

Bulletin of the Atomic Scientists

Can Germany survive without nuclear power?

Confronted with stringent goals for greenhouse gas emissions reductions, Germany is trying to find the right balance of energy sources and efficiency measures to meet electricity demand. Nuclear may or may not be part of the mix.

BY LEN ACKLAND

WHILE THE NOTION OF A NUCLEAR POWER “RENAISSANCE” is being peddled in the United States, China, Italy, and many other countries, Germany—the world’s largest exporter and the most powerful economy in the 27-member European Union—is pursuing the opposite path. Although Germany’s 82 million inhabitants currently get about one-fourth of their electricity from 17 domestic nuclear reactors, the country plans to phase out nuclear power completely by 2022 under an agreement reached in June 2000 between the German federal government and the country’s four major utilities. That same year, the German parliament passed a renewable energy act to aggressively promote solar, wind, and other alternatives that, along with efficiency and combined heat and power plants, were to restructure the country’s energy system.

Even as Germany’s utility executives signed the nuclear phase-out agreement with the ruling Social Democratic Party-Green Party coalition, known as the “Red-Green coalition,” they hoped it would be reversed if the more conservative, pro-nuclear Christian Democratic Union and its Bavarian-based sister party, the Christian Social Union, regained power. Yet when the tight 2005 parliamentary elections resulted in a “grand coalition” between the Social Democrats and Christian Democrats/Christian Social Union, the Social Democrats exacted a promise that the nuclear phaseout would not be altered. Thus, even though Chancellor Angela Merkel, a Christian Democrat, favors nuclear power, she has dutifully represented the German phaseout position at international meetings.

IT IS 5 MINUTES TO MIDNIGHT

www.thebulletin.org



As Germany prepares for its September 27 national parliamentary elections, the debate over nuclear power has again taken off. The central issue is whether or not the country can meet its ambitious greenhouse gas emission goals and simultaneously produce enough electricity without nuclear power plants as part of the mix. The government's declared climate goals are to reduce greenhouse gas emissions by 40 percent from the country's 1990 levels by 2020 and 80 percent by 2050. The outcome of the debate, and the elections, will have a significant impact in Germany—and beyond. Observers around the world are watching Germany because it is the only major industrial power actively pursuing energy policies aimed at cutting carbon emissions through demand-reducing efficiency measures and supply-enhancing renewable energy while phasing out nuclear power. Indeed, nations such as Sweden that had similarly disavowed nuclear power are reconsidering their decisions, and many hold up France, which gets 78 percent of its electricity from nuclear, as a model.

The German aversion to nuclear power stems from the risks the technologies present, including a fear of reactor accidents, a decades-long concern about nuclear waste disposal, and worry about the proliferation of nuclear weapons. Nuclear proponents argue that this energy source doesn't emit carbon dioxide and that nuclear power is necessary to prevent a deficit in the country's electricity supply.

While the themes in the German debate are common to nuclear power arguments elsewhere, the German discussion is unusual because it focuses on the extension of lifetimes for operating reactors rather than on the construction of new plants. All involved recognize the subtext of the arguments though and the significance of the upcoming elections for the future of German nuclear power. The new government will decide the fate of existing reactors and will also determine if the investments needed to build a non-nuclear future will be forthcoming.

Electricity is the focus. When considering sources of greenhouse gas emissions, electricity should be distinguished from overall energy, or primary energy, which also includes the use of fuels for heating and transportation. Germany's primary energy consumption in 2007 was 33 percent oil, 26 percent coal, 23 percent natural gas, 11 percent nuclear power, and 7 percent renewable and other energy, according to federal government figures.¹ That same year nuclear power accounted for 22 percent of Germany's electricity production, a drop from about 26 percent the previous year due in part to five nuclear plants being offline for lengthy periods.² The other major electricity sources were coal at 49 percent, natural gas at 12 percent, and renewables at 14 percent. Wind was the single largest renewable source, accounting for 44 percent of electricity from renewables.³

Electricity production, particularly from coal-fired power plants, is the single largest source of German greenhouse gases. Overall, Germany emitted 957 million tons of greenhouse gases in 2007, a reduction of 22.4 percent from 1990, according to a government report released in November 2008.⁴ This means the country has already achieved its Kyoto Protocol agreement pledge of a 21 percent reduction by 2012.⁵

The growth of photovoltaics, which supplied less than 0.5 percent of German electricity in 2005, is expected to have little impact on greenhouse gas emissions in the short term. In contrast, the federal Environment Ministry predicts an 11 percent reduction in electricity demand by 2020 due to greater efficiency.

