4 Why There is No Energy Transition in France
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1 Introduction

In August 2015 the French parliament passed the law for an energy transition (la loi relative à la transition énergétique pour la croissance verte). The law included various ambitious goals for the future of the energy system of France. The main aspects incorporate a reduced share of nuclear power in France’s electricity mix (from 75% to 50% by 2025), an expansion of renewable energy to 23% until 2020 and to 32% until 2030, an energy consumption cut by 50% until 2050 and a reduction of greenhouse gas emissions by 40% until 2030 and 75% until 2050.1

However, more than three years later the implementation of some of those political goals does not seem to be certain. Reaching the reduction goal for nuclear energy was postponed from 2025 to 2035. This delay was announced by the then French minister for energy and environment Nicolas Hulot who, in turn, stepped down from office in August 2018 because he was unsatisfied with the environmental commitment of the French government.2 Furthermore the development of renewable energies is progressing very slowly.

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From 2012 to 2017 the share of renewable energies rose from 8.8% to 10.6%, significantly failing to meet its target of 23% until 2020.

What are the reasons for those delays in some of the main goals of the French energy transition? Many facts suggest that the solution might lie in the field of France’s nuclear energy sector. Nuclear power is the key energy source in the French energy system. 19 power plants with 58 reactors account for 79% of France’s primary energy production, which in turn satisfies 40.2% of the whole French energy demand and 72% of its electricity. Additionally, nuclear energy and the French state are widely entwined. The companies for uranium exploitation and production Orano (formerly Areva) and the nuclear power plant operator and biggest electricity supplier Électricité de France (EDF) are majority-owned by the State.

The research interest of this article is thus to find out, what hindrances for the implementation of the French energy transition can be found and if they can be linked to the nuclear energy sector. For the sake of stringency and precision the article will mostly treat the topics of the French energy transition that are linked to electricity. This enables a precise look at the connections between nuclear and renewable energy and French energy politics. Other parts of the transition énergétique such as the building or traffic sector will just be treated briefly.

To answer the research question, the article is divided into the following parts: in part two a short overview shall be given about the current state of research as well as the status quo concerning nuclear power and renewable energies in France. Part three then tries to identify obstacles by examining the economic, political and systemic implications of the transition énergétique. Part four will then evaluate the severity of those obstacles by examining if there are factors in favour of the implementation that might counterbalance the hindrances identified in part three. Lastly, all findings shall be consolidated in a conclusion in which the research question examining the origin of possible obstacles for the transition énergétique and their linkage to the nuclear power sector will be answered.

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2 Research and status quo of the energy transition in France

The genesis of the French energy transition was accompanied by scientific work inside and outside of France. A close inspection was given on the reasons for the launch of the transition énergétique. Namely the rising need for a plan to cope with the aging nuclear reactor park in France – which was mostly built in the 1970s and 1980s – as well as the Fukushima incident. Furthermore, the starting primaries for the presidential election in 2012 opened a window of opportunity for energy and climate topics to enter the political debate.⁴ Some researchers also acknowledged the symbolic implication of the energy transition law as well as the setting of ambitious goals for a future energy system.⁵

However, the majority of the scientific reports also included forms of initial criticism, especially targeting the reduction of nuclear energy and the expansion of renewables. It was noted that neither clear outlines on the number and dates of reactor shutdowns, nor concrete measures on how to expand the renewables sources were available.⁶ Additionally, studies questioned whether and how a parallelism of reducing the share of nuclear power and increasing the share of renewables could work in terms of maintaining the security of supply and price levels.⁷

More than three years later these critical questions still remain open. This becomes evident if one takes a look at the implementation laws, the so-called PPE (programmation pluriannuelle de l’Énergie), which were enacted by the French government in order to set specific steps for the realisation of the transition énergétique. At first

glance, both versions of the PPE\textsuperscript{8} describe concrete target figures for the future of renewable energies that seem to satisfy the critical accounts. The goal in the power sector, for instance, is to raise the installed generation capacities by 50% until 2023 and by 100% until 2028 in reference to 2017.\textsuperscript{9} But if one looks deeper into the numbers, those goals might not be enough to reach the renewable goals of 23% until 2023 and 30% until 2030. Firstly, it is uncertain if the described capacity goals can be fulfilled. An official report of the French power grid operators from September 2018 shows that the quotas for installed capacities of renewables for that year set in the first PPE were not reached. From June to September that year 281 MW were added to the installed wind energy capacity totalling at 14.288 MW. This is still a few hundred MWs away from the PPE goal set at 15.000 MW.\textsuperscript{10} Solar energy also lags behind with only 8.374 MW capacity despite its original goal set for 10.200 MW in 2018.\textsuperscript{11} With this current speed of implementation it seems unlikely that the target figures for 2023 and 2030 can be reached. But even if the capacities could be delivered it is not certain if they would suffice for reaching the stable 23 or 30% marks of renewable final energy consumption in 2023 or 2030, which currently lies at 10,6%, less than half of the desired goals.\textsuperscript{12}

