Germany's withdrawal from nuclear energy

Reasons and strategies behind a new energy policy

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- Following the May 2011 annoucement of Germany's coalition government to phase out all the nuclear power plants by 2022 a debate across Europe arose.
- Germany's neighbours are concerned about the future of the European electrical power system and the EU environmental policies. The increasing number of jobs in the renewable energy sector in Germany is also drawing attention.
- The article addresses the reasons for Germany's withdrawal from nuclear energy as well as its consequences for Germany and Europe. It also discusses whether Germany's competiveness could be affected and whether the withdrawal could be revised.

1. What are the cornerstones of the withdrawal from nuclear energy?

In June 2011, Germany decided to decommission all 17 of its nuclear power stations (28 reactors) by 2021/22. The first eight power stations (8.5 gigawatt/GW) were decommissioned shortly after Fukushima. The remaining 9 stations are to be gradually taken offline. Eight new laws regulate the framework for the withdrawal from nuclear energy; the development of renewable energies; new grids and stores; saving energy and energy efficiency. Numerous regulations will follow. The Federal Cartel Office has already warned against excessive state intervention.

2. Why is the withdrawal from nuclear energy a shock to Europe?

The new nuclear policy changes key coordinates in Europe: in Germany for the party system and industry, in Continental Europe for the common energy market and environmental policies – subjects potentially as explosive as the euro crisis.

2.1 With its decision of June 2011, Germany is returning to the withdrawal from nuclear energy, which in 2001 had been agreed by the red-green Schröder government together with the major electricity companies by 2020. In Europe, the withdrawal from nuclear energy had been barely considered. At the end of 2010, the conservative Merkel government decided to extend the service life of the existing reactors to approx. 2033/38. This controversial decision has now been reversed - a complete U-turn. The new change of policy in June 2011 has taken Germany and Europe by surprise. There are two short-term reasons for this change in policy: firstly, the political decay of the liberal coalition partner FDP since 2010 means that Chancellor Merkel needs the Green Party or the social democrats for a government in 2013. To this extent, the withdrawal from nuclear energy serves to help the current conservative government retain power. Secondly, Fukushima gave the Chancellor the opportunity to force the CDU and FDP parties into a radical change of policy. In doing so, the Chancellor, herself a qualified physicist, followed the vast majority of the population and stood up to the long-standing defendants of nuclear energy within her own coalition and the four major energy companies.

In the long term, the withdrawal from nuclear energy is connected to two special developments of the party system and the economic structure:

- Germany's political system is taking a different direction to the rest of Europe. Globalisation, immigration and Islamism have led to strong right national movements almost all over Europe. This is not the case in Germany. Here, after a 30-year debate on nuclear energy, a green party has firmly established itself in the middle-class centre of the political party system.

- Industrial production has around a 30% share in the German economic system (France, UK and USA: 15%). The country is therefore highly dependent on energy and has high emissions levels. It has strongly focussed on energy technologies and could in the future greatly benefit from a move to renewable energies.

2.2 Following the decision in Berlin, a debate about their own energy policy developed in the media and political parties in France and other Continental European countries, but not in the United Kingdom. To date, the British government has been rejecting change. The go-ahead for the building of a new generation of 8 nuclear power stations still stands. Several consortia have announced plans to build new reactors without public funds. Hence, the construction programme depends on the capital markets willingness to finance the extremely costly and technologically futuristic third generation reactors, which at present are under controversial scrutiny in France and Finland. Political parties and media (with the exception of the Scottish Government) have not yet begun to seriously debate Britain's nuclear strategy.

2.3 The German withdrawal from nuclear energy has important consequences for Europe. It was not coordinated in the EU. From a foreign policy perspective, it affects Europe's dependency on high-risk gas suppliers such as Russia. From an energy policy perspective, it may affect the stability of the European energy system on which

German energy policy depends. From an environmental perspective, it may endanger important German and European policy objectives. From an economic perspective, it influences the competitiveness of certain European industries.

3. Why is Germany taking a route of its own?

The route taken by Germany is based on historic reasons:

3.1 World War II has left Germany with a sense of enlightened pacifism with an original scepticism of military, but since 1970 also of civil nuclear technology. However, the main nuclear conflict was not between right and left as both entrepreneurs and the major industrial unions advocated civil nuclear technology.

