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## Germany and nuclear energy: towards a necessary readjustment?

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The war in Ukraine is shaking Europe in many ways. Germany, like its eastern neighbors, is experiencing the direct consequences of this conflict both in its industry and in the supply of gas, which is essential to it. As a country with relatively few energy resources on its soil – with the exception of coal – but with significant needs, especially for its industry (automotive, mechanical, electronic, chemical, etc.), Germany is very dependent on energy imports. The primary production of gross energy on its territory is composed of coal (about 28 %), nuclear power (12 %) and now renewable energies (40 %), particularly *via* wind power<sup>1</sup>. Most of this domestic production is used to generate electricity, thus covering just over half of its final consumption. For the rest, energy is imported from various parts of the world (based on 2021: from France for electricity and from Russia for natural gas, coal and oil). In 2022, due to the geopolitical circumstances in Ukraine, the German government is confronted with the urgent need to reduce or even replace the country's heavy dependence on Russian gas to meet the energy needs of households and industry. At the same time, Germany is faced with the deadline for phasing out nuclear power by the end of this year<sup>2</sup>. This decision to phase out nuclear power has been accompanied by an anti-nuclear policy on the international stage, particularly in Europe, as evidenced by attempts to veto all European projects that include nuclear power. The tense debate on the inclusion of nuclear energy in the European taxonomy as a “green” energy source is another significant example<sup>3</sup>. While the European Commission and the International Energy Agency (IEA)<sup>4</sup> call for maximum diversification of energy sources in order to address the dependence problem, Germany is facing an ideological paradox on the role of nuclear power in managing the current energy security crisis.

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<sup>1</sup> German Federal Statistical Agency ([Destatis](#)), based on 2021.

<sup>2</sup> Decision passed by the Federal Parliament with a large majority on 30 June 2011, following the Fukushima

<sup>3</sup> François-Marie Bréon, « Science et politique autour de la taxonomie verte de l'Union européenne », [La Tribune](#), 7 July 2022.

<sup>4</sup> [UNEP, IEA, and IAEA \(2022\) Energy Security and Climate Change: A Path Forward](#)

# 1. Nuclear power in Germany: between interest and historical rejection

The relation to nuclear energy has long been controversial in Germany, with both a certain scientific-political interest for the atom and a limited social acceptance of it, including for military purposes. In fact, Germany, before the Second World War, was one of the countries most involved in nuclear energy research. This scientific interest was revived with the signing in 1955 by Chancellor Konrad Adenauer of the Treaty of Paris, which directed research and development into civil nuclear power, followed by the signing of the European Cooperation Treaty Euratom in 1957. Considered at the time as a clean and inexhaustible method of energy production<sup>5</sup>, nuclear energy was to reduce dependence on oil. The connection of the first nuclear power plant in Großwelzheim to the national grid in 1961 paved the way for the project, accelerated by the 1973 oil crisis, to install 40 nuclear reactors in the country by 1985.

However, this period of interest was accompanied by a growing societal rejection of the atom. The first safety concerns arose in the early 1970s together with the private project to build two 600 MW reactors for the energy use of the chemical company BASF in Ludwigshafen. The politically supported project gave rise to an initial wave of fear among the local population, which was confirmed by the assessment of risks related to a potential accident on the industrial site<sup>6</sup>.

Shortly afterwards, in 1975, the planned construction of the Wyhl power plant (1,300 MW) on the border with France gave rise to strong protests, leading to the formation of increasingly powerful anti-nuclear movements in the country<sup>7</sup>. Several reasons were advocated by these movements to stop the construction of this power plant – skepticism about the soundness of using nuclear power while coal was available and cheap and, but above all fears linked to the release of water vapor which, according to some local residents, could reduce the amount of sunlight and thus harm the yields of their vines, and finally, for the longer term, the management of radioactive waste. An attempt to move the project ten kilometers further away was unsuccessful, with the inhabitants of the new site protesting on the same grounds.

The clashes between anti-nuclear opponents and the police marked the beginning of a strong media focus on this issue, leading to public solidarity with the demonstrators. This event was the starting point of a societal anti-nuclear organization that continued the

<sup>5</sup> [Das Parlament Nr. 46](#), 15. November 2021, p. 10. & c : + É Á

<sup>6</sup> Some experts, starting with the German Technical Inspection Association (TÜV) for the Rhine region, considered that the release of water vapor from the reactors, the repercussions of which could have caused the death of 100,000 inhabitants in the Ludwigshafen and Mannheim region, as well as the contamination of more than one million people. The project was eventually cancelled for ecological reasons. [Die Rheinpfalz](#), 12. September 2017.

<sup>7</sup> [Frankfurter Rundschau](#), 18. März 2011, p. 1.

demonstrations in Wyhl and throughout Germany<sup>8</sup> via anti-nuclear associations and networks.

