the time to learn about the latest measurements of radioactivity in the area and in produce. Kids couldn't play in playgrounds, for example, because parents feared the sand might be contaminated."

Chernobyl was a monumental turning point in the way Germans thought about nuclear power, says Becker-Schaum. The disaster and its fallout changed the minds of many who until then had been pro-nuclear or undecided, including many conservatives, trade unionists, and center-of-the-road burgher. The slow, wrong-footed response of West Germany's own authorities illustrated that they hadn't prepared for such a disaster. It took days before they issued warnings not to eat produce or drink fresh milk. (In East Germany, officials played down the catastrophe, calling it an "incident." "Experts say: No danger from Chernobyl in East Germany," read one headline.) Since Chernobyl, says Becker-Schaum, a majority of Germans have opposed nuclear power – and this consensus would only grow in the decades to come.

Many follow-up studies show that the Germans weren't overreacting. While most of the radioactive fallout happened in Ukraine, the food chain in Western Europe was affected, too. A World Health Organization report on the 20th anniversary of the accident stated that major releases of radioactivity "continued for ten days and contaminated more than 200,000 square kilometers of Europe." The report asserts that "animals and vegetation in forest and mountain areas had high absorption of radiocaesium, with persistent high levels in mushrooms, berries and game." (Radiocaesium is a radioactive isotope of the chemical cesium.) Elevated concentrations of radiocaesium were found in fish from lakes as far away from the disaster site as Germany and Scandinavia, claims the report.

"The climate catastrophe" - this famous 1986 cover of Der Spiegel, one of Germany's largest weekly magazines marks the beginning of discussions over climate change in Germany, according to some observers.

It was a decisive moment for the Social Democrats, too, who had minority anti-nuclear voices in the party like the political scientist Hermann Scheer, one of the early fathers of the Energiewende. "The party was increasingly divided and had been backing away from nuclear step by step," explains Nina Scheer, the late Hermann Scheer's daughter and today an SPD MP in the Bundestag. "But Chernobyl changed everything. This is when the SPD as a party turned on nuclear power."

Though less spectacular, 1986 also witnessed the introduction of climate change into the German dis-

course. Sebastian Helgenberger, head of the Transdisciplinary Panel on Energy Change at Institute for Advanced Sustainability Studies in Potsdam, sees the dramatic 1986 cover story in Spiegel magazine showing the Cologne cathedral half covered in water as a pivotal moment. "This marked the beginning of the discussion around climate change in Germany," he says.

Helgenberger says that Germans were relatively quick to understand climate change as a compelling, man-made threat. "Science has a high reputation in Germany and Germans take it seriously," he says, adding that studies in the late 1980s and 1990s, like the first report of the Intergovernmental Panel on Climate Change in 1990, were read in Germany. But, he underscores, "it was the Greens that brought climate change onto the table in legislatures, institutionalised it as an issue for Germany, and forced other parties to respond in the years ahead."

While in the U.S. the buzz around renewable energies faded in the 1980s when Republican administrations held office (President Ronald Reagan took Carter's panel off the White House in 1986), it was proceeding apace elsewhere, like to Germany's north, in Denmark. "Germans could look and see the impressive strides the Danes were making with wind power," says Lutz Mez.

> *"Germans could look and see the impressive strides the Danes were making with wind power."* *Lutz Mez, political scientist.*

In 1991, German chancellor Helmut Kohl and Germany's center-right government instituted one of the world's first feed-in tariffs designed to encourage investment in renewable energy production. "It was a limited measure but something to build upon," says Mez, who notes that it was effective mostly in expanding small hydro-electric generation. According to Mez, though, the measure underscored a consensus in Germany on renewable energy and against n clear power that had solidified as a result of Chernobyl. There were, for example, no new nuclear reactors planned and built in West Germany after 1986.

Red-Green Germany

In autumn 1998, Germans voted out Kohl's conservatives after 16 years in office in favor of a coalition run by Social Democrats and Greens. "Red-green" governments already existed in many localities and in some federal states (Länder), too, but the 1998 oelection marked a sea change in the country. The coalition promised it would prioritise "ecological modernisation," which included climate protection, renewable energy expansion, energy efficiency, and sustainability measures. An "Energiewende" – though not mentioned as such in the coalition agreement – was now part of the Federal Republic's agenda.

Two of the administration's first major moves were to pass ground-breaking laws to phase out nuclear energy and promote investment in renewable energies.

The 2000-finalised nuclear phase-out was a compromise with the big utilities to shut down Germany's nuclear reactor sites (which accounted for 35 percent of Germany's power) gradually over a period of thirty years. Although observers saw the deal as a crowning victory of the anti-nuclear movement, its activists and many Greens saw the long transition period as a betrayal – and an opening for the utilities to revise the agreement when the conservatives returned to power. They had manned the barricades for years and braved winter nights blocking nuclear waste transports in order to end Germany's nuclear era immediately, not three decades down the road.

As for clean energy, the Renewable Energy Act (EEG), also passed in 2000, established significant feed-in

tariffs for a wide range of renewable energies that – because of high investment costs – were not competitive with conventional energy on the market. The tariffs acted to stimulate investment by covering the difference between the cost of production and the market price. The act also stipulated that grid operators must buy electricity and gas generated by renewable energy producers at the price fixed by the act. The stated goal was to cover 12.5 percent of Germany's electricity needs with renewables by 2010. Remarkably, the act, which would catapult Germany to a global leader in renewable energy production, was passed with virtually no fanfare or opposition in the Bundestag – unlike the fiercely contested nuclear phase-out.

Another factor that prepared the ground for the Energiewende to take off were several late-1990s EU directives designed to open up national electricity and gas markets. They demanded the deregulation and liberalisation of domestic energy markets in the EU with the aim of lowering energy prices by encouraging competition, which had until then been severely limited by sector monopolies. (In Germany, four giant utilities, the so-called "Big Four," owned almost all of the energy production as well as the transmission grids.) Another directive addressed the "unbundling" of the ownership of production facilities and distribution infrastructure.

These directives were turned into national law by Germany, which in the years to follow effectively broke up the production and distribution monopolies. This opened the market for the entry of many smaller renewable-energy producers; customers could thus choose their energy supplier. Today, there are more than one thousand participants in Germany's electricity market, the vast majority of which do not own power plants or supplier networks. Moreover, the Federal Network Agency – a key player in the Energiewende – was established in 1998 as part of the process. Its task is to regulate the electricity and gas markets, which includes ensuring fair competition and overseeing the transmission networks.

The red-green government came and went (leaving office in 2005) with non-energy-related issues – like the stagnant economy – dominating the news shows. But in the form of the feed-in tariff and grid priority for renewables, the seeds had been planted in the newly liberalised market. Mostly small actors, like farmers, co-ops, citizen-led groups, and other non-industry companies, began investing in green energy production, mostly thermal and PV solar, bio-energy and onshore wind technology. The share of renewably produced electricity in Germany shot up to 14.2 percent in 2007, far outpacing the original targets.

> *"The renewable energy act sparked a real grassroots citizen's movement. Germans turned the Energiewende into their own project."* *Nina Scheer, MP.*

"No one expected the renewables to shoot up so high, so fast," says Nina Scheer. "The act sparked a real grassroots citizen's movement. Germans turned the Energiewende into their own project."

A key component of the act's success (renewables electricity's share rose to 17 percent by 2010) was the fact that it didn't prioritise one kind of technology or another, says Scheer. "There was no master plan but rather a general direction and a support scheme with priority access for renewable energies. No one knew in 2000, for example, that the cost of solar PV would sink so dramatically and become such an important pillar of the Energiewende," she says.

In 2010, the center-right government led by Angela Merkel formulated an Energy Concept that set ambitious targets for renewable energy expansion, energy efficiency, CO_2 reduction, and low-carbon

transportation. Yet the administration maintained that Germany could not expand renewables so rapidly without its nuclear fleet functioning as a "bridge technology." That same year it passed laws extending the lifetimes of Germany's reactors for more than a decade, a significant modification of the red-green phase-out.

On March 11, 2011, the world watched aghast as reactors at the Fukushima Daiichi power station in Japan melted down after being hit by an earthquake and then a tsunami. The disaster deeply unsettled Chancellor Merkel, a professional physicist, who immediately shut down three of Germany's oldest reactors and formulated a new plan for an accelerated phase-out of nuclear power by 2022.

"As a scientist, Merkel understood climate change and the dangers of nuclear power," says Martin Faulstich, chairman of the German Advisory Council on the Environment (SRU). "But she thought there could never be a meltdown in advanced, developed countries like Germany or Japan. To her credit, when exactly that happened, she acted quickly and took steps that might not have been possible at a later point."

Only in the aftermath of Fukushima did Merkel begin to regularly use the term "Energiewende." In autumn 2011, her administration beefed up the Energy Concept, replacing some of the goals and time tables with more ambitious targets. In 2014, the new center-left Merkel-led government revised the Renewable Energy Act by lowering feed-in tariffs, authorising new transmission corridors, and devoting more funds to facilitate energy efficiency.

In understanding the Energiewende, says R. Andreas Krämer, founder and former director of the Ecologic Institute, a Berlin-based think tank, it's essential to see that Germany "was never as hooked on nuclear power as other nations." Moreover, says Krämer, Germans consider themselves "citizens of the world with a sense of duty to do good."

"Germans seem to be proud of the Energiewende as a model that the rest of the world can learn from," said Dieter Rucht, explaining the consistently high approval rating for the Energiewende, despite concerns about cost. "But we're only going to know if it is successful two or three decades from now."

Paul Hockenos is a freelance contributor to the Clean Energy Wire. He has also written about energy issues for a wide range of international publications and is the author of the blog Going Renewable. He is the author of Joschka Fischer and the Making of the Berlin Republic: An Alternative History of Postwar Germany (Oxford University Press).

Factsheets

- Milestones of the German Energiewende
- German utilities and the Energiewende
- Defining features of the Renewable Energy Act (EEG)
- The history behind Germany's nuclear phase-out

www.cleanenergywire.org/dossiers/dossiers/history-energiewende

Dossier

The energy transition's effect on jobs and business

Jobs won, jobs lost – how the Energiewende is transforming the labour market

30 Mar 2015 | Paul Hockenos

From solar-panel cleaners to housing-insulation specialists and wind-turbine climbers, Germany's move to a low-carbon economy powered by renewable energy sources is shaping new businesses and the jobs market. In this dossier, we look at the effects of the Energiewende on business models and employment in Germany's services, trade and manufacturing sectors.

Germany's Energiewende, or renewable energy transition, is dramatically transforming Germany's economy. On this point just about everyone in Germany concurs. New jobs and business models have emerged, well beyond the renewables industry. And analysts see potential in services, research and high-tech.

But the conventional energy sector has been bleeding jobs. Business leaders worry that the costs of the nuclear phase-out and the move into renewables could hurt manufacturers such as machinery makers, the car industry or other traditional pillars of Germany's economic success.

Statisticians and researchers are having trouble keeping track of the rapid changes, making a full assessment difficult. And the collapse of the solar industry in recent years has shown how fast fortunes can turn on the way to a completely different energy system. The jury is still out on whether the Energiewende headed for an ultimate economic success as many upcoming political decisions such as a new power market design will have fresh impact.

Talk to some German business leaders, like those at the Federation of German Industries (BDI) and the Association of German Chambers of Commerce and Industry (DIHK), and you'd hear that the high price of electricity is putting jobs and business at risk. They claim that manufacturers are investing less, leaving Germany for better conditions abroad, or even perishing because pro-renewables incentives have pushed power prices higher for end-users. At times, the BDI even warned of Germany's potential "de-industrialization".

A broad range of experts, green businesses and lobbies, much of the public and most of Germany's political class, however, see the transition as a modernising catalyst that benefits German businesses up and down the value chain. Chancellor Angela Merkel and her cabinet regularly underscore the job and revenue-creating impact of the Energiewende, as well as its export potential.

The Borderstep Institute and the University of Oldenburg estimate that 81 percent of new "green economy" start-ups between 2006 and 2013 were in renewable energy, energy efficiency, and climate protection. Their research shows that 170,000 start-ups in the "green economy" were founded between 2006 and 2013, with young green businesses providing 1.1 million jobs (Also see Factsheet The Energiewende's impact on jobs and businesses).

Of the roughly two million jobs the German Federal Environment Agency (UBA) estimates belong to environmentally related fields at least half are tied to the Energiewende, the study's author said.

According to a study commissioned by the Federal Ministry of Industry and Energy, about 371,400 jobs (2013) stem from renewable energy production and supply, manufacturing power generation hardware, related R&D, and servicing renewables generation facilities. The German Industry Initiative for Energy Efficiency (DENEFF) calculates 848,000 jobs (2013) from the energy efficiency push.

These figures omit other sectors also impacted by the Energiewende, including higher education and training programmes; think tanks and consulting firms; emissions-reduction technology; the decommissioning of nuclear reactors; IT and smart technology; power grids (for the growing renewable energy supply); sustainable mobility; green investment services (like GSL Bank, Ökobank, and the Umweltbank); as well as power storage, architecture, tourism and more. No official or unofficial figure exists for all Energiewende-created jobs, exports or revenue.

At times, the Federation of German Industries (BDI) even warned of Germany's potential "de-industrialization".

"In some sectors there's a direct impact, like on e-mobility, storage and grid technologies. And then there's an indirect

impact on many others caused by energy prices or climate protection measures," argues Krischan Ostenrath of the Science Shop Bonn, an NGO focusing on economy and sustainability. Businesses benefit (or suffer) from the Energiewende to different degrees, making it hard to calculate the full economic impact, he says. The two-million figure is out-dated (2010) and incomplete, he says, asserting the actual figure today is much higher.

> *"The economy will be better off with the Energiewende."*
>
> *Ulrike Lehr, GWS.*

Business creator

Economists such as Ulrike Lehr and Philip Ulrich of the Institute for Economic Structures Research (GWS), who work extensively on the topic, say: "The economy will be better off with the Energiewende." By 2020, they calculate, the renewable energy industry could contribute as much as 37 billion euros annually to GDP and the total number of jobs will be 120,000 higher than would be the case in the absence of the Energiewende. According to the Institute for Employment Research (IAB), the research arm of the Federal Employment Agency, these jobs tend to demand higher qualifications than those in the conventional energy sector and are 10-14 percent better paid.

Many Energiewende-related businesses owe their existence to public policies, Lehr says. "Whether the Energiewende creates growth and jobs in Germany in the future depends on how seriously it is taken by policymakers and the private sector. The Energiewende is not a panacea for economic growth and jobs," says

Jobs in the renewables business increase with the Energiewende but other sectors - particularly in mining and conventional power production - will be lost. Photo: Fotolia © ted007.

Lehr. If policy doesn't actively back renewable energy expansion and energy efficiency, much of the investment to date will be squandered, she argues. But if supported, she says, "growth and employment will benefit in the long term." Her analysis of the Energiewende's economic effects – with high and low models – takes different degrees of policy support into consideration.

Carola Kantz of the German Engineering Association (VDMA), representing 3,000 machinery companies, is of similar opinion. VDMA's largely medium-sized businesses, she says, such as makers of power plant components, cables, batteries, transformers, compressors, and a wide range of construction equipment, "have benefitted considerably" from demand for renewable energy and efficiency-related hardware and technology, much of which they export. She notes that most of the VDMA's members are not exempt from the renewable energy-support fees, as are larger, energy-intensive firms in Germany.

But Kantz complains that the "zigzag course" of German governments in recent years is a problem. "Our members need to know that there'll be consistent policies and a steady energy supply in the future, 5 to 10 years down the road. This will create a stable investment climate today," she says.

The current centre-left government also sees this as critical to business and job creation in Germany. It passed measures in 2014 intended to make the Energiewende more predictable and supply more stable. Businesses, for example, can count on policy measures that aim for 40 to 45 percent renewables in the power supply by 2025 and 55 to 60 percent by 2035. In terms of capacity, solar energy should increase annually by 2.5 gigawatts (gross), onshore wind energy by 2.5 gigawatts (net), and biomass by approximately 100 megawatts (gross). Offshore wind energy installation is planned to hit 6.5 gigawatts by 2020 and 15 gigawatts by 2030.

