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Mauger, Romain

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CHAPTER XII

CLOSURE OF NUCLEAR POWER PLANTS IN GERMANY, SWEDEN AND FRANCE

Different Strategies for Different Results

Romain MAUGER

1. INTRODUCTION

Among the European Union Member States, three of the countries with the highest levels of electricity produced from nuclear energy in the past decades¹ have either decided to completely phase out this form of electricity generation (Germany and Sweden) or at least to reduce it significantly (France).

One decisive factor motivated these decisions: nuclear accidents, with Three Mile Island and Chernobyl pushing for the phase-out in Sweden and Germany, and Fukushima later reinforcing the German commitment and prompting the decision to reduce the share of nuclear electricity in the electricity mix from 75 to 50 per cent in France by 2025.

These three countries have had different timelines towards their nuclear energy phase-out or reduction, with Sweden embarking on this pathway since the 1980s, Germany taking this decision in the late 1990s, while France took this stance in the early 2010s. These three countries have also adopted different legal mechanisms to reach their targets, with varying results. Sweden had set a phase-out target for 2010 but failed to comply with it due to a lack of political action to use the available legal tools. Since then, Sweden has remained in a limbo

¹ Over 70% for France, over 50% for Sweden in the early 2000s and around a quarter for Germany until the 2010s. See for France: 'Nuclear Power in France' (2019) *World nuclear association*, available at <<https://www.world-nuclear.org/information-library/country-profiles/countries-a-f/france.aspx>>; for Sweden: 'Nuclear industry development – Nuclear Power in Sweden' (2019) *World nuclear association*, available at <<https://www.world-nuclear.org/information-library/country-profiles/countries-o-s/sweden.aspx>>; and for Germany: 'Nuclear Power in Germany' (2019) *World nuclear association*, available at <<https://www.world-nuclear.org/information-library/country-profiles/countries-g-n/germany.aspx>>.

concerning nuclear energy, with no set phase-out target but nuclear reactors still shutting down rapidly for economic reasons. Germany had decided on its phase-out to be completed by the early 2020s, before the Merkel Government extended this date, only to come back to the original system six months later, following the Fukushima disaster. It is now progressing swiftly towards its targets thanks to an adapted legal framework which does not require political action once launched. In contrast, France recently postponed its 75–50 per cent by 2025 objective to 2035 due to its lack of action. It also failed to adopt adequate planning tools to schedule the shutdowns and to create an effective legal framework for energy policy-backed closures. As a result, no nuclear reactor has been shut down since the adoption of the 2015 Energy Transition Act setting this target and the government has had to commit to massive compensation for taking the first two reactors offline by 2020.

This chapter describes and compares the nuclear phase-out or significant reduction of the nuclear industry as planned in Germany, Sweden and France. It identifies the main characteristics of each national policy and related legal framework in this regard, their changes over time and their effectiveness up until mid-2019.

2. STRATEGIES FOR PLANNING NUCLEAR REACTORS SHUTDOWN

This section will present the strategies adopted in Germany, Sweden and France – some more than 20 years old – to plan and organise the forced shutdown of nuclear energy reactors for policy reasons. In each country, the extent of the involvement of the State and of the reactors’ operators varies, as do the legal mechanisms which have been created. This can be considered as the ‘phase one’ of the nuclear reactors shutdown policy for each country, while the ‘phase two’ will be presented in section 3.

2.1. GERMANY: A SELF-UNFOLDING, LONG-TERM POLITICAL AGREEMENT BECOME LAW

In 2000, the newly-elected German Federal Government reached an agreement with the national nuclear power industry after six months of negotiations. In essence, the ‘Agreement [on the future role of nuclear energy] provides for the application of a residual electricity volume’, calculated per reactor ‘on the basis of a standard operating life of 32 calendar years.’²

² Agreement on the future role of nuclear energy (2000), General Legislation, Germany, National Legislative and Regulatory Activities (2000) 66 *Nucl Law Bull* (*Nuclear Law Bulletin*), p. 40.

The major feature of this agreement is its automaticity, as ‘the right to operate a nuclear power plant will cease when the residual electricity volume, or that volume revised as a result of transfer from another installation, has been generated.’³ The nuclear reactors must go offline without any exterior decision from a minister or other authority, shielding the State against possible litigation over administrative acts which would otherwise have to be taken for the shutdown and against potential political changes. This non-binding political agreement was eventually made law in 2002.⁴ Here the legislature is side-lined and only provides legal status to an agreement it has not participated in drafting. The *modus operandi* of this legislation questioned the very constitutional principle of parliamentary democracy, especially as the *Kalkar* decision taken by the Federal Constitutional Court (*Bundesverfassungsgericht*/BVerfG) in 1978 established that ‘the fundamental decision for or against the use of nuclear power is incumbent on the legislator,’⁵ but still allowed a very effective mechanism that enabled the swift shutdown of nuclear reactors.

The average standard operating life of 32 calendar years in the Agreement was not randomly chosen. It was calculated to ensure its constitutionality with regard to the ‘limitation on business activity’ the nuclear reactors’ operators will suffer. Indeed, in 2000 the Federal Ministry of Environment calculated that

the average amortization of a nuclear power plant is reached after approximately 19 years [while] after 27 years of operation, at the latest, investments in nuclear power plants have yielded a profit that corresponds to the running yield of government bonds.⁶

In other words, after 32 years of operation, it is believed that the invested capital will have had time to be amortised. In addition, as the Agreement leaves an ‘average residual operating period for German nuclear power plants of about 11.5 years,’⁷ this gives operators ample time to plan their maintenance investments on this basis, in order to maximise their revenues while respecting a ‘high standard of safety.’⁸ The significant amount of time available before the required shutdown of a reactor also plays a role in establishing the constitutionality of

³ *Ibid.*

⁴ A. VORWERK, ‘The 2002 Amendment to the German Atomic Energy Act Concerning the Phase-out of Nuclear Power’ (2002) 69 *Nucl Law Bull*, p. 8.

