

#“Energiewende”

#climate change

#renewables & #coal exit

#phasing out nuclear

#timetable: G20, elections, COP23

#sustainable transport revolution; BMW, Daimler, VW?

#utilities in turmoil

www.cleanenergywire.org

A Reporter's Guide to Germany's Energy Transition

Context. Contacts. Access.

4th edition 2017

CLEAN
ENERGY
WIRE

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

A Note from CLEW



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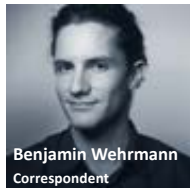
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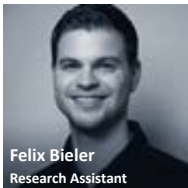
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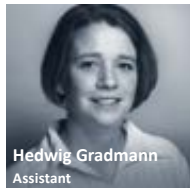
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The landmark Paris Climate Agreement heralds a global shift to a low-carbon future to get climate change under control. Germany's pioneering energy transition provides valuable lessons on weaning a major economy off fossil fuels: The repercussions of the country's Energiewende are felt all across society and the business sector, offering journalists a wealth of exciting and important stories.

Yet researching this massive undertaking in a foreign country with a tricky language is a difficult job, even for the most seasoned reporter. This is compounded by the immense complexity of the technology and economics behind energy policy. At the same time, strong fact-based and critical journalism is essential to inform the international debate about how to decarbonise the global economy.

Which is why Clean Energy Wire (CLEW) has set out to support journalists in their work. Fully funded by two non-profit foundations – Stiftung Mercator and the European Climate

Foundation – we enjoy full independence from any business or political interests. We share our funders' commitment to work towards the decarbonisation of the economy in order to limit man-made climate change.

The CLEW "Reporter's Guide to Germany's Energy Transition", now in its fourth edition, gives journalists a starting point for their work by highlighting the main storylines of the energy transition, providing lists of experts and links to key readings. Our website cleanenergywire.org offers plenty more in-depth information and contacts. Our daily news digest and our Twitter feed @cleanenergywire keep readers in the loop about Energiewende debates and events. We also organise workshops for journalists, providing a first-hand view of the transformation. But most importantly, we offer support with specific questions and put you in touch with experts – so don't hesitate to ask CLEW.

*Sven Egenter and
the Clean Energy Wire team*

1973-1975

"Nuclear power? No thanks!" Birth of Germany's anti-nuclear movement as protests force plans for a nuclear power plant in Wyhl to be aborted

1979/1980

Enter the Greens Germany's Green Party is founded, with an exit from nuclear energy and a renewable future as key demands

Activists first use the term "Energiewende"

1986

Chernobyl disaster solidifies Germans' resistance to nuclear energy

Climate change enters the discourse – a magazine story leads parliament to establish an advisory council

1991

Kick-starting renewables New legislation introduces feed-in tariffs for renewable power

1997/2005

Kyoto Protocol Germany, the world's sixth largest emitter at the time, has to reduce CO₂ emissions under the agreement

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What is the Energiewende? And where did it come from?

The energy transformation, in Germany widely known as the “Energiewende”, is the country’s planned transition to a low-carbon, nuclear-free economy. So far there have been two key elements to the process:

- The phase-out of nuclear power (by 2022)
- The development of renewable energies in the power sector

However, since the first introduction of feed-in tariffs for renewable energies in the 1990s, the project has started to radically reshape the energy system as a whole. As the traditional model of centralised power generation is being replaced by diverse sources of energy that fluctuate with the weather, not only the grid and the power market are affected. While so far mainly focused on electricity, the Energiewende is now also expected to transform other sectors like industry, housing, construction, heating and transport. *For specific energy transition targets see pages 4-5.*

Already, there are winners and losers: Big utilities’ traditional business models have been hit hard while consumers and some businesses are concerned about higher electricity costs. The coal industry first benefitted from the nuclear phase-out, but its future is now uncertain as the government steps up its efforts to cut greenhouse gas emissions. At the same time, entirely new industries have sprung up.



2000	2007	2010	2011	2014	2015	2016	2017
Renewable Energy Act Renewables granted feed-in tariffs and grid priority	EU targets EU sets 2020 climate targets: 20% renewables share, 20% GHG reduction, 20% more efficiency	Extending nuclear The nuclear consensus is reversed by a conservative government	Nuclear phase-out #2 Merkel government formulates new nuclear phase-out by 2022 with large parliamentary majority after Fukushima disaster	New EEG & climate action Govt. lowers feed-in tariffs, starts PV auctions and introduces plan to achieve 2020 climate targets	Slow progress The Energiewende monitoring report shows climate targets are “in serious danger”	Spin-off Utilities E.ON and RWE split to separate renewables from fossil plants	Renewables Reform Auctions determine renewable payments
Nuclear phase-out #1 Red-Green government and utilities agree to phase out nuclear by 2022		Energy concept Govt. sets out renewables and climate targets for 2020 and 2050				Climate Action Plan Govt. adopts ambitious 2030 emission targets for individual economic sectors	Federal elections to determine future course of Energiewende; G20 and COP23 in Germany

#Energiewende – Targets

The overall objective of the Energiewende is to reduce Germany's greenhouse gas emissions and phase out nuclear power, making the economy more environmentally sustainable.

On a national level, Germany aims to cut greenhouse gas emissions by 40 percent by 2020, by 55 percent by 2030 and by up to 95 percent by 2050. The share of renewables in gross final energy consumption is to rise to 60 percent by 2050 (from 14.9 percent in 2015).

Renewables are to cover at least 80 percent of the country's gross power consumption by the middle of the century (31.6 percent in 2015).

The expert opinion accompanying the latest **Energiewende Monitoring Report** by the federal economy ministry in December 2016 warned that the country would probably miss its 2020 emission targets and other crucial Energiewende goals, threatening the entire project's credibility. The economy ministry's 2014 **Climate Action Programme** detailing additional measures and CO₂ saving potential is likely to be less effective than predicted.

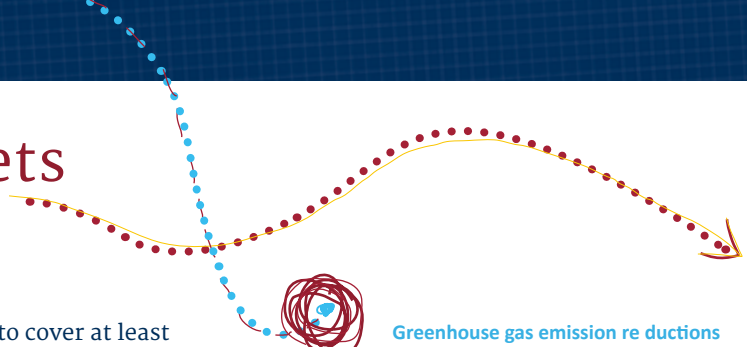
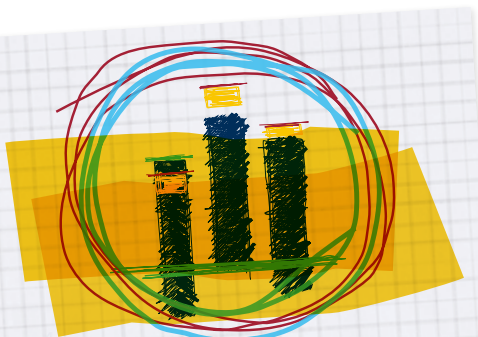
In November 2016, Germany's government agreed on a basic framework for largely decarbonising its economy by mid-century – the **Climate Action**