Until the early 2000s, the anti-nuclear movement was at the origin of numerous local citizens' initiatives and environmental associations. The attempt in 1977 by the Minister-President of Lower Saxony to establish the municipality of Gorleben as the largest storage site for high-level radioactive waste in Europe resulted in a decade-long legal battle, making Gorleben a "stronghold" for anti-nuclear groups<sup>9</sup>. The project was finally abandoned by a decision of the Federal Ministry for the Environment and Nuclear Safety (BMU/BMUV) in September 2021<sup>10</sup>. Thereafter, the protests became more systematic and shifted slightly from their original focus on the refusal to build new power plants to waste disposal and the call for Germany to leave the Euratom Treaty<sup>11</sup>. The formation of the association *ausgestrahlt* in 2008 is representative of a certain degree of national coordination of anti-nuclear movements, with a more systematic lobbying strategy, following the example of other NGOs such as Greenpeace, BUND, or Naturfreunde.

It is important to remember that this "fear of nuclear power"<sup>12</sup> has its roots in a context of great insecurity, in the middle of the Cold War, in a country that was then divided between the Eastern and Western blocks and with a high population density (especially in Western Germany). The anti-nuclear demonstrations of the 1960s were mainly aimed at opposing the use of the nuclear bomb. Examples include the 1958 campaign against the planned nuclearization of the Bundeswehr, known as "*Kampf dem Atomtod*" (Fight against Nuclear Death), and the Easter marches (*Ostermärsche*) which drew up to 300,000 people in 1968 to protest against the proliferation of nuclear weapons and later also against NATO in the context of the Euromissile crisis<sup>13</sup>. But the public soon made the connection between the effects of an atomic bomb and those of a civil nuclear accident. From this awareness arose the firm feeling that even with a "peaceful use" it was impossible to consider nuclear power as risk-free for the German population<sup>14</sup>. The anti-nuclear and pacifist movements in Western Germany embodied an anti-risk vision, with the fear of a nuclear attack or a civil accident, which in both cases would have had an impact on a large part of the population. This same fear was shared in the GDR, where uranium deposits in the Wismut reserve in Saxony were di-

<sup>8</sup> *Der Spiegel*, 17 September 1977, p. 112. The article describes the escalation that took place between the police and the approximately 30,000 demonstrators, and another one in Kalkar in 1977, with 40,000 people on the street.

<sup>9</sup> *Die Zeit*, 17 September 2021, p. 112. The article describes the escalation that took place between the police and the approximately 30,000 demonstrators, and another one in Kalkar in 1977, with 40,000 people on the street.

<sup>10</sup> The BMU believes that the choice of location was primarily a political decision and that the storage location is not suitable for geological reasons, while the Federal Society for the Final Disposal of Waste (BGE) announced in 2020 that a large part of the national territory was suitable for the purpose of final disposal of nuclear waste according to the requirements of the German Basic Law (Grundgesetz). *NDR*, 17 September 2021, p. 112. *Süddeutsche Zeitung*, 17 September 2021, p. 112.

<sup>11</sup> The latter point is made by, among others, the NGOs *ausgestrahlt*, *NaturFreunde* and *Greenpeace*.

<sup>12</sup> *Der Spiegel*, 17 September 2021, p. 112. The article describes the escalation that took place between the police and the approximately 30,000 demonstrators, and another one in Kalkar in 1977, with 40,000 people on the street.

<sup>13</sup> Ute Finckh-Krämer, *Friedensbewegung*, pp. 123-132, in H. Gießmann, B. Rinke, *Handbuch Frieden*, Springer VS, Wiesbaden, 23 February 2019.

<sup>14</sup> *Der Spiegel*, 17 September 2021, p. 112. The article describes the escalation that took place between the police and the approximately 30,000 demonstrators, and another one in Kalkar in 1977, with 40,000 people on the street.

rectly used for the Soviet Union's nuclear bomb development programs<sup>15</sup>; the GDR was considered the fifth largest supplier of uranium in the world at the time<sup>16</sup>. The working conditions without any protection or prevention against radiation, as well as the environmental consequences of this exploitation, left a deep mark on the inhabitants<sup>17</sup>. Finally, in this same context, the accident at the Chernobyl power plant in 1986 and its immediate consequences for the Germans had a profound effect on a population that was already distrustful of this technology and of the political speeches aimed at promoting it<sup>18</sup>. The absence of emergency plans and the lack of unity between the Länder in the management of the crisis largely contributed to the rejection of nuclear power by the population<sup>19</sup>.

From a political point of view, the anti-nuclear movements initially brought together people from all sides, even though the nuclear phase-out was essentially part of the program of the Greens and the Left. For example, the coalition of the Social Democratic Party (SPD) and the Green Party (Bündnis 90/die Grünen) from 1998 to 2005 resulted in the 2002 amendment to the German Atomic Energy Act<sup>20</sup>. In 2010, the date of the nuclear phase-out was revised by the Christian Democratic Union-Liberal Party (CDU-FDP) coalition that had come to power the previous year, providing for an extension of the operating life of the reactors from eight to fourteen years (based on the 32 originally planned). The Fukushima disaster the following year had immediate and radical political repercussions: the shutdown of the eight oldest reactors within three months, the complete overhaul of the remaining 17 plants, and a definitive return to the original nuclear phase-out plan by the end of 2022. The approval of the nuclear phase-out was almost unanimous among the four major political parties and signals a unified German position towards nuclear energy<sup>21</sup>.

