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Coming in from the coal: Protesters don't want the Hambach Forest in North Rhine-Westphalia to be cleared to make room for a strip mine.

Blackout

Germany wants to quit nuclear energy and coal, and fast

BY HEIKE HOLDINGHAUSEN

It's an ambitious goal: By 2022, Germany will close its last nuclear power plant and, only 16 years later, stop burning coal altogether. Too slow or too ambitious? It's a hot debate in Germany, at the moment. Nevertheless, the federal government plans to follow the recommendations of the so-called Coal Commission, and to codify it in law by May. It will also stipulate which regions and companies directly affected by the fossil-fuel phase-out will receive government aid – and how much. There's a lot of money at stake here.

The Coal Commission comprises politicians, company representatives, advocates for environmental organizations and scientists. After months of consultations and one final overnight negotiation marathon at the end of January, a compromise was reached: By 2030, the output for power plants burning lignite and bituminous coal will be reduced to 17 gigawatts – less than half of today's installed capacity. And Germany will quit coal altogether by 2038; in 2032 it will be determined whether it's possible to shift coal's termination year forward to 2035.

The environmental organizations issued a dissenting opinion in which they stated that, in terms of climate policy, Germany must quit coal by 2030. Commission member Karsten Smid, an energy expert at Greenpeace Deutschland, claims that "from a technical standpoint, it's easily achievable."

Representatives of the pro-business wing of the Christian Democratic Union (CDU) voiced their skepticism about 2038 as the target year for quitting coal. While Ralph Brinkhaus, the CDU caucus leader, conceded to the *Welt am Sonntag* that "there's wide societal consensus that something must be done to address the climate," he claims that whatever action is taken must also guarantee the security of Germany's energy supply. And furthermore, consumers and businesses should not be unduly burdened by the government's fossil-fuel phase-out.

The minister-presidents of Germany's federal states that would be particularly affected by quitting coal are demanding a certain measure of planning security. In other words, the recommendations of the commission must be implemented and the €40 billion promised by the federal government must be written into law. This admittedly hefty figure should cushion – both socially and economically – the transition to a power supply based on renewable energy sources. North Rhine-Westphalia, Brandenburg, Saxony and Saxony-Anhalt, the federal states that are home to lignite mines, are expecting aid, as are energy-intensive industries such as aluminum smelters and the fossil-fuel energy sector.

In its recommendations, the commission envisages within four years' time the removal from the grid of facilities with a capacity totaling 12 gigawatts, three gigawatts of which derive from burning lignite. The power stations slated for closure lie chiefly in the west of Germany, i.e. in North Rhine-Westphalia. The Rhineland's lignite region and its vast mines would be affected first, with the upside that the vigorously contested Hambach Forest could be preserved. This swath of land between Cologne and Aachen, with an area of no more than 500 hectares, is all that's left of a once expansive forest of beech trees; and it is scheduled to be cleared to make room for a strip mine in development by the Essen energy firm, RWE.

In autumn 2018, the Hambach Forest became a symbol leveraged by Germany's ecological movement for greater climate protection. Activists erected tree houses and occupied the forest; environmental organizations obtained court injunctions against the authorized clearings; thousands of citizens responded to appeals to take "forest walks" to save the Hambach. And on the other side of the coin, RWE employees demonstrated to keep their jobs. The police ultimately cleared the protesters from the forest, during which a young journalist fell to his death from a rope bridge.

To date, no concrete action has been taken for the coal regions in eastern Germany. It is clear, however, that quitting coal necessitates the forced expansion of renewable energy sources, which was the sticking point for finding a solution in eastern Germany. But then the German wind energy industry was hit with some bad news. According to a report issued in January by the German Wind Energy Association (BWE), in 2018 only 743 wind turbines were erected with a capacity of 2,402 megawatts – a 55-percent drop from the previous year.

Germany oversees a total installed capacity of 52,931 megawatts produced by onshore wind facilities. By midyear 2018, the BWE was still expecting an increased installed capacity of 3,300 megawatts. According to BWE President Hermann Albers, it is thus "even more important to pin down the 2030 goal as it applies to the expansion of renewable energy sources and then to adjust the prescribed paths." He goes on to portend that the 2018 slump "jeopardizes the leading position enjoyed by the German wind industry among international competition."

The German government's Climate Action Plan 2050 had laid out certain benchmarks for emissions reductions. The goal for 2030 is a 55-percent reduction in greenhouse gases compared to 1990 CO_2-output levels, as well as an even loftier aim of 62 percent in the energy sector.

Reaching this goal requires technology-specific expansion pathways as well as the dismantling of certain regulatory hurdles. Technologies like Power2X – i.e. the conversion of electricity into a gaseous or liquid form along with industrial-scale energy storage devices – must be promoted and implemented.

Last year's low growth figures appear to be lingering. In 2019, the BWE expects only a modest increase of 2,000 megawatts for onshore wind power. However, things look a bit rosier for the offshore industry. According to the consultancy firm Windguard, 2018 saw Germany's 1,305 offshore facilities generate wind energy with a total installed capacity of 6,382 megawatts. This figure met the level of expansion predicted by industry associations, and at the beginning of the year, the Trade Association Power Systems (VDMA) announced that the legally prescribed expansion limit of 7.7 gigawatts can be reached by 2020.

Moreover, the expansion goal of 1.9 gigawatts for photovoltaic facilities appears to be too modest. The Fraunhofer Institute for Solar Energy Systems (Fraunhofer ISE) considers it necessary to produce five to seven additional gigawatts of installed capacity from photovoltaic facilities if Germany is to meet its goal of full reliance on renewable energy sources by 2050.