Greenhouse gas emission reductions

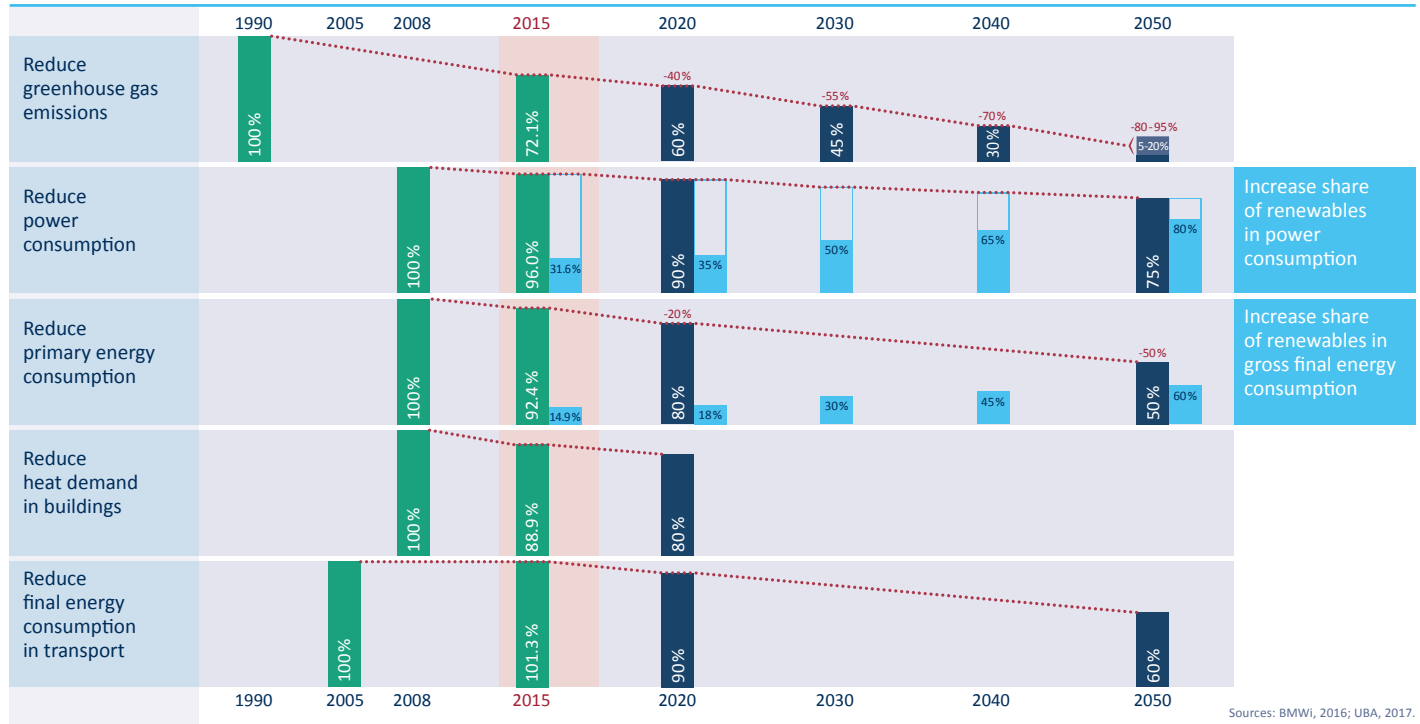
Sector	2014 status cut from 1990 levels	2030 target cut from 1990 levels
Energy	23%	61-62%
Buildings	43%	66-67%
Transport	2%	40-42%
Industry	36%	49-51%
Agriculture	18%	31-34%
Other	69%	87%
Total	28%	55-56%

Source: Climate Action Plan 2050, BMUB (2016).

Plan 2050. In light of the Paris Climate Agreement, the plan fine-tunes German climate goals. It includes target corridors for reducing greenhouse gas emissions in the individual economic sectors as interim goals for the year 2030. The energy sector will have to cut its emissions roughly in half, compared to today's levels.



Quantitative targets of the energy transition



#Energiewende – Key Figures



45.8 m Passenger cars registered in Germany (01/2017)

34,022 Pure electric cars registered = 0.07% (01/2017)

€3.9 bn value of E.ON fossil spin-off Uniper at stock market launch in September 2016

€20 bn value of RWE renewables spin-off innogy at stock market launch in 2016

3.6% Renewables' share in gross German power generation in 1990
29.5% Renewables' share in gross power generation in 2016

12 minutes and 42 seconds: Average power outage in 2015
 Compare (2014)
 Denmark: 12 mins
 France: 50 mins
 UK: 53 mins
 Poland: 192 mins

93% of Germans believe use and roll-out of renewables is important (2016)

€22.8 bn Renewable surcharge paid by power consumers in 2016

330,000 People employed in the renewables sector (2015)

20,214 People employed in the lignite industry (09/2016)



20.6 → 29.2 ct/kWh
 Average household power price 2007 and 2017 – thereof 6.88 ct/kWh renewable surcharge in 2017

50% of newly built houses 2015 supported through gov programme “Energy-efficient Construction”

11.1% Drop in energy demand for heating 2008 - 2015

12.6% Renewables' share in primary energy consumption in 2016 (up from **1.3%** in 1990)

32.3% Renewables' share in gross power consumption in 2016 (up from **3.2%** in 1991)

4.48 ↘ 2.86 ct/kWh
 Average wholesale electricity price in 2007 and 2016

34.6% of natural gas imports came from Russia (2015)