In referring to the 2008 report, Sigmar Gabriel, head of the Federal Ministry for Environment, Nature Conservation, and Nuclear Safety, praised this accomplishment as an illustration of the country's successful climate protection policies, singling out reductions by industry, transportation, and households.

These reductions could grow as producers of renewable sources such as wind and photovoltaic solar panels sell excess electricity back to utilities under Germany's "feed-in" law, which requires that this electricity be bought at rates higher than market prices.⁶ But, the growth of photovoltaics, which supplied less than 0.5 percent of German electricity in 2005, is expected to have little impact on greenhouse gas emissions in the short term. In contrast, the federal Environment Ministry predicts an 11 percent reduction in electricity demand by 2020 due to greater efficiency, according to an energy policy roadmap it released in January.⁷

Environment Minister Gabriel expressed concern that the overall figures for greenhouse gas reductions hide the fact that emissions from electricity generation have been rising since 1999. Utility emissions increased in 2007 in part as a consequence of having to offset the offline nuclear plants and also because more electricity was produced by higher carbon dioxide emitting coal-fired plants as a response to an increase in natural gas prices.⁸ Gabriel used the emissions increase to urge Germans to be more energy efficient by using green building techniques for new houses and buying more efficient appliances.

Higher energy efficiency and more renewables are the two key elements in the electricity mix proposed by experts who argue that Germany can both meet its energy needs and reduce greenhouse gas emissions without nuclear power. For example, Rainer Baake, a former government official from the Green Party who is executive director of the nongovernmental organization German Environment Aid, calculated both sides of the equation a couple of years ago.⁹ Baake, who was an architect of the nuclear phaseout agreement, first estimated the country's real need for electricity

in 2020. Starting with Germany's actual production of 580 terawatt hours in 2006, he calculated that efficiency measures could cut electricity usage by nearly 11 percent or 62 terawatt hours, and the elimination of German electricity exports would equal 20 terawatt hours resulting in a 2020 total electricity demand for Germany of 498 terawatt hours.

Baake then calculated the electricity production mix that would result in 2020 after the phaseout of nuclear power, the shutdown of obsolete coal-fired plants, as well as the addition of new renewable energy. The resulting mix of coal, natural gas, and renewable energy plants would total 441 terawatt hours, leaving a shortfall of 57 terawatt hours. In Baake's plan, that gap would be filled by new, efficient natural gas plants that produce both electricity and heat called combined heat and power or cogeneration plants. Other studies also suggest that significant growth in such plants, which produced 15 percent of Germany's electricity in 2006, is vital.¹⁰ Baake opposes the building of new coal-fired plants, which produce about twice the emissions of natural gas-fired plants, unless they incorporate carbon capture and sequestration (CCS), a process still in its pilot demonstration phase. (The argument for increasing reliance on natural gas-fired plants took a hit, however, in early January 2009 when a price dispute between Russia and Ukraine cut off the supply of Russian natural gas to Europe for several days during a cold spell.)

Changing Germany's electricity production mix in this way would indeed reduce the country's greenhouse gas emissions from electricity generation, which totaled 369 million tons of carbon dioxide in 2006. Baake suggests that Germany could reduce its emissions by 110 million tons of carbon a year if it shut down old coal-fired plants. If Germany is to achieve its greenhouse gas reduction goal by 2020, however, the addition of renewable energy and combined heat and power plants to offset shut coal plants could emit no more than 21 million tons of carbon dioxide annually.