Through the Euratom Treaty, Germany is committed to support research and development in civil nuclear energy, specifically fusion, fission and protection against radioactivity. Germany is particularly involved in research projects on nuclear safety, radioactive waste management and fusion (*via* ITER and the Munich-based *startup* Marvel Fusion<sup>22</sup>). Research in nuclear safety also represents an international challenge for Germany since the country wishes to use its knowledge to contribute to the safety of nuclear installations beyond its borders but whose geographical location is likely to have consequences for its national territory in the event of an accident. In fact, its involvement in nuclear safety research gives

<sup>15</sup> Rainer Karlsch, *Uran für Moskau: Die Wismut. Eine populäre Geschichte*, Christoph Links Verlag, 2007; Eiichi Saito, *Asian Journal of Peace Building*, vol. 7, n° 1, 2019, pp. 55-72.

<sup>16</sup> See the report of the cooperative project between Le Monde diplomatique, Nuclear Free Future Foundation, Rosa-Luxemburg-Stiftung and BUND, funded by the Federal Ministry for Economic Cooperation and Development, *Örizzat*, September 2019, pp. 30-31.

<sup>17</sup> Uwe Gellert, *of the 5,300 miners who died of lung cancer and the 15,000 who suffered from silicosis between 1946 and 1989, more than 90 % belonged to the first generation to start mining (Wismut: Uranabbau im Erzgebirge)*, *EMDR*, January 26, 2022; environmental site report *Umweltbericht 2020*, Wismut GmbH.

<sup>18</sup> Moreover, it is interesting to notice that the population of the GDR became aware of the disaster through the *Yankee* magazine, *Örizzat*, April 2011.

<sup>19</sup> *Qatar*, *Örizzat*, March 2022.

<sup>20</sup> *Uwe Gellert*, *Örizzat*, April 2012.

<sup>21</sup> 512 parliamentarians voted in favour out of the 619 members of the Bundestag assembly, 30 June 2011.

<sup>22</sup> See the company website, <https://marvelfusion.com/>

Germany the legitimacy to take part in international debates on these subjects, and even, if necessary, to offer its technical expertise to issue assessments within the framework of agreements – on safety standards, for example<sup>23</sup>.

## 2. Nuclear power seen as a secondary energy source

Beyond all the fears mentioned above, interest in civil nuclear power has remained limited also due to the significant production of coal and to the socio-political issues related to this fossil fuel. Thus, nuclear power seems to have been considered in Germany as only a secondary energy source<sup>24</sup>. In contrast, coal has been mined since 1870 and until the 1990s was the second most important source of energy (after oil), making a significant contribution to the country's industrial development by providing sufficient heat and electricity at low cost for industry and households<sup>25</sup>. In sum, Germany's energy mix was mainly based on fossil fuels, almost half of which were available within the country, with considerable socio-economic importance at the regional level. The most important mining basin (about 50 % of the total) is in the Rhine region (North Rhine-Westphalia), a second one in the central-eastern part of the country (Saxony-Anhalt, and northwestern Thuringia) and finally Lusatia in the eastern part of the country (southeastern Brandenburg and northern Saxony)<sup>26</sup>. Thus, the deployment of nuclear power was not considered necessary and too dangerous compared to coal and its well-controlled extraction.

Germany does not share France's vision, which sees civil nuclear power as a means of retaining a certain degree of energy sovereignty in the sense of an ability to control the entire energy chain (production, transformation, transport)<sup>27</sup>. In Germany, the principle of sovereignty consists in the freedom to form partnerships with supplier countries that export their energy products to its territory. In other words, sovereignty refers to freedom from external pressure (from another country or institution) on the choice of partner countries. Germany guarantees its own security of supply by virtue of its economic importance for the supplier country, whether through the importance of the revenues from energy exports that the latter receives or through its dependence on imports of – advanced – manufactured goods exported by Germany. In short, this means that sovereignty does not correspond to the degree of control over the energy chain, but to freedom in the choice of supplier countries with which the relationship is based on co-dependence – energy for Germany, economic for the

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<sup>23</sup> See the 2021-2025 grant program of the Federal Ministry of Economics (BMWi) for nuclear safety research [BMW-Forschungsförderung zur nuklearen Sicherheit+ BMWi](#), January 2021.

<sup>24</sup> R [ æ & @ã { Á Ü æ â \ æ ~ Ê Á % Õ ã } ^ Á \ ~ | : ^ Á Õ ^ • & @ã & @c *États des Atomszeitalters*, @^ } Á (E) c ä from the series *Aus Politik und Zeitgeschichte*, bpb, Bonn, 14 November 2011, pp. 7-15.

<sup>25</sup> Û ^ ^ Á % Õ ã ^ Á â ^ ~ c • & @^ Á Ó | æ ~ } \ [ @ | ^ } , ã | c • & @æ ~ c K Á P ã • c [ ! ã • & @^ Á Õ } c Strukturen und Umweltauswirkungen+, a study published by [Agora Energiewende](#) and the European Climate Foundation, in partnership with Öko-Institut, May 2017.