Concerning the reduction of nuclear power the current PPE just delivers incomplete answers. On the one side, the French government decided that 14 reactors have to be shut down in order to reach the 50% goal in 2035. The first two reactors will concern the Fessenheim plant and shall be closed in spring 2020.\textsuperscript{13} Apart from that, however, the regulations remain vague. The exact number of reactors to be shut down by 2030 remains unclear (numbers range from

\textsuperscript{8} The initial version covered the period from 2016-2019, the second version is a revision of the first which covers now the period from 2019-2028.
\textsuperscript{9} See Ministère de la transition écologique et solidaire: Stratégie Française pour l’énergie et le climat. Dossier de presse, November 2018, p. 21.
\textsuperscript{11} See Réseau de transport d'électricité et al., 2018, p. 22 / p. 16.
\textsuperscript{12} See Ministère de la transition écologique et solidaire: Chiffres, 2018, p. 18.
\textsuperscript{13} See Ministère de la transition écologique et solidaire: Stratégie, 2018, p. 4.
3 Why there is no energy transition: obstacles and hindrances

Part two of this article has shown that from the start of the energy transition there has been criticism on the implementational structure of the project, as well as the lack of implementation of multiple goals in the power sector itself. This section tries to identify where those obstacles are situated. It does so by analysing the key relations between the power sector and three different areas. Firstly the economic area. Mayor changes in the energy system of a country also imply mayor changes in its energy related economical structure. Economical disadvantages caused by transitional projects might work against its implementation.

Secondly, the political reasons shall be examined. As energy policy is one of the key issues for a country many influential factors can be found in the connection between energy and politics. This area is especially interesting, because it covers the actors that paved the way for such a project in the first place but, on the other hand, might have an interest in delaying or hindering its successful implementation. Furthermore, the close relationship between the government and the state owned energy companies in France is worth analysing.

Thirdly and lastly, systemic factors shall be drawn into consideration for evaluating, if the current energy system itself hinders a successful implementation of the transition énergétique.

3.1 Economic factors

One of the most important figures when it comes to energy issues is the energy price. In France household consumers pay 0,1754 €/kWh which is significantly lower than the European Union average of 0,2049 €/kWh. This low price is attributable to the high amount of

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nuclear energy in France. Nuclear power plants generate a high and stable base load of energy. Additionally, electricity prices in France were subsidised by the state for a long time. This situation and the fact that EDF owns all of the nuclear power plants cemented the energy company’s dominant position in the power sector despite the liberalization policy of the EU.\textsuperscript{15} However, renewable energies are different in character. Solar panels or wind turbines generate much lower quantities of energy per generating unit and are exposed to the volatile factors of sunlight and wind. Thus, a reduction of nuclear power and an expansion of renewables might lead to a price increase in France as the stable and relatively cheap nuclear power would be partly replaced by more expensive renewable energy or more expensive energy imports.

Another economic factor that might fuel the reluctance to implement the energy transition is the industrial leadership of the French nuclear sector. State companies like Orano and EDF are leading players in the nuclear energy field operating not only inside of France but worldwide. Roughly 2,500 French companies exist in the nuclear sector employing 220,000 people making it the third biggest industrial branch after the automotive and aeronautical sector.\textsuperscript{16} Reducing the nuclear share in the power mix could therefore lead to job cuts in those enterprises. Additionally, it might be harder for French companies to keep the innovative leadership in a sector with diminishing domestic importance.

3.2 Political factors

Energy has always played a major role in French politics. After experiencing serious energy shortages during and between the two world wars, the government decided to create national energy ‘champions’ that should ensure the independence and supply security for France’s energy system.\textsuperscript{17} From then on, energy supply was seen as a public task. This stance was reinforced after the oil crisis


\textsuperscript{17} See Engels, Florian: Die französische Energiewende im Rahmen der EU-Energiedpolitik, Marburg, 2016, p. 45.
in 1973, which led to the quick development of the civil nuclear energy program. The civil and military use of the atomic technology is therefore closely linked to France’s understanding of a militarily and economically independent nation.\footnote{See Diechtl/Fischer, 2015, p. 4.}

The effects of this state driven construction of the French power system can still be seen today. The subsidies for electricity prices mentioned above directly derive from the understanding of the state as a guarantor for affordable and secure energy to its people. Therefore, any measures that might lead to a major increase in French energy prices are very unpopular among the French government due to the possible negative effects on the public opinion.