> *"Installation is extremely labour-intensive, so carpenters and craftsmen are needed for every building that's retrofitted."*
>
> *Christian Noll, DENEFF.*

Moreover, the 2013-elected government has made efficiency a priority. It upped financing to retrofit buildings to two billion euros a year as of 2016 (from €1.8 billion now). The government will also introduce competitive tenders for a range of energy efficiency projects and it plans to design new tax incentives for energy-saving renovations. Germany wants to reduce primary energy consumption by 20 percent by 2020 (compared with 2008) and halve it by 2050.

The bulk of jobs in the renewables industry stem from wind power (119,000 onshore; 18,800 offshore), followed by bio-energy (126,400) and photovoltaics (68,500), government data show. These segments also constitute the lion's share of 2013 investment (€16.09 billion) in renewables facilities and revenue (€22.70 billion) from manufacturing installations and components. Geothermal, thermal solar, and hydro is much smaller.

Exports are also a big driver of jobs and business. The Renewable Energies Agency (AEE) says exports account for 44 percent of the jobs in the renewable facilities manufacturing sector. In 2014, the biogas technology manufacturing industry, which was hard hit domestically by critical reports and incentive cuts, exported 68 percent of its product. The solar photovoltaic (PV) sector, which also flagged in Germany, tripled its exports to Asia in 2013, doing 81 percent of its business abroad. Germany's wind turbine industry, located on the North Sea and Baltic coasts, sells 67 percent of its technology to global markets.

The breadth of the renewables segment is vast. It includes businesses along the entire value chain from, for example, the planting of energy crops to their sale on the retail market. Wind power jobs include employment in pre-production stages like steel and

mechanical engineering, design, tax consultancy, and management; a second stage that includes making foundations, rotors and towers, and providing transportation and administration; and finally, construction and installation. In the 317,400 jobs in the renewables field, 8,300 positions in research and in public administration are also included.

Efficiency jobs

Energy efficiency has also spawned jobs. According to DENEFF, 848,000 persons were employed in the sector 2013, which had a turnover of 162 billion euros. "Energy efficiency is often underestimated in terms of job creation," explains Christian Noll of DENEFF, whose calculation is based on industry surveys and other data. "Installation is extremely labour-intensive, so carpenters and craftsmen are needed for every building that's retrofitted," he says. Carola Kantz of VDMA says every old appliance – from coffee machines to automobiles – replaced by a new, energy efficient model is business attributable to the Energiewende.

The efficiency branch is driven by regulatory (EU and German policy), socio-economic (environmental consciousness, energy prices) and technical (new production modes and technologies) factors. The 2012 EU Energy Efficiency Directive will "directly lead to significant economic growth and employment," says Noll. Germany is in the process of writing this into law.

The ups and downs of a new business sector

Despite government targets and long-term fixed incentives, the Energiewende economy is fluid and extremely dynamic – highly susceptible to external shocks, policy shifts, technological innovation, and the evolving character of the Energiewende. The solar sector, for example was the wunderkind of German renewables – its turnover tripling between 2007 (€4.4 billion) and 2011 (€13.3 billion) – as Germany led the world in installed solar capacity. Many of its globally known companies, like SolarWorld, SMA, Q-Cells and others, were based in eastern Germany where the boom lent a helping hand to the region's beleaguered, post-unification economy.

But the industry laid off tens of thousands of workers and shut factory doors when feed-in incentives were slashed and cheap Chinese modules flooded the global market. In 2012, the sector employed around 100,000 people, but by November 2013 it had shrivelled to 60,000.

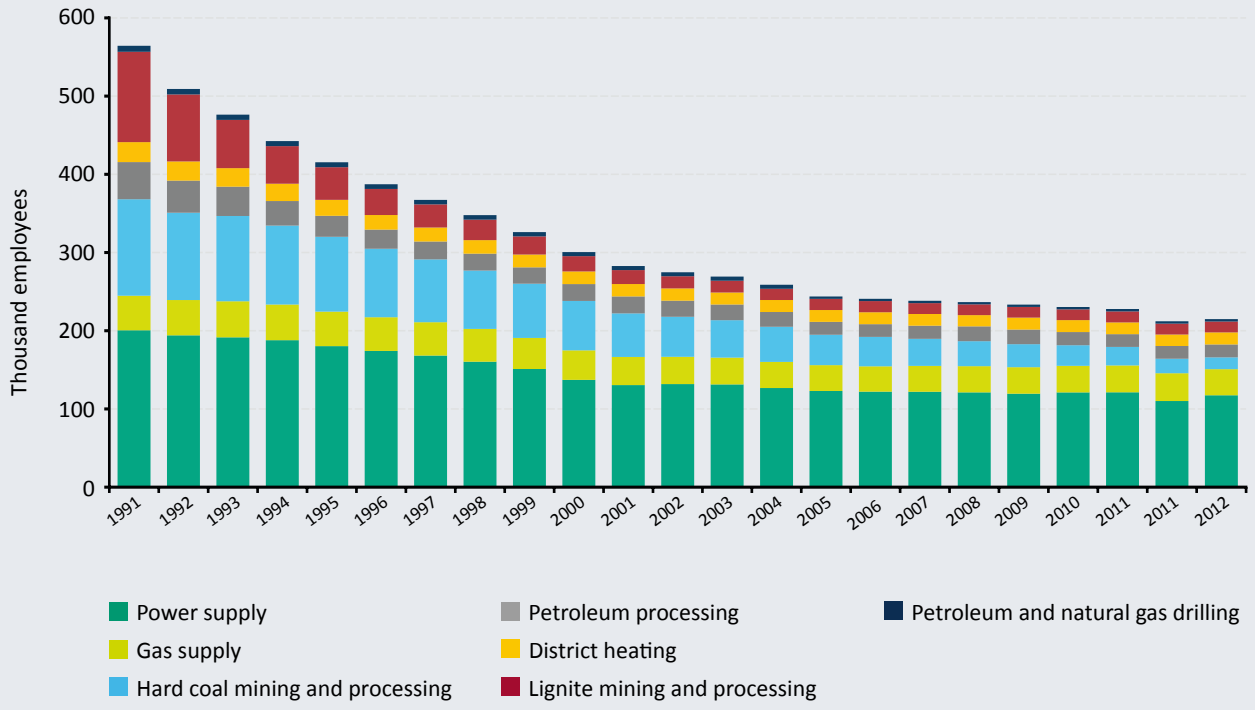
The offshore wind industry, on the other hand, hit rock bottom when the solar industry was thriving. Technical glitches, financing issues, bureaucratic and environmental obstacles, and uncertainty about policy support left it with a meagre 100 megawatts of power capacity in 2011. But just last year, the offshore industry turned the corner, surpassing the one gigawatt mark in generation with 258 turbines in the Baltic and North Seas (142 of which went online in 2014).

"It took longer than we ever thought but offshore wind finally figured it out," says Sebastian Sahm of the Stiftung Offshore Wind Energy, a group representing the industry. "Offshore was also one of the winners of the revamped EEG [the 2014 revised Renewable Energy Act which stipulates incentives for production]. This has breathed new confidence into the market," he says.

Right after the law was revised, for example, Swedish utility Vattenfall and the German power supplier Stadtwerke München said they would move forward with the Sandbank park in the North Sea – an investment of 1.2 billion euros. The park's 72 Siemens turbines will provide 288 megawatts of capacity. Wind industry insiders

> *"It took longer than we ever thought but offshore wind finally figured it out."*
>
> *Sebastian Sahm, Stiftung Offshore Wind Energy.*

Figure 1 | Jobs in the conventional energy sector 1991-2013.



Source: BMWi Progress Report 2014 / Statistisches Bundesamt 2014.

predict offshore capacity will triple in 2015 and revenue could exceed ten billion euros this year.

Ulrike Lehr of GWS estimates 500,000 to 600,000 jobs in the renewables industry by 2020, most new jobs from the onshore wind sector, and maybe another 250,000 in the efficiency sector. On the other hand, Uwe Leprich, Scientific Director of the Institute for Future Energy Systems (IZES) based in Saarbrücken, believes it will be a long time before the renewable energy market reaches its 2012 peak when it added 7.5 gigawatts of capacity thanks to solar PV's dramatic expansion.

Business killer

Not everybody is as bullish about the Energiewende economy as its beneficiaries and supporters. While the business community largely backs the idea, many have been highly critical of how it has been implemented.

> *"Those who claim that net jobs are created must prove that the capital intensity of production in the new sectors is lower than in the old sectors. And for this there is no evidence."*
>
> *Hans-Werner Sinn, IFO.*

The conventional energy sector, for example, has been rocked by the nuclear power phase-out, the rapid ascent of renewables, the fall in wholesale electricity prices, the decline in energy demand, disastrous investments, and most recently, plummeting global petroleum prices. The conventional

energy supply sector currently has 215,000 jobs, down from 564,000 in 1991. Germany's biggest utilities – once called the "Big Four" because of their dominance in supply and distribution – have suffered severe declines in revenue, jobs, and investment (see Clean Energy Wire Dossier "German Utilities and the Energiewende").

> *"Because of the high cost of electricity some companies are directing their investments abroad. In the long term, this is to the detriment of local jobs."*
>
> *Matthias Wissmann, VDA.*

Businesses in these sectors and Energiewende critics say that the net employment effect of the Energiewende (confined to renewables supply) is more or less neutral. The Bonn-based Institute for the Study of Labor (IZA) concludes that studies show "both positive and negative employment effects from a green energy policy. But the effects are quantitatively moderate, so the overall net employment effect is rather limited."

The economist Hans-Werner Sinn of the Institute for Economic Research (IFO) is less generous: "The Energiewende shifts purchasing power from the traditional consumer and capital goods industries to industries that manufacture wind turbines, solar panels and other equipment needed for alternative power," he says in the economics ministry newsletter Energiewende Direkt. "Those who claim that net jobs are created must prove that the capital intensity of production in the new sectors is lower than in the old sectors. And for this there is no evidence."

A DIHK report, titled "More Losers, Fewer Winners," asserts that "industry and trade see themselves as the losers." In a survey of 2,193 companies, 34 percent said the Energiewende had an adverse impact on their firms, including negatively affecting their competitive edge in foreign markets, while 14 percent saw its impact as positive. The high price of energy and stability of supply were seen as culprits.

At the same time, members of the machinery association VDMA, most of them moderately sized companies, didn't suffer as a result of the higher energy prices, Carola Kantz says. Roughly 43,000 German firms, many of them considered "Mittelstand"companies, a backbone of the German economy, are not exempt from a surcharge added to the power price to pay for renewables incentives. However, the big electricity users, such as aluminium smelters, making up for around one sixth of German power consumption are exempt, therefore paying one of the lowest prices in Europe on the wholesale market.

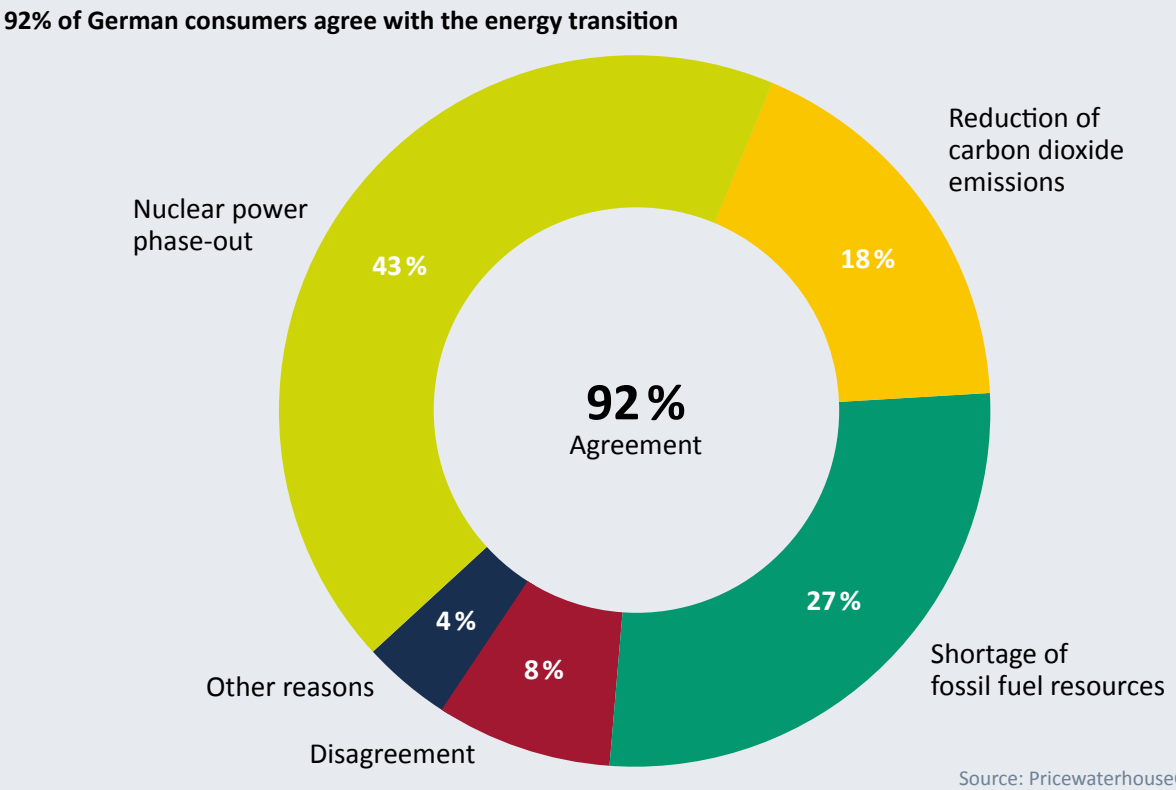
Sebastian Bolay of the DIHK admits that German industry is highly competitive abroad. But the 2014 EEG revoked the exempt status of some German firms, like in the metallurgy sector, who now say they're disadvantaged on the European market. "German companies aren't leaving the country en mass," says Bolay, "but it's a creeping, long-term process". Renewable energy has driven down the price of wholesale power in Germany, he says, but it's still not as cheap as it is in Texas.

The electricity price paid by German carmakers, who are for the most part only partially exempt from the surcharge, is more than twice as high as in the US because of the EEG, says Matthias Wissmann, president of the German Association of the Automotive Industry (VDA). "Because of the high cost of electricity some companies are directing their investments abroad. In the long term, this is to the detriment of local jobs."

Energiewende businesses of the future

Both Germany's renewables sector and conventional energy are striving to adapt as the Energiewende reconfigures the country's power supply and markets.

Figure 2 | Why Germans support the Energiewende.



Source: PricewaterhouseCoopers 2015.

Business models are changing too, including those of the over 1,000 utilities in Germany – from giants like E.ON and RWE to the many smaller Stadtwerke, or municipal utilities, scattered across Germany.

"The new businesses and jobs of the Energiewende will be created through the networking of decentralized options," explains Uwe Leprich of IZES. They "will have to fit small networks on a local level where wind, PV, cogeneration, demand management and small storage units are linked through IT and communications technology," he says. This has already started in services that balance demand and supply to ensure the security and quality of electricity.

"The drivers now and in the near future are security of supply. In the old system it was solely the central grid operators, the TSOs [transmission system operators], that handled this. In the near future DSOs [distribution system operators] have to contribute as well," Leprich says, referring to local network companies who distribute energy across a decentralized smart grid. As ever-more weather-reliant renewables supply power, the next generation of successful energy suppliers will have to work closely with these options, he says, adding that flexibility will be a hallmark of the new system.

Who will be big players in the new energy world?

Tobias Federico of the consulting firm Energy Brainpool agrees that the energy-sector business models of the future are up in the air. "The utilities won't be the big players," he says, adding that he doesn't see any current market actors properly outfitted for Germany's emerging decentralized, high-tech energy market.