Some observers question whether plans such as Baake's are realistic. The future of coal-fired plants in Germany's energy picture is a major point of contention in the discussion about how to reduce carbon dioxide emissions, abandon nuclear power, and produce sufficient electricity. For example, the October 2008 "Lead Study," written by Joachim Nitsch of Stuttgart University for the Environment Ministry, notes that "no robust long-range statements by power-plant operators" have been made to suggest that operators are preparing to decommission coal-fired plants.¹¹

The Environment Ministry's January roadmap projects that coal will have a diminished, but significant, part in Germany's energy mix by 2020.¹² While calling for the portion of electricity from

The question of how much to invest in renewable energy sources is tied directly to the German debate over whether to extend the operating lifetimes for its 17 reactors.

coal-fired plants to drop to 40 percent from the current 49 percent and urging the construction of combined heat and power plants, the ministry states that obsolete coal-fired plants should be replaced by newer, more efficient ones, even without CCS technology. Baake has sharply criticized the ministry's position on coal,

arguing that new coal-fired plants would impede climate protection goals and curtail the investment in renewable energy needed to achieve the ministry's objective of generating 30 percent of energy with renewables by 2020—more than double the current contribution.¹³

There is broad agreement that significant investment will be needed, not only to develop renewable resources but also to adapt the electricity transmission grid and create storage technologies to accommodate the irregular electricity flow from sources such as wind farms, for example. The Lead Study estimates that investment in renewables will require \$12.7 billion–\$15.2 billion a year in funding until 2020 to reach prescribed goals, and funding must increase thereafter.¹⁴ For Baake, the cost is more than worth it: “Protecting against climate change costs money, but too little protection will be at least ten times as expensive.”¹⁵

Longer reactor lifetimes? The question of how much to invest in renewable energy sources is tied directly to the German debate over whether to extend the operating lifetimes for its 17 reactors. The June 2000 phaseout agreement, which became law in the amended Atomic Energy Act in 2002, calls for a reactor operating lifetime of roughly 32 years, but that lifetime is based on the amount of electricity produced by a reactor rather than on calendar years and was arrived at primarily for political and not technical safety reasons.

Realists within the Green Party recognized that they had to negotiate the phaseout policy terms so the government would not have to pay compensation to the four large utilities, which had already written off the large startup costs of their nuclear reactors and would profit from long reactor operating lifetimes.¹⁶ The utilities consequently retained the flexibility to shift production allowances between plants under certain conditions, a policy aimed at enabling the most efficient plants to run longer, although some companies have sought to shift production to older plants.

Today, the German public is split over nuclear energy. An opinion poll commissioned by the federal Environment Ministry in April 2009 found that 66 percent of the public favored the phaseout of nuclear power.¹⁷ Last February, however, a poll commissioned

by the German Atomic Forum, a pro-nuclear lobbying group, found that 48 percent of the public supported extending reactor operating lifetimes and 42 percent opposed it.¹⁸ “[The differences] just depend on how the questions are put,” says Lutz Mez, a political science professor at the Free University of Berlin.

Sensitive to the widespread, strong anti-nuclear views among the German public, the pro-nuclear Christian Democrats passed a resolution calling for extensions of operating lifetimes but opposing new reactors at their party congress last December. “We do not want to build new nuclear power plants,” the party’s general secretary Ronald Pofalla reiterated in a February interview with the German Atomic Forum. Pofalla added that nuclear power would provide a bridge until new renewable technologies were sufficiently developed.

Nuclear advocates not running for election are less circumspect about the implications of running reactors longer. “First comes the lengthening of reactor operating lifetimes, then we’ll see,” said Jürgen Grossman, CEO of Germany’s large RWE AG utility, in a February interview. Pressed to explain what he meant, Grossman said that “nuclear power must have its place” in any future German energy plan.¹⁹ Walther Hohlefelder, president of the German Atomic Forum, says his country should “not give up the option of new nuclear plants in the long run.”²⁰ Such proponents argue that turning off the nuclear plants will result in an unacceptable shortage of electricity in the country, that nuclear power is cheap, that German reactors are safe, and that the country would withdraw from the global discussion about nuclear safety were it to abandon this source of electricity.