3.2 In the densely populated country of Germany, a major accident at a nuclear reactor was regarded as an unacceptable risk (unlike with water and coal-powered plants) even despite the low probability of earthquakes, airplane crashes, terrorist attacks or extreme technical or human faults.

3.3 Opposition is also resulting from a lack of transparency in construction plans, safety standards, accidents, the origin of the uranium supply, recycling and the fruitless search for end storage sites. Doubts existed about the independence of the state nuclear supervisory body from government and pro-nuclear lobby influence. The same applied to the subsidising of the nuclear industry as well as the costs of dismantling decommissioned power stations, insuring nuclear risks or end storage.

3.4 Furthermore, the energy companies stopped showing interest in new-builds a long time ago and instead opted for extended service lives due to the costs, construction times and objections by citizens.

3.5 Unlike United Kingdom and France, Germany is decentrally organised in terms of the state, the mainstream medium-sized companies, the small financial institutions with a large market share and an energy sector with numerous local utility companies with a potential to increase their present market share of around 20%. This fosters mistrust in a nuclear power oligopoly. The service life extension agreed in 2010 was regarded as a strengthening of this oligopoly to the detriment of small energy companies.

3.6 In Germany, 20% (2011) of the total electricity generated comes from nuclear energy as opposed to approx. 80% in France, but only 15% in the UK (2011). However, the UK must replace a 70% share of fossil fuels in the longer term, whereas Germany only needs to replace approximately 50%. In Germany, renewable energies provide 20% of electricity supply (2011), while in the UK they make up less than 3%. Concerns about the prospect of an 'energy gap' are also more pronounced in the UK than in Germany.

3.7 Germany has a strong renewable energy industry with approximately 275,000 jobs (2011) – almost comparable to the chemical, automotive and mechanical engineering industries. The changeover is therefore expected to bring many new jobs despite growing competition from China and without estimating the number of jobs that were lost in the general economy due to the creation of green jobs following government subsidies. For the German industrial giant Siemens, that is ready to exit the nuclear energy business, Germany's shift towards renewable energies is "the project of the century".

4. What is the withdrawal plan?

The withdrawal plan is a phased plan with a fixed target of 2021/22 and annual monitoring. The eight oldest power stations have been decommissioned since March 2011. They account for a third of the nuclear energy. This decision has reduced the traditional German electricity export surplus from 10.9 TWh in the first half of 2010 to 4.1 TWh in the first half of 2011. The remaining nine nuclear power stations will be gradually - depending on age and technical criteria - shut down between 2015 and 2022. Independent institutions should provide the government with annual reports on new grids, power stations, renewable energies and energy efficiency.

Germany is acting as a test laboratory for a risky energy revolution – in Europe and around the world.

5. Can the withdrawal from nuclear energy be revised?

By the end of 2021, there will have been three German federal elections. A revision of the current withdrawal is therefore possible from a legal perspective. In the longer term, however, the rapidly expanding renewable energies sector and the capital markets scepticism to commit funds to nuclear projects could prevent a new revision.

6. What is the bridge between the withdrawal from nuclear energy and the changeover to renewable energies?

It is not possible to precisely plan the interaction between the withdrawal from nuclear energy and the development of renewable energies. Supply security therefore demands a flexible bridge for the transition. This has to be ensured through state framework conditions and market dynamics. Most economic scenarios indicate that a nuclear withdrawal by 2022 at the latest is possible without a blackout risk.

The bridge to a renewable energy supply will temporarily comprise coal (2011: 42% of power generation) and gas (2011: 14%). By 2013, fossil fuel plants with a 10 GW capacity should replace the missing nuclear energy. Additional plants with a capacity of 10 GW are required by 2022. Major power generators prefer to use cheap hard coal and local brown coal rather than more efficient but more expensive natural gas. However, there are currently major technical problems with newly built 10 GW capacity coal-fired power stations, which may lead to serious delays.