⁵ *Ibid.*, pp. 7–8, in reference to the decision 49, 89 of 31 January 1978 taken by the *Bundesverfassungsgericht* (BVerfG) *Kalkar*.

⁶ A. ROSSNAGEL and A. HENTSCHEL, ‘The legalities of a nuclear shutdown’ (2012) *Bulletin of the Atomic Scientists*, p. 61.

⁷ A. VORWERK, ‘The 2002 Amendment to the German Atomic Energy Act Concerning the Phase-out of Nuclear Power’ (2002) 69 *Nucl Law Bull*, p. 10.

⁸ *Ibid.*, p. 8.

the Agreement. Indeed, as the operation rights ‘are not abolished immediately or within a very short space of time, and ... instead a pay-back period for their investments and a suitable profit is possible within an appropriate transitional period’, the German Government considers that this mechanism constitutes ‘permissible stipulation of the terms and limits of property rights according to Constitutional law’ instead of an expropriation.⁹

The 2000 Agreement hence created a self-applying long-term mechanism for the nuclear phase-out which allowed for high foreseeability and legal certainty for nuclear reactor operators while shielding the State against current or future litigation and exempting it from paying compensation for expropriation.

2.2. SWEDEN: A LONG-TERM TARGET BECOME LAW BUT REQUIRING POLITICAL ACTION

In 1980, a referendum was held in Sweden and resulted in the majority voting for the prohibition on building new nuclear power facilities and for the gradual phase-out of existing ones.¹⁰ Seven years later, Parliament amended the Act on Nuclear Activities to enforce the first part of the referendum, by prohibiting the issuance of new construction licences.¹¹ These dates are likely connected to the two worst nuclear energy accidents of the twentieth century: the Three Mile Island accident of 1979 in the USA, and the Chernobyl accident of 1986 in the former USSR. Finally, in 1995, ‘an inter-party agreement was made between the political parties forming the majority in the Parliament on guidelines for a new Swedish energy policy’ that resulted in the 1997 Act on the Phasing-out of Nuclear Power.¹² This Act allowed the Government ‘to revoke a permit to operate a nuclear power reactor’ on a date it would decide, in order to roll out ‘the transformation of the energy system’ as decided by Parliament (based on energy security, price stability, and environmental impact) and with the final goal of a nuclear energy phase-out by 2010. To justify its decision to revoke a permit, the Government must base it on a set of criteria including: location, age, design and importance to the national energy supply of the reactor. In addition, the Act requires that compensation should be given to the operator, calculated on an estimated lifespan of 40 years.¹³

On 5 February 1998, only one month after the 1997 Act entered into force, the Swedish Government used this mechanism to order the shutdown of the Barsebäck 1 reactor by July of that year, due to its proximity to Denmark and

⁹ *Ibid.*, p. 10.

¹⁰ *Nuclear Legislation in OECD and NEA Countries – Sweden*, OECD, NEA, 2008, p. 5.

¹¹ *Ibid.*

¹² *Ibid.*, p. 6.

¹³ ‘Sweden – General Legislation’ (1998) 61 *Nucl Law Bull*, p. 86.

the fact that over three million people lived within a few dozen kilometres.¹⁴ However, the fast and unpredictable decision to shut down this reactor, without prior negotiations with the operator (Sydkraft) or any established compensation, resulted in a case brought by the company to the Swedish Supreme Administrative Court, which suspended the Government's decision.¹⁵ On 16 June 1999, the Supreme Administrative Court ruled that the 1997 Act was compatible with the Swedish Constitution and with the European Convention for the Protection of Human Rights and Fundamental Freedoms (ECHR), thereby validating the mechanism itself and the reasoning behind the first shutdown on the grounds of its geographical location.¹⁶ Meanwhile, the Government and Sydkraft negotiated on the compensation to be provided, agreeing on a package in the same year. Under this agreement, Sydkraft would obtain a 25.8 per cent share in a new company, merging Barsebäck's two reactors with Ringhals's four nuclear reactors. This other plant is operated by Vattenfall, the publicly-owned company. In addition, the State agreed to provide financial compensation to Sydkraft, but primarily to Vattenfall. When the Barsebäck 2 reactor would be shut down, Sydkraft's share in the joint-venture would increase to 30.2 per cent.¹⁷ Ultimately, Barsebäck 1 was shut down on 30 November 1999 while Barsebäck 2 did so on 31 May 2005, the latter doing so without a court case, since legal certainty, timely information and reasonable compensation were provided to the operator.

Despite its proven legality and positive experience when properly implemented, this shutdown mechanism was not used in the following years and was even abolished in 2010.¹⁸ In addition, since 1 January 2011 the ban on new nuclear reactors construction has been lifted, but only for the replacement of the then 10 remaining running reactors.¹⁹ The goal to completely phase out nuclear energy in Sweden has been officially abandoned, arguably because of a mechanism relying on regular political decisions instead of having implemented a self-unfolding one.