Indeed, German utilities have for years been positioning themselves to extend the operating lifetimes of their older reactors. RWE and Energie Baden-Württemberg AG (EnBW) affirmed their intentions last October when they made decisions that will allow two older reactors to run into 2010 even though they were scheduled to be phased out this year. The utilities’ decisions to shut down the Biblis A reactor south of Frankfurt and the Neckarwestheim 1 unit near Stuttgart for maintenance ensured this extension. The temporary shutdowns mean that prior to the September elections, neither plant will attain its electricity production quota, which would require it to close permanently. If the new government reverses the phaseout, the clock keeps running much longer for these and other reactors. In a setback to company efforts, a top German administrative court ruled in March 2009 that RWE and Vattenfall Europe AG, a separate utility, could not operate two of their reactors longer than planned.²¹

Nuclear critics adamantly oppose lengthening reactor lifetimes

and keeping the door open for new plants down the line. They say that longer operating times will simply mean more profits for the utilities, more nuclear waste to be disposed of at a time when Germany has no permanent repository for high-level waste, more risk of accidents, and less investment for renewable energy. Extended re-

actor lifetimes would mean that “any new potential competitors would have much worse prospects for gaining a foothold [in] the German energy market,” according to analyst Felix Christian Matthes of the Ecological Institute in Berlin. He estimated that extended reactor lifetimes would reward utilities billions of dollars in windfall profits annually since nuclear plants are relatively cheap to operate once the high front-end building costs are repaid.²² “The companies make 1 to 2 million Euros per plant, per day,” Matthes explains.

The global recession has further complicated the question of whether or not to keep all of the German reactors running. Several German economists recently warned that hard economic times would be worsened by a shutdown of reactors across the board.

Acknowledging the profitability of running nuclear plants longer, the big four utilities offered last summer to contribute billions of dollars to the development of climate-friendly energy or to public subsidies in exchange for longer reactor lifetimes.²³ At the May 2009 annual meeting of the German Atomic Forum, president Hohlefelder said the nuclear industry would detail its plans after the polls close on election day next September. He also proposed a partnership between the nuclear and renewable energy sectors.

Hohlefelder’s overture was soundly rejected by the growing renewable energy industry. “We argue against nuclear because according to our analysis there is not enough grid capacity for a lengthening of [reactor lifetimes] and the expansion of renewables,” says Bjorn Klusmann, the managing director of the umbrella Association for Renewable Energy, which represents more than 5,000 companies and 30,000 individual members. He says that nuclear power plants, which provide base-load electricity through continuous operation, require a transmission system different from one with a large contribution of renewables with their fluctuating supply. Once renewables provide more than 30 percent of the electricity—the government goal that Klusmann sees as too conservative—then nuclear and renewables will be in direct conflict. “It’s either them or us,” he says.

The global recession has further complicated the question of whether or not to keep all of the German reactors running. Several German economists recently warned that hard economic times would be worsened by a shutdown of reactors across the board. For example, Thomas Straubhaar of the Hamburg Institute of Interna-

tional Economics advocated, “our main concerns should be first: safety, and second: profitability,” so that only unsafe reactors should be shut down. Environmentalists charged that the economists were simply lobbying for the utility companies.²⁴ They point particularly to large offshore wind farms as alternatives and argue that the government should support renewables in any economic stimulus packages because some wind projects have been put on hold.²⁵

Safety, waste, and the nuclear legacy. The ongoing discussion of German nuclear power has revitalized debates about a slew of issues impacted by the energy source. Never far from the surface are issues of nuclear safety, which peaked in the years after the April 1986 Chernobyl nuclear accident. That accident accelerated the formation of Germany’s federal Environment Ministry on June 6, 1986, mainly through a combination of units from other ministries, and was still a major factor in September 1998, when parliamentary elections enabled the Social Democrats and Greens to form the coalition that pushed through the nuclear phaseout agreement.