Besides, the connection of the government and the state-owned energy suppliers is still strong. The current Prime Minister, Edouard Philippe, for example, was head of public affairs of Areva from 2007 to 2010. The fact that the initial goal of the \textit{transition énergétique} to reduce the share of nuclear energy to 50\% until 2025 was postponed to 2035 under the presidency of Emmanuel Macron is another sign for the reluctance of the state to tackle the dominant nuclear power structure. The French President even holds open the door for future reactor builds in France, which will be decided in 2022.\footnote{See Nucléaire: La décision de construire d’autres EPR prise “autour de 2022”, selon Emmanuel Macron, in: l’opinion.fr, 8 February 2019, available at: https://www.lopinion.fr/edition/economie/nucleaire-decision-construire-d-autres-epr-prise-autour-2022-selon-177363 (28 March 2019).} That position is also backed by the French Minister of economy, Bruno le Maire, who sees nuclear power as a “trump for France”.\footnote{le Maire, Bruno cited in: Bezat, Jean-Michel: Nucléaire: Un rapport préconise la construction de sux nouveaux EPR, in: LeMonde.fr, 30 August 2018, available at: https://www.lemonde.fr/planete/article/2018/08/30/nuc-leaire-un-rapport-preconise-la-construction-de-six-epr_5348004_3244.html (28 March 2019).}

In addition to all those factors, it has to be said that the nuclear and renewable energy discussion is not on top of the political agenda in France. The country is currently preoccupied with a variety of reforms started by president Macron (e.g. pension scheme and labour marked) that have a much more immediate impact on the French

\footnote{18 See Diechtl/Fischer, 2015, p. 4.}
society than the long term and sometimes abstract goals of an energy transition.

3.3 Systemic factors

Last but not least, underlying systemic factors should be taken into account when looking for obstacles on the way to a successful implementation of the energy transition goals. The dominant position of nuclear energy also plays the key role in this regard. Due to the enormous share of atomic energy in the power mix, the whole systemic structure is centred around this energy source. As already briefly stated in the economic chapter, it is hard to replace electricity generated by nuclear reactors with renewable energy. The reason for that is not only the price issue but also a question of supply security.

The high base load generated by nuclear power plants fits very well in the centralized energy structure of France. Replacing this base load with more volatile renewable energy would not only be an enormous and costly effort but also render the country more vulnerable to electricity spikes on the generation and demand side. Particularly during cold winter months France is in need of a high and steady supply of electricity due to the high dispersion of electrified heating systems in French households. Furthermore, due to its volatility, a higher share of renewables could increase the risk of power shortages in those periods, which in turn would have to be evened out by improved energy storage capabilities or importation.21

The question of electricity importation and exportation leads to the next systemic fact. France is a net energy electricity exporter with 40 TWh in 2017.22 France’s role as an energy exporter is especially important for the Iberian Peninsula being the only over land connection for energy supplies. A weakening of France’s exportation capabilities could therefore also endanger the energy supply security of its neighbouring countries like Spain – and with that Portugal – but also Italy or Switzerland.23

22 See Ministère de la transition écologique et solidaire: Chiffres, 2018, p. 57.
23 See Engels, 2016, p. 97f.
France’s electricity export surplus is also – next to the other mentioned factors – part of the reason why the extension of renewables is progressing so slowly. There is simply no need to create more power generating capacities. Electricity not needed in the country itself has to be sent to the neighbouring countries via the interconnectors. Although a steady power exchange between European states is needed to circumvent shortages and unforeseen demand spikes, too much exported power leads to excess capacities in the grid system, which in turn creates own problems like the necessity of loop flows or overloading dangers of the power grid.\textsuperscript{24}

Lastly, there is the CO\textsubscript{2}-argument. Nuclear energy in France is considered a ‘clean’ energy source, because it does not emit carbon dioxide or greenhouse gases.\textsuperscript{25} Thus – following the French logic – this decreases the incentive to invest in renewable energies because there is no gain on the climate balance.

4 Is energy transition in France really impossible?

The analysis in part three has identified several factors in different areas that can be seen as obstacles on the way to a successful implementation of the French energy transition in the power sector. Those findings might lead to the conclusion that a significant change in the French energy structure could be considered an almost impossible task. This section investigates the severity and long-term stability of the findings and asks the question if there are possible indicators for a change of the described blockading stance towards the implementation of the transition énergétique.

4.1 Future price developments

As already indicated, low electricity prices play a crucial role in France for various economic and political reasons. Thus, there is little voluntarily incentive to change the energy system in a way that would significantly increase the price levels. However, this does not necessarily produce an unsolvable deadlock situation. The will to

\textsuperscript{24} See Rüdinger, 2014, p. 7.