2.3. FRANCE: A CHANGING AND UNCERTAIN TARGET WITHOUT ADAPTED LEGAL TOOLS

France has been a latecomer to the group of countries wishing to reduce (or end) their dependency on nuclear energy. The sheer size of its reactor fleet explains

¹⁴ O. TORP and O.J. KLAKEGG, 'Challenges in Cost Estimation under Uncertainty – A Case Study of the Decommissioning of Barsebäck Nuclear Power Plant' (2016) 6 *Admin Sci (Administrative Sciences)*, p. 9.

¹⁵ 'Sweden – Case Law' (1998) 62 *Nucl Law Bull*, p. 52.

¹⁶ 'Sweden – Case Law' (1999) 64 *Nucl Law Bull*, p. 44.

¹⁷ 'Sweden – Administrative decisions' (2000) 65 *Nucl Law Bull*, p. 27.

¹⁸ 'Sweden – General legislation' (2010) 86 *Nucl Law Bull*, p. 84.

¹⁹ *Ibid.*

this reluctance, as nuclear energy in France is a significant industry²⁰ just as it is an expression of its historically-centralised State model.²¹ It has progressively locked France on this pathway with 58 reactors operating as of 2019, accounting for a total installed capacity of 63.2 GW. In 2017, this accounted for '71.6 percent of the country's electricity, the lowest share since 1988, on the decline for the fourth year in a row.'²² The commitment to reduce the share of nuclear energy in the electricity production from approximately 75 per cent to 50 per cent by 2025 was made in 2012 during the presidential election campaign by François Hollande.²³ Once in power, he struggled to implement this commitment during the course of his term. The commitment was made law in August 2015 with the Energy Transition towards Green Growth Act (Energy Transition Act).²⁴ However, the lack of planning and enforcement mechanisms has led to not a single reactor being shut down in the four subsequent years, despite the commitment to ceasing operations in the oldest plant (Fessenheim, with its two reactors),²⁵ leaving no clear perspective on how to reach the 2025 goal.²⁶

The French legal framework for a nuclear reactor's shutdown authorises only two options: either the reactor is shut down for safety reasons under the control of the nuclear safety authority (ASN),²⁷ or it is the reactor's operator which voluntarily requests authorisation from the Government to take this decision, based on the ASN's opinion.²⁸ This was the rule before the 2015 Energy Transition Act and has remained such, as this legal development was not used to elaborate an automated shutdown mechanism such as in Germany or to provide the Government with the power to decide on a shutdown for policy

²⁰ A 2011 study indicates 410,000 direct, indirect and induced employees, although this is a debated figure which, according to the International Atomic Energy Agency itself, likely contains double counting. See 'Measuring Employment Generated by the Nuclear Power Sector' (2018) *NEA-IAEA*, pp. 42–43.

²¹ Labelled as 'jacobinism'. See R. MAUGER, 'Forced nuclear energy reactors shutdown in France: the Energy Transition Act's mechanisms' (2018) 11(3) *JWELB (Journal of World Energy Law & Business)*, p. 270.

²² M. SCHNEIDER *et al.*, 'The World Nuclear Industry Status Report 2018' (2018), p. 53 <<https://www.worldnuclearreport.org/IMG/pdf/20180902wnsr2018-lr.pdf>>.

²³ A. SENECA, 'La baisse du nucléaire à 50% en 2025, une promesse jamais suivie de moyens' (8 November 2017) *Le Monde*, available at <https://www.lemonde.fr/les-decodeurs/article/2017/11/08/la-baisse-du-nucleaire-a-50-en-2025-une-promesse-jamais-suivie-de-moyens_5212107_4355770.html>.

²⁴ R. MAUGER, 'Forced nuclear energy reactors shutdown in France: the Energy Transition Act's mechanisms' (2018) 11(3) *JWELB*, p. 271.

²⁵ 'Hollande: "Une centrale fermée en 5 ans"' (2 May 2012) *Le Figaro*, available at <<http://elections.lefigaro.fr/flash-presidentielle/2012/05/02/97006-20120502FILWWW00700-hollande-je-ne-fermerai-que-fessenheim.php>>.

²⁶ R. MAUGER, 'Forced nuclear energy reactors shutdown in France: the Energy Transition Act's mechanisms' (2018) 11(3) *JWELB*, p. 281.

²⁷ *Ibid.*, p. 272.

²⁸ *Ibid.*, pp. 272–273.

reasons, such as in Sweden.²⁹ The tools provided by the 2015 Act to reach the target of 50 per cent of nuclear electricity by 2025 are explained in the following lines. Firstly, an installed nuclear capacity cap has been fixed at the total capacity at that time: 63.2 GW. This means that to commission the new EPR reactor being built in Flamanville, Électricité de France (EDF) will have to shut down an equivalent installed capacity (1650 MW). But this measure can at best merely stabilise the share of nuclear energy in the electricity mix, as the total electricity consumption is forecasted to diminish in the coming years.³⁰ Secondly, a strategic plan must be elaborated by EDF (which operates all of France's nuclear reactors) in order to detail how the utility will respect the energy policy, elaborated in the multi-annual energy plan (MEP in English, PPE – *programmation pluriannuelle de l'énergie* – in French). In this plan, EDF must specify which nuclear reactors are to be shut down and when, and the document has to be validated by the Minister in charge of energy. However, the first version submitted in April 2017 was rejected by the then Minister and no new plan had been submitted as of October 2019. The problems with this plan are twofold: although it since recently has to be published, this obligation excludes business confidentiality,³¹ which is a wide exemption; in addition, it constitutes a pure 'delegation by the Government to EDF of the responsibility to plan and organize the shutdown of numerous nuclear reactors.'³² This can be considered an indirect recognition that this part of the French energy policy is not in the hands of the Government. Thirdly, the 2015 Act created a Government commissioner to be placed within EDF's decision-making structure to oppose investment decisions which would be 'incompatible with the goals of the strategic plan or, if it does not exist, with the MEP.'³³ This negative power seems unlikely to be sufficient to mean that the French Government has control over the nuclear reactors' shutdown organisation and process.