<sup>26</sup> North Rhine-Westphalia is the most populous Land and has the highest GDP compared to the other Länder, while these . Saxony, Saxony-Anhalt and Thuringia . have less economic weight and have been subject to major restructuring since reunification. The coal industry in particular became a major political issue in the face of high unemployment (15-20 Ä D Ä ~ } c ä | Á G € € Í Á Ç Daten und Fakten | zü ]B[alinc Á }%ä Á U c ^ ä } \ [ @ | ^ } + [Umweltbundesamt](#), December 2017).

<sup>27</sup> Nicolas Mazzucchi, Annabelle Livet, Quelles sont les conditions de la souveraineté énergétique ?, in Michel Derdevet (ed.), *Dans l'urgence climatique, penser la transition énergétique*, Gallimard, Paris, March 2022.

supplier country<sup>28</sup>. In this view, the use of nuclear energy does not contribute to increasing Germany's energy sovereignty, unlike it is the case in France or the United States.

From an environmental perspective, in the original *Energiewende* concept introduced by the Öko-Institute.V. in 1980, the exit from oil and nuclear power was given top priority in favor of the use of renewable energies (RES) and domestic coal<sup>29</sup>. The energy transition according to the ecological model of the Öko-Institut underlines that the risk of radiation leakage (in extraction, production and waste) is incompatible with the search for "prosperity of the population and preservation of the environment"<sup>30</sup>. Today, some environmental and anti-nuclear organizations such as Greenpeace are fully in line with the *Energiewende* adding to the radiological risk the risk of dependence on uranium and civil nuclear technologies considered to be largely influenced by Russia<sup>31</sup>. Following this line of thought, policies to support renewable energies have developed, with a view to replacing nuclear power with wind, solar or biomass. Here again, Greenpeace illustrates this principle well with the creation in 1999 of its cooperative electricity supplier company which owns and invests in renewable energies while totally excluding coal and nuclear power<sup>32</sup>.

Germany's national and international policy follows this prioritization of energy sources. It is also important to consider the economic aspects induced by this energy strategy based on the coal-gas-RES trio. In a context of strong development of renewable energies in the 2000s<sup>33</sup>, Germany is faced with the paradox of energy security *versus* the fight against climate change. The use of national coal combined with gas at controlled cost from Russia had allowed to establish a certain competitiveness at the economic level, but the development of renewable energies, Germany being almost a pioneer in Europe (considering their level of deployment), turned out to be much more expensive<sup>34</sup>. The choice was therefore made in the 2000s to place the economic burden of the energy transition on households, resulting in electricity prices that are among the most expensive in Europe. In the 2010s, Germany had the second most expensive residential electricity in the European Union (EU), at around 0.3 EUR/KWh, compared to an average of 0.15 for France. For industrial customers, on the other hand, the price of electricity in Germany is below the European average (approx. 0.08 EUR/KWh compared with an EU average of approx. 0.1 EUR/MWh)<sup>35</sup>. The objective is to compensate for the price increases induced by this chosen electricity mix through shifting a higher economic pressure on households in order not to burden the competitiveness of the most electricity-intensive German companies, in particular in industry.

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<sup>28</sup> S. A. J. C. Y. C. | @æ | Ê Á % Û c | æ c ^ \* ä [SMA Comment](#), n° 3, January 2021. Á Ò } ^ ! \* ^ Á Æ ~ æ ä ! •

<sup>29</sup> See *Energiewende: Wachstum, Wohlstand ohne Erdöl und Uran*, report by the Öko-Institut, Freiburg, 1980.

<sup>30</sup> It should be noted, however, that global warming is not addressed in this report.

<sup>31</sup> T. A. & @æ ^ | Á Y ^ - v p æ | ð Ê Á % Û c | æ & @ Á ! ~ • [Greenpeace](#), 17 May 2022. & @+ Ê Á

<sup>32</sup> Û ^ ^ Á c @ ^ Á & [ { } æ <https://green-planet-energy.de>

<sup>33</sup> Driven in particular by the investment of German companies in wind power.

<sup>34</sup> The analyses of the full costs (LCOE) of electricity production proposed by the US Energy Information Administration (EIA) in the mid-2010s recall the large gap that existed in the years 2000/2010 between coal (around 100 USD/MWh), onshore wind (around 150 USD/MWh) or solar photovoltaic (around 400 USD/MWh). See *Annual Energy Outlook 2010*, [EIA](#).

<sup>35</sup> Eurostat, 22 June 2022.

Following this line, Germany has wanted to embody an alternative energy model based exclusively on renewable energies and imports of natural gas and, in the long run, green hydrogen, while displaying the ambition to denuclearize Europe. The BMU, supporting this position, presented in March 2021 its “12 points to achieve a complete exit from atomic energy”<sup>36</sup>. In parallel with the closure of the last operating plants and the development of renewable energy sources on its territory, Germany is “seeking the solidarity of nuclear countries”<sup>37</sup> in order to encourage a nuclear phase-out in Europe, and is opposed to European public funds being spent on nuclear power plants in the EU.