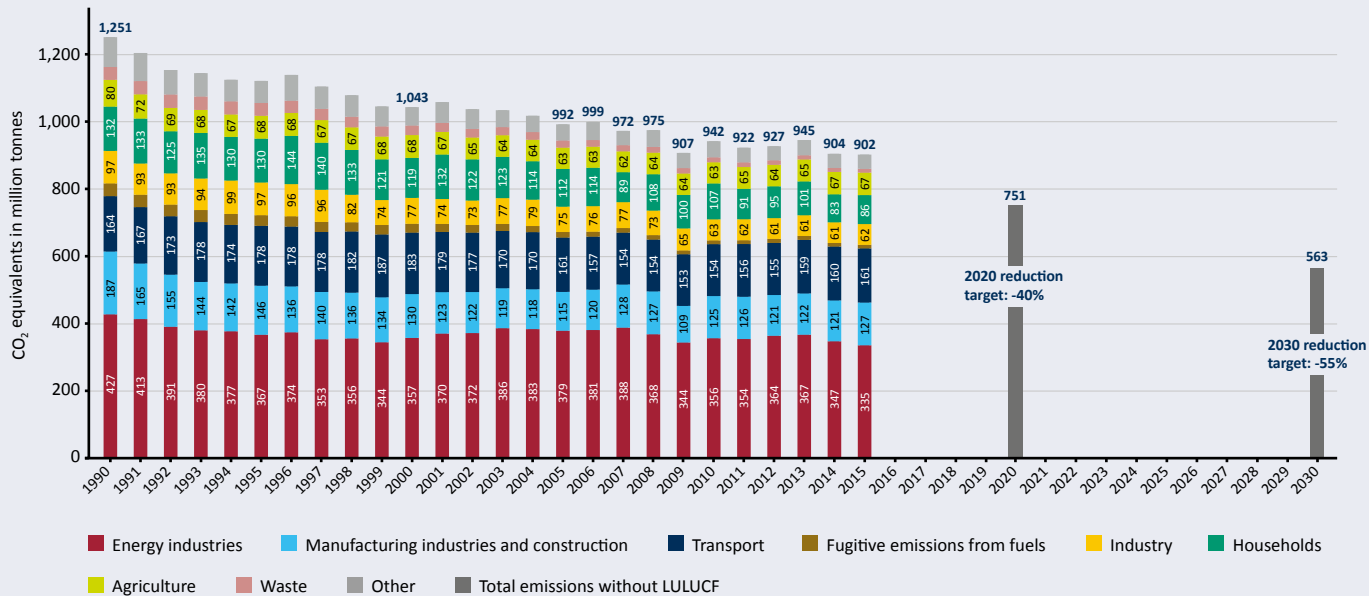
63% of natural gas imports to Germany came from Norway (34.1%) and the Netherlands (28.9%) (2015)

902 m tonnes CO₂ equivalents greenhouse gas emissions in 2015

27.9% Fall in greenhouse gas emissions 1990 - 2015

27.9% greenhouse gas reduction since 1990

Emission trends for Germany by sector 1990-2015

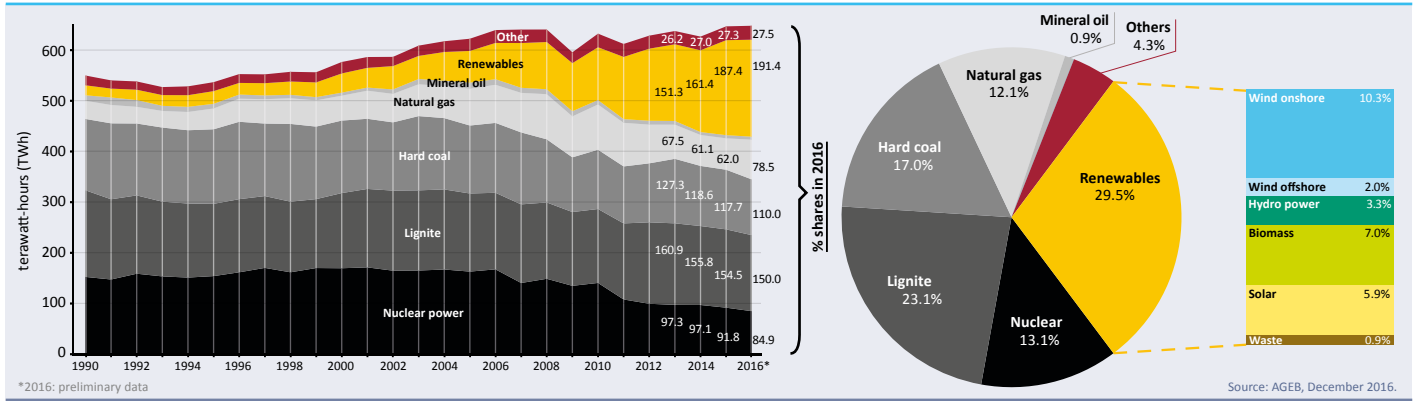


Without emissions from land use, land-use change and forestry (LULUCF)

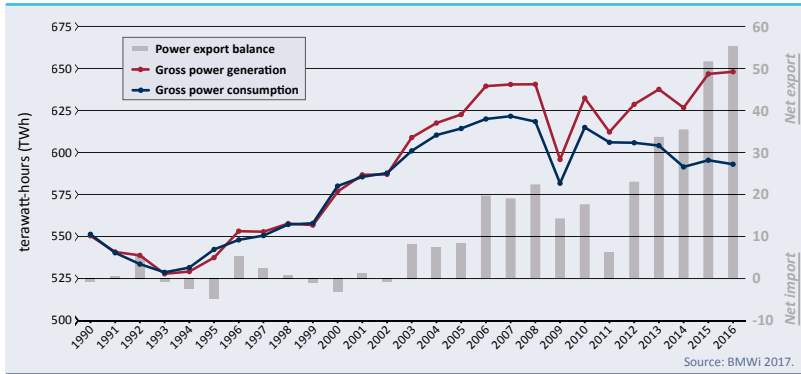
Source: UBA, 2017.

gross power production

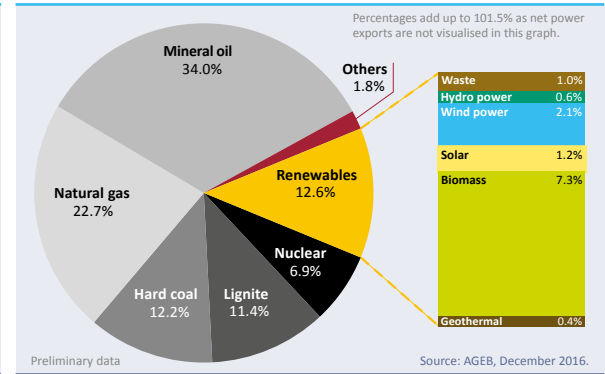
Development of gross power production in Germany 1990-2016



Germany's power export balance 1990-2016



Share of energy sources in primary energy consumption 2016



power export balance

#Energiewende – Dates 2017

17 – 18 March: Meeting of G20 Finance Ministers and Central Bank Governors, BADEN-BADEN.

20 – 21 March: The German government's annual Berlin Energy Transition Dialogue 2017 – “Towards a global Energiewende”. Speakers include foreign minister Sigmar Gabriel and IRENA head Adnan Z. Amin, in BERLIN.

26 March: State elections in Saarland.

4 – 5 April: 14th Hamburg Offshore Wind Conference, in HAMBURG.

3 – 5 May: Berlin Energy Days 2017 Conference, in BERLIN.

7 May: State elections in Schleswig-Holstein.

9 – 10 May: Handelsblatt Digital Energy Industry Conference, in BERLIN.

14 May: State elections in North Rhine-Westphalia.

Late spring / early summer: Germany's political parties will decide on their election campaign programmes.

21 – 22 June: German Association of Energy and Water Industries Congress 2017 – conference on energy markets and energy policy, in BERLIN.

7 – 8 July: G20 Summit, in HAMBURG.