In addition to this weak legal framework for nuclear reactors' closure, France experienced difficulties over the past few years in publishing energy planning documents on-time and of sufficient quality, especially the MEP. The first MEP for the period 2016–2018 was already adopted with a significant delay and was particularly blurry on the rolling out of nuclear shutdowns.³⁴ The new MEP for 2019–2023 is being finalised as of October 2019 but is already delayed, as it should have been published at the end of 2018. However, a draft version was published in January 2019 which plans to shut two reactors down in 2020

²⁹ *Ibid.*, pp. 273 and 276–277.

³⁰ *Ibid.*, p. 274.

³¹ Loi n° 2019-1147 du 8 novembre 2019 relative à l'énergie et au climat, art. 6 (4).

³² R. MAUGER, 'Forced nuclear energy reactors shutdown in France: the Energy Transition Act's mechanisms' (2018) 11(3) *JWELB*, pp. 275–276.

³³ *Ibid.*, p. 276.

³⁴ *Ibid.*, p. 275.

(in Fessenheim) irrespective of whether Flamanville will be commissioned or not,³⁵ as this has already been postponed several times.³⁶ In addition, 12 other reactors will be shut down from 2027 to 2035 which will supposedly allow the 50 per cent target of nuclear energy in the electricity mix to be reached.³⁷ Nevertheless, it appears that this plan to diversify the electricity mix is built on dubious, hidden scenarios foreseeing a steep increase in electricity consumption in France in the coming decades to justify the extension of the nuclear reactors' lifetime to 50 years and over, while adding dozens of GW of renewable energy sources instead of gradually replacing the former with the latter.³⁸ If this increase in internal consumption does not happen, then the only solution is a strong increase in electricity exports to France's neighbours. Independent experts estimate the level of electricity exports will have to triple in size compared to the average historical levels in the past four decades.³⁹ If this planned increase does not take place, then France will be in a situation of massive overcapacity, mechanically lowering electricity market prices and weakening the profitability of all French electricity producers, thereby threatening the very transition to harder-to-finance renewable energy sources.⁴⁰ As a result, the new MEP for 2019–2023 seems to follow the steps of the previous version by being of no help to the proper organisation of an ordered and coherent reduction of nuclear energy in the electricity mix. The only positive point is that the Government states that the shutdown of the reactors at their 50th year will not lead to the payment of compensation.⁴¹ This is the result of planning providing between 10 and 16 more years to the utility to rationalise its investments in these reactors.

A direct consequence of this new energy planning document in the making is that a new act is needed to legally postpone the 75–50 per cent by 2025 goal to 2035. This has been done by Article 1 of the Energy and Climate Act, adopted

³⁵ 'Programmation pluriannuelle de l'énergie 2019-2023 2024-2028 – Projet pour consultation' (2019) *Ministère de la Transition Ecologique et Solidaire*, p. 142, available at <<https://www.ecologique-solidaire.gouv.fr/sites/default/files/Projet%20PPE%20pour%20consultation.pdf>>.

³⁶ M. SCHNEIDER *et al.*, 'The World Nuclear Industry Status Report 2018' (2018), p. 53 <<https://www.worldnuclearreport.org/IMG/pdf/20180902wnsr2018-lr.pdf>>.

³⁷ 'Programmation pluriannuelle de l'énergie 2019-2023 2024-2028 – Projet pour consultation' (2019) *Ministère de la Transition Ecologique et Solidaire*, p. 144, available at <<https://www.ecologique-solidaire.gouv.fr/sites/default/files/Projet%20PPE%20pour%20consultation.pdf>>.

³⁸ Y. MARNAG, 'Trajectoire du parc nucléaire et transformation du système électrique: l'attentisme coupable de la Programmation pluriannuelle de l'énergie (PPE)' (25 January 2019) *Wise Paris*, pp. 28–29.

³⁹ *Ibid.*, pp. 29–30.

⁴⁰ *Ibid.*, pp. 30–35.

⁴¹ 'Programmation pluriannuelle de l'énergie 2019-2023 2024-2028 – Projet pour consultation' (2019) *Ministère de la Transition Ecologique et Solidaire*, p. 144, available at <<https://www.ecologique-solidaire.gouv.fr/sites/default/files/Projet%20PPE%20pour%20consultation.pdf>>.

on 8 November 2019.⁴² Despite this new opportunity to use this act to modify French Energy Law, no provision has been included to provide the State with efficient and appropriate legal mechanisms to shut nuclear reactors down for policy reasons.

3. ORGANISATIONAL AND FINANCIAL CONSEQUENCES OF THESE STRATEGIES

This section presents what can be considered as ‘phase two’ of the nuclear reactor shutdown policy for Germany, Sweden and France. It focuses mainly on the (mostly financial) consequences of unplanned policy changes, of its failure to reach target, or of the simple implementation of a poor legal mechanism.