### 3. Germany in an energy security crisis

The war in Ukraine and the support of Western countries have led to the implementation of a series of sanctions against Russia, as well as the development of the REPower EU plan, the objective of which is to “*imports as soon as possible*”<sup>38</sup>. On both tracks, the energy sector is strongly affected through embargoes on coal and oil imports<sup>39</sup>. So far, a total gas embargo seems too risky for EU countries to implement. However, with Gazprom’s announcement of a drastic reduction in gas deliveries to Europe to 20 % of the capacity level of the Nord Stream pipeline (*i.e.* now 33 million m<sup>3</sup> per day), EU member states have agreed on a 15 % reduction in their gas consumption and on principles of solidarity with the most affected countries such as Germany<sup>40</sup>. In this context, Germany is finding itself in a particularly complex situation, due to the importance of its economic links with Russia, which even led to a temporary “nationalization” of Gazprom’s assets in Germany, the Russian state-owned company being the largest holder of gas storage capacity on German soil.

In this energy emergency context, Germany is faced with a complex energy equation, with a need:

- 1 to move away from dependence on Russian gas, with supplies from Russia accounting for 55 % of Germany’s gas imports until 2020 – gas being its second most important energy source after oil. In Germany, gas is essential for heating buildings, process heat in industry and electricity generation<sup>41</sup>;

<sup>36</sup> BMU, 11 March 2021, [BMU](#), 11 March 2021.

<sup>37</sup> *Ibid.*, p. 4, point B.

<sup>38</sup> European Economic and Social Committee and the Committee of the Regions (230 final), [European Commission](#), Brussels, 18 May 2022.

<sup>39</sup> Council of the European Union, 16 August 2022.

<sup>40</sup> RTBF, 26 July 2022.

<sup>41</sup> See press release, 21 July 2022, [German Federal Statistics Agency](#) (Destatis), 21 July 2022.

- 1 to find alternative energy sources to meet a demand of 95 billion m<sup>3</sup> of gas (compared to 40 billion m<sup>3</sup> in France)<sup>42</sup>;
- 1 finally, to find sufficient alternative energy sources in a short period of time (either by changing their origin or possibly by resorting to alternative energy sources). These changes in the energy system, even if they are *a priori* temporary, must be able to extend over time, since a return to the initial situation with Russia is not currently possible. As an example, the fact that the gas heating sector in Germany is difficult to transform (in the short term) makes it a priority compared to other gas consumption sectors, such as electricity production, which will be compensated by an increase in the production capacity of coal-fired power plants and the continued deployment of renewable energies<sup>43</sup>. It remains to be seen whether the residential gas heating system, which is in the majority in Germany, should be converted to electricity and/or whether the now missing share of gas in the electricity generation mix should be replaced by other primary energies in line with climate commitments.

To date, the German government, a left-green-liberal coalition, has officially recognized the great difficulty that this situation represents for the country. It is noticeable that the government's crisis reasoning on energy issues stems from the concept of *Energiewende*

- 1 with a new target of increasing the share of renewable energy in electricity production to 80 % by 2030 (from the current 41 %)<sup>44</sup>;
- 1 in order to gradually compensate for the 40 billion m<sup>3</sup> of gas imported so far *via* Nord Stream 1 over a ten-year period, Germany is embarking on the accelerated construction of an LNG terminal in Brunsbüttel with a capacity of 8 billion m<sup>3</sup>, followed by two LNG terminals in Wilhelmshaven (floating in 2023 and later stationary for hydrogen) as well as the gradual commissioning of four floating storage and regasification units (FSRU)<sup>45</sup>;
- 1 the reopening of coal-fired power stations until 2024 within the framework of a law on the provision of alternative (energy) plants<sup>46</sup>;
- 1 and the gradual recognition of the role that the last three nuclear power plants can play in stabilising electricity supply in this crisis context.

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<sup>42</sup> Knowing that gas is mainly used for heating (residential and industrial), it is a network that is difficult to convert to an electric heating system, except at the cost of a complete renovation of the urban gas network. While hydrogen could appear as a compromise solution as gas substitute, it is only at the beginning of its deployment (technological and production capacity) and will also require constraining technical adjustments, for example to cope with a higher degree of corrosion.

<sup>43</sup> Gas contributes 15 % of gross electricity production (AGEB *via* [Zukunft Gas](#), 2 February 2022).

<sup>44</sup> New target passed by the Federal Parliament on 7 July 2022 as part of the *Osterpaket für Energiewende* (see [Bündesregierung](#), 28 July 2022).

<sup>45</sup> [LNG-Import-Vorhaben](#) (BMWK, 6 May 2022) and [FSRU](#) (AGGL, 10 May 2022).

<sup>46</sup> [Ersatzkraftwerkebereithaltungsgesetz](#) proposed by the coalition on 8 June and entered into force on 12 July 2022.

This last possibility was considered in March but was rejected for political rather than technical reasons. The German government is now running a second stress test, commissioned by the BMWK, on the four transmission system operators (50Hertz, Amprion, Tennet and TransnetBW) with data adapted to the context of the conflict in Ukraine, the evolution of prices, and the need to redistribute electricity to neighboring countries, in particular France, due to the numerous maintenance stoppages of its nuclear power plants. The objective of this test is to simulate the electricity supply capacity for the coming months without importing Russian gas and without using nuclear power – at least to measure whether its contribution to the security of electricity supply would be significant or not. In short, the objective is to verify whether the temporary extension of the operation of the last three power plants (Isar, Emsland and Neckarwestheim) is absolutely necessary to meet the country’s energy needs<sup>47</sup>.