Federico says flexibility will come from both supply and demand sides. These players will have to evaluate the flexibility of various consumers. "This means

collecting enormous amounts of data about decentralized production and consumption, and then understanding it. Germany's energy companies will have to deal effectively with the power market, the grid, and the consumer market as one entity," he says.

The trajectory of two of Germany's energy heavyweights – the solar PV firm SolarWorld and the nation's biggest utility, E.ON – illustrate the path Germany's energy market players are trying to forge.

> *"Today no one fears that the lights will go out but in ten years we'll need new capacities."*
>
> *Uwe Leprich of IZES.*

SolarWorld made the leap to a new model after the bottom fell out of the solar PV market in 2011. It recast itself from manufacturer of solar cells, silicon wafers and PV modules to on-the-ground "energy management" provider, offering services and state-of-the-art technology at the interface of supply and demand markets. This includes energy consulting, installation and design, demand and consumption management, automated energy management, and combined rooftop PV and storage options.

Not everybody is convinced that the solar industry will make it with this new model. Bernd Hirschl of the Institute for Ecological Economy Research (IÖW) says the PV sector was hit very hard by abrupt changes to state incentives in 2011-2014. Now, new measures include a surcharge on the power use of self-consumers – exactly the market segment that SolarWorld and others hope to capture with their energy system packages.

E.ON is a different story, one of the Big Four that shared in a lucrative, closed oligopoly in energy supply and distribution. But market liberalisation, the unbundling of supply and distribution channels, the entry of renewables and its failure to invest in them, some poor investment, the decline in wholesale power prices, topped off by Germany's shutdown of a third of its nuclear fleet (two of the biggest plants belonging to E.ON) were tough on E.ON. Early in 2015, the group reported a record loss. It already announced a tough cost cutting programme including lay-offs in 2011.

Last year, E.ON said it would separate its conventional fossil fuel and nuclear assets into one firm, creating a new company for renewables, networks and customer solutions. The latter will focus on innovation, offshore and onshore wind power in Europe, and to a lesser extent, solar power. It will also upgrade its energy distribution networks in Europe and Turkey making them "smarter," to offer products and services in energy efficiency and distributed generation.

Some observers don't believe either E.ON or SolarWorld are the next model for Germany's fast changing market. "Today no one fears that the lights will go out," says Leprich of IZES, "but in ten years we'll need new capacities. We don't know yet who'll cover supply at times when renewables can't. Will it be gas turbines, batteries, power-to-gas, pumped storage in Norway, concentrated solar power in MENA, demand control or a mixture of these?," he says. "The field is wide open."

Factsheets

- Where the Energiewende creates jobs
- What business thinks of the energy transition

www.cleanenergywire.org/dossiers/energy-transitions-effect-jobs-and-business

Dossier

The people's Energiewende

Germany between citizens' energy and Nimbyism

10 Mar 2015 | Lars Borchert

Since the energy transition took off in 2000, millions of Germans have become energy producers, investing in solar panels on their houses and buying shares in wind parks. Citizens' engagement is one reason that support for the energy transition is high despite rising power prices. But as the transition gathered pace the government changed regulations, stoking concerns that more complex rules will put citizens off. At the same time, important Energiewende projects have run into resistance, requiring new ways to keep the public on board.

The roof of the Leptin family's Hamburg home is a mini green power plant. 44 square metres of glossy panels cover its south-facing aspect, turning the sun's rays into electricity which is fed onto the German grid. Soon, it will also be turning a profit for the family. "It's a useful technology, for economic and ecologic reasons," said Luise Leptin. "We would have been stupid not to do it ."

The installation harvests some 5,000 kilowatt-hours (KWh) per year. For every kilowatt they feed onto the grid the family are paid 51 cents by their power provider. "This way, our investment will have paid off by next year, 10 years after the installation," Leptin told the Clean Energy Wire. "From then on we should make a profit, because the 51 cents are guaranteed for 20 years."

"If people participate with their own money, for example in a wind or solar power plant in their area, they will also support it."

Manfred Fischedick, Wuppertal Institute.

Millions of Germans like the Leptins have installed solar panels on their roofs or come together to form renewable energy cooperatives, meaning they have a direct stake in their country's transition to a low-carbon economy. According to a study by the Leuphana University of Lüneburg, citizens owned almost half the country's installed biogas and solar capacity and half the installed onshore wind power capacity.

From the start, the "Energiewende", which has its roots in the early environmental and anti-nuclear movements of the 1970s, has been driven by a broad social consensus. The transition has gripped large parts of society, and local initiatives, research and educational projects as well as new business models have sprung up across the country.

But now the project enters a new phase as renewables produce over 27 percent of the electricity used in Germany. Revised rules governing the payment for renewable power, as well as the construction of vital new infrastructure, have triggered uncertainty over who will shoulder the social costs of the Energiewende – and even sparked public protest.

A large majority of Germans are in favour of the goals of the Energiewende, with polls showing support of between 60 and 90 percent depending on the question, despite the fact that electricity prices have risen, in part because of the payments for renewables.

Many observers say that citizens having a stake in the project has kept support high. "If people participate with their own money, for example in a wind or solar power plant in their area, they will also support it," Manfred Fischedick, Director of the Wuppertal Institute for Climate, Environment and Energy told the Clean Energy Wire.

Citizens' involvement has also started to turn the old structures in the energy market upside down, leaving the big utilities with unexpected competition. "So far, the energy transition has been strongly influenced by the financial commitment of citizens," said Heinrich Degenhart of the Leuphana University Lüneburg. "With their investments, the energy market has grown from a virtually monopolistic to a polypolistic market."

This dramatic shift to a decentralised energy system has taken place under the framework of the Renewable Energy Act (EEG), introduced in 2000. Small investors were given an incentive through feed-in tariffs for new renewable power installations, guaranteed for 20 years. The share of renewables in Germany's electricity consumption surged from below 7 percent in 1990 to over 27 percent in 2014.

The government is quick to acknowledge the role of citizens in the German energy transition, as deputy energy minister Rainer Baake stressed during the New Year reception of the German Cooperative and Raiffeisen Confederation in early 2015. "We are often asked

abroad: How did you manage to get such broad support for the Energiewende and the rapid development of renewables? The key answer is: participation," Baake said, citing ownership as the major factor.

Is the EEG reform breaking the backbone of the Energiewende?

But Baake then highlighted that the Energiewende had entered a new phase given the growing share of renewables, making recent changes to the EEG indispensable. His remarks were met with audible dismay by the cooperatives' representatives.

The new framework conditions under the latest reform of the EEG, enacted in August 2014, expose renewable energy producers to market forces by phasing in a switch from feed-in tariffs to a "contract for difference" (CFD) system of payments. Investors in new wind parks and solar projects larger than the average roof-top installation must market their power themselves (or through a third party), selling their electricity on a daily basis to the wholesale power market. Smaller installations are affected in a different way by the revised regulations. In response to the plummeting price of solar panels, the guaranteed feed-in tariff for new installations like the Leptins' has been cut from 51 to less than 13 cents per kilowatt-hour over the years.

Yet the changes have led to uncertainty. "Due to the changes in the energy policy and the lack of lucrative projects, the population's willingness to support the energy transition is waning," said Silke Eulenstein, a board member of the Energiegenossenschaft Otterndorf, an energy cooperative in the north German state of Lower Saxony, whose 89 members have so far invested in two solar installations with a total capacity of 40 KWh. The group is in talks with the municipality over how to integrate windparks into a concept for renewables for the community.

For the small-scale producers – private households, farmers and cooperatives – whose production has so far been seen as the backbone of German clean energy, the new regulations have lead to uncertainty over future investments.

Consequences for cooperatives

While residential-scale facilities are largely unaffected, the reform began to have an impact on investment in energy cooperatives even before its parliamentary approval. According to a study from the Bundesgeschäftsstelle Energiegenossenschaften (Federal Office of Energy Cooperatives), in 2014 almost a third of energy cooperatives refrained from investing, while in 2013 only 8 percent of them had lacked an investment plan. And the number of new cooperatives formed was lower than in previous years, falling back to the level of 2009. According to the Bundesgeschäftsstelle, cooperatives want to be sure of the feasibility of implementing the new legal requirements before they invest.

"The lack of certainty over feed-in tariffs makes it difficult to guarantee fixed interest rates for the money put into a cooperative."

Silke Eulenstein, Energiegenossenschaft Otterndorf.

"The lack of certainty over feed-in tariffs makes it difficult to guarantee fixed interest rates for the money put into a cooperative. This causes a 'wait-and-see' attitude amongst potential members," Eulenstein said.

Infrastructure casts a shadow

And the revised renewable energy legislation isn't the only development that could dent public support for the Energiewende. Recent sur-

veys still show that a vast majority of Germans want green energy and support the transition, but projects key to its implementation have triggered mixed feelings, as the social costs to some parts of society become apparent.

Resistance has been building across the country to large-scale infrastructure projects such as transmission grid expansion and biomass plants, as well as large wind and solar parks. This has led some observers to wonder if so-called "Nimbyism" (Not In My BackYard) might become a serious stumbling block for the whole project.

> *"The growing number of wind turbines is ruining our state's image as a region of unspoilt landscapes [...]."*
>
> *Norbert Schumacher, Free Horizon.*

Some citizens fear their property will plummet in value as the result of proximity to a wind turbine, power mast, or high-voltage transmission cable. Others worry these constructions could impact the local environment, cause health problems or damage the appeal of tourist spots.

Grid expansion is seen by most experts as crucial for Germany to hit its target of 55 percent of power generated from renewable sources by 2035, reducing emissions and guaranteeing energy security. The government has made its importance clear in several chapters of its Progress Report on the Energy Transition published last year. But the project is also highly controversial – particularly in Bavaria.

"Not in my Alps"

In many ways, Bavaria is at the forefront of the energy transition. The state came first in a ranking comparing the overall performance of all 16 German states in the Energiewende – mainly because Bavaria increased its share of renewables in energy consumption much faster than any other state, according to the study. It is also home to 237 energy cooperatives and more than 60,000 Bavarians make a living from renewables. And opinion polls show the population is overwhelmingly in favour of the Energiewende.

But many Bavarians have also taken to the streets to protest the power lines planned to transport wind power from the North and Baltic Sea to the industrial hubs in the south. When Chancellor Angela Merkel addressed citizens in the central Bavarian town of Ingolstadt in May last year, her speech was drowned out by the shouts protestors, who gathered in their hundreds to oppose the construction of a power line from Bad Lauchstädt in Saxony-Anhalt to Meitingen in Bavaria.

And Bavarians aren't alone in their resistance. Although studies show limited effect of renewable installation on tourism and evidence of health dangers is lacking, concerns have been on the rise in various places. Eulenstein says plans for onshore wind turbines have been met with protest in Otterndorf. And in Mecklenburg-Western Pomerania, a northern state bordering Poland, 40 citizens' initiatives opposing wind power development founded the action alliance "Freier Horizont" (Free Horizon) in November 2014.

"The growing number of wind turbines is ruining our state's image as a region of unspoilt landscapes and intact natural areas and hence threatens our earnings from tourism," Norbert Schumacher, head of Free Horizon, told the Clean Energy Wire. "Our government is systematically destroying the identity of our region." Schumacher also worries about health hazards from the turbines.

Free Horizon says far better citizen participation is needed in future wind power projects. "The way the local and the federal government say that they integrate us is nothing but a joke," said Schumacher. "We feel patronised. When they conduct their surveys, they don't even let us comment on wind power itself, only on certain side-effects of the turbines. Afterwards they claim that we are actually in favour of this energy source, which is not true."

The call for greater participation in decision-making processes is echoed around Germany. "Unfortunately, there is neither the support nor measures from the

municipality to integrate the local population in order to support the energy transformation," said Eulenstein.

As the Energiewende moves into its next phase, public support is as important as ever. But given the scale of the transformation, the concerns of ordinary citizens are understandable, experts say.

"What this all boils down to is uncertainty," said Lars Waldmann of Berlin-based think-tank Agora Energiewende. "The energy transition is a deeply interconnected system and a complex challenge for all actors involved. New technologies, new protagonists and new modes of governance characterise it. This means a high level of uncertainty for citizens."

"Even though all surveys prove that the population wants and supports the Energiewende it still holds lots of potential for conflict," Waldmann told the Clean Energy Wire. "People quickly feel insecure, especially when they receive contradictory information, or feel left out."

Joint decision-making dispels doubts

Waldmann said early public participation is key to building acceptance. "And early public participation in this case does not mean to display project plans somewhere in the basement of a town hall and posting a small ad about the times when they can be inspected somewhere in the local newspaper. It means organising events at convenient times for everybody, to give them a chance to inform themselves and discuss matters, before coming to a personal and hopefully also a joint decision."

Waldmann isn't the only one advocating this kind of open process of public consultation. "If space for common shaping is created, chances for broad approval of jointly developed problem-solving are high," writes social sciences professor Ortwin Renn, a former member of the German government's Ethics Commission. "Participation procedures, which follow the model of an analytical-deliberative discourse and combine this scientific expertise with ethical and moral considerations are particularly promising."

Hagen-Garenfeld, a small town in the state of North Rhine-Westphalia, provides a case study for just this kind of collective decision-making. For almost 18 months, its citizens fought the construction of a transformer station, which they thought was too big and too close to their homes. Perhaps the biggest stumbling block was that they didn't feel they had been informed early enough, or provided with enough information.

In May 2013, network operator Amprion invited residents of Garenfeld to an event to inform them about the building. But many citizens didn't know about it, and others only found out by chance. Those who did attend the event were shocked: Amprion wanted to begin the construction of a building over 22 metres high in the autumn of that year.

The people of Garenfeld felt the network operator was trying to get one over on them, while politicians and the local authorities turned a blind eye. They founded the citizens' initiative "Menschen unter Strom" (People carrying Current) to block the construction. At the same time they agreed to enter mediation with Amprion, rather than go to court.

Following 17 meetings, the citizens of Garenfeld came to an agreement with Amprion in December 2014. The transformer will be built, but as far as possible from their homes (more than 400 metres from the nearest house) with the height reduced to 14.5 metres. Orchards and fast-growing trees are to be planted to screen the construction from view. Both the network operator and citizens said they were satisfied with the outcome, agreeing that mediation achieved what a court process could not have done.

Lars Borchert is a freelance contributor to the Clean Energy Wire. He has written for Platts, Der Tagesspiegel and Reuters among others.

Factsheets

- Polls reveal citizens' support for Energiewende
- What German households pay for power
- Citizens' participation in the Energiewende

www.cleanenergywire.org/dossiers/peoples-energiewende

Dossier

Utilities and the energy transition

Fighting for survival: Germany's big utilities look for a future in the new energy world

20 Feb 2015 | Jakob Schlandt

Germany's ambitious transition to renewable energy has left the four major utilities that have dominated the market for decades out in the cold. E.ON, RWE, EnBW and Vattenfall have started to adjust their business models - yet despite some drastic steps, their future role in Germany's greener, fast-changing energy markets is far from clear.

E.ON has set the tone: Germany's largest utility will split in two next year after a radical restructuring, selling its conventional power stations to focus on grids, renewables and energy services. Just a few years back, such a drastic move was unthinkable. But Germany's energy market is in turmoil and the transition from fossil and nuclear power to renewables has profound consequences for the utilities.

> *"We have seen a kind of worst case-scenario materialise for the big energy companies."*
>
> *Thorsten Lenck, Energy Brainpool*

All companies in the sector have to adjust. But coping with a new energy landscape is perhaps toughest for the four biggest German utilities, E.ON, RWE, Vattenfall and EnBW. Epitomising the "old" energy world of centralised generation and large-scale investment, they have the most to lose from political decisions taken over recent years.

"We have seen a kind of worst case-scenario materialise for the big energy companies," says Thorsten Lenck of Berlin-based consultancy Energy Brainpool. "The whole business model of the 'Big Four' is called into question over the coming years and decades. They didn't see this coming."