3.1. GERMANY: THE COST OF SUDDEN POLICY CHANGES

Although the German nuclear energy phase-out mechanism was working well without the need for any intervention, in December 2010 the Merkel Government decided to extend the production quotas for nuclear energy ‘from eight to 14 years per power plant, with an average of 12 years.’⁴³ However, the Government could not have foreseen that on 11 March 2011, only three months after its decision, the Fukushima Daiichi nuclear disaster would strike Japan. As a consequence, the newly-attributed electricity production quotas were cancelled, the final date for total phase out was set to 31 December 2022 and the eight oldest reactors were permanently shut down.⁴⁴

Following this rapid policy reversal, three of the four nuclear operators in Germany (E.ON, RWE and Vattenfall) took the State to the Constitutional Court (BVerfG) to obtain compensation for their investments made between the end of 2010 and mid-2011 and for the direct shutdown of some of their reactors. For this alleged violation of the right to property, the three companies demanded €15 billion.⁴⁵ On 6 December 2016, the BVerfG issued a landmark decision for the nuclear phase-out process in Germany. Firstly, it decided that

⁴² Loi n° 2019-1147 du 8 novembre 2019 relative à l’énergie et au climat.

⁴³ C. GLINSKI, ‘Regulatory Expropriation’ Under German Constitutional Law and in International Investment Law – The Case of Vattenfall’ in B. HOOPS *et al* (eds), *Rethinking Expropriation Law: Context, Criteria and Consequences of Expropriation Law*, vol. II, Eleven International Publishing, 2015, p. 194.

⁴⁴ G. WINTER, ‘L’ascension et la chute de l’utilisation de l’énergie nucléaire en Allemagne : les processus, les explications et le rôle du droit’ (2014) 2 *Revue Juridique de l’Environnement*, pp. 237–238.

⁴⁵ M. LUDWIGS, ‘Germany’s Nuclear Phase-Out and the Right to Property’ (2016) 4 *ENLR* (*European Networks Law & Regulation Quarterly*), p. 43.

the 2011 amendment to the Atomic Energy Act (the post-Fukushima act) ‘is for the most part compatible with the Basic Law.’⁴⁶ Secondly, it stated that the electricity production quotas allocated in 2002 and 2010 ‘do not constitute, in and of themselves, stand-alone property rights enjoying protection of property’, but as they are so important to the operation of a nuclear plant, they ‘benefit from protection of ownership of the power plants.’⁴⁷ The Court continued with its line of reasoning and rejected the qualification of ‘expropriation’ for the 2011 U-turn,⁴⁸ asserting that Parliament was justified in using the Fukushima accident ‘as an opportunity to accelerate the nuclear phase-out for the protection of the health of the people and the environment.’⁴⁹ However, it ultimately decided that it constituted an unreasonable ‘determination of the contents and limits of property [...] as it hinders two of the complainants from using up substantial parts of the residual electricity volumes of 2002.’⁵⁰ As a result, ‘the legislature must [...] provide adequate compensation, a prolongation of operational lifetimes, or some other form of settlement.’⁵¹ This applied more specifically to Vattenfall and RWE as they owned nuclear reactors which had been immediately shut down after the accident and remained so. Of the available options for compensation, the German Federal Government chose a financial agreement and agreed to pay up to €1 billion to the two companies. Although the figure may ultimately be a lesser amount, it will only be made public in 2023.⁵²

The 2010–2011 double policy change constituted a loss of legal certainty which cost time and money to the German State but resulted in obtaining judicial confirmation that the Agreement, reached 10 years earlier, was constitutional. However, in parallel to this proceedings, Vattenfall lodged another claim with an arbitrary tribunal, the International Centre for Settlement of Investment Disputes (ICSID), on the basis of the Energy Charter Treaty. Indeed, in 2011 Vattenfall was not sure its claim would be accepted by the BVerfG, since the literature underlined that ‘State-owned companies are not subjects of fundamental rights.’⁵³ Despite this, the BVerfG accepted Vattenfall as a party to the case with the following reasoning:

A legal person governed by private law, which is operated domestically for profit and entirely owned by a Member State of the European Union, can, by reason of the Basic

⁴⁶ BVerfG, Judgment of the First Senate of 6 December 2016 – 1 BvR 2821/11 – para. 1.

⁴⁷ *Ibid.*, para. 3 a).

⁴⁸ *Ibid.*, para. 4.

⁴⁹ *Ibid.*, para. 6.

⁵⁰ *Ibid.*, para. 7.

⁵¹ *Ibid.*, para. 374.

⁵² ‘Germany to compensate utilities for nuclear phaseout losses’ (24 May 2018) *World Nuclear News*, available at <<https://www.world-nuclear-news.org/Articles/Germany-to-compensate-utilities-for-nuclear-phaseout>>.

⁵³ M. LUDWIGS, ‘Germany’s Nuclear Phase-Out and the Right to Property’ (2016) 4 *ENLR*, p. 44. This is also the reason Vattenfall is publicly providing on its website: Questions and

Law's openness toward European law, as an exception, invoke freedom of property and file a constitutional complaint.⁵⁴

Hence, Vattenfall was a party to both the Constitutional Court case and the arbitration case. The outcome of the constitutional case is known but the arbitration (named *Vattenfall II*) is still pending. While it was expected to be resolved by 2017, the case has been delayed firstly by a parallel judicial event: the 2018 *Achmea* judgment of the Court of Justice of the European Union (CJEU) on intra-EU bilateral investment treaties.⁵⁵ Later that year, the ICSID tribunal cleared the potential obstacle to the continuation of its process formed by the *Achmea* judgment in a widely-commented decision.⁵⁶ Between the end of 2018 and early 2019, the process was stalled once again after Germany asked for the suspension of the judges of the arbitrary tribunal.⁵⁷ This request was rejected by the ICSID on 6 March 2019,⁵⁸ and the final decision is cautiously expected by the end of 2019.