24 September: Federal elections in Germany, followed by coalition talks.

18 – 20 October: 5th World Collaborative Mobility Congress “wocomoco”, in BERLIN.

6 – 17 November: COP23, in BONN.



#Energiewende – Contacts

... for official statements

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... for latest data and research

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Fraunhofer ISE, Solar energy research institute and publisher of electricity production data. Also see their data and graphs at www.energy-charts.de/index.htm, +49 761 4588-5147, www.ise.fraunhofer.de/en

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the experts

... for a list of over 250 experts and institutions with insights into the Energiewende see:

www.cleanenergywire.org/experts

#Energiewende – Reading in English



cleanenergywire.org Our website provides dossiers for in-depth analysis, factsheets, news articles, a daily press digest, an expert database, and more.

Agora Energiewende (2015) *Understanding the Energiewende*; (2013) *12 Insights on Germany's Energiewende*. Good introductory readings on the energy transition in the power sector.

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energytransition.de A website/blog, funded by the Heinrich Böll Foundation, explaining what the energy transition is, how it works, and what challenges lie ahead.

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Hager, Carol and Christoph H. Stefes (eds.) (2016) *Germany's Energy Transition. A Comparative Perspective*.

Ecologic Institute (2016) *Understanding the Energy Transition in Germany*.

#Climate and CO₂ #Fossil Fuels

Green pioneer Germany struggles to make climate protection a reality



As the home country of the *Energie-wende*, Germany is considered a pioneer in the fight against man-made climate change. But despite a spectacular rise in power generation from renewables, the country's track record on cut-

ting greenhouse gas emissions is mixed: It is set to miss its 2020 climate targets. Germany is now aiming at 2030 targets with its Climate Action Plan 2050, a roadmap to a climate-neutral economy by mid-century. But the protracted bat-

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tle over the details of the plan revealed it will be a bumpy ride to turn climate ambition into practice, as the country will ultimately need to kick its habit of burning coal for power production – and say goodbye to petrol and diesel cars.

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📖 Reading

Agora Energiewende (2016) Eleven Principles for a Consensus on Coal

Agora Energiewende (2017) The energy transition in the power sector: State of Affairs 2016

Agora Energiewende (2014) The German Energiewende and its climate paradox

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The energy transition and climate change

📁 **Article:**

German carbon emissions rise in 2016 despite coal use drop

📁 **Factsheets:**

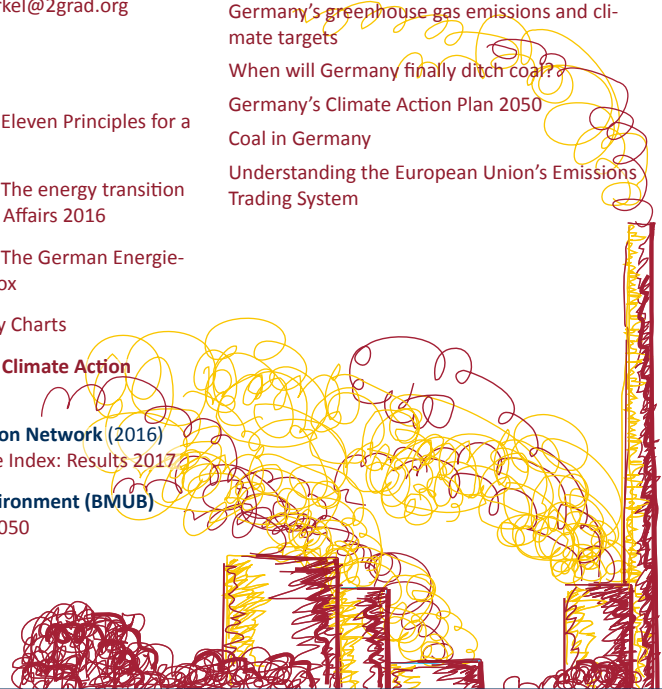
Germany's greenhouse gas emissions and climate targets

When will Germany finally ditch coal?

Germany's Climate Action Plan 2050

Coal in Germany

Understanding the European Union's Emissions Trading System



#Energiewende #Society

Energiewende – the first four decades



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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 Fukushima nuclear plant in Japan. But the societal project started decades before the Merkel

government reinstated plans to exit 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. The Energiewende – a full-scale

"The renewable energy act sparked a real grassroots citizens' movement. Germans turned the Energiewende into their own project."

Nina Scheer, Social Democrats MP

transformation of society and the economy – arose out of enduring grassroots movements, 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.

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📖 Reading

energytransition.de: Timeline Energiewende

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📁 On cleanenergywire.org

📁 Dossier:

The history of the Energiewende

📁 Factsheets:

Milestones of the German Energiewende

The history behind Germany's nuclear phase-out



#Elections & Politics

German elections will shape Energiewende for years to come



©[Marc-Steffen Unger] Deutscher Bundestag.

Germans will elect a new federal government in autumn 2017. Security, economic stability and refugees are likely to dominate election campaigns, but keeping the Energiewende on a steady course and fulfilling Germany's inter-

national climate obligations will still be major tasks for any new administration. Elections in the federal states of North Rhine-Westphalia, Schleswig-Holstein and Saarland will be closely watched for indications of the autumn result.

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Coalition negotiations in the wake of September's federal elections will be crucial to determine the future course of the energy transition. Many areas of the project will require urgent attention by the new government.

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German Bundestag (2016) Facts – The Bundestag at a glance

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Vote2017 – German elections and the Energiewende

Preview2017 – Outlook for Germany's Energiewende

📖 Factsheets:

German elections ahead: The road to the next Energiewende government

German federalism: In 16 states of mind over the Energiewende

#COP23 #Climate and CO₂

COP23 in Germany puts spotlight on country's Energiewende ambitions



Germany will be the venue for the 2017 United Nations Climate Change Conference. The November COP23, which will be organised by Fiji, will focus international attention on “climate pioneer” Germany’s efforts to put the celebrated

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📖 Reading

Climate Action Plan 2050 (2016) Website with latest documents and process updates

European Council (2015) EU position for the UN climate change conference in Paris: Council conclusions

United Nations Global Compact (2015) Special Edition: A Call to Climate Action

Greenpeace (2015) Effects of a partial coal exit (in German)

German government (2016) Climate Action Plan 2050

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COP21 – The view from Germany
The energy transition and climate change

📄 Articles:

Paris deal fuels German coal exit debate, stirs industry concerns

Germans celebrate climate deal, turn to task ahead

📄 Factsheets:

Paris climate deal – does Germany get what it hoped for?