While German Chancellor Olaf Scholz (SPD) decided to wait for the publication of the results of this second test before making a decision, Economy Minister Robert Habeck (Greens) has already announced that he is ruling out the use of nuclear power in order to save gas<sup>48</sup>. The results of this test, published on 5 September<sup>49</sup>, indicate that there is a risk of difficulties in the electricity network in the south of the country, which will require a fairly large recourse to redistribution power stations (*Redispatchkraftwerke*) in neighboring countries. The three nuclear power plants can make a contribution to electricity generation, but this is considered to be very limited. It is stated, for example, that in a “*very critical*” scenario, the production of the three German nuclear power plants will be able to provide only “0.5 GW of capacity”, while 4.6 GW will still have to be transported from abroad.

On the proposal of Minister Robert Habeck, the German government will build up a capacity reserve (grid, production and storage) for this winter by integrating the two nuclear power plants in the south of the country that are still in operation, Isar 2 and Neckarwestheim, with a possible extension until 2023. In this case, the latter would only be commissioned in an emergency, which would remain in line with the decision to phase out nuclear power by 2023.

On this issue, positions diverge within the coalition between the Liberal Party (FDP), which is in favour of extending the power plants until 2024, and the Green Party – the party of the Vice-Chancellor, who holds the post of Minister for the Economy and Climate –, which traditionally holds an anti-nuclear position. The SPD, German Chancellor’s party, remains divided on this issue<sup>50</sup>. Like the FDP, the CDU – currently the opposition party – is firmly opposed to this decision, even going so far as to describe it as “*madness*”<sup>51</sup>. This decision has also pro-

<sup>47</sup> Süddeutsche Zeitung, 18 July 2022. [Süddeutsche Zeitung](#), 18 July 2022.

<sup>48</sup> Handelsblat, 21 August 2022. [Handelsblat](#), 21 August 2022.

<sup>49</sup> See the press release summarizing the results: Veröffentlichung der Langfassung der Ergebnisse des zweiten Stresstests zum Stromsystem, [BMWK](#), 14 September 2022; and the full results: Sonderanalysen Winter 2022/2023. Ergebnisse und Empfehlungen, [50Hertz](#), [Amprion](#), [TenneT](#), [TransnetBW](#), 5 September 2022.

<sup>50</sup> Tagesschau, 26 July 2022. [Tagesschau](#), 26 July 2022.

<sup>51</sup> Translation of the speech by CDU party leader Frederich Merz during the general debate in the Federal Parliament (see [Tagesschau](#), 7 September 2022).

evoked a wave of criticism from some MEPs from Poland, the Czech Republic and the Netherlands about Germany's crisis management and its attitude towards its partner countries<sup>52</sup>.

Finally, on 17 October 2022, Chancellor Olaf Scholz informed the Ministers of the Environment (SPD), the Economy (Greens) and Finance (FDP) of his decision to extend the operation of the three power plants until 15 April 2023 at the latest, without buying new nuclear fuel, and mandated them to prepare a legislative proposal accordingly<sup>53</sup>. This decision mixes the demands of the different parties: to extend the service of the three power plants (FDP), not to buy new nuclear fuel (Greens); without however satisfying them completely: the Greens were in favor of the immediate shutdown of the third power plant Emsland while the FDP wanted to extend the operation of these power plants to 2024. The decision was welcomed by the Minister of Finance, but the Ministers of the Environment and of the Economy see it above all as a means of closing a debate within the coalition that seemed unable to produce a compromise. The decision must now be debated and voted on in the federal parliament in the next few weeks.

This context also provides an opportunity to note that the power plants have no longer been subject to periodic safety inspections (PSÜ) since 2009, whereas the law on the atom stipulates an inspection every ten years (with an exception for reactors that must be shut down within three years). This raises concerns about the potentially higher risk when the reactors are commissioned. In addition, current nuclear fuel reserves allow for 80 days of extended service at reduced performance. The supply of new fuel normally takes 18 to 24 months, which means it could not be used before autumn 2023 according to the Ministry of Environment and Nuclear Safety. Uranium supply for Urenco's Gronau enrichment facility has also been identified as potentially limited due to the sanctions against Russia<sup>54</sup>.

In parallel to these national reflections on a possible extension of the use of civil nuclear power, the events around the Zaporizhia power plant against the background of Russia's nuclear signaling<sup>55</sup> have amplified the fears linked to the risks of nuclear power. This context echoes the one experienced by Germany during the Cold War.