The big companies have been slow to respond to the transition to green power that has turned millions of Germans into producers in a much more decentralised electricity market. And while the other three are unlikely to follow E.ON's lead, they too are overhauling their business models. Experts see new business opportunities for utilities arising, but whether the "Big Four" can seize them is uncertain.

Old times phase out

For nearly a century, the German energy sector was the playing field of giants. Under the Nazi regime, the electricity sector was consolidated and regional monopolies established. During the early years of the Bundesrepublik, it came under the firm control of large, well-established and deeply politicised utilities. Emerging from state-owned regional monopolies, the consolidation process that followed the liberalisation of the German energy market in 1998 seemed to tighten their grip still further, resulting in a carved-up market with clearly demarcated regions of dominance. The Big Four – Germany's largest energy companies by a wide margin – were born.

E.ON owns power stations and grids in the north and west of Germany and in southern Bavaria. RWE, the second largest of the four, is particularly strong in the Rhine-Ruhr region, Germany's industrial heartland, while EnBW controls Baden-Wurttemberg in the south-west. Vattenfall Deutschland, subsidiary of Swedish state-owned power company Vattenfall, controls the territory of the former GDR.

Each was able to use size to their advantage, reaping big profits for their shareholders from the late 1990s on. This sparked concerns of an oligopoly and led to an inquiry by the German antitrust office. In the electricity sector in particular, size, entrenchment and vertical integration seemed to give an almost insurmountable advantage to the incumbents. In 2009, E.ON booked a record profit of over 8 billion euros.

Fast-forward not even a decade, and the tables have turned. The economic power of the Big Four has been dramatically reduced. Share prices have tanked. German market leader E.ON is now worth only 26.4 billion euros, compared to 92 billion in 2007. RWE's value dropped from 53.5 billion to 14.2 billion and EnBW is worth just 7 billion. Vattenfall Deutschland is owned by the Swedish state, but their assets have taken a similar hit.

So, what happened? A number of interlinked developments associated with Germany's transition to green energy have wrecked the business model of Germany's energy corporations to the point where their ability to survive is seriously called into question.

Most obvious is the nuclear phase-out. Having reversed a nuclear phase-out policy dating back to 2002 the previous year, German government responded to the Fukushima meltdown in 2011 by shutting down eight of the country's 17 nuclear power plants immediately. The rest are to be taken offline one by one by 2022. Since these facilities are almost exclusively owned by the Big Four, they must take the burden of a greatly diminished generation capacity. Even with legal disputes over compensation for the decision ongoing, this was clearly a blow to their balance sheets.

What is more, a renewable energy boom that began in the late 1990s with the rapid expansion of wind power is sweeping across Germany. Helped by a support scheme, the share of green energy in electricity production has risen from 9.2 percent a decade ago to 25.8 percent in 2014, according to preliminary figures. The energy giants missed out on this bonanza and, apart from a few larger offshore wind farms, own only a fraction of green capacity. RWE e.g. began investing in green energy on a significant scale in 2007. According to the most recent figures, green energy makes up only 6.4 percent of RWE's electricity generation – for its German operations alone the figure is still lower. The situation is similar for the other three large utilities.

As a consequence, their market share in power generation has fallen by about ten percentage points to around 50 percent in only three years, according to a calculation by Clean Energy Wire*.

Hence, the two-pronged Energiewende – switching off nuclear and investing in green energy – is often portrayed as the sole source of calamities for the Big Four. And it has certainly had a powerful impact, not only on market share, but also on power prices. But that is only half the truth, says Helmuth Groscurth, managing director of the Arrhenius Institute for Energy and Climate Policy.

A political bet gone sour

In the early 2000s, the Big Four embarked on a massive programme of investment in conventional energy. Back then, electricity prices were high and power stations highly profitable. "But they did not take into account that naturally, in a power market, many power stations cannot earn a profit. Many will end up with just enough money to recoup running expenses, not investment cost." Why did they invest anyway? Groscurth says they were thinking along old lines, assuming that the government would eventually cover their costs in case their calculations went wrong. "This was not only an economic bet, but also a political bet gone sour," says Groscurth.

Dwindling power prices have exacerbated the situation over the last years. Electricity for delivery in the second quarter of 2015 currently fetches just under 3 cents per kilowatt hour (KWh) – half the price of 2010. RWE estimates only 40 percent of the price drop is due to the rapid expansion of renewables, with 60 percent down to the weak European economy in the wake of the financial crisis. As a result, many power plants are deep in the red. There is a long list of potential closures, and in some cases only government intervention has kept even new and highly efficient gas power stations from being mothballed. Each of the major utilities has reacted with cost-cutting programmes and shed tens of thousands of well-paid jobs.

A comparison with their European peers underlines that the woes of the German utilities cannot be solely blamed on the Energiewende. Companies based in countries with far less

> *"[The Big Four] did not take into account that naturally, in a power market, many power stations cannot earn a profit."*
>
> *Helmuth Groscurth, Arrhenius Institute.*

* Based on the market share in 2013 and 2010 according to the German regulator Bundesnetzagentur and the overall power production statistics according to the AG Energiebilanzen.

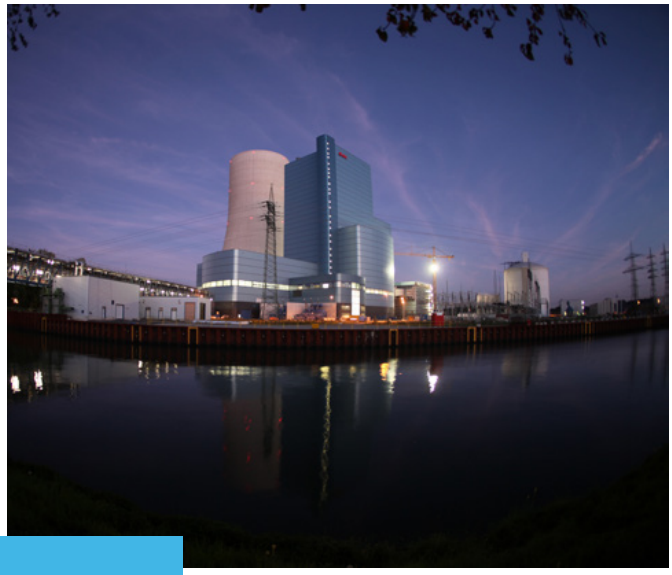
of a green agenda than Germany have also suffered write-downs of billions of euros. GDF Suez of France, currently the largest privately owned utility in the world, posted a record loss of nearly ten billion euros last year because it had to reduce the book-value of power stations and energy storage by more than 20 billion euros. The consultancy Accenture recently estimated that European utilities could lose another 61 billion euros in sales over the next 10 years due to "energy demand-disrupting technologies", including green power, self-produced electricity and better demand-side management.

Renewables, therefore, are not only a competing power source, but – combined with "smart" IT and rise of the "prosumer", who stores and consumes energy from, say, rooftop solar panels – they spell the end of a centralised energy market where large power stations produce power that is distributed to consumers.

"Two energy worlds" split E.ON

The Big Four have shared the path to their current calamity but their recipes for how to move forward have begun to diverge. Germany's number one utility by sales, Düsseldorf-based E.ON, has taken the most radical approach. The surprise announcement that E.ON plans to split its business in two came last autumn. Over a year ago, the company's CEO Johannes Teyssen initiated a strategy rethink without taboos, talking to energy experts the world over. In the end, management concluded it would be increasingly difficult to "bridge the widening gap between two energy worlds," Teyssen told journalists, after the decision was made public on 30 November.

The larger part of E.ON will keep regulated businesses like energy grids and new business units like renewable energy (most assets are outside of Germany) and smart energy solutions. A "new company" to be spun off in 2016 via a share split will inherit what was once considered E.ON's core, but now largely consists of ailing assets: Power plants, energy trade, and exploration. However, the company's enormous debt will remain with the larger E.ON. The rationale: The two parts are more than



"Two energy worlds" - German utility E.ON, formerly involved in both renewable power generation (solar power plant in Pellworm) and in fossil-fuelled electricity production (hard coal plant Datteln), will split operations in 2016. Photos: E.ON.

> *"Many people in the company [E.ON] had their foot on the brake and were just trying to weather the storm."*
>
> *Jonas Rooze, Bloomberg New Energy Finance.*

the sum, because they need different strategies to survive. Whereas one focuses on new business fields, the other can concentrate on making the best of its old assets.

Reactions to E.ON's bold move were mixed. Public discussion focused on the consequences for the utility's provision fund for the decommissioning of its nuclear power plants and permanent disposal of nuclear waste. But energy experts and analysts largely applauded. Jonas Rooze from the London-based consultancy Bloomberg New Energy Finance says E.ON has not only rid itself of problematic assets on its balance sheet, but also has the chance to change its corporate culture. "Many people in the company had their foot on the brake and were just trying to weather the storm. Most of them will be in the 'new company', which gives E.ON the chance to take a new direction," he says.

> *"We will have to fight hard for our conventional electricity generation capacities."*
>
> *Peter Terium, RWE CEO.*

Diverging routes

For the remaining three of the Big Four, no such solution is currently on the table. Vattenfall – the odd one out because it is in foreign ownership – is taking a route closest to E.ON's. Just like the other three major utilities, most of its plants in Germany are fossil-powered. Investment in renewable energy in Germany is low, even though Vattenfall is now one of the world's leading offshore wind companies. But that's not enough in the eyes of Vattenfall's owner, the Swedish state. Following the election of a red-green government in Sweden, the company announced plans to sell its extensive and carbon dioxide-intensive lignite operations in Germany in order to reach its emissions targets for 2020. More recently, Vattenfall announced that it has separated its lignite business, forming a separate company in preparation for the sale, which could take place as early as April 2015. Rumours about potential buyers abound, focusing mostly on East European utilities.

EnBW, meanwhile, which is almost wholly owned by municipalities and the state of Baden-Wurttemberg, has embarked on a significant overhaul it calls "strategy 2020", admitting that "the traditional business model of large utilities is not viable anymore." Steered by a red-green coalition government in Stuttgart, it plans to focus on investing in renewable energy. Unlike RWE and E.ON with their commitment to international profiles, EnBW plans to focus strongly on its home state of Baden-Württemberg. And power plants are no longer seen as an important part of its future. Profits from fossil, nuclear generation and trade are expected to fall by 80 percent between 2012 and 2020. EnBW expects the regulated business (like operating grids) and renewables will generate three quarters of EnBW's profits in 2020.

Of the four, RWE seems most attached to its core business. In a recent interview, CEO Peter Terium told the Frankfurter Allgemeine Zeitung that the company's grids, trade and sales were going strong. "That's the reason I don't feel fundamentally nervous about the company: Because only one of four main pillars is dented." However, he added: "We will have to fight hard for our conventional electricity generation capacities."

For RWE an E.ON-style split does not seem to be an option. Even though it is also a listed company, municipalities in North Rhine-Westphalia own about a quarter of the company. Any radical measures the group takes would need their approval – and its impact on employees, for example, would be instantly politicised.

RWE is active in areas like smart homes – energy management and services are seen as a profitable business opportunity for the future.

But many see RWE in an even worse position than E.ON, because it is not as diversified and has a strong focus on coal. Currently, the company's many lignite

plants in the Rhine area are more profitable than hard coal power stations. But if prices for emissions certificates – which are currently very low – begin to rise, the company would be in even deeper trouble. RWE is in danger of entering a downward spiral: It is highly indebted and with falling profits, credit ratings could fall further. Already, its debt to profit ratio is alarmingly high. RWE CEO Terium has repeatedly stressed that the company is facing a "culture shock". In five years, he promised, RWE would be a completely different company.

A smart home for the Big Four?

Simon Skillings, director of consultancy Trilemma UK, says it is hard to predict the success of the utilities' new businesses. "One of the main aims is to develop energy-related products that enable them to be a lead deployer of home automation systems. But a lot of industries are aiming at that sector," he says, citing Telecoms and IT companies as the most obvious examples.

The utilities' position in new energy management markets is also unclear. RWE, for example, has developed "Smart Home" for German customers, a package including electricity management and heating optimisation. RWE's British subsidiary, npower, has teamed up with Google-owned Nest Labs to sell automated thermostats. If and how deep the German utilities try to penetrate the supply chain of smart home solutions will be one of their major strategic decisions.

Financing these new business fields will be a critical issue, Skillings says. Utilities currently promise their shareholders stable returns in the form of dividends. It is unclear if management and investors would be willing to take a more risky approach, investing substantially in new areas. "It will be very interesting to see how E.ON deals with this dilemma and how it plans to develop its new businesses," says Skilling. E.ON's new strategy decisions are expected this year.

> *"If and how Germany's largest utilities will survive the next ten years depends heavily on government decisions to be taken in the near future."*
>
> *Thorsten Lenck, Energy Brainpool.*

According to a recent study by consultancy Arthur D. Little, energy services in the broadest sense are set to grow in coming years. In Germany, sales are projected to rise from less than 17 billion euros in 2014 to over 22 billion in 2020, with decentralised energy and virtual power plants – fluctuating sources of electricity – among the fastest growing business opportunities. Vattenfall for one, has invested in such a project. This market growth of roughly five billion euros might represent a huge opportunity for small companies. But for the Big Four – even if they were able to dominate these developments – it would only make up a fraction of the turnover lost in recent years from their power plants.

As in the past the future of the Big Four is dependent on politics. "If and how Germany's largest utilities will survive the next ten years depends heavily on government decisions to be taken in the near future," says Lenck of Energy Brainpool.

The German energy market design is currently being overhauled. Most crucially for the Big Four, a decision is planned by the end of this year on whether fossil power plants will receive payments for providing backup capacity (For more information: See the CLEW dossier on capacity markets). The energy giants, faced with huge losses from their conventional power plants, are lobbying for the swift introduction of such a scheme, arguing they currently provide a service – security of supply – that is not

remunerated. The notable exception is Vattenfall, which says a capacity mechanism is only necessary after 2020.

Despite promising there will be no preliminary decision on capacity markets, Energy Minister Sigmar Gabriel, a Social Democrat, recently quashed the large utilities' hopes of substantial subsidies, saying that "many of those who argue for a capacity market disguise their real interest: Conserving existing overcapacities at the expense of consumers. That is the opposite of reasonable energy policy."

To make matters worse, the Environment Ministry's climate action plan earmarks a reduction of CO_2 emissions by 22 million tonnes from fossil power plants by 2020. It is yet unclear how this could be achieved, but the most likely scenario involves some compensation for owners of stations that will need to be closed. Still, no one in the business expects to be showered with generous gifts.

Over recent years, Germany's energy giants have lost political capital (See Factsheet Municipal utilities), while municipal utilities have generally been more successful at selling their message. And the Big Four's greatest political victory seems with hindsight like their largest blunder. Having successfully lobbied for the lifetime extension of their nuclear power plants in 2010, the Fukushima catastrophe and the subsequent U-turn of Angela Merkel's energy policy cost them political support, both among the general public and in Berlin's political circles. Suing the government for compensation for the nuclear phase-out has not helped.

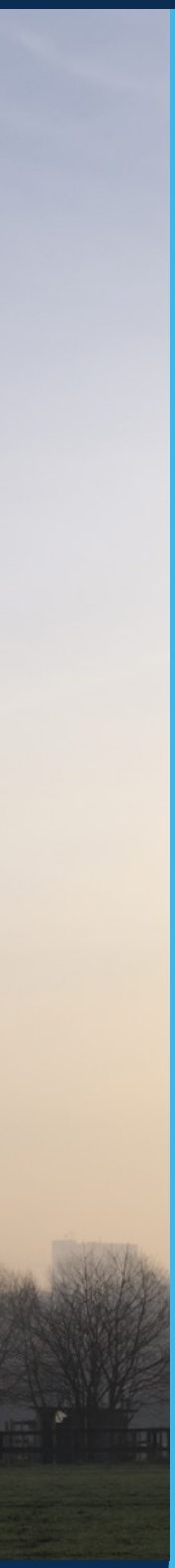
Then again, almost everybody now recognises the Big Four aren't the behemoths they once were but instead are rather vulnerable. Even staunch supporters of a radical Energiewende acknowledge that the energy giants have changed direction substantially. Bärbel Höhn, a Green Party member of parliament and one of Germany's most outspoken critics of both their market power and environmental profile has softened her tone. "The relationship has normalised," she told the Clean Energy Wire, adding she is finding more and more common ground with E.ON and EnBW, both on support for renewable power and energy market design.