This judicial development will provide a very interesting case in which both a Constitutional court and an international arbitration tribunal will take a position following a change in legislation. This might allow the highlighting of the different perceptions held by these two, very different, institutions on a similar case and provide an interesting comparison for future legislation on energy transition worldwide.⁵⁹

answers – Vattenfall – ICSID, The lawsuit, 1. Available at <<https://group.vattenfall.com/who-we-are/about-us/vattenfall-icsid/questions-and-answers-vattenfall-icsid>>.

⁵⁴ BVerfG, Judgment of the First Senate of 6 December 2016 – 1 BvR 2821/11 – para. 2.

⁵⁵ CJEU, case C-284/16, *Achmea*, ECLI:EU:C:2018:158. For a description of this case's impact on EU law and on the Vattenfall case itself, see: C. GLINSKI, 'Achmea and its Implications for Investor Dispute Settlement' (2018) 3 *CEVIA Working Paper Series*, p. 13.

⁵⁶ A. LANG, 'Regime Collision between EU Law and Investment Law: New Developments in the Vattenfall Case' (12 September 2018) *Verfassungsblog*, available at <<https://verfassungsblog.de/regime-collision-between-eu-law-and-investment-law-new-developments-in-the-vattenfall-case/>>; Q. DECLEVE, 'Vattenfall v. Germany: Tribunal Subtly Avoids Applying Achmea Judgment and Finds that Article 26(6) ECT Does Not Apply to Jurisdiction Issues' (4 October 2018) *International-litigation-blog*, available at <<http://international-litigation-blog.com/vattenfall-germany-tribunal-subtly-avoids-applying-achmea-judgment/>>; K. SCHWEDT and H. INGWERSEN, 'Intra-EU ECT Claims Post-Achmea: Vattenfall Decision Paves the Way' (13 December 2018) *Arbitrationblog*, available at <<http://arbitrationblog.kluwerarbitration.com/2018/12/13/intra-eu-ect-claims-post-achmea-vattenfall-decision-paves-the-way/>>.

⁵⁷ 'Germany stalls Vattenfall nuclear case in World Bank court' (16 November 2018) *Reuters*, available at <<https://www.reuters.com/article/vattenfall-arbitration-nuclear/germany-stalls-vattenfall-nuclear-case-in-world-bank-court-idUSL8N1XR10E>>.

⁵⁸ The Decision of the Acting Chairman of the Administrative Council can be found on the ICSID's website: <<https://icsid.worldbank.org/en/Pages/cases/casedetail.aspx?CaseNo=ARB/12/12>>.

⁵⁹ Especially towards the notion of Legitimate expectations in a time of massive policy change impulse by the climate crisis. See e.g. V. VADI, 'Energy Security v. Public Health: Nuclear Energy in International Investment Law and Arbitration' (2016) 47 *Geo J Int'l L (Georgetown Journal of International Law)*, p. 1069.

3.2. SWEDEN: FISCAL TOOLS AND MARKET MECHANISMS ARE EFFICIENT BUT OUT-OF-CONTROL

In the late 1990s, the Swedish Government submitted the nuclear energy sector to a so-called capacity tax on electricity generation. This tax was increased on various occasions by the different governments until 2014 and already seemed to represent ‘about one-quarter of the operating cost of nuclear power in Sweden’ by 2008 before being gradually abolished between 2017 and 2019.⁶⁰ This element, added to new safety rules after the Fukushima disaster, entailing heavy investments,⁶¹ low regional electricity prices,⁶² and the competition from renewable energy sources with very low marginal costs,⁶³ resulted in the shutdown of reactors Oskarshamn 1 and 2 in 2013 and 2017, and Ringhals 1 and 2, scheduled for 2019 and 2020.⁶⁴ If these shutdowns are realised, fiscal policy will have been more efficient and less costly for the Swedish State in terms of nuclear phase-out than others piloted by the Government and Parliament in the previous decade. However, this comes at the cost of a lack of planning for the electricity system. According to Tangerås and Lundin, these rapid shutdowns might cause a lack of electricity supply in Sweden, resulting in rising electricity prices, especially if the new nuclear energy reactor being built in neighbouring Finland (Olkiluoto) is not running well.⁶⁵ The costs to be supported by Sweden could then end up much higher than when using a State-led policy following proper planning.

It should be noted that, in addition to the above, a new inter-party energy agreement was reached in 2016, where Sweden pledged to reach 100 per cent of its electricity production from renewable energy sources by 2040, but without prohibiting nuclear energy. Nuclear energy will not be subsidised but reactors will not be shut down for policy reasons either.⁶⁶ This agreement is to some extent

⁶⁰ ‘Nuclear capacity tax – Nuclear Power in Sweden’ (2019) *World nuclear association*, available at <<https://www.world-nuclear.org/information-library/country-profiles/countries-o-s/sweden.aspx>>.

⁶¹ *Ibid.*, ‘Boosting nuclear capacity and operational life’ and ‘Oskarshamn’.

⁶² *Ibid.*, ‘Oskarshamn’.

⁶³ J. BLAZQUEZ *et al.*, ‘The renewable energy policy Paradox’ (2018) 82 *Renewable and Sustainable Energy Reviews*, pp. 2–3.

⁶⁴ ‘Oskarshamn’ and ‘Ringhals’ – ‘Nuclear Power in Sweden’ (2019) *World nuclear association*, available at <<https://www.world-nuclear.org/information-library/country-profiles/countries-o-s/sweden.aspx>>.

⁶⁵ T. TANGERÅS and E. LUNDIN, ‘Vad händer om kärnkraften läggs ned?’ / ‘What happens if nuclear power is shut down?’ (18 March 2016) *Kvartal* <<https://kvartal.se/artiklar/vad-hander-om-karnkraften-laggs-ned/>>.