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<sup>53</sup> This decision is considered an act of authority (*Machtwort*) and is part of a political solution that is relatively little employed in Germany. The chancellor appeals to his competence to give the orientation to the cabinet of the executive (*Richtlinienkompetenz*, reference to Article 65 of the German fundamental Law . *Grundgesetz*). In short, the Chancellor can decide on an issue and take responsibility for it when a compromise between the different ministries does not seem possible. The ministers concerned must then adapt their proposal to the legislative branch (federal parliament) accordingly before it is voted on (see Dr. Patrick Heineman} Ê Á % ò Y æ • Á B ä s t a c Á á æ • Á Machtwort des Kanzlers rechtlich wert?+, [Legal Tribune Online](#), 18 October 2022).

<sup>54</sup> Û ^ Á c @ ^ Á | ^ ] [ | c Á % Û | > ~ ~ } \* Á á ^ • Á Y ^ ä c ^ ! á á c ! ä ^ S a ! • ä Á ç \* [ • ] + Ä Ê c ä [ ] { Á \ | : æ è - cc ä , point 7, page 4, [BMWK/BMUV](#), 7 March 2022.

<sup>55</sup> See Isabelle Facon, *Guerre en Ukraine: le sens du signalement nucléaire russe*+, [Notes de la FRS](#), n° 30/2022, FRS, 26 July 2022.

## 4. What does the extension of the operation of nuclear power plants mean for Germany?

Beyond the purely security-related question of the role of nuclear power in energy supply, nuclear power features in other very active debates within the government. One of these debates, initiated by the SPD and the Greens, concerns the taxation of the very high profits generated in a crisis context. Indeed, with the exit from nuclear power, the companies concerned, more precisely Vattenfall, RWE, PrussenElektra (now the nuclear branch of the E.ON group) and EnBW were able to obtain compensation of up to 2.4 billion euros in order to make up for their loss of earnings as well as for their activities and investments made following the authorization of a first extension of the reactors in 2010<sup>56</sup>. However, with a possible extension of the plants, such as the Isar plant in Bavaria, and taking into account electricity prices, some preliminary estimates anticipate gains amounting to nearly 2 billion euros for the operators of the plants by May 2023<sup>57</sup>. This possible profitability of nuclear power, together with the extension of plant operation, is not well received under a newly installed government, whose majority parties have been supporting a nuclear phase-out for several decades.

Another topic of debate is the possibility of a short-term extension of nuclear reactors and the question of legal liability in the event of an accident. In March, the BMUV reported that the operators of the power plants who have committed themselves to phase out nuclear power by 31 December 2022 under the Atomic Energy Act (*Atomgesetz*) would refuse to accept responsibility for the risks associated with this extension. This liability, which the private operators will bear until the end of 2022, implies a cover of 2.5 billion euros. This means that the legal and economic risks will be borne by the German state from 2023 onwards. This also means that the operation of the power plants would then be on behalf of the state. Since Germany has historically had a liberalized energy market, such a forced nationalization seems difficult to accept, especially for an energy-kind that is destined to be abandoned. The Federal Ministries of the Economy and Climate (BMWK, formerly BMWi) and the Environment (BMUV) already took a position in March against this possible nationalization, arguing that the liability involved does not correspond to “the German safety philosophy for the operation of nuclear power plants”<sup>58</sup>.

According to the results of the BMWK and BMUV simulation on the question of the extension of plant operation, the plants would have to operate until at least 2024 for investments in nuclear fuel renewal and safety assessments to be relevant. This would no longer be consistent with the coalition agreement signed after the September 2021 elections, which endorsed a continued nuclear phase-out<sup>59</sup>. Moreover, with the next federal elections taking place in September 2025, one can wonder whether nuclear power could become an election

<sup>56</sup> [RedaktionsNetzwerk Deutschland](#), 5 March 2021.

<sup>57</sup> [Zeit](#), 27 July 2022.

<sup>58</sup> See the [BMWK/BMUV](#), 7 March 2022.

<sup>59</sup> See the coalition agreement 2021-G [Bundesregierung](#), 24 November 2021.



conducted in 2011 and 2000, when 56 % and 50 % respectively said they were afraid of the atom or considered it “very dangerous”<sup>63</sup>.

If the postponement of the nuclear phase-out appears socially acceptable, nuclear power could be used to maintain its current contribution of 6.4 % (17.8 TWh) in electricity production – compared to 11 % in 2021. The extension of the plants will not allow to go beyond the current production but it could at least reduce the 10 % (28 TWh) gap left by gas in the electricity mix. Coal (hard coal and lignite) will account for almost 31 % (86 TWh) of the electricity mix and the remaining almost 52 % will be produced by RES<sup>64</sup>. However, gas supply remains the major concern as it affects mainly non-electrified – or non-electrifiable in the short term – applications. Indeed, 35 % of gas is used in industry, notably for process heat in the chemical and metallurgical industries. Natural gas – 95 % of which is imported – also accounts for 41 % of residential energy needs, mainly for heating, although electrification is progressing slowly in this sector. This is a structural consumption that is difficult to adjust or replace – with electricity for example – in the short term. For this reason, the BMWK has requested the activation of the “Alarm Level” provided for in the “Gas Emergency Plan”<sup>65</sup>, which calls for close cooperation with gas and electricity associations and players in order to ensure the continuity of the energy supply throughout the country’s energy network. This emergency plan also involves the mandatory participation of gas players in the crisis unit of the Federal Ministry of Economic Affairs.