Jakob Schlandt is a freelance contributor to the Clean Energy Wire. He also writes for Europolitics and BIZZ energy today and his own blog http://phasenpruefer.info.

Factsheets

- Small, but powerful – Germany's municipal utilities
- German utilities and the Energiewende
- Vattenfall's German brown coal: what's being sold and who wants to buy

www.cleanenergywire.org/dossiers/utilities-and-energy-transition



Dossier

The energy transition and climate change

Climate targets force Germany to tackle coal

16 Feb 2015 | Kerstine Appunn

To keep Germany from missing its own greenhouse gas reduction targets, the government presented its "Climate Action Programme" at the end of 2014, a package of measures aimed at cutting emissions. Shortly after, new data showed power usage and CO_2 emissions easing again after a recent ascent, leading some analysts to predict better years ahead. But environmentalists warn that conventional power plants, especially those fired with coal, still pose threats.

Reducing greenhouse gas emissions that cause global warming lies at the heart of the Energiewende. So when emissions began rising after 2009, the year an all-time low gave credence to Germany's success, critics and proponents alike became alarmed. Observers, including the government, worried that the massive effort to green the economy was being undermined by Germany's failure to meet its own climate targets – reducing CO_2 emissions 40 percent by 2020 over 1990 levels. Battling the rise has had implications for policy in a number of areas, with new approaches already put in place or under discussion.

The majority of German citizens and the government have accepted man-made climate change as a scientifically proven fact and they have set out to help limit global warming by turning the country into a low-carbon economy. Germany's ambitious energy transition – the drive to simultaneously phase out nuclear energy and reduce greenhouse gas emissions – has now been underway for over 14 years. The share of renewables in the power mix has been considerably stepped up, while plans to shut down the last nuclear power stations in 2022 are underway. Coming to grips with emissions levels is the next big hurdle.

The government presented its Climate Action Programme (CAP) in December, outlining details of new CO_2 savings measures. The plan "shows that we are not only setting goals, we are reaching them too," Environment Minister Barbara Hendricks said when it was published. Her ministry had estimated that Germany could fall as many as seven percentage points short of its carbon-cutting goals. Now, the CAP and a National Action Plan for Energy Efficiency (NAPE) specify a range of efforts required from the energy sector, as well as energy efficiency and emissions-cutting measures for other sectors like transport and agriculture.

Meanwhile, the 2014 figures on German energy production and usage, published in January 2015, showed that gross energy consumption, power demand and CO_2 emissions fell considerably compared to 2013. For the first time, renewables had the largest share in both power generation and consumption, overtaking lignite as the biggest power source. Renewables were also responsible for pushing power from hard coal-fired plants out of the market, Patrick Graichen, director of think-tank Agora Energiewende said, concluding that the "Energiewende paradox" was showing signs of resolving itself.

This paradox refers to the fact that even though renewable energy production has grown (the share of renewables in German power generation rose from 3.6 percent in 1990 to 25.8 percent in 2014), CO_2 emissions continued to rise. This is because power production from coal and particularly lignite, the most CO_2-intensive fossil fuel, increased while power generation in comparatively clean gas-fired power stations subsided.

The stakes are high

After saying for months that a coal phase-out wasn't possible in parallel with a nuclear phase-out, the Ministry for Environment and the Ministry for Economic Affairs and Energy announced in the CAP that an additional 22 million tonnes of CO_2 will have to be cut by the power sector. Exactly what form this emissions cap would take wasn't specified, but a draft law by Energy Minister Sigmar Gabriel is anticipated in the first half of 2015.

With the CAP and the NAPE providing the groundwork, implementing additional climate protection efforts is the big task facing the German government this year. The stakes are high for Angela Merkel – dubbed the "climate-chancellor" after her push for international climate action in 2007 – and her cabinet. The Energiewende is under scrutiny

> *"The climate action programme shows that we are not only setting goals, we are reaching them too."*
>
> *Environment minister Barbara Hendricks.*

abroad, as world economic leaders gather in Germany in June for a G7 meeting, and the UN Climate Conference in Paris is expected to establish a binding climate protection treaty in December.

At the same time, the German coal industry is campaigning for its product – in particular domestically-mined lignite, a big employer in some areas – as the perfect complement to solar and wind power, arguing that coal plants could easily and cheaply be fired up to secure the electricity supply when there is neither wind nor sun.

> *"Now the government wants to cut some additional 22 million tonnes CO_2 from the power sector – that is far from enough."*
>
> *Oliver Krischer, Green Party.*

But researchers and environmentalists warn that the recent drop in power usage and emissions is no reason to relax. Both Agora Energiewende and the AG Energiebilanzen, who published power generation data for 2014, said that the mild winter temperatures in the beginning of the year were pivotal for the reduction in power consumption and falling CO_2 emissions.

Oliver Krischer, deputy leader of the Green Party parliamentary group in the Bundestag told the Clean Energy Wire that Germany's dependence on lignite was still endangering the country's 40 percent reduction target. "Now the government wants to cut some additional 22 million tonnes CO_2 from the power sector – that is far from enough," Krischer said, who had warned before that Germany will not only miss its climate targets, but will also lose its standing in the world. "First we call ourselves the country of the energy transition and then our greenhouse gas emissions increase – it just does not fit together," he said in 2014. Krischer worried that if Germany fails in its attempt to mitigate climate change, it would damage the government's credibility in international negotiations, and thus efforts to achieve an effective global climate protection deal.

CAP and NAPE in place to fill the climate gap

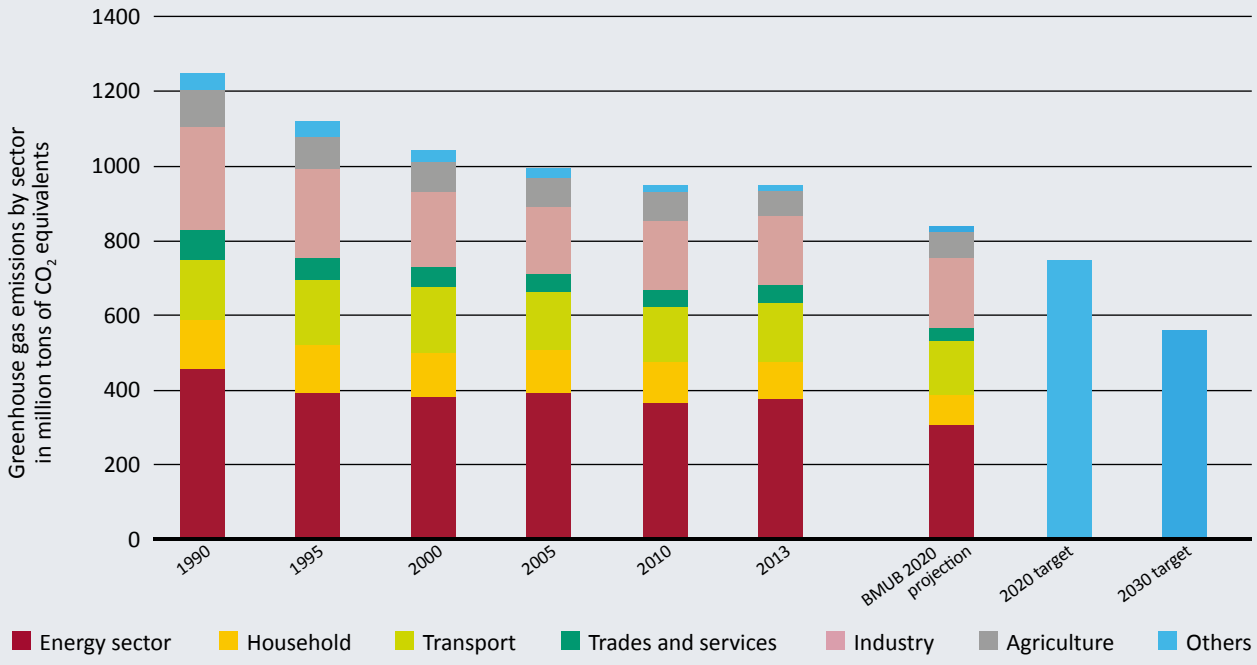
Researchers at the German Institute for Economic Research (DIW) have calculated that increased energy efficiency standards could reduce overall greenhouse gas emissions by five percentage points by 2020.

But the lion's share (40 percent) of Germany's greenhouse gas emissions come from the electricity sector. The rapid development of renewable energies should have made this area the country's showcase, and indeed Germany recorded an all-time high of 27.3 percent renewable energy in electricity consumption in 2014. However, for the first time, the German government has imposed caps on renewables capacity (See Dossier EEG 2.0) in a push to better manage market integration of renewables and to cut costs. German energy cooperatives who run many of the renewables installations owned by citizens, criticise that these changes to the Renewable Energy Act (Erneuerbare Energien Gesetz, EEG) are causing a slow-down in renewables development and have unsettled investors.

Phasing out nuclear instead of coal?

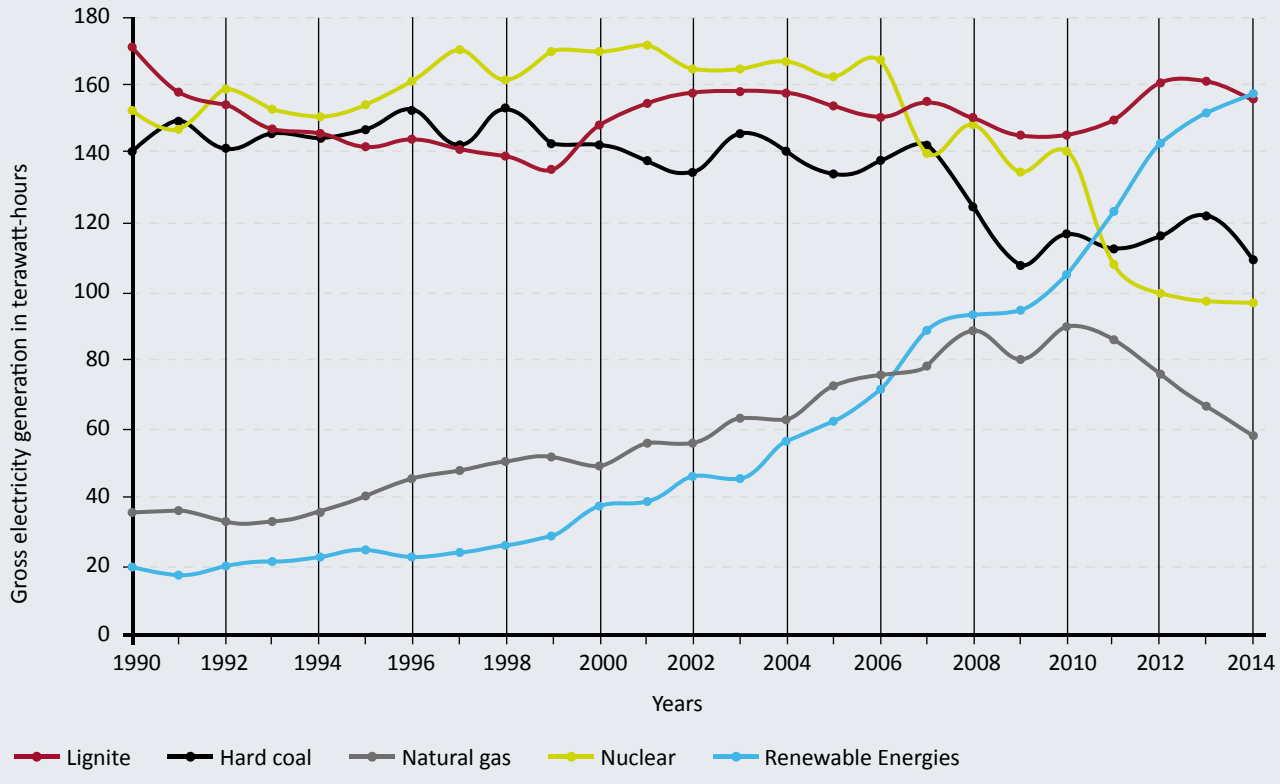
With energy efficiency standards and renewables doing their bit, all eyes are on Germany's biggest emissions problem: coal-fired power stations. While Minister Hendricks says that a full-blown coal phase-out is not feasible at the moment, many analysts and environmentalists are adamant this is where the next big policy change is needed.

Figure 1 | Germany's greenhouse gas emissions by sector and reduction targets.



Source: Agora Energiewende, 2014.

Figure 2 | Gross electricity generation of German conventional and renewable (wind, solar, biomass, hydro, waste) power stations in terawatt-hours, 1990-2014. There is a correlation between the 3.3 percent rise in power from coal and the 3.5 percent fall in electricity from gas-fired plants between 2009 and 2013.



Source: AG Energiebilanzen, December 2014.

Power generation from lignite (also called brown or soft coal), which causes the greatest CO_2 emissions per kilowatt-hour of electricity, rose to its highest level since 1990 in 2013 before dropping slightly last year (Figure 1).

The renaissance of coal coincided with the nuclear phase-out, re-initiated by the German government in 2011 and a major component of the Energiewende (See Factsheet Nuclear phase-out). So is Germany phasing out (largely carbon neutral) nuclear power in favour of (carbon intensive) coal? "No," said the Greens' Krischer, "because nuclear power stations are so inflexible in their electricity generation that they do not fit into a system built around fluctuating power from renewable energy sources anyway."

Furthermore, several studies have shown that the lack of nuclear power is being offset by growing renewables capacity, not by coal. Carsten Petersdorff, regional director for German speaking countries at the energy consultancy Ecofys, said: "It is true that the share of nuclear power production decreased by around 7 percent between 2010 and 2013, but at the same time renewables generation increased by 7.5 percent which shows that they are more than capable of offsetting the missing nuclear capacity."

Nevertheless, while average power generation from renewables matches what has been eliminated in nuclear output, renewables – at this point in time – are not capable of maintaining a continuous, reliable supply on their own. Many experts consider power stations that run on natural gas the best technology to provide backup for a system increasingly dominated by renewable energy. That is because these are able to fully ramp up or down power production within minutes and because natural gas is the least CO_2 intensive carbon fuel.

However, natural gas has been pushed out of the power market by coal, which is mined locally in Germany (lignite) or cheaply imported from Russia and the US (hard coal). Coal prices worldwide have fallen by 30 percent since 2012, and in Europe low prices for CO_2-allowances under the EU Emissions Trading System (ETS) have made coal even more competitive (See Factsheet EU ETS). Consequently, existing coal-fired power stations have ramped up production, replacing energy from gas-fired plants that could not keep up as wholesale prices on the electricity exchange dropped.

This has had an effect on emissions in surrounding countries as well. While coal-fired stations are ramping up production in Germany, electricity consumption has been decreasing. This has led Germany to export its cheap power to neighbouring countries such as Austria, the Netherlands and France, causing gas plants there to shut down as well. Net power exports reached a new record high in 2014.

"It is true that the share of nuclear power production decreased by around 7% between 2010 and 2013, but at the same time renewables generation increased by 7.5%."

Carsten Petersdorff, Ecofys.

Fixing the coal-conundrum

For Environment Minister Hendricks, fixing the ETS is a priority that will help solve the coal issue. Coal produces more carbon emissions than natural gas, but is still a slightly cheaper source of power. To make it more expensive, companies should theoretically have to pay more for the allowance to burn it. But because the market for emissions has been flooded with allowances, their price is very low, creating no economic disincentive to burning coal.