⁶⁶ ‘Ramöverenskommelse mellan Socialdemokraterna, Moderaterna, Miljöpartiet de gröna, Centerpartiet och Kristdemokraterna’/‘Framework agreement between the Social Democrats, The Moderates, the Green Party the Green, the Center Party and The Christian Democrats’ (2016) *Regeringen*, available at <<https://www.regeringen.se/49cc5b/contentassets/b88f0d28eb0e48e39eb4411de2aabe76/energioverenskommelse-20160610.pdf>>.

contradictory as nuclear energy is not a renewable energy source and should therefore automatically be banned from the 2040 electricity generation mix. The fact this was not done at the time was, and remains, confusing.⁶⁷ Nevertheless, in the meantime, the agreement has accompanied a movement to extend the remaining reactors' operating lifetime to 50 years, such as in Forsmark.⁶⁸ The future of nuclear energy in Sweden is therefore particularly uncertain, as its policy over the last 10 years has been quite unstable and the one for the coming 10 years does not seem to be any clearer or more enduring.

3.3. FRANCE: A VOLUNTARILY POWERLESS GOVERNMENT FORCED TO NEGOTIATE COSTLY COMPENSATION

The Fessenheim nuclear power plant shutdown process is the most interesting nuclear reactor closure case to analyse in modern France for several reasons: firstly, because it is the only one being currently prepared; secondly because Fessenheim is the oldest nuclear power plant still running in France and hence somehow shows the possible way to deal with the other reactors in the future. Finally, the Fessenheim shutdown turned into a political issue in 2012 due to its location in an earthquake-prone zone and below the level of the Grand Canal of Alsace while being very close to Germany and Switzerland.⁶⁹

The plan of the Government in 2015 was to force EDF, the operator of the reactor, to shut it down when the new Flamanville reactor was commissioned, due to take place in 2017 at the latest.⁷⁰ With the nuclear capacity cap introduced by the 2015 Energy Transition Act, EDF would then have had to shut down an equivalent installed capacity elsewhere. The two 900 MW reactors at Fessenheim were first in line because of their age and location. However, due to the cumulated delays for Flamanville's reactor commissioning, now scheduled for 2022,⁷¹ and the hostility of EDF, this plan backfired. This situation has had two

⁶⁷ 'Kristersson: Utan nytt kärnkraftsmål lämnar vi energioverenskommelsen'/'Kristersson: Without a new nuclear target, we leave the energy agreement' (2 April 2019) *Di*, available at <<https://www.di.se/debatt/kristersson-utan-nytt-karnkraftsmal-lamnar-vi-energioverenskommelsen/>>.

⁶⁸ L. KARAGIANNOPOULOS, 'Sweden says two aging nuclear reactors safe to run til 2028' (24 June 2019) *Reuters*, available at <<https://www.reuters.com/article/us-sweden-nuclear-vattenfall/sweden-says-two-aging-nuclear-reactors-safe-to-run-till-2028-idUSKCN1TP1FC>>.

⁶⁹ R. Mauger, 'Forced nuclear energy reactors shutdown in France: the Energy Transition Act's mechanisms' (2018) 11(3) *JWELB*, p. 278.

⁷⁰ Décret n° 2007-534 du 10 avril 2007 autorisant la création de l'installation nucléaire de base dénommée Flamanville 3, comportant un réacteur nucléaire de type EPR, sur le site de Flamanville (Manche), art. 3, II.

⁷¹ 'Résultats semestriels 2019' (26 July 2019) *EDF*, p. 12, available at <<https://www.edf.fr/sites/default/files/contrib/groupe-edf/espaces-dedies/espace-finance-fr/informations-financieres/informations-reglementees/resultats-financiers---semestriel/2019/20190726-s1-2019-cp-fr.pdf>>.

consequences: the need to negotiate with EDF and the impossibility to decree Fessenheim's reactors to shut down at the Government's will.

In 2017, the *Conseil Constitutionnel* stated that an 'authorization to operate an electricity production facility cannot be considered an asset subject to property rights by its holder',⁷² thereby excluding any expropriation claim. However, in a similar move to that made by the German BVerfG in 2016,⁷³ the judge also took into account the importance of such authorisations and especially under the principle of legitimate expectation or a 'legally established situation based on the guarantee of the rights proclaimed in article 16 DDH' in French law.⁷⁴ As a result, although the nuclear capacity cap does not breach this principle due to it being based on general interest objectives (the 'diversification of the energy mix' goal) and leaves, theoretically, the choice of which reactor to shut down and when to the operator, EDF can still request compensation.⁷⁵ It is the Government's combined lack of efficient legal tools for pursuing enhanced nuclear policy and its will to see EDF execute a political commitment (to shut down Fessenheim by 2017 at the latest), that the latter was not invited to discuss, which led to the need for compensation. Consequently, the agreement reached requires the State to pay €490 million by 2021 to EDF, in addition to complementary payments until 2041, calculated on the electricity market price and the average production of other reactors similar to the ones in Fessenheim.⁷⁶ The outcome of the new legal regime for nuclear reactor shutdowns in France is therefore much more expensive than the German one⁷⁷ and closer to the Swedish outcome,⁷⁸ but without the proper energy policy tools themselves. Above all, the French Government validates the view 'that a nuclear reactor can be operated for 60 years or more by accepting compensation until 2041',⁷⁹ in spite of no nuclear reactor in France having reached this age and the ASN not having provided its agreement to such a perspective. Nevertheless, the current Government validated the principle of commercial exploitation until the 50th year of operation for the 12 reactors to be shut down by 2035 (in addition to Fessenheim's two reactors) and probably until the 60th for the others as it appears in the latest draft of the MPE.⁸⁰

⁷² R. MAUGER, 'Forced nuclear energy reactors shutdown in France: the Energy Transition Act's mechanisms' (2018) 11(3) *JWELB*, p. 278.