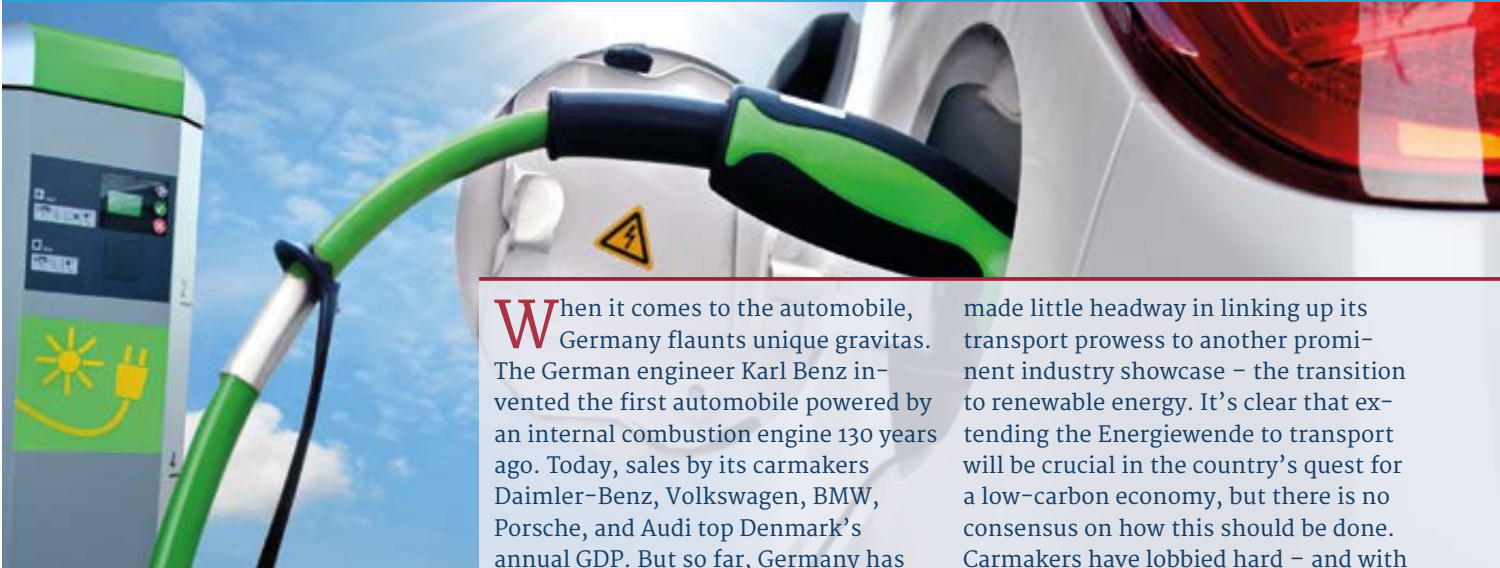
The making of “Climate Chancellor” Angela Merkel

Controversial climate summit issues – positions in Germany

Paris Agreement into practice, by shifting to a low-carbon economy, and the urgent need to phase out coal.

#Transport

Car giant Germany struggles to ignite Energiewende in transport



When it comes to the automobile, Germany flaunts unique gravitas. The German engineer Karl Benz invented the first automobile powered by an internal combustion engine 130 years ago. Today, sales by its carmakers Daimler-Benz, Volkswagen, BMW, Porsche, and Audi top Denmark's annual GDP. But so far, Germany has

made little headway in linking up its transport prowess to another prominent industry showcase – the transition to renewable energy. It's clear that extending the Energiewende to transport will be crucial in the country's quest for a low-carbon economy, but there is no consensus on how this should be done. Carmakers have lobbied hard – and with

“Decarbonisation isn't happening anywhere in the sector. Measures are expensive and intervene with our daily life. Thus, it just hasn't been pushed by either politicians or industry.”

*Peter Kasten,
Institute for Applied Ecology*

some success – against stricter emissions limits, and they risk falling behind the global competition on battery technologies. Consumers are also slow on the uptake of electric vehicles, making it unlikely the government will reach its target of putting 1 million electric vehicles on German roads by 2020.

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#Cars

BMW, Daimler and VW vow to fight in green transport revolution



In Germany, the birthplace of the automobile, three iconic carmakers, BMW, Daimler, and VW, are facing the greatest challenge in their history: The mobility revolution to create a green transport future. Tarnished by the scan-

dal over the manipulation of emission tests by Europe's largest car producer VW – and facing new and powerful competitors in Google, Tesla, Apple, and Uber – the future of Germany's horsepower proud carmakers in an age of

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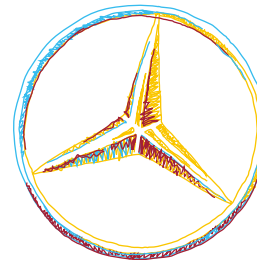
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Reluctant Daimler plans “radical” push into new mobility world

Early e-car starter BMW plans new mobility sprint

decarbonisation, self-driving vehicles, and car sharing is less certain than ever. But experts warn it is far too early to write off the powerhouses of auto innovation in the global race to master the future of mobility.



#Nuclear phase-out

Managing the nuclear legacy – a project into the next century



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. Legal hurdles, decommissioning technicalities, and above all, the question of where to store the radioactive waste, are the main issues at hand. In 2016, an agreement between plant operators and the state

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at least established financial clarity: In addition to paying for the decommissioning of their plants, operators will fund the disposal of nuclear waste with up to 23.6 billion euros. The rest of the yet unknown bill will be footed by taxpayers.

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German utilities buy out of nuclear waste liability for 23.6 bln euros

Germany's constitutional court backs speedy nuclear exit

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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

„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.“

Barbara Hendricks, Environment Minister

#Renewables

Maturing renewable industries navigate risks and new opportunities



Renewable energy sources are the most fundamental ingredient of Germany's low-carbon future, and certainly the Energiewende's most visible expression today. The roll-out of solar panels, wind turbines at sea and on land, as well as biomass installations,

have already pushed renewables' share to around a third of Germany's power consumption. But their share of the country's primary energy needs remains at a paltry 12.6 percent.

This is why renewables still have a long way to go in Germany, as eventu-

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“Renewables are no longer a niche product but have become the strongest and largest pillar of Germany’s power supply.”
Chancellor Angela Merkel

ally they will have to power transport and heating as the country phases out the burning of coal, oil, and natural gas to reach its climate targets.

This means plenty of challenges lie ahead for Germany’s rapidly evolving renewable industry, which

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already employs hundreds of thousands of people. After a turbulent history with spectacular booms and busts, many companies now hope a global energy transition will bring new growth opportunities abroad.

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Bioenergy in Germany – facts and figures on development, support and investment

Germany’s energy consumption and power mix in charts

Volatile but predictable: Forecasting renewable power generation

#EEG2016/Law

Germany's energy transition revamp stirs controversy over speed, participation



The German Renewable Energy Act (EEG) is the mechanism that has made the energy transition possible so far. It guaranteed renewable energy producers high returns on investment, which in turn helped to bring

down the costs of installing renewable power capacity. Lawmakers now say the sector is mature enough to take the training wheels off and be exposed to market forces. Major reform of the EEG aims to do just that, reducing costs for

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“Economic logic and all experiences from other countries show: In tenders the largest bidders have an advantage.”

Lars Holstenkamp, Leuphana University

consumers. At the same time, the new legislation will limit how much new renewable capacity can be built each year. But the plans are hugely controversial. Big energy companies and industry see it as a step in the right

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direction. The renewable lobby and citizens’ energy groups say it will result in Germany missing its climate targets and betray the collective spirit of the Energiewende in an effort to appease big business.