Another element that is lacking is an efficient network through which wind energy from northern German and solar energy from southern Germany can be distributed. The four operators of Germany's high-voltage electric grid estimate the cost for expanding the network at €52 billion. Integrating the offshore wind farms in the North Sea and Baltic Sea into the electricity grid would require an additional €24 billion. For solar and wind energy to expand at a faster rate than predicted, two additional north-south routes would be needed. The three large-scale north-south links that are currently in planning are scheduled to be completed by 2025.

Experts have long bemoaned Germany's delays in expanding its grid. One reason is the country's tedious planning procedures, as property owners refuse to yield their land for power lines and local citizens' initiatives protest against the electric-cable super highways laying claim to the countryside.

The Grid Expansion Acceleration Act, spearheaded by Federal Minister for Economic Affairs and Energy Peter Altmaier (CDU) and enacted in December 2018, provides for faster planning processes and higher compensation for property owners, who are often farmers and lumbermen. "The Coal Commission's recommendations have succeeded in initiating the withdrawal from fossil fuels," says Greenpeace representative Karsten Smid. "And we're well prepared for the disputes that are sure to follow."

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GERMAN ENERGY MIX AND THE ENERGY REVOLUTION

Electricity production 2017		Goals	Selected costs
Lignite:	22.5%	– Quit nuclear energy by 2022	Expanding electric grid:
Stone coal:	14.1%	– Quit coal by 2038	€52 billion
Gas:	13.2%		
Nuclear energy:	11.7%	Increase the share of renewable	Integrating offshore wind
Renewables:	33.2%	energies in gross electricity	farms in the North and
Others:	> 5.0%	consumption to 50% by 2030,	Baltic Seas: €24 billion
		to 65% by 2040 and to 80% by 2050.	

Source: AG Energiebilanzen e.V.

Rethinking energy security

Burning fossil fuels jeopardizes the very livelihoods of vulnerable groups and could result in a massive rise in the world's already significant number of refugees

BY SHI DINGHUAN, STEPHAN KOHLER AND SERGEI SHMATKO

The focus has shifted in debates over the security of energy supplies. While the secure supply of energy sources (coal, petroleum and natural gas) was once the central theme and will remain necessary for some time, of even greater importance are sustainability and climate compatibility. Headlines touting decisions by the Organization of Petroleum Exporting Countries have been replaced by those citing international climate conferences and their declarations on decarbonizing the global economy.

The still readily available supplies of fossil fuels should be replaced, as the CO_2 emissions that result from burning these resources are transforming the earth's climate, which will and already is having massive negative effects on the well-being of large population groups. This destructive trend could jeopardize the very livelihoods of these vulnerable groups and result in a massive rise in the world's already significant number of refugees.

Nuclear energy should also be ruled out due to the high risks it poses. What we need is a forward-looking policy that promotes and supplies low-risk energy solutions that are both sustainable and compatible with our climate. This "new" understanding of energy increasingly requires energy efficiency, the exploitation of regenerative energy sources and the CO_2-free burning of fossil fuels using carbon capture and storage.

A successful provisioning strategy needs a stable foundation of suitable, decentralized elements, a broad range of energy sources, innovative technologies and high intelligence. This requires well-developed infrastructure such as pipelines like Nord Stream 2 and liberalized markets that are free of trade restrictions, which will help realize economic efficiency potentials and greatly reduce global energy consumption.

The use of regenerative energy sources is on the rise worldwide; along with hydropower and biomass, which have played an important role in energy provision for some time, solar power, wind power and geothermal energy are growing in importance. The fluctuating generation of solar and wind energy requires that we develop and deploy additional energy storage technologies to guarantee supply security. The decarbonization of fossil fuels, such as natural gas, is also needed in order to be able to use cost-effective energy sources with long-term storage capacities.

An energy-efficient and regenerative energy economy – often termed a Smart Energy System (SES) – can reduce supply problems with fossil fuel and nuclear energy sources, yet creates new challenges and security problems. Implementing an SES relies on numerous new technologies, such as photovoltaic plants, wind power stations and storage technologies, (autonomously driven) electric vehicles, smart-home and smart-grid systems as well as a high degree of web-based connectivity.

In an SES, the question of the availability of and access to raw materials like rare earths, indium, platinum group metals, lithium and cobalt plays an increasingly important role. These elements are needed for manufacturing technologies that are critical for the energy revolution, including photovoltaic plants, wind farms, fuel cells as well as hydrogen electrolysis and battery systems for electric cars.

However, these raw materials are often not sufficiently available, and deposits of these elements and minerals are found in other countries. For instance, the Democratic Republic of the Congo is home to around two-thirds of all known reserves of cobalt, which is indispensable to the manufacture of lithium-ion batteries for use in electric cars. Rare earth elements, 95 percent of which are found in China, are also necessary for a number of innovative energy revolution technologies.

The ability to access such resources is critical to the technological, industrial and economic development of countries and their industries, and thus also a key element for maintaining the social stability of these states. For instance, in resource-poor, industrialized countries like Germany, access to future raw materials is essential.

Cybersecurity within an SES is becoming central to the security of energy supplies. The digital networking of millions of decentralized generation facilities with millions of electronic applications like electric cars, industrial facilities and household appliances harbors an immense risk of disruption to the systems, including a catastrophe such as a complete blackout affecting all of Europe.

While the new energy world, its challenges, dependencies and risks are discernible in outline, we do not yet have the complete picture – in all its complexities – before our eyes. The transformation from a fossil fuel-based energy economy to one centered on mineral resources (mainly metals) and a technology-driven energy world requires completely new solutions. The future security of our energy supply depends on it. We must therefore forge new bridges of cooperation in our quest for supplies of raw materials, as well as in the realm of artificial intelligence and systems optimization.

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