⁷³ See section 3.1 of this chapter.

⁷⁴ R. MAUGER, 'Forced nuclear energy reactors shutdown in France: the Energy Transition Act's mechanisms' (2018) 11(3) *JWELB*, pp. 278–279.

⁷⁵ *Ibid.*, p. 279.

⁷⁶ *Ibid.*, p. 280. In addition to a couple of non-financial side clauses.

⁷⁷ See section 3.1 of this chapter.

⁷⁸ See section 2.2 of this chapter.

⁷⁹ R. MAUGER, 'Forced nuclear energy reactors shutdown in France: the Energy Transition Act's mechanisms' (2018) 11(3) *JWELB*, p. 280.

⁸⁰ 'Programmation pluriannuelle de l'énergie 2019–2023 2024–2028 – Projet pour consultation' (2019) *Ministère de la Transition Ecologique et Solidaire*, p. 144, available at <<https://www.ecologique-solidaire.gouv.fr/sites/default/files/Projet%20PPE%20pour%20consultation.pdf>>.

However, the Fessenheim reactors are still running.

On 8 April 2017, the minister in charge of energy adopted a decree stating in Article 1 that the operating authorization of Fessenheim's reactors was abrogated, before adding in Article 2 that this abrogation will take place when EDF's last conditions are met.⁸¹

Still, as was expected by many legal scholars due to the poor quality of this decree,⁸² on 25 October 2018 the *Conseil d'Etat*, the supreme administrative court in France, repealed it.⁸³ Indeed, the decree was illegal, as it disrespected the Energy Code, since EDF had not requested a repeal of the operating authorisation of Fessenheim's reactors. This would have been the only way by which to proceed in this case due to the lack of an effective legal framework adopted two years earlier by the same Government. At the date of writing, this request had still not been submitted by EDF although it should happen soon, as the utility announced it would shut the reactors down in the spring of 2020 at the latest.⁸⁴

In the long term, the lack of an appropriate legal mechanism for organising the required nuclear reactor shutdowns to reach the goal of diversification of the electricity mix in France might lead to other such unclear and costly situations. For example, in the MEP the Government wants EDF to spread out the shutdown of the reactors both time- and location-wise. The rationale behind this smoothened-out transition is to facilitate the adaptation of the electricity system (generation, transportation and distribution) and to reduce the societal impact, in terms of unemployment for the local areas, by requesting EDF to avoid completely decommissioning a power plant (hence maintaining at least one reactor running per site). The problem is that the more the Government is willing to control the date, order and location of the reactors to shut down – in other words, to force EDF to adapt to its energy policy (including social concerns) – the more it might have to pay for it.

4. CONCLUSION

This chapter has presented the different strategies developed by Germany, Sweden and France for organising the closure of nuclear reactors. These

⁸¹ R. MAUGER, 'Forced nuclear energy reactors shutdown in France: the Energy Transition Act's mechanisms' (2018) 11(3) *JWELB*, p. 280.

⁸² *Ibid.*

⁸³ CE, 25 October 2018, *Commune de Fessenheim et autres*, n° 410109 and following, para. 4.

⁸⁴ 'Programmation pluriannuelle de l'énergie 2019–2023 2024–2028 – Projet pour consultation' (2019) *Ministère de la Transition Ecologique et Solidaire*, p. 142, available at <<https://www.ecologique-solidaire.gouv.fr/sites/default/files/Projet%20PPE%20pour%20consultation.pdf>>.

strategies have had different consequences in terms of democratic oversight, compensation costs, and target-reaching. The table below provides a summary of the characteristics of each mechanism but does not constitute a thorough analysis of the full legal framework for nuclear energy (e.g. setting out all the conditions permitting shutdown of a reactor). It also allows less nuanced statements than in the body of the text of this chapter.

Table 1. Characteristics of national nuclear energy reactors closure mechanisms

Country	Germany	Sweden (1997–2010)	Sweden (2010–2017)	France
Negotiation with nuclear industry companies beforehand to create the shutdown mechanism	Yes	No	Not relevant	No
Involvement of Parliament in the creation of the mechanism	No	Yes	Not relevant	Yes
Self-unfolding mechanism	Yes	No	No	No
The Government can order a shutdown for policy reasons	No	Yes	No	No
The Government can organise the order of shutdowns	No	Yes	No	No
Court cases launched by companies against the mechanism	Not for the first version. Yes following the rapid policy change	Yes against the first, not for the second	No	No
Compensation provided to operators	Not for the first version. Yes following the rapid policy change	Yes for both reactors (significantly more for the first)	No	Yes (significantly more expensive than in Germany)

As a conclusion, it is clear that the key factors for a stable and fiscal revenue-saving nuclear shutdown mechanism are foreseeability and legal certainty. Mechanisms such as the German one or the first Swedish one, when implemented with enough foreseeability and without sudden policy changes, lead to limited or no compensation liability. Other mechanisms based on taxes and markets or insufficiently clear and prescriptive legal frameworks can have extremely variable direct compensation costs (from virtually zero to hundreds of millions), but deprive policy-makers of any control over nuclear reactor shutdowns and can therefore endanger security of supply.