The German government based its CO_2 reduction targets for 2020 on an assumed price of 14 euros per tonne of CO_2. Scientists at the DIW have calculated that only a price higher than 40 euros per emitted tonne of CO_2 would make power from lig-

nite more expensive than competing energy sources. Instead, CO_2 allowances were as low as 2.81 euros per tonne of CO_2 in early 2014, with the average price hovering around 5 euros since January 2013.

The European Union is using a process called backloading to reduce the number of certificates in the current trading period. Their approach is to create scarcity by temporarily removing certificates on the market, which are then scheduled to be phased back in at a later date. But this approach is not rigorous enough, according to Hendricks who is pushing for the implementation of a Market Stability Reserve (MSR). This tool would be introduced in 2020, according to current EU plans, and would adjust the supply of allowances to accommodate unforeseen events, like economic swings, helping steer prices.

Germany wants to see the system implemented by 2017 and is seeking allies in the EU to back this approach. A report by think-tank Agora Energiewende underlined the urgency, saying that the whole scheme would die if prices were allowed to remain as low as the current 5 euros. But even with the MSR, Germany could only achieve its 40 percent CO_2 reduction target if it complemented the ETS with a national carbon steering mechanism, Patrick Graichen, director of Agora Energiewende said.

The Greens' energy expert Krischer supports the efforts to repair the ETS, but wants further action in case the price of CO_2 does not rise to a level that would make coal less competitive. "Germany should think about implementing a carbon price floor like the UK or a coal tax like the Netherlands, which facilitates the European carbon trade," he said.

Back in Germany, the government is facing resistance from the power sector to all policies that could make power generation from coal more expensive – be it by keeping the energy-only market or by imposing emissions caps on old plants in order to achieve the extra 22 million tonnes of CO_2 cuts needed. Politicians like Garrelt Duin, Economy Minister of Germany's most populous state North-Rhine Westphalia (NRW), a traditional industry and power generation hub, keeps defending what remains of the coal industry, reiterating that it would not be possible to phase-out nuclear power and coal at the same time.

Operators of thermal coal plants and the mining industry are fighting for their business models. To date, circumstances are in their favour. Not only are emissions allowances cheap, but so is coal, because Germany itself still has a viable domestic coal industry. Companies such as Sweden's Vattenfall, which operates 11 coal-fired plants in Germany (5 of them lignite), profit from inexpensive lignite mined locally. "Lignite is the only energy commodity that Germany does not have to import and there is still plenty of it in the ground – if current mining permits are upheld, the supply will last at least till 2050," says Olaf Adermann, head of asset management at Vattenfall Germany.

> *"Lignite is the only energy commodity that Germany does not have to import and there is still plenty of it in the ground."*
>
> *Olaf Adermann, Vattenfall.*

So far, local policies have often acted in their favour. The government of the state of Brandenburg – home of Germany's second largest lignite mining region – ruled in June 2014 that Vattenfall may continue mining in Welzow-Süd beyond 2026, even though it will mean 810 people have to be relocated from the site. Despite the dirty image of coal and the loss of landscape and homes, there is still a strong lobby, particularly for the lignite industry, which they say provides around 10,000 jobs in eastern Germany and even more in NRW. Even as Vattenfall announced in 2014 that it would sell its lignite mines in Germany in a move to focus operations on renewables and cut its CO_2 emissions, immediate interest from Czech-

owned competitor MIBRAG showed that the lignite business is still considered viable – even in the time of the Energiewende.

Other proposals for limiting coal, and some for keeping it

While Greenpeace called for coal phase-out legislation as early as 2008, an approach that was backed by Friends of the Earth Germany (BUND) in August 2014,energy market researchers have suggested emissions performance standards as a way to limit power generation from coal.This policy would halt new coal-fired power stations and force the phase-out of the most inefficient plants, by setting a CO_2-emission limit per kilowatt-hour of electricity produced. The UK, Canada and California have recently adopted such measures.

German coal-power operators favour a different approach. Engineer Olaf Adermann at Vattenfall stresses the need for electricity from lignite – precisely because of the expansion of renewable energies. Talking to the Clean Energy Wire in 2014, he named three reasons why lignite will be indispensable to the German power mix until 2050: It is cheap; without it Germany would have a power capacity deficit; and investment in process and control technology makes lignite power plants flexible enough to maintain a stable power system, together with renewables.

Vattenfall's lignite power stations, such as Jänschwalde, near Cottbus, can cut production to 30 percent capacity as needed, Adermann said. "On a normal day with moderate wind and sunshine, lignite plants can keep the system running, almost without the help of hard coal or gas-fired power stations." In the future, enhanced lignite plants will be able to cope with even more abrupt changes in renewables production, he said. At the moment however, lignite stations show little of this flexibility, as market conditions make it profitable to keep them running even during times of very low electricity prices.

Other utilities do not have this much faith in their ability to adapt to a world of growing renewables. RWE, another of the big, established power producers in Germany, announced in 2014 that it would eliminate 1000 megawatts of conventional production after already cutting another 12,600 megawatts in Europe since 2013. This may be a way of putting pressure on the German government, which has to ensure grid stability. It is currently considering a new law that – instead of phasing out coal – would give it a fixed position in the system by paying power stations just to be on standby. This so-called capacity market would give coal-fired stations a second form of income and therefore strengthen the existing, CO_2-intensive energy industry, scientists from the DIW in Berlin said.

If Germany keeps too much coal in the mix, researchers at the Institute for Applied Ecology (Öko-Institut) and the Fraunhofer ISI paint a bleak future for meeting CO_2 goals. Even if renewables supply roughly 80 percent of electricity by 2050, 20 percent would still be needed from lignite plants. This would have "fatal consequences for the greenhouse gas budget," the researchers said in a study. Implementing the CAP and power market changes in 2015 will therefore be important indicators for how serious Germany is about decarbonising its economy, its influence on international climate negotiations, and the climate itself.

Factsheets

- Germany's greenhouse gas emissions and climate targets
- Coal in Germany
- Details of new Climate Action Programme
- Understanding the European Union's Emissions Trading System

www.cleanenergywire.org/dossiers/energy-transition-and-climate-change

Dossier

The energy transition and Germany's power grid

Connecting up the Energiewende

26 Jan 2015 | Kerstine Appunn

As the German power system shifts to renewable sources the network must be updated to cope with decentralised, fluctuating supply. But not everyone is in favour of grid extensions needed to bring electricity from the rapidly growing wind power capacity in northern Germany to the country's industrial south.

Their names were Elon and Felix and at a certain point on Friday 9 January they powered the generation of 30,700 megawatts (MW) of electricity between them. On the weekend when these two low-pressure weather systems blew over Germany, the country's wind turbines produced electricity equivalent to 25 nuclear power stations.

But this new record for renewable power generation wasn't only a cause for celebration. Grid operators soon calculated that keeping the network stable under this sudden influx of wind power cost around 13 million euros, highlighting once again the missing link between the power system in windy north-eastern Germany and high demand in the country's industrial south.

"It's foreseeable that Germany will have the third largest offshore wind capacity in Europe, following the UK and Denmark."

Norbert Giese, VDMA.

Germany's Energiewende – the transition to a low-carbon economy whose energy needs are largely satisfied by renewable sources – needs adaptations to the power system, including the transmission grid and power distribution network. The growth of renewable capacity (the share of renewables in German power generation rose from 3.6 percent in 1990 to 25.8 percent in 2014) means that more and more power is fed into the grid from a multitude of small, decentralised sources, and – depending on the weather – in unpredictable quantities.

So far, Germany's power grid ranks among the most reliable in the world despite the rapid increase in renewable energy. Its System Average Interruption Duration Index (SAIDI), which measures the average yearly downtime per customer, was 15.91 minutes in 2012, meaning it suffered a quarter of the disruption of the UK grid, and dropped further in 2013 to 15.32 minutes (See CLEW Factsheet on the set-up of Germany's power grid).

In order to accommodate large influxes of renewable power and keep the grid stable, the Federal Network Agency (Bundesnetzagentur) and the four transmission grid operators (TenneT, 50Hertz, Amprion, TransnetBW) have put forward plans to expand the power network. But while the growth of renewable installations – from solar panels on detached houses to wind turbines in fields and along the coast – have triggered relatively little opposition from citizens, overland grid connections are far more controversial.

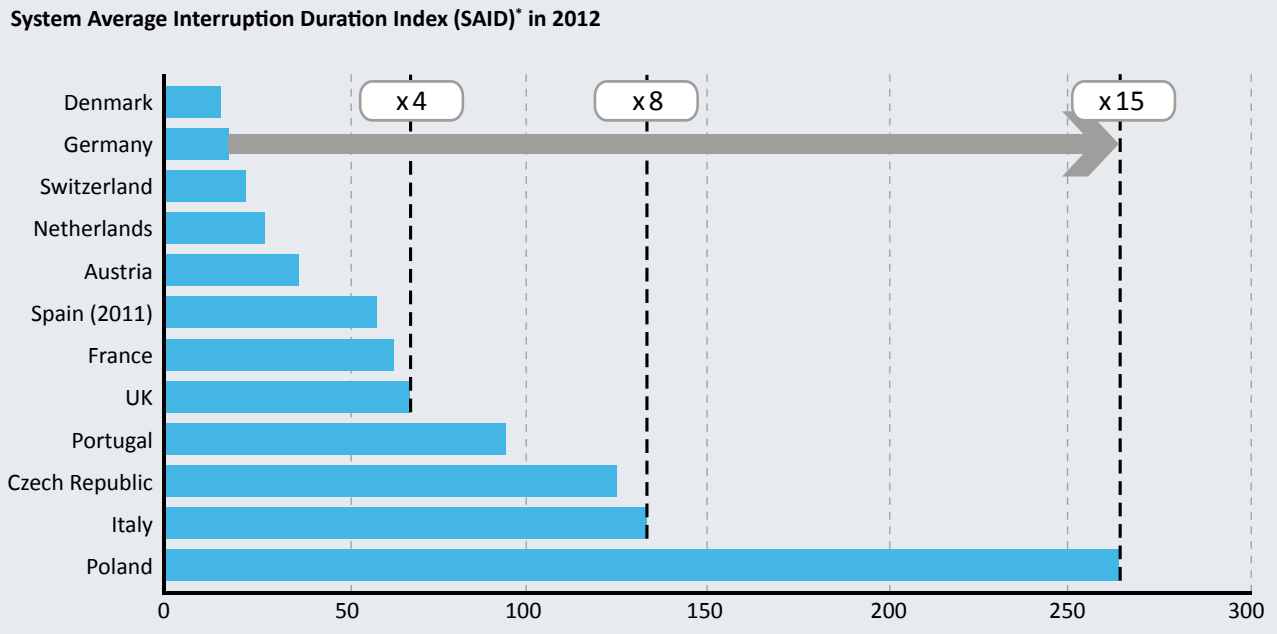
Backing citizens' associations attempting to prevent power lines running "through their backyard", the Bavarian state premier defied federal government plans to rapidly develop grid connections between the north-east of Germany and the south. With grid planning and construction already taking an average of ten years, these further delays are one of the major challenges that Germany now faces in the implementation of the Energiewende.

Another recent record from the German renewables sector could compound the problem. The offshore wind energy sector announced that by the end of December 2014, offshore wind capacity feeding the German grid passed the 1,000-megawatt mark. The construction of a further 1,200 MW was completed last year, Deutsche WindGuard said, but these turbines are yet to be connected to the network. Together with installations to be constructed this year, a total of up to 2,000 MW of new offshore capacity is expected to go online in 2015.

"It's foreseeable that Germany will have the third largest offshore wind capacity in Europe, following the UK and Denmark," said Norbert Giese, chairman of the German Engineering Association (VDMA) steering committee for the offshore wind industry.

But north Germany's growing wind power capacity puts increasing pressure on the grid. "As long as the new power lines between north and south Germany are not completed, the problem of a lopsided system that

Figure 1 | International comparison of grid stability.



* including exceptional events

Source: Agora Energiewende/Council of European Energy Regulators (CEER)

requires frequent interference from grid operators will only worsen," Andreas Jahn of the Regulatory Assistance Project (RAP) told the Clean Energy Wire.

Even Germany's neighbours have felt the surplus of renewable power that windy days have landed on the grid: in Poland, an overspill of electricity from Germany and Denmark forced grid operators to shut down plants and disturbed their load planning. At times, power exchange between Germany and Austria took place via the Polish network. Because of this, so called phase shifters will be installed at the German-Polish border in 2015, enabling grid operators to control the flow of power crossing the border. Similar problems occur between Spain (wanting to export renewable power) and France (saying that this would interfere with running its nuclear power stations).

> *"As long as the new power lines between north and south Germany are not completed, the problem of a lopsided system will only worsen."* *Andreas Jahn, RAP.*

But cutting grid connections between countries is in contrast to German and European Union plans for an Energy Union that would interconnect and diversify EU members' energy sources, reducing dependency on non-EU suppliers. The German government said in an internal paper seen by the Clean Energy Wire that it supports "cross-border grid reinforcement" and a 10 percent goal for inter-connection of installed electricity production capacity in all member states by 2020. In an interview, economy and energy minister Sigmar Gabriel said security of supply could be best achieved through increased cross-border connections, eventually reaching a level of integration where not every country would need to hold power for its per-day maximum load on its own grid.

Bilaterally, Germany is planning grid connections with Norway via a 1,400 megawatt sub-ma-

rine cable, which will transport German renewable power to and from Norwegian hydropower storage facilities. Grid operator Amprion in North Rhine-Westphalia and Belgian counterpart Elia are planning the first power line to connect Germany and Belgium. The 1,000-MW capacity line is due to be completed in 2019.

The German grid regulator, Bundesnetzagentur, has repeatedly indicated that an added 2,650 km of domestic power lines are needed by 2023. In particular, two high-voltage direct-current transmission lines, the SuedLink between Wilster (near Hamburg) and Grafenrheinfeld in Bavaria (See map), and the "Gleichstrompassage Süd-Ost" line from Saxony-Anhalt to Bavaria, are seen as essential to transport wind power from north to south. But their construction is yet to begin.

"I cannot agree one day to the federal plan for grid extension and the next day I am against it."

Johannes Kempmann, BDEW.

More grid vs. a decentralised power system

First, Bavarian citizens' groups complained about potential power lines running past their towns and villages. Then Bavarian state premier Horst Seehofer took up the issue and wondered if Bavaria could not cope by building up its gas-fired power capacity, or importing more power from Austrian hydropower plants. Later, Seehofer announced that a process of consultation was needed to decide whether the power lines were really necessary. The results of this "Energy Dialogue" are expected in February 2015.

While Seehofer received support from his counterpart in Thuringia, through which the "Gleichstrompassage Süd-Ost" line to Bavaria is supposed to pass, the Chambers for Commerce and Industry (DIHK) and the power sector represented by the German Association of Energy and Water Industries (BDEW) made it clear that his arguments were not supported by businesses. "Federalism is a high good but no excuse for a lack of responsibility in politics. I cannot agree one day to the federal plan for grid extension and the next day I am against it. This is not the environment we need," BDEW president Johannes Kempmann said in January.

Expanding the gas-fired power supply in Bavaria would increase its dependency on natural gas imports from Russia and would be expensive, an analysis by the DIHK found. Seehofer's argument that power lines from eastern Germany would bring electricity mostly produced from coal and lignite to the south was "physically and economically not comprehensible," the paper says.

Yet some scientists and many citizens have argued that the additional power lines suggested by the grid operators are not all needed. Professor Lorenz Jarass from the RheinMain University of Applied Sciences has calculated that less additional grid would be needed if official plans took into consideration that generation from conventional power stations and renewable sources should be curbed in the event of a storm. Citizens in power line-affected regions tend to argue that the energy transition should lead to a decentralised power system where every region becomes self-sufficient, reducing the need to transfer electricity over large distances. A study by the Federal Environment Agency (UBA) has shown that such closed systems would work in rural areas, but only with immense additional power storage. And the cost of becoming self-sufficient would be even higher in southern Germany than in the north. Rural areas with business and industry as well as urban settlements could not become self-sufficient at all, the study found.