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Defining features of the Renewable Energy Act (EEG)

#Electricity market

The country of the Energiewende strengthens competition and flexibility



The Energiewende involves tough choices for politicians: How will Germany organise the market around the ever-increasing share of renewable energy? What happens to energy security when the sun doesn't shine

and the wind doesn't blow? Fluctuating energy production challenges the entire power grid. The German government is trying to solve these problems with a complete overhaul of the power market and has opted to put its trust

"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

in the free market. These plans will have long-lasting implications. Most experts agree there will be little or no investment in fossil power plants in the future, but opinions diverge over whether this really matters.

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German draft power market law sticks to lignite reserve

Capacity markets around the world

How can Germany keep the lights on in a renewable energy future?

Why power prices turn negative

#Cost & Prices

German industry and its competitive edge in times of the Energiewende



Industrial competitiveness in times of an energy transition – few issues have been watched as closely. 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 power prices in Europe, as they are exempt from levies that fund the Energiewende. But the topic of competitiveness is likely to persist as the Energiewende progresses. Many business leaders warn the costs

*“Perceptions
[of the Energiewende]
varied widely depending
on the size of the
business, their location
or industrial sector.”
DIHK Energy Transition Barometer, 2015*

of the nuclear phase-out and the move into renewables could drive some manufacturing abroad. They say this could take a toll on the car industry and other pillars of the economy. But other sectors hope Energiewende technologies will secure future export success.

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What business thinks of the energy transition

What German households pay for power

#Technology

Technology to transform the energy system – made in Germany



©[WEMAG AG] Batteriespeicher Schwerin Akkuhalle.

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 to keep pace.

German scientists say their work has already made important contributions to the global goal of decarbonisation.

Batteries that can store power and help to regulate the grid within seconds with high accuracy, smart grids

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Combined heat and power – an Energiewende cornerstone?

How can Germany keep the lights on in a renewable energy future?

and other solutions for flexibility and integration of different power sources are key to adapting the power system to a high level of renewables. Germany has doubled research and development funds in under a decade.

“What we will have is an electricity system that is very cheap in terms of getting fuel for free.”

Hans Schöfers, Hamburg University of Applied Sciences

#Business & Jobs

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



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Germany's transition to a low-carbon, nuclear-free economy shakes up the country's labour market. The Energiewende has created hundreds of thousands of jobs – from solar-panel cleaners to housing-insulation specialists and wind turbine engineers. Countless new business

models have emerged, many beyond the renewables industry. Meanwhile, the conventional energy sector has been bleeding jobs, and many business leaders warn the Energiewende will cost many more jobs in other traditional pillars of Germany's economic success, such as steel or the

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car industry. Changes are so rapid that researchers have trouble keeping track. How many jobs the drive to renewables and the energy transition as a whole will eventually create remains hard to gauge and hinges on many political and individual decisions in coming decades.

“Installation is extremely labour-intensive, so carpenters and craftsmen are needed for every building that's retrofitted.”

Christian Noll, German Industry Initiative for Energy Efficiency

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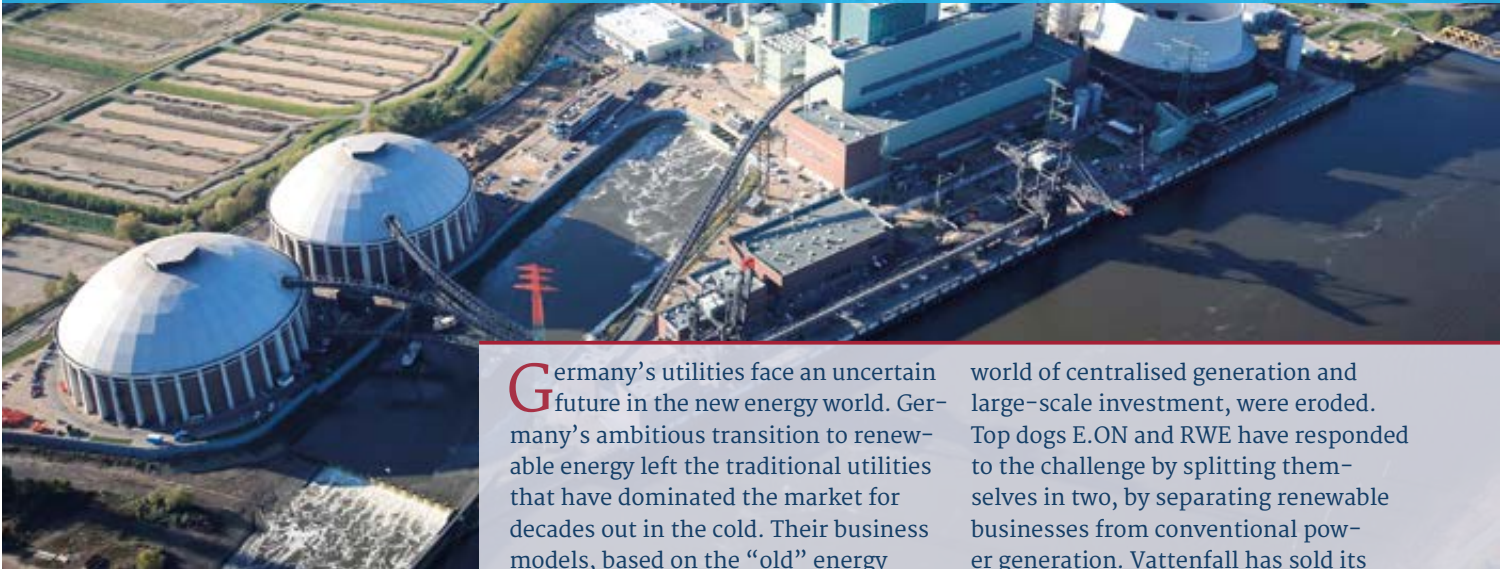
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Where the Energiewende creates jobs



#Utilities

Fighting for survival: Germany's big utilities look for a future in the new energy world



©[Bengt Lange] Moorburg Power Plant 11, Vattenfall.

Germany's utilities face an uncertain future in the new energy world. Germany's ambitious transition to renewable energy left the traditional utilities that have dominated the market for decades out in the cold. Their business models, based on the "old" energy

world of centralised generation and large-scale investment, were eroded. Top dogs E.ON and RWE have responded to the challenge by splitting themselves in two, by separating renewable businesses from conventional power generation. Vattenfall has sold its

"We have seen a kind of worst case scenario materialise for the big energy companies."

Thorsten Lenck, Energy Brainpool

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E.ON shareholders ratify energy giant's split

RWE's plans for new renewable subsidiary

Securing utility payments for the nuclear clean-up

German brown coal operations, state-owned EnBW is redoubling efforts to become greener, and smaller municipal utilities also look for alternative business models.