The 17 operating German reactors include 11 pressurized water reactors and six boiling water reactors. All of these reactors were purchased from one vendor, Siemens/KWU, “so that they all have a largely identical ‘genetic pool’ in terms of technology and safety,” according to RWE. The company uses its oldest operating reactor, the 35-year-old Biblis A, located on the banks of the Rhein River, to make its safety case. It invested more than \$1.4 billion in recent years to modernize the 1,225-megawatt reactor, and insists that the reactor’s safety levels are on par with new plants. RWE argues that, in general, Germany’s reactors “were technically designed to operate for at least 40 years. Today’s very positive findings from research and operation suggest that continued operation up to 60 years, too, is an entirely feasible option in safety terms.”²⁶

Environmentalists disagree, pointing out that both Biblis A and its companion Biblis B reactor were shut down in 2006 for faulty screw anchors holding down steam pipes and remained offline for a year. A lawsuit was recently filed to close the plants permanently.²⁷ Both reactors are currently offline, one for upgrades and the other for refueling, and are slated to be restarted later this year.

While utilities contend that the similar DNA of the country’s reactors enhances their safety, nuclear opponents say this simply makes the risks more widespread. As evidence, they point to accidents in June 2007 at two reactors in northern Germany jointly owned by utilities E.ON AG and Vattenfall and operated by the latter, a subsidiary of Sweden’s Vattenfall AB. A short-circuit caused the 806-megawatt Brunsbüttel reactor to be turned off on June 28 and later the same day a fire broke out in the transformer building at the 1,402-megawatt Krümmel reactor. Gita Trauernicht, social min-

While utilities contend that the similar DNA of the country's reactors enhances their safety, nuclear opponents say this simply makes the risks more widespread.

ister of the north German state of Schleswig-Holstein, where the plants are located, said the accidents had not directly endangered the public but showed the “vulnerability of complex nuclear technology.”²⁸ Environmentalists agreed. The accidents demonstrate that “catastrophic accidents are possible at any time,” according to the

2008 annual report of the German Environment Aid organization.²⁹ Vattenfall commissioned its own accident report, which pinpointed communication rather than technical problems at the plants but said it would use the report's recommendations to improve the plants' safety.³⁰ As of May 2009, nearly two years after the accidents, both plants were still offline.

Federal Environment Minister Gabriel said the accidents demonstrated that the oldest seven German reactors should be shut down and the other 10 should be allowed to run somewhat longer than originally planned. The head of the federal Office of Radiation Protection endorsed the idea, saying the shutdowns would significantly improve reactor safety in the country.³¹

Opposition to nuclear waste transportation and storage has also gained renewed attention. Water seepage problems at a low- to medium-level radioactive waste repository in Asse grabbed headlines last fall, and an estimated 15,000 anti-nuclear demonstrators gathered in early November at an interim storage facility near the north-German town Gorleben to protest the delivery of high-level nuclear waste from France. This waste stemmed from the French reprocessing of German nuclear power plant fuel rod assemblies at its sprawling La Hague facility in Normandy. Ten thousand police were on hand to clear the road of demonstrators, some carrying signs saying “Nuclear Power? No thanks.” While some news accounts highlighted the violence of the protest, others said it was less confrontational than earlier demonstrations against the waste shipments, which have usually occurred once a year although the previous delivery was in 2006.

On the opposite side, the utility companies have seized the reopening of the debate to try to convince the public of the role they see for nuclear power in Germany's future. As the highly publicized Gorleben protests were drawing public attention, RWE, the second largest German utility, began what it called a “pro-climate power” sales campaign. It posted an ad on its website on November 11 offering “climate protection through a virtually CO₂-free source of electricity” derived 68 percent from nuclear reactors and 32 percent

from hydroelectric generators. The company, which owns all or a majority share of five German nuclear reactors, claimed in December that 100,000 customers had accepted its offer to keep their electricity rates flat until the end of 2011.³²

RWE has been among the most vocal supporters of a continuation of nuclear power in Germany and abroad. Before starting its “clean power” campaign, RWE announced its intention to operate a plant in Bulgaria. Then in January, RWE announced that it and E.ON intend to build at least four nuclear plants in Britain at a cost of about \$28 billion.³³ The company’s aggressive position on nuclear power is seen by some as a reflection of the company’s heavy reliance on coal-fired plants. The company is coming under increasing pressure from the European Union to address these emissions and announced in January that it would not build any more coal-fired plants in Western Europe.³⁴ However, German utilities are likely to continue looking for opportunities to develop their foreign nuclear business despite the controversy at home.