With both onshore and offshore wind power capacity in northern Germany still expanding, grid operators like 50Hertz and experts including the RAP's Jahn are adamant that grid expansion is needed – and fast. "Otherwise, we will have the situation of the

Keeping the grid stable: Network operators warn that more and more re-dispatch measures will be needed to balance the grid, if input from renewables grows while grid expansion lags behind. Photo: 50Hertz.

last stormy weekend more often," Volker Kamm, spokesperson for 50Hertz, told the Clean Energy Wire.

Chancellor Angela Merkel has also made her position clear: "If the southern states are saying they can import power from Austria instead– that 'we are not interested in the wind in northern Germany' – then we have a huge problem," Merkel said at a reception of the German Renewable Energy Federation (BEE) in January.

Consumers pay

Grid operators like 50Hertz and Tennet have a particular interest connecting up the grid. And so do consumers: whenever the grid operators have to interfere with the input and output of the power network it costs money. 50Hertz did a rough calculation of 7 million euros of added "re-dispatch" costs as a result of storms over the weekend of 9 till the 11 of January 2015, with Tennet estimating 6 million euros over the same period.

"If the southern states are saying they can import power from Austria instead – that 'we are not interested in the wind in northern Germany' – then we have a huge problem."

Chancellor Angela Merkel.

Normally, supply and demand on the power market determine which power stations deliver a given amount of electricity on a given day (See CLEW factsheet merit order effect). Grid operators receive a power plant "dispatch" list, based on the market figures a day ahead, allowing them to check whether adjustments are needed to ensure the network runs smoothly.

> *"The grid expansion and building SuedLink would definitely be the most cost-efficient method of solving the re-dispatch problem."* *Simeon Hagspiel, EWI.*

On the weekend of Elon and Felix, they indeed had to adjust, taking several re-dispatch measures. At peak times, 50Hertz had to throttle more than 6,700 MW of conventional capacity to allow for excess wind power, Kamm explained. When this was not enough, the grid operator had to temporarily shut off some 800 MW – or 300 wind turbines – in eastern Germany to stabilise the system. At the same time, Tennet and 50Hertz had to tell power stations in the south of Germany to ramp up production because not enough of the excess power in the north could be funnelled through existing power lines to Bavaria and Baden-Württemberg.

This ramping up and suppression of generation resulted in the extra costs. The coal-, gas- and oil-fired power stations in southern Germany that grid operators use for re-dispatch generate power at costs higher than the market price. And when power stations are told to limit production, they must receive compensation (minus expenses the power plants save on fuel). Grid operators pass on these costs to consumers in the form of a grid fee that households pay via their electricity bills.

"Essentially, this means that consumers in north and eastern Germany where most of the wind power capacity is located, and where 50Hertz operates, pay for the fact that southern Germany does not agree to have power lines built to receive the electricity," said Jahn.

Meanwhile, large industrial consumers save money thanks to the strong wind, because the increased input of cheap renewable power forces down the prices on the power market. Between mid-December 2014 and mid-January 2015 the average wholesale power price fell to 23 euros per kilowatt-hour (KWh), nine euros less than the 2014 average, Jahn said.

When renewable power producers are disconnected from the network, grid operators must also compensate them for some of their lost profit, but these costs are smaller than those for re-dispatch measures, Kamm said. In 2013, 7,695 hours of re-dispatch interventions concerning 4,390 gigawatt-hours (GWh) were necessary, costing 132.6 million euros, the Bundesnetzagentur reports. This was less than in 2012, and compared to the 23 billion euros consumers paid for renewable electricity in 2014 via the renewables surcharge, it is only a small proportion of the costs linked to the growth of renewables.

Still, with an added 2 gigawatts (GW) offshore wind capacity, critical situations for the grid and re-dispatch measures will potentially multiply, Kamm said. "Finishing the South-West Interconnector between Thuringia and Bavaria (Thüringer Strombrücke) which is now partially built, would mean a lot of stress relief in the coming years and the 250 to 300 million euros in construction costs would be recovered within a few years." On 21 January TenneT announced it had received permission from the regional government in Franconia (Bavaria), to build the part of the South-West interconnector running from Altenfeld to Redwitz and said it expected 50Hertz to receive permission for its connecting power line in the Thüringer Wald soon.

SuedLink or different price zones

"The grid expansion and building SuedLink would definitely be the most cost-efficient method of solving the re-dispatch problem," power market researcher Simeon Hagspiel from the Institute of Energy Economics at the University of Cologne (EWI) told the Clean Energy Wire.

Other possibilities would be to curb the feed-in priority for renewables, or to split Germany into two different power price zones. "From an overall economic perspective it would make sense to divide the German power market into a northern zone and a southern sector

With ever more offshore wind capacity coming online in the North of Germany, grid stability is put to the test on windy days. Photo: 50Hertz (of Baltic 1).

including Bavaria and Baden-Württemberg," Hagspiel said. A study for the European Commission concluded that power prices could rise to ten percent more than those in the north.

While the Federal Ministry for Economic Affairs and Energy participates in Bavaria's "Energy Dialogue", the patience of the Minister and his advisors is wearing thin. "I said it in Munich and I say it again in Berlin: There are no white-and-blue [editor's note: Bavaria's national colours] electrons and there is no white-and-blue energy transition. Either we manage the grid expansion or we will get two separate price zones, for economic, technical and legal reasons," Urban Rid, head of energy policy, power and grid at the ministry said at a conference in Berlin.

Kamm at 50Hertz is sceptical of this solution, too: "It would be problematic for businesses and consumers in southern Germany if they had to pay a higher power price. And instead of getting renewable wind power from northern Germany they would probably start importing coal, oil or nuclear power from the Czech Republic, Slovenia or Austria." Since Bavaria will see 5.3 GW of nuclear capacity shut down by 2022, the state also needs capacity to compensate for this loss.

The offshore sector would be happy to deliver – provided power lines are built for it. But in the meantime it refuses to be distracted from its growth targets because of grid expansion issues. "Of course the complexity of running the grid will increase but it would be exaggerated to fear any kind of collapse, Hermann Albers, president of the German Wind Energy Association (BWE) told the Clean Energy Wire. "But we are sure that the bottleneck between north-east and south Germany will be fixed."

Factsheets

- Germany's electricity grid stable amid energy transition
- Set-up and challenges of Germany's power grid
- Setting the power price: the merit order effect

www.cleanenergywire.org/dossiers/energy-transition-and-germanys-power-grid

Dossier

The social impact of Germany's energy transition

How the Energiewende is transforming Germany as we know it

5 Nov 2014 | Paul Hockenos

Germany's energy revolution is having a far-reaching impact on everything from the landcsape to education, as farmers earn more from their „energy harvest" than traditional crops and citizens rethink lifestyle choices to go green.

Just take a drive through Germany, say from the Baltic coast down to one of Germany's southern states – Bavaria or Baden-Württemberg. You cannot miss the transformation of German landscape from a decade ago: the north's flat, windy hinterlands are dotted with gigantic turbines and sprawling wind parks, while in town after town across the country's south, the rooftops of neatly kept farms and homes are covered with black solar panels. Few are the farming villages in Bavaria and Lower Saxony that don't have at least one rotund, metal biogas plant alongside fields growing energy crops like grasses and maize.

> *"Energy regimes shape the nature of civilisations."*
>
> *Jeremy Rifkin, US economist.*

These changes are just an inkling – the most obvious to the eye – of how the "Energiewende" or energy transition, is transforming Germany. In fields as diverse as law and markets, media and education, Germany is in the throes of far-reaching, paradigmatic shifts propelled by the Energiewende. The project to turn the country into a low-carbon economy reaches deep into architecture, landscape design, tourism and urban planning.

The country now generates nearly a third of its electricity from renewable sources, namely photovoltaic solar, onshore wind, hydro and bio-energy, and aims to produce at least 80 per cent of its energy from renewables by 2050. This has meant the deployment of 1.4 million solar PV panels and 1.9 million solar thermal collectors, 7,850 biogas installations, and 24,193 onshore wind turbines. In addition to renewable energy production, Germany's policies to meet targets on energy efficiency and greener heating and transportation contribute to the country's on-going metamorphosis.

In his book The Third Industrial Revolution, US economist and advisor to the EU and Germany on energy issues, Jeremy Rifkin, argues that when a civilisation's energy supply changes, everything in that society changes with it: the economy, architecture, agriculture, cities, employment, transportation, political power, and even human relationships.

"Energy regimes shape the nature of civilisations – how they are organised, how the fruits of commerce and trade are distributed, how political power is exercised, and how social relations are conducted," he argues. The transformation of energy supplies have "profound implications for how we orchestrate the entirety of human life in the coming century." Rifkin's best-practice case study is Germany, which he cites as leading the way into the new era.

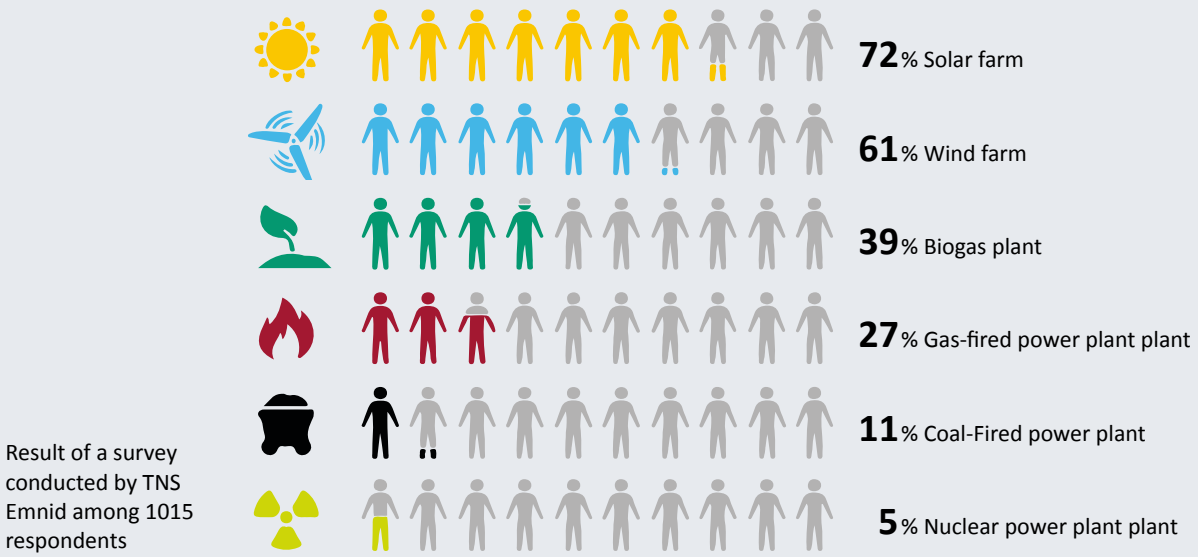
Take education: there are now 385 renewable energy-related programs at German universities and colleges, and 824 "solar (secondary) schools" that either operate solar panels or regularly address the topic of renewable energy in the classroom. Germany boasts 6,635 certified "passive houses". There is now even a tourist guide that catalogues 190 destinations for holidaymakers interested in renewable energy generation, and there is a nation-wide competition for Energiewende-related art.

The changes and their knock-on effects don't please everybody: there are winners and losers when a society and economy undergo such sweeping reconstruction. Preservationists, for example, have rebelled against energy efficiency measures in old houses. Some architects and landscape architects gripe about the "ugliness" of wind turbines and solar panels, and environmentalists sometimes fight new wind parks in order to protect bird populations.

Farmers become energy producers

The farmers of Bavaria, one of Germany's most conservative corners, where agriculture has underpinned the local economy for centuries, have adjusted well to the new opportunities. The state boasts the largest number

Figure 1 | More and more citizens are producing their own power and acceptancy for renewable power stations is far greater than for conventional electricity sources.



of biogas plants (2,300) in Germany, almost all of which are run by farmers. Farms are also the location of many of Bavaria's 465,000 PV panels with a technical capacity of 10,400 megawatts (MW) – roughly equivalent to ten nuclear reactors. And Bavaria has more energy cooperatives – 237 (2013) – than any other state. For these reasons and others, the Bavarian Farmers' Association has made renewable energy generation one of its foremost priorities alongside traditional concerns. With its Climate Programme 2020 Bavaria is committed to doubling the share of renewable energy in its primary energy consumption to 20 per cent by 2020.

Josef Göppel, an MP for the Christian Social Union – the Bavarian sister party to Chancellor Angela Merkel's Christian Democrats – says the Energiewende has reinvented the way Bavarians farm. Twenty per cent of all arable land in his district is used for energy crops, overwhelmingly maize. Manure is now used as biomass, and then recycled as fertiliser. While most barns already have solar PV or thermal panels on their roofs, more farmers are investing in the latest generation of wind turbines – sophisticated technology that now works even in not-so-windy Bavaria.

Bavarian farmers used to rely on "milch pfennigs" from Brussels to compensate their meager earnings from the dairy business. "Today, our income from renewable energy is five times that of the EU agricultural subsidies my district gets," explained Göppel, referring to Ansbach, his electoral district in western Franconian Bavaria and one of many traditional farming regions that now earn more from their "energy harvest" than from produce and livestock. In terms of

"Today, our income from renewable energy is five times that of the EU agricultural subsidies my district gets." *Josef Göppel, MP.*

solar PV, Ansbach led Bavaria with the production of 310,500 MWh of green electricity in 2012 – most of which it sold to the grid operator. Soon the region will be marketing its own electricity rather than selling it to grid operators.

The dynamic of a shifting energy supply can distort business as usual – in unexpected and sometimes adverse ways. Across Germany, for example, the increased planting of maize as a monoculture for use in biogas plants dangerously depletes the soil of nutrients. Such challenges demand the attention of academic institutions, as well as a new generation of school and college graduates equipped to tackle them, sparking far-reaching change in German education.

"The decentralisation of the energy supply, like the creation of the new small companies and co-ops, has changed the energy system."

Harald Welzer, FuturZwei.

There are now 3,384 secondary schools participating in the National Climate Protection Initiative, a programme that promotes the Energiewende to school-age children, while universities and colleges offer 385 programmes (BA and MA) that address renewable energy. And these courses aren't confined to engineering and science departments, the traditional home of the discipline of "energetics".

While programmes like the Bachelor in Renewable Energy Management offered by the agriculture faculty at the Weihenstephan-Triesdorf University of Applied Sciences in Bavaria respond to the new landscape of decentralised energy production, the "enEEbler" research project of institutions, including the Alanus University of the Arts and Social Sciences in Bonn and the Nuertingen-Geislingen University for Economy and the Environment, looks at the "spillover effect" of citizens' engagement in the renewable energy revolution on the businesses they work for. The project aims to find ways for companies to help their employees bring ideas for sustainable energy use into the workplace, and address the need for new production patterns and energy management.

"Technology and renewable energy production are changing faster than society does."

Günther Bachmann, Sustainability Council.

The forces driving change

Experts note that there are different drivers of the transformation underway in Germany. There's the upward push of a changing energy supply with more and more Germans becoming energy producers themselves, as well as the "top-down" pull of sustainability criteria, Energiewende-related legislation, as well as other German and EU laws. In terms of energy efficiency, EU guidelines have set the pace, while Germany's feed-in tariffs paved the way for the expansion of renewables. The German Council for Sustainable Development, funded by the German government, is the force behind the greening of German business practices.

But Harald Welzer, professor of transformation design at the University of Flensburg and director of the foundation FuturZwei, argues that the fundamental transformative force is the push of the new energy supply. "The Energiewende is so significant because it's a change of the mode of production, it's not just green-washing," he said. "The decentralisation of the energy supply, like the creation of the new small companies and co-ops, has changed the energy system in Germany. This is forcing economic models, policies and lifestyles to be rethought, too."

Josef Göppel said his constituents' positive, hands-on experience with the Energiewende has inspired them to rethink their needs and lifestyles, ranging from their choice of mobility and clothing, to how they organise their households and take vacations. "The Energiewende has served as a catalyst for transitioning to a sustainable lifestyle," he said.