Despite these drastic steps, the utilities' future role in Germany's

fast-changing energy markets is far from clear. Digitalisation will herald new industry upheavals, and smaller players like Sonnen and Next Kraftwerke enter the fray. Experts say it remains to be seen if the utilities can innovate their way out of the crisis.

#Grid

Connecting up the Energiewende



Germany has to update its network to cope with decentralised, fluctuating supply as the country shifts to renewables.

Rapidly-growing wind power capacity in the north means a bountiful supply of low-cost electricity. But too much

power can be as big a problem for the stability of the grid as too little. And not everyone is in favour of building new power lines to carry electricity to the country's industrial south. The debate raises key challenges, not only of public acceptance but of how central

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government works with regional states to make the Energiewende a success. Meanwhile, other possible solutions are floated, such as a decentralised power supply, demand-side management, power storage, or splitting the German power market.

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How can Germany keep the lights on in a renewable energy future?

Volatile but predictable: Forecasting renewable power generation

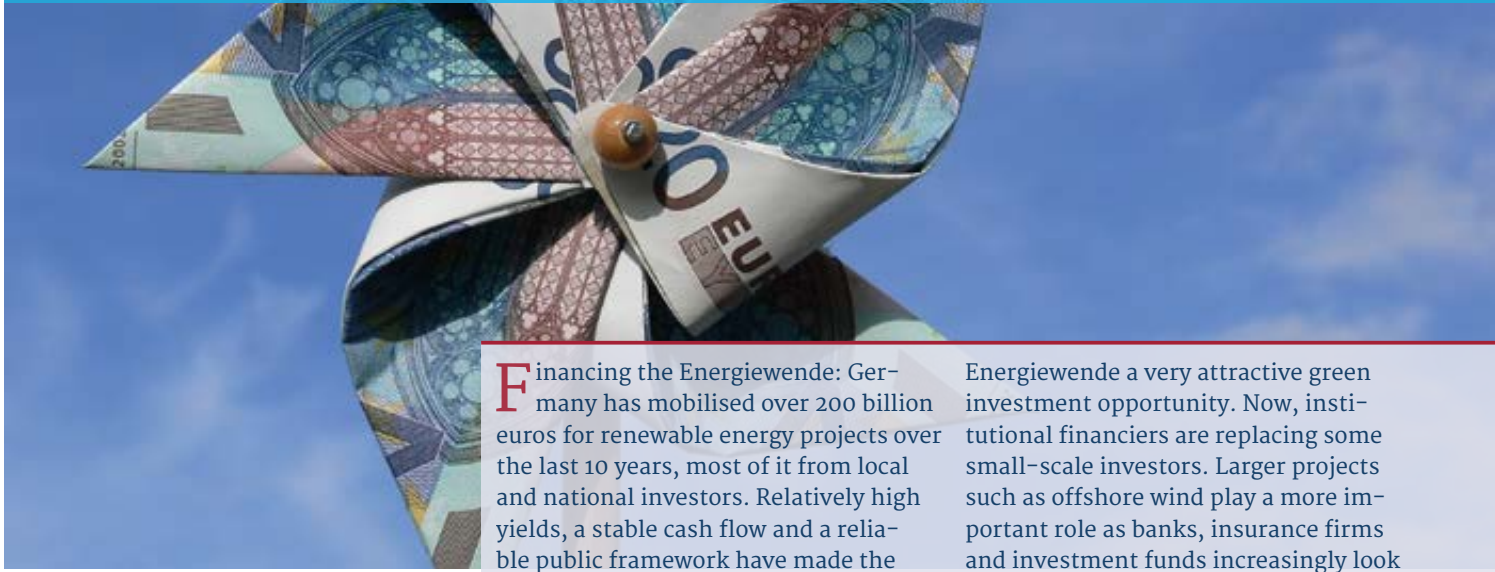
Germany’s renewable generation peaks remain shrouded in data fog

“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, Regulatory Assistance Project (RAP)

#Finance

Financing the future of energy



Financing the Energiewende: Germany has mobilised over 200 billion euros for renewable energy projects over the last 10 years, most of it from local and national investors. Relatively high yields, a stable cash flow and a reliable public framework have made the

Energiewende a very attractive green investment opportunity. Now, institutional financiers are replacing some small-scale investors. Larger projects such as offshore wind play a more important role as banks, insurance firms and investment funds increasingly look

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*Relatively high yields,
a stable cash flow
and a reliable public
framework have made
the Energiewende a
very attractive green
investment opportunity.*

for carbon-free investment. Funding by the public banking system is also playing an increasingly important role. The Energiewende will continue to be financed by a broad mix of investors, but is part of global finance rather than a German singularity.

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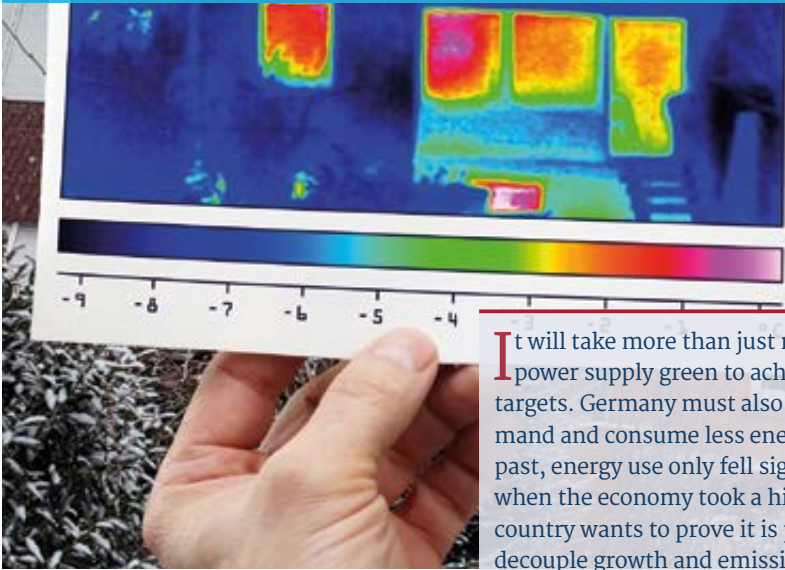
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#Efficiency

Taming the appetite for energy



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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 dra-

matically increasing efficiency. The potential is huge and so far largely untapped, which is why efficiency 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

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more emissions cuts – 25 to 30 million tonnes per year – than any other measure. But saving energy on a large scale – by insulating buildings, changing behaviour and introducing many new and often expensive technologies – requires everyone's participation and has proven a hard sell so far.

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The Energiewende and Efficiency

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Details of new Climate Action Programme

Homes for the Energiewende

Germany's greenhouse gas emissions and climate targets

Combined heat and power – an Energiewende cornerstone?

"Germany can achieve its emission targets much faster if energy is used more efficiently."

Robert Pörschmann, BUND

#Citizens' Energy

Germany between citizens' energy & nimbyism



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 has been key to main-

taining high public support for the energy transition despite rising power prices. But plans for new regulations including the transition to a more auction-based system have stoked concerns that more complex rules will

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put citizens off. At the same time, important Energiewende projects – such as grid extension and wind parks – have run into resistance, requiring new ways to keep the public on board.