The role the nuclear phaseout debate will play in the September elections will become clearer when the campaigning kicks into high gear after the August holiday season. Still Matthes notes, “We have a saying in Germany that you can’t win an election with energy policy but you can lose an election with energy policy.” Regardless of whether Germany sticks to the phaseout plan, the country will have to deal with a range of nuclear legacies from existing plants. They include the health claims of former uranium miners and nuclear workers, disputed studies about exposures to populations living around facilities, and the disposition of nuclear waste—both what has already been created and that which is to come. A total of 19 German reactors, including 12 commercial power reactors, are in various stages of decommissioning or dismantlement, with the costs borne by the utilities (and, ultimately, by consumers). Of this total, just two smaller reactors have been dismantled and the land recultivated, according to the Environment Ministry. Since the 2000 phaseout agreement, two commercial reactors have been shut down. The latest plant to close was the small 357-megawatt Obrigheim plant, operated by EnBW, which was shuttered in May 2005. Its decommissioning will continue until about 2020 and is estimated to cost approximately \$634 million.³⁵

While estimates for the overall costs of decommissioning and dismantling German reactors are elusive, the companies have been required by law to “set aside” about \$40 billion to cover such work. Like just about everything concerning nuclear power in Germany, this set aside is controversial because companies don’t have to keep these funds, which aren’t taxed, in a separate reserve account. Says Hermann Scheer, a Social Democrat member of parliament and a

major figure in the push for renewable energy in Germany, “We need to take this money out of the companies’ hands and put it in a fund that can only be used for waste management.” ■

Len Ackland teaches journalism at the University of Colorado at Boulder and was editor of the Bulletin from 1984–1991. Research for this article was supported by the John Simon Guggenheim Memorial Foundation.

NOTES

1. Bundesministerium für Wirtschaft und Technologie database, “Zahlen und Fakten Energiedaten,” table 4, available at <http://www.bmwi.de/Navigation/Technologie-und-Energie/Energiepolitik/energiedaten.html>.

2. International Energy Agency (IEA), “Electricity Information 2008,” part III, p. 245.

3. IEA, “Energy Balances of OECD Countries 2008,” part II, p. 219.

4. Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety (Environment Ministry) news release, “Deutschland beim Klimaschutz weiter auf Erfolgskurs,” no. 278/08, November 28, 2008. This report was prepared by the Federal Environment Agency, a unit of the Environment Ministry.

5. Under a European Union burden-sharing agreement for the Kyoto Protocol, Germany agreed to reduce its greenhouse gas emissions by 21 percent of 1990 levels. Those levels, however, were relatively high as a result of the reunification with pollution-heavy East Germany in 1990. Following reunification many obsolete industrial facilities in the former East were shut down, some of which were replaced with state-of-the-art facilities. See Federal Environment Agency, “National Inventory Report for the German Greenhouse Inventory 1990–2006,” May 9, 2008, p. 101.

6. Felix Chr. Matthes, “Chapter 2: The Near and Medium-Term Potential of Climate-Friendly Technologies: Experiences and Lessons from the German Debate and Policies,” in *Short-Term Solutions to the Climate and Energy Challenge*, American Institute for Contemporary German Studies, Johns Hopkins University, Issue Brief 37, December 2008.

7. Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety, “Roadmap Energiepolitik 2020,” January 2009.