A higher contribution of nuclear power to replace gas used in electricity generation is possible but requires the reopening of more capacities. This would imply redirecting significant public investments in this energy (new buildings, fuel purchases...), which would remove the exclusive state support to RES (Germany’s objective so far has been to replace fossil energies – coal and gas – with RES electricity production). This public investment issue is emerging in a context where the German authorities have already had to inject more than 60 billion euros into the economic shield to protect consumers, households, and industries from price increases due to the situation in Ukraine<sup>66</sup>. As for non-electrical applications, Germany is embarking on a conversion of the natural gas network by developing green hydrogen – *i.e.* hydrogen produced by electrolysis with electricity from renewable sources<sup>67</sup>. In short, Germany wants to develop renewable energies on its territory as well as through international partnerships for the entire electricity mix and indirectly for hydrogen, which is supposed to replace the second energy source, which currently is gas. Since nuclear power offers the same possibilities for producing electricity and, also through electrolysis, hydrogen, it appears to be a rival – or a brake – to the RES objectives defined by the government over the

<sup>63</sup> In 2000, another 35 % of respondents in a survey conducted in 2000, when 56 % and 50 % respectively said they were afraid of the atom or considered it “very dangerous” (Umweltbundesamt, June 2000).

<sup>64</sup> See *Electricity Market Report*, IEA, July 2022.

<sup>65</sup> This is a three-level plan to be implemented in case of a gas supply crisis. The first (preventive) level continues to use normal market mechanisms but with enhanced cooperation between the BMWK and the gas sector. The alarm level corresponds to the second level and precedes the last level (emergency level), which provides for a mandatory participation of gas players in the crisis unit of the Federal Ministry of Economic Affairs (BMWi, September 2019).

<sup>66</sup> See *Electricity Market Report*, IEA, July 2022.

<sup>67</sup> Nicolas Mazzuchii, Annabelle Livet, *La course à l'hydrogène décarboné : une nouvelle compétition énergétique globale*, *Recherches & Documents*, n° 7/2020, FRS, Paris, July 2020.

past ten years, since the resources allocated would then be assigned to different areas. This raises the question of competition between companies in the renewable energy sector and the few German players still involved in the nuclear sector. Given the influence of the major RES players, starting with Siemens, the struggle appears unbalanced.

Until now the German strategy was based on a gradual transition, stabilized by imports. The urgency of the current geopolitical context has revealed the difficulty of achieving the objectives in a short period of time and leaves certain questions open as to the capacity to manage an energy crisis for a model based essentially on renewable energies – as non-controllable energies –, and on imports; and whose emergency energy sources are coal and gas.

## Conclusion

Germany's view of nuclear power is largely marked by a complex history of geopolitical insecurity and fear of a technology whose consequences in the event of an accident are deemed too great for this technology to be considered a first-rate option. In this context, national policies have developed over decades that are not very favorable to nuclear power, which has never really been able to find its place in relation to coal, gas, and renewable energies.

On the international scene, Germany has even cultivated a form of anti-nuclearism in order to establish the energy model it is trying to implement according to its *Energiewende* concept – a transition based solely on renewable energies for electricity and eventually gas (green hydrogen), compensated by high imports. Nevertheless, the geopolitical context (the Russian aggression on Ukraine) reminds us of the direct energy and industrial consequences for Germany as well as the strategic dimension of its energy model based on a strong dependence.

In addition to Germany's energy dependence, the dependence on gas underlines the structural problem of its replacement by an alternative energy source, particularly for heating as well as for electricity production. As it stands, an extension of the service life of nuclear power plants "only" offers the means to guarantee the contribution of nuclear power in the national electricity mix, without making up for the shortfall caused by gas in this electricity mix. In other words, under the conditions mentioned above, nuclear power cannot provide more generating capacity in Germany than it does today, but it can at least maintain its share in the current mix. This also indicates that the fallback energies considered by the government in the event of a supply crisis are systematically fossil fuels (coal and gas). These energies are certainly controllable, unlike renewable energies, but they are no longer in line with the climate commitments and remain subject to resource depletion. In this sense, nuclear power could be a solution as a low-carbon, controllable fallback energy that would make it possible to meet the high and constantly growing energy demand that characterizes Germany.

From a political point of view, despite the security urgency that the energy supply represents for Germany, we observe that the ideological dimension tinges on the government's judgment and influences how the prioritized should be ranked. This highly strategic context,

however, points to the importance of pursuing a flexible policy that can be adapted to short- or even medium-term challenges in order to ensure a certain resilience. Germany's energy situation is a good example of the challenge of managing this crisis as objectively as possible, integrating all available options in a pragmatic way, and being able to ignore a paralyzing feeling of fear. Berlin is probably becoming aware of the limits of its desire to be completely free of nuclear power and will probably have to reconsider its perception of this technology beside other energies, insofar as it can technically enable the country to maintain a certain degree of autonomy in the face of external pressures and threats. If Germany does not wish to use nuclear power in the future on its national territory, it will in any case have to reconsider its anti-nuclear positions in the European context since, as things stand, its model hardly represents a resilient and low-carbon alternative relevant to geopolitical tensions.

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