There are also sectors that have thus far evaded the push of the Energiewende and the pull of legislation. Germany's automobile industry, for example, has moved very slowly. California alone has ten times as many hybrid and electric cars on the road than Germany.

Günther Bachmann of the Sustainability Council believes that some of the biggest changes for Germany are yet to come. "There's a lag between the technological status of the Energiewende and policy, cultural, and social changes. Technology and renewable energy production are changing faster than society does. For example, the time for small-grid decentralisation, smart-metering, and peak management is now, but Germans are still catching up with new business models and behaviour."

"We're on the brink of many changes being possible," said Bachmann. "Our options are currently much greater than we realise."

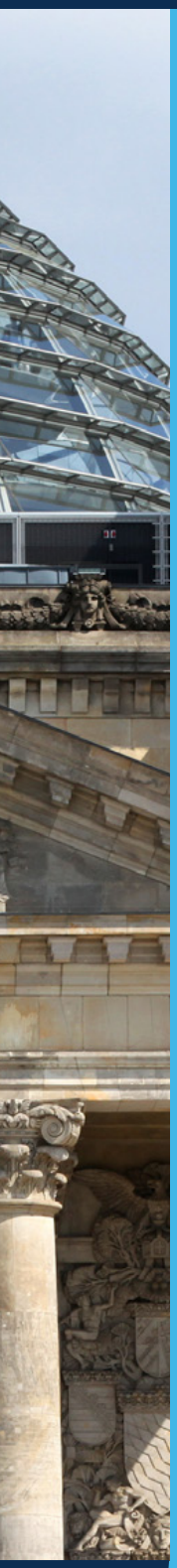
Paul Hockenos is a freelance contributor to the Clean Energy Wire. He has also written about energy issues for a wide range of international publications and is the author of the blog Going Renewable.

Factsheets

- Facts and figures on the social impact of the Energiewende
- Polls reveal citizens' support for Energiewende

www.cleanenergywire.org/dossiers/social-impact-germanys-energy-transition


DEM DEUTSCHEN VOLKE



Dossier

EEG 2.0 – A new legal framework for the German energy transition

Germany revamps renewables law as it adapts to future with green power

1 Aug 2014 | Peter Dinkloh

Germany's energy market is bracing for the most far-reaching legislative changes since green power incentives were introduced a quarter of a century ago. The controversial revamp of the renewable energy law aims to cut the costs of Germany's ambitious transition to a low-carbon economy, exert greater control over the expansion of renewables and maintain exemptions that help large energy users deal with costs related to the so-called Energiewende, or energy transition.

Some of the measures have a short track record and strike at the very heart of the 1990 law – guaranteed prices for renewable energy producers, now the model for legislation in 97 countries worldwide, the so-called "feed-in tariffs". Energy experts stress that this is just one of many steps to adjust the evolving energy market as the country pursues its low-carbon goal. Further reforms are expected in the next two years, which will affect power plants, the building of power lines and emissions trading.

While other countries are also tackling climate change by boosting renewables, Europe's largest economy is braving a triple dare: cutting emissions by burning less fossil fuel, ramping up renewables and phasing out nuclear power – all at the same time. German industry is keeping close tabs on the process, as the European Union threatened to force Germany to abandon its subsidies for heavy users. Such power price subsidies have been a hotly contested element of the Energiewende.

The transition itself has widespread popular support, but not everyone agrees on how to go about implementing it. One sticking point, legally-enshrined price guarantees for green power, have created a huge wave of renewable energy projects since the law was introduced in 1990, offering safe and sometimes lucrative returns for investors. When the seven-month-old ruling coalition of conservative Christian Democrats and centre-left Social Democrats decided to gradually replace these with an auction-based system by 2017, the reform did not garner much favour with green power producers. The renewable-energy industry, small electricity producers and environmentalists fear it will stifle investment and the growth of renewables. The government, large industrial companies and utilities claim this new competitive element will help lower electricity prices.

The planned change also means green energy producers will have more exposure to competition and to a much more detailed planning process. Previously, anyone with a permit to build a green power facility could do so – without having to bid against competitors. Utilities were obliged to connect the facility to the grid so that its access to the market was guaranteed. Indeed, these policies, together with price guarantees, have pushed green energy production from record to record in recent years.

The coalition is also using financial incentives – and disincentives – to exert greater control over the number of new green power facilities being built, after the renewable energy market saw large volumes of capacity additions in the past. While the capacity of green power facilities doubled between 1988 and 2000, it has expanded more than sixfold since the introduction of the current version of the renewable energy law in 2000. Renewables have thus reached almost the same capacity as conventional power plants. The law has been modified more than four times since then to adjust subsidies to the falling costs of new green power facilities, mostly windmills or solar panels. The new law caps the amount of renewable energy that qualifies for state-guaranteed income – so-called capacity limits, which sharply reduce guaranteed returns once a targeted number of installations have been built. More may be built, but the remuneration falls drastically, implementing a sort of "financial cap".

Germany still emits too much carbon

The remuneration for renewables falls drastically, implementing a sort of 'financial cap'.

But despite an abundance of green power, the country as it is at risk of missing its climate targets unless it intensifies efforts to lower carbon dioxide emissions. According to a commission of experts convened by the Economy and Energy Ministry, "the target of reducing greenhouse gas emissions by 40 percent by 2020 will be clearly missed." The Environment Ministry predicts it will fail to do so by one-fifth. Germany was an early advocate of climate targets, first setting emissions hurdles in

1995, well before renewable energy goals were established in 2000.

The nuclear phase-out also has a long history: After more than three decades of fierce public opposition to nuclear power, a ruling coalition of Social Democrats and Greens decided in 2000 to phase out nuclear plants by around 2021. A decade later, the new government of Liberal Democrats and Conservatives partially rolled that back, extending the lifespan of nuclear plants. But this short-lived move ended in one of the most sweeping turnarounds ever in German politics. The government reinstated the original plan almost entirely after the nuclear power station accident in Fukushima / Japan. It set it a deadline for the last nuclear power plant to go offline in 2022.

Closing the country's remaining nine nuclear power plants is a complex project, followed attentively by the nuclear-weary public. Other parts of the Energiewende, such as improvements in energy efficiency and battery-powered cars have yet to be tackled with the same determination as electricity production. So far, the focus remains on renewables. Opinion polls consistently show strong support for the project that has been barely dented by rising electricity prices for households and parts of the business community.

Consumers support green power with 24 billion euros in 2014, but public happy to pay

Germans will pay some 24 billion euros in 2014 through the renewable energy legislation, according to an estimate from the four transmission grid operators. The money – mostly from commercial electricity consumers followed by households – flows to green energy producers, many of which are households themselves, demonstrating how green power is wresting market share from large utilities.

The government said it wants to better integrate renewables into the existing power market.

Besides stemming the burden for households, the government has said another reason for changing the law was to appease European Union complaints about industry exemptions, with the European Commission, the EU's executive arm, opening formal proceedings to study the German subsidies. Some industries pay only a fraction of the so-called EEG-surcharge, a top-up on electricity prices to fund the feed-in tariffs for renewables. In addition, the government said it wants to better integrate renewables into the existing power market. This means that a larger number of green power producers will have to sell their power directly on the power market and cannot rely on just handing it over to their local grid operator.

The renewables' levy on the power price has risen from 0.4 cents in 2003 to 6.2 cents per kilowatt hour this year, making up about a fifth of the current average power price for consumers. Despite much media coverage, most consumers are little fazed by their electricity bill, as the share of their total power bill – including all levies – of their overall spending has remained stable at around 2 percent since 1990.

A majority, however, opposes the surcharge exemption for large, power-consuming industrial companies such as BASF and ThyssenKrupp. Nonetheless the German government reached an agreement with the Commission in September 2014, which left the overall subsidy package stable at 5 billion euros. Industry association BDI called the agreement "positive", after saying that at least 900,000 jobs would be threatened should the exemptions end. That would represent more than 2 percent of the German workforce.

The renewable energy industry has also grown into a big business, investing some 16 billion euros in new facilities in 2013 thanks to the electricity surcharge. The industry, which includes wind farm makers and companies that maintain them, employs 262,000 people

(0.6 percent of Germany's overall workforce) and generated revenue of 23 billion euros, around 1 percent of German gross domestic product (GDP) last year. Support for solar energy made Germany the largest market for solar panels worldwide, sparking a global boom and a rapid fall in production costs. China's solar panels are now cheaper than those made in Germany, triggering a decline of the German solar industry, accusations of price dumping, and ultimately, EU import duties on Chinese panels.

> *"The amendment is the beginning of the end of the renewable energy act."*
>
> *Hans-Josef Fell, Green Party.*

The end or a beginning of the renewables?

Opinions vary widely about the mechanisms and parameters of the new legislation. "The amendment is the beginning of the end of the renewable energy act," said Hans-Josef Fell, a former lawmaker for the Green Party and one of the authors of the original act. "We are taking an important step for our future energy supply with the reform of the renewable energy legislation," Chancellor Angela Merkel said.

The hot issue is the bidding process. The government posts a tender to build a given capacity using, for example, solar panels or windmills. The investor offering to sell electricity at the lowest price wins the project. The government expects this to lower prices and says the new regime helps comply with EU competition regulation. It is noteworthy, however, that the European Union, although cited by the government as an instigator, was not directly demanding the change. The EU has been asking member states to introduce tenders, but gives them leeway to use other methods too. In a letter to the German government in December 2013, the Commission actually said it approved of the previous German system of feed-in tariffs. Felix Matthes, responsible for energy at the think tank Öko-Institut, says the law is guided by abstract principles rather than experience, which might "set us up for a less than optimal development in the future."

Most notably, the changes may herald a new era for small private investors who own some 43 percent of the renewables generation capacity: Households with solar panels and farmers with windmills on their properties may have to compete with utilities and funds for the right to build renewable power plants from 2017 onwards. Experience from countries such as China or Britain has shown that investors sometimes make unrealistically low offers and are unable to complete the project.

"Economic logic and all experiences from other countries show: In tenders the largest bidders have an advantage," economist Lars Holstenkamp from Leuphana University said in a study financed by the environmental group Friends of the Earth Germany. Accordingly, the 800 municipal utilities and the large power providers favour tenders. These are mostly publicly owned infrastructure providers, a trademark of the German energy market. But the government has pledged to ensure the diversity of players. Using tests with solar installations, it will determine how tenders will work in the future and enshrine it in a successor to the current renewable energy act.

Another contested novelty are so-called growth corridors, or limits on the number of new green energy installations. For the two largest renewable energy sources by capacity, solar and wind onshore – wind farms on land as opposed to at sea – the annual limit for new construction has been set at 2.5 gigawatts each. That is slightly below what was built last year and equals the capacity needed for Berlin, a city with 3 million inhabitants. Replacing existing wind facilities does not count towards the target.

That part is particularly sensitive for Germany's 16 federal states, which approved of the new law but only after initially opposing those parts that would hit the dominating renewable energy in their respective regions, be it wind power on the rough North Sea

The next EEG reform is planned in 2016 - then renewable support is likely to be switched from feed-in tariffs to an auction system. Photo: © Vladislav Gajic.

coast or biomass in the south. "Everything damaging the expansion of wind power makes the renewable energy law more costly," said the state premier of Schleswig Holstein, Thorsten Albig, for example. In neighbouring Denmark, onshore wind power is becoming the cheapest form to produce power, according to the Danish Energy Agency.

Researchers from arrhenius Institute for Energy and Climate Policy in Hamburg say the caps are fine in the short term and allow the country to reach its target of 35 percent renewable power generation in the year 2020. However, they argue that the plans fail to take into account Germany's ambition to replace current fossil fuel usage with green power. For example, the government aims to raise the number of electric vehicles from 12,000 now to a total of 6 million by 2030. By 2050, that would require twice the power produced today, and accordingly more green power to keep its share stable, according to researchers from Fraunhofer Institute.

> *"Economic logic and all experiences from other countries show: In tenders the largest bidders have an advantage."*
>
> *Lars Holstenkamp, Leuphana University.*

Renewables producers fear the caps on new installations will deter investors who worry that the caps will be exhausted before their facilities qualify for the basic feed-in tariffs. Investors put up 818 megawatts of solar facilities in the first five months of 2014, 45 percent less than in

the same period last year – a year in which new construction already halved – after a limit on the number of new installations and falling rates for solar power. That makes it likely the country will miss the target of at least 2.5 gigawatts of capacity this year, the solar industry said.

The government and think tanks such as the Rheinisch-Westfälisches Institut für Wirtschaftsforschung argue that the caps allow for more new facilities than were added in past years and therefore will not deter investors. German industry voiced content that the "hazard scenario" created by the current rate of renewable energy expansion is being curbed, while its own power facilities remain largely exempt from contributing to the energy transition. "The reform is a sound footing for many energy-intensive companies," the BDI Association of German Industry said in a statement.

> *"Everything damaging the expansion of wind power makes the renewable energy law more costly."*
>
> *SH state premier Thorsten Albig.*

While the effects of the new law remain to be seen, it is undisputed among the general public and acknowledged by the government that Germany needs additional efforts, such as saving more energy, to reach its emissions targets. Some acute issues need tackling. While it may remain profitable to build renewable energy installations, incentives against cutting carbon emissions were not strong enough: Prices for allowances to emit carbon dioxide have dropped and cheap gas in the United States is pushing an additional supply of hard coal on the market, reducing coal prices to their lowest in four years and incentivising utilities to sell more power from brown- and hard coal-fired power stations. For three of the last four years, greenhouse-gas emissions from Germany have been rising, even with the massive build-up in renewables, reaching their highest level in five years in 2013. The Federal Environment Agency calls the situation worrying and says Germany would need to push the EU towards a stricter greenhouse gases target, as it is the 28-nation bloc that dispenses emissions allowances. But German heavy industry does not want a European agreement, saying only a global agreement makes sense for climate protection.

The issue looks set to stay on the agenda as the European Union prepares its next green energy push ahead of the 2015 global climate conference in Paris when countries hope to hammer out a follow-up agreement to the Kyoto Protocol. Chancellor Merkel's notable absence at the United Nations climate summit in September, held to prepare for the Paris conference, has raised concerns among environmentalists about her commitment to the issue.

One of many steps to adapt the market to renewables

> *"The reform is a sound footing for many energy-intensive companies."*
>
> *BDI Industry Association.*

The fact that Germany will not meet its own emissions targets does not help that image. According to scientists advising the government on energy, "given the few years remaining until 2020, it will only be possible to stop the target from being missed if additional energy and climate policy measures are implemented as promptly as possible." Energy Minister Sigmar Gabriel's plan covers the next three years. But in addition to the EU measures, this year's plan mainly envisions studies and focusing on the power market and facilities.

That means Germany has got its work cut out. Structural changes to achieve the energy transition are far from over. Green power is driving conventional power plants out of the market, even though they may be needed for now to kick in when the sun is not shining and the wind is not blowing. The debate about how otherwise unprofitable plants can be kept on stand-by without earning money from selling power has just begun. Discussions continue about the location of new power plants or the need for new power lines to connect plants with consumers. The question of how to synchronise these needs with those of neighbouring countries, with Poland complaining of excess power from Germany flooding its market, all against the backdrop of an evolving system, adds another dose of complexity to the agenda.

Factsheets

- Defining features of the Renewable Energy Act (EEG)
- Comparing old and new: Changes to Germany's Renewable Energy Act
- Germany's energy transition in numbers
- Positions of key stakeholders on the EEG: Research Institutes
- Positions of key stakeholders on the EEG 2.0: Business and consumers
- Positions of key stakeholders on the EEG: Government and federal states
- Position of key stakeholders on the EEG 2.0: Environmental groups

www.cleanenergywire.org/dossiers/eeg-20-new-legal-framework-german-energy-transition-0

More backround information on www.cleanenergywire.org

CLEAN ENERGY WIRE