8. Michael Bauchmüller, “Kyoto-Ziel schon jetzt erreicht,” *Süddeutsche Zeitung*, November 27, 2008.

9. Rainer Baake, “Klimashutz, Kohle und Atom,” *Deutsche Umwelthilfe*, October 2007.

10. IEA, “Energy Balances of OECD Countries 2008,” part II, p. 65.

11. Joachim Nitsch, “Lead Study 2008,” Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety, October 2008, p. 82.

12. “Roadmap Energiepolitik 2020,” January 2009.

13. “Ausrichtung auf neue Kohlkraftwerke demontiert, ‘Roadmap Energiepolitik’ von Umweltminister Gabriel,” *Deutsche Umwelthilfe*, February 2, 2009.

14. Nitsch, “Lead Study,” p. 25.

15. Interview with Rainer Baake, “Annual Report 2007/2008,” *Deutsche Umwelthilfe*, December 2008, pp. 9, 18.

16. For a detailed description of the negotiations see Wolfgang Rüdiger, “Phasing

Out Nuclear Energy in Germany,” *German Politics*, vol. 9, no. 3 (December 2000), pp. 58–69.

17. FORSA poll, “Meinungen zum Ausstieg aus der Atomkraft,” April 2009, available at http://www.bmu.de/atomenergie_sicherheit/downloads/doc/43814.php.

18. German Atomic Forum, press release, “Endlagerung von zentralen Bedeutung für Akzeptance der Kernenergie,” February 25, 2009, available at <http://www.kernenergie.de>.

19. Marc Beise, “Mittelfristig werden die Strompreise steigen,” *Süddeutsche Zeitung*, February 10, 2009.

20. Thorsten Denkler, “Chef der deutschen Atomlobby im Interview: ‘Wir brauchen ab 2020 neue Kernkraftwerke,’” *Süddeutsche Zeitung*, July 8, 2008.

21. Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety, press release, “Gabriel begrüßt Entscheidung des Bundesverwaltungsgerichts zu Strommengen,” March 26, 2009.

22. Felix Chr. Matthes, “Laufzeitverlängerung der deutschen Kernkraftwerke und Strompreissubventionen,” Öko-Institut, July 7, 2008.

23. K. H. Büschemann and S. Höll, “Milliarden für ein paar Jahre Aufschub,” *Süddeutsche Zeitung*, July 11, 2007.

24. “Economists Criticize Planned Nuke Phaseout,” *The Local*, December 28, 2008.

25. Sebastian Knauer, “Projects on Hold,” *Spiegel Online*, January 30, 2009.

26. RWE Power, “Power: Perspectives 2007—Nuclear Power and its Contributions to Sustainable Energy Supply.”

27. Armin Simon, “Verstrahlter Goldesel,” *TAZ Online*, December 12, 2008.

28. Michael Bauchmüller, “Gabriel will alte Atomkraftwerke abschalten,” *Süddeutsche Zeitung*, August 31, 2007.

29. “Annual Report 2007/2008,” *Deutsche Umwelthilfe*, p. 10.

30. Holger Dambeck, “Experten urteilen milde über Vattenfall,” *Spiegel Online*, November 6, 2007.

31. Bauchmüller, “Gabriel will alte Atomkraftwerke abschalten.” Gabriel’s call for a faster shutdown of reactors was incorporated in the SPD platform in March 2009. See Klaus Stratmann, “SPD will Atomausstieg beschleunigen,” *Handelsblatt*, March 23, 2009.

32. For more information, see http://www.enviam.de/produkte_services/5723.html.

33. Robin Pagnamenta, “Germans to invest £20bn in new UK nuclear plants,” *The Times*, January 15, 2009.

34. “RWE: No new coal plants in western Europe, looks east,” *Power Engineering*, January 21, 2009.

35. “License to Begin Decommissioning Obrigheim,” *Nuclear News*, December 2008, p. 43.

Len Ackland, “Can Germany survive without nuclear power?” *Bulletin of the Atomic Scientists*, July/August 2009, vol. 65, no. 4, pp. 41–52.

DOI: 10.2968/065004005

Copyright © 2009 Bulletin of the Atomic Scientists. All Rights Reserved.