Smaller gas-powered power stations could be predominantly set up by utilities companies. They are quick to construct and can make the fossil fuel bridge shorter than with large coal-fired power stations with long service lives. They are efficient (effectiveness of up to 60%) and can flexibly balance out any fluctuations in wind and solar energy. They can use combined heat and power (e.g. heating pumps in buildings) to improve the carbon footprint. They can be constructed in a consumption-oriented manner and thus save on overhead lines. However, their profitability depends upon a careful reorganisation of the local energy markets.

The feared dependency on Russia for gas can be restricted through liquid gas from several countries, clean biogas and methane from the conversion of wind energy. The International Energy Agency expects a global diversification of gas sources by 2035. However, according to the latest studies by the Cornell University, the modern drilling of natural gas releases more environmentally-damaging methane than coal mining. The risks to groundwater pose a further problem.

In the longer term, no major price difference is expected between coal and gas. The cost advantages of the dirtier coal can be eliminated through the higher costs of the EU emission certificates. The emission differences between coal and gas are put into perspective by the increase in renewable energies. The fossil fuel bridge must, however, remain compatible with the target of a 40% reduction in German CO2 emissions by 2020 compared to 1990. Government authorities believe that 30-33% is feasible with major efforts. The future German CO2 emissions level is restricted by European emissions trading. If Germany increases its CO2 emissions, this trading system will lead to higher electricity prices in Europe. New technologies such as the splitting off and compression of CO2 (CCS technology) in fossil fuel power stations are currently still classed as high risk; insurance companies regard them as incalculable and will not yet insure them.

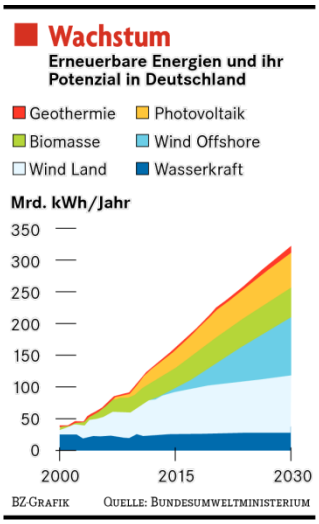
7. Will German competiveness be impaired?

There are no concerns about longer term risks to German competitiveness due to the withdrawal from nuclear energy. In the medium term, however, a clear increase in electricity prices is expected for industry and major customers. Energy-intensive industries such as cement, steel,

aluminium, paper, glass or basic chemicals with a turnover of approx. €300 billion s are deemed to be at risk due to simultaneously increasing raw material, energy and emission costs, the latter of which could increase by 20-60% by 2050. To prevent them from leaving Germany, the provision of annual subsidies of €500 million is planned for a wide range of smaller companies. Although the structural change brought about by the energy policy could destroy energy-intensive jobs, it could also create many jobs in the clean energy sector thanks to the high energy investments of several €100 billion over the long term. One should, however, be sceptical of any estimate of the net effects on jobs of clean energy policies.

8. How is the changeover to renewable electricity supply being organised?

In 2011, 20% of electricity supply are planned to be covered by renewable energies. This figure should reach 35% in 2020, 50% in 2030, 65% in 2040 and 80% in 2050. Off-shore and on-shore wind farms will occupy the top two ranking positions by 2035; photovoltaics and biomass will rank at the same level but be a long way behind wind. The development of the changeover in the market economy cannot be precisely predicted due to technological developments, stricter environmental targets and global energy prices. The government can only establish framework conditions for individual types of energy.



Wind power currently accounts for the largest proportion among renewable energies. This proportion is set to vastly increase, in particular through strongly state-subsidised off-shore wind farms from 2015. Wind farms with a capacity of up to 25 GW (equivalent to that of 25 nuclear power stations) are to be constructed off the northern coasts by 2030. This will increase the demand for wind turbines. On-shore wind farms are expected to experience stable growth, especially in the previously restrictive southern regions. As with photovoltaics, their expensive state funding is being cut.

Solar energy: although photovoltaic energy costs are currently far higher than those of nuclear energy, the manufacturing costs of solar cells are expected to fall by around 60% over the next five years. In southern Europe, solar energy is already competitive; in Germany, without state funding, this is only possible in the medium term. The exploding funding costs for photovoltaics (€6.5 billion p.a.) are subject to a general 9% cut and a complete cut for plants on arable land. Solar thermal energy from southern Europe and the Sahara could become far more important from 2020/2050.