Wuppertal Institute for Climate, Environment and Energy+49 202 2492 187,
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Citizens' participation in the Energiewende

Polls reveal citizens' support for Energiewende

Facts and figures on the social impact of the Energiewende

What German households pay for power

"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

#Energiewende #Society

How the Energiewende is transforming Germany as we know it



Germany's energy revolution is having a far-reaching impact on everything from the landscape to education. As some farmers earn more from their "energy harvest" than traditional crops and citizens rethink

lifestyle choices to go green, the transformation doesn't stop at architecture, tourism or urban planning. The changes and their knock-on effects don't please everybody: there are winners and losers when a society and economy undergo

"Technology and renewable energy production are changing faster than society does."

*Günther Bachmann,
Sustainability Council*

such sweeping reconstruction. While some jump aboard, transforming their homes into small solar power stations, others gripe about the "ugliness" of wind turbines and photovoltaic panels.

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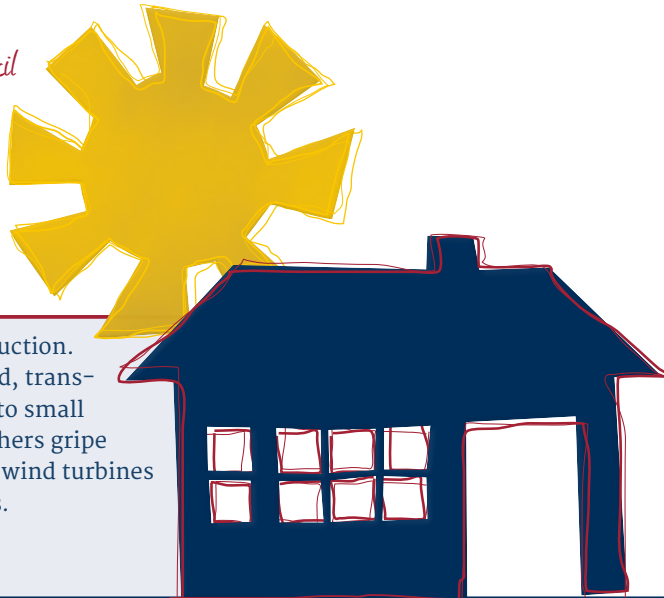
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📖 Dossier:

The social impact of Germany's energy transition

📖 Factsheet:

Facts and figures on the social impact of the Energiewende



#Cities

Energy transition to transform German cities



German cities, counties and municipalities all have their role to play in the Energiewende. With the shift to a decentralised energy system, renewable power is increasingly generated in, and often owned by, local communities. Urban centres are where much of the country's energy is distributed and consumed. And as the energy transition

expands its focus from the power sector to heating, buildings and mobility, population centres will be where crucial changes take place.

Germany will only meet its climate targets if localities implement their own energy transitions – which can also bring economic benefits. They have opportunities to take different paths but must

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also overcome local challenges. Germany's municipalities, many of which are chronically underfunded, must negotiate the complex interplay between EU, federal, and state structures that set overarching goals and provide funding, in order to apply their own ideas, agency, and expertise to shape their own green future.

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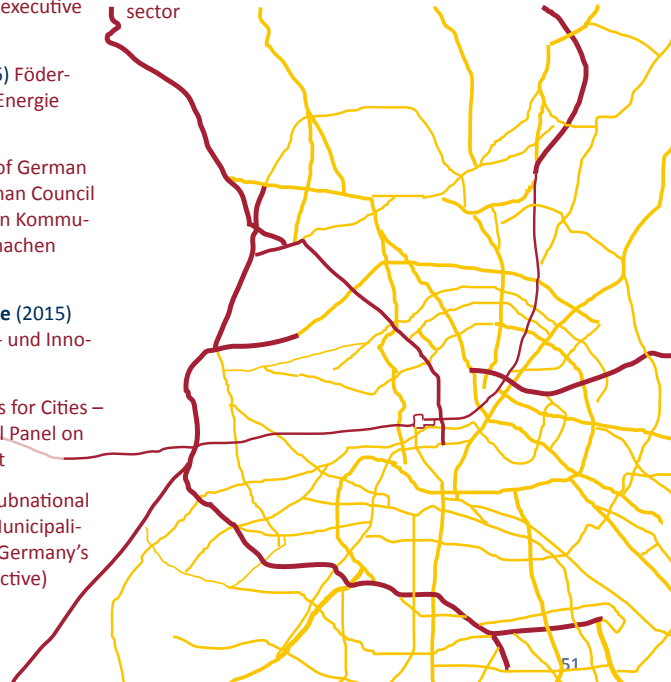
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The energy transition and Germany's transport sector



#Digitalisation

Digitalisation ignites new phase in energy transition, but also poses risks

The rapid spread of digital technologies in the energy sector is about to revolutionise the field once again. The roll-out of smart meters among energy providers and consumers is the first step to create smart grids capable of efficiently matching supply and demand in unpre-

cedented ways, such as in virtual power stations. The technology will be crucial for running a more flexible power system increasingly based on decentralised and variable renewable electricity production, and for integrating transport and heating into the electricity system. Intelligent

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information processing of “Big Data”, rather than large-scale power plants, is poised to become the yardstick for business success in the sector, enabling a new class of players to conquer the field. But the technology also raises concerns about data privacy, and the risk of cyberattacks.

#International #Energy Union #Security

Energiewende impacts EU neighbours and shapes foreign policy



Germany's energy transition began as a lonely expedition, but rapidly impacted markets in neighbouring countries. The country had to learn it cannot reach its goals independently and needs to cooperate in areas such as power grids, trade, and research.

Energy is also inseparable from German foreign policy beyond the EU, as the country still relies heavily on imports to feed its energy appetite. Germany's shift to renewables will loosen these ties, with uncertain consequences for international security.

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The Energiewende and its implications for international security

📄 Factsheets:

Understanding the European Union's Emissions Trading System

Energiewende – Germany is not alone

Germany's energy consumption and power mix in charts

Capacity markets around the world

Loop flows: Why is wind power from northern Germany putting east European grids under pressure?

Germany's dependence on imported fossil fuels

The implications of a low-carbon future reach well beyond questions of supply security. If Germany is to make its energy transition a success, it could have profound geopolitical repercussions across the globe.

*Clean Energy Wire is a joint initiative of
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CLEW Factsheets summarise key aspects of the Energiewende and provide an overview of current issues.

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Imprint

A Reporter's Guide to the Energiewende
(4th edition March 2017)
A publication of the Clean Energy Wire, Smart Energy for Europe Platform (SEFEP)
gGmbH, Anna-Louisa-Karsch-Str. 2,
10178 Berlin
Responsible Sven Egender (Editor in Chief)
Editing Sören Amelang
Gestaltung Annika Langer
Pictures Detlef Eden (Team)
Print Laserline, Berlin – printed on Blauer Engel and FSC-certified recycling paper