By 2035, **biogas** could be as important as photovoltaics. Its effectiveness will vastly increase. Unlike wind and solar energy, biogas is easy to store. It can therefore provide peak and base loads and is available when neither sun nor wind are. As the quality of biogas should reach that of natural gas within the foreseeable future, it will be possible to feed it in natural gas networks. Subsidies are being particularly provided for biogas from waste instead of from agricultural products.

Hydropower will remain relatively stable in the long term. New designs of hydroelectric shaft plants (Technical University of Munich) may promise new potentials. Only a small proportion of power will be generated from geothermal power.

Some research institutes estimate that in 2022 the installed capacity by all electricity providers (at this point without nuclear power stations and with 35% renewable energy) will exceed the maximum power consumption, e.g. during winter days. According to them, it would therefore, in principle, be possible to guarantee long term supply security without any major power imports.

9. Saving energy and increasing efficiency

Saving energy and increasing efficiency are key topics within the scope of the changeover, especially with regard to reducing emissions. Industry has halved its energy expenditure per production unit since 1980. Today, it has come far further than buildings and households. Buildings consume about 40% of the total power amount. Currently, only 1% of residences are being renovated each year. This should be accelerated as the savings potential from buildings is particularly high. Experts believe that up to €5 billion per year is required to this end to prevent major increases in rent prices. Intelligent power technologies are expected to give rise to high savings in households.

10. How does the power reach the consumers?

The interaction between the fossil fuel bridge and the changeover to renewable energies requires new power grids and energy stores at a cost of €10 - 50 billion. Firstly, this includes up to 5,000 km of efficient DC networks for wind energy from the North Sea, solar energy from southern Europe and the Sahara, or the transportation of power from Norwegian energy storage reservoirs. Secondly, the European network needs modernising. Thirdly, numerous decentralised distribution grids need to be developed into 'smart-grids' (up to 380,000 km of decentralised grids) so as to enable stable energy systems at a local level (municipalities, companies, buildings). Systems such as pump water and compressed air reservoirs or battery systems are required to balance out fluctuations in wind and solar energy. In the future, all electric vehicles could be part of these storage systems. Such investment, however, requires costly imports of materials such as rare earths from countries like China.

On a more strategic level, Germany will have to decide whether in future it will rely mainly on large scale projects and technologies such as offshore wind parks and Sahara solar installations or combine these with a wide range of decentralised power systems managed on the local level. Studies about the appropriate technologies, the cost-effectiveness of these investments, the local management systems, the time perspective of these strategies etc. are still under discussion. The Social Democratic Party, controlling many regional and city governments, is strongly supporting these strategies expected to reduce the market domination of the four German energy oligopolists.

11. How are the costs and prices developing? Grids and stores

In Germany, electricity prices for end consumers are higher than in France and other European countries. This is due to high government taxes on the wholesale price to finance renewable energies. The basis is the Renewable Energy Law (Erneuerbare Energiegesetz – EEG) from 2000, a role model for 47 countries. Green electricity is subsidised by guaranteed purchase prices above the market price. A levy on electricity consumers (except power-intensive industries) balances out the difference. Scenarios developed by independent economic institutes predict a more than 20% increase in electricity prices by 2020/2030 due to expensive new ways of power production. By 2030/50, these will then fall again thanks to renewabl energies. €25 billion worth of investments in energy efficiency are a further prerequisite for this.

In all events, the (external) economic costs of all primary energies are insufficiently reflected in the prices, e.g. in the case of nuclear energy, the costs of end storage, the extremely high "insurance costs" for reactors and the cost of measures arising from safety inspections of the 143 reactors in the EU. International fuel and CO2 prices are expected to have a greater influence on electricity prices in the longer term than the withdrawal from nuclear energy and the precise withdrawal times. If the renewable energy policies could be combined with a reduction in the current per capita annual power consumption of 7149 kWh (2008 – World Bank) to 2000 kWh by no later than 2050 or with a reduction of the total energy consumption by 3% per year, Germany could try to withdraw from nuclear energy even before 2021. This, however, would require deep and rapid changes of private and social life styles.

Über den Autor

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