\textsuperscript{25} Different to Germany the nuclear waste disposal discussion plays just a minor role in the French public debate.
reduce cheap nuclear energy in favour of an extension of more expensive renewable energy might not come voluntarily but through systemic necessity. Due to the fact that the majority of French nuclear reactors were built during the same relatively short period of time, the maintenance and investment costs for the upkeep of plants and enhanced security mechanisms are also to rise at the same time. In 2014, the French audit office calculated that the operating costs for the nuclear power fleet rise each year by 1.4%.26 Furthermore, the construction cost and duration of the new nuclear power plant projects, like the EPR-reactor in Flamanville (North France), continues to go up as well. In 2007, when the construction started, it was initially estimated at 3 billion Euros with a completion date in 2012. Through the years costs have risen up to 10.9 billion Euros with a new completion timeframe of late 2019 or early 2020.27 A continuous increase in prices in the nuclear sector might open a window of opportunity for the French government to diversify its energy sources in the power sector. An extension of renewables could in that case be the remedy for the cost explosion of nuclear plants.28 However, it is unlikely that this scenario would be possible without a substantial increase in energy prices for the French people which is still a very unpopular and conflicted political topic. Furthermore, lower production costs of renewable energies do not automatically negate the other challenges that come with those energy sources like the aforementioned volatility or the need for a development of new storage and grid capacities.

4.2 Political changes

The favourable stance towards atomic energy displayed under the Macron presidency and his government is not shared by every political actor in France as the resignation of the environmental activist Nicolas Hulot from his ministerial office has shown. After the

revision of the PPE many politicians stated their criticism on the slowdown of the nuclear reduction. Former energy minister and responsible of the energy transition law Ségolène Royal reproached the government for not having faith in the development of renewable energies. Additionally, she suspected that Emmanuel Macron extended the deadline of the reactor shutdowns to 2030 in order to push that decision out of the period of his presidential term. This shows that there is no political consensus over the future of nuclear energy in France. Depending on which political forces hold the power in France, the atomic question is valued differently. It is therefore not clear what will happen in the electricity sector after the presidency of Macron.

Similarly to the political sphere, the French society has no clear stance towards the future of the atomic energy as well. Recent polls suggest that there is a slight majority (53%) against nuclear power. However, to this date there is no real societal opposition against nuclear energy in France that engages fundamental debates about the inherent dangers of atomic energy as they were carried out in Germany during the past decades. Debates over the nuclear topic still remain limited in scope and seldomly leave the political or expert area.

4.3 Energy transition ≠ electricity transition

To fully answer the question about the origin and severity of hindering factors for the implementation of the transition énergétique in

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32 See Engels, 2016, p. 57f.
France one has to take a brief look at the other components of the transition project apart from the power sector. The energy transition law also defines goals for the transport and building sector. This is especially important in relation to the greenhouse gas reduction targets of 40% until 2030 and 75% until 2050.

Due to the massive share of nuclear power in France’s energy mix, the possibility for reducing CO₂ emissions in that sector remains rather limited. The per capita emissions of France are with seven tons already below the European average of 8.4 tons.³³ Thus, in terms of greenhouse gas reduction France is more likely to achieve greater reduction successes in the building and traffic sector through for example energy efficient refurbishment measures or alternative fuels. When evaluating the feasibility of the transition énergétique there is hence a scenario where not much might change in the energy structure of the country itself but progress could still be generated in terms of CO₂ reduction.

5 Conclusion

The energy transition project in France started with an ambitious set of goals to tackle the future energy and climate related challenges of the country. Particularly the reduction of the nuclear power share was seen as a novelty in French energy policy. After more than three years of temporal distance one can observe that progression towards those energy goals is indeed going slowly. As analysed in this article many reasons for that staggering progress can be related to the dominant position of nuclear power in France’s energy mix. France’s history of atomic energy goes back almost 50 years and has become a leading industrial branch and top employer for the country. Furthermore France’s low electricity prices depend on a stable power output from nuclear power plants. Those prices in turn are seen as a national achievement by both politicians and citizens, which is further reinforced by the state-owned structure of the leading energy companies.

The strong position of this energy source in economic, political and systemic aspects makes diversification efforts hard to carry out. This is because other CO₂-neutral energies, like renewables simply cannot replace nuclear power generation due to a higher price structure or greater volatility without any added value for the greenhouse gas emission goals. The systemic dominance of nuclear power is even harder to touch because it not only affects the French energy system but also the supply structure of the neighbouring countries on account of France’s electricity exportation surplus. All those facts lead to the conclusion that an energy transition in France is indeed hard to achieve when it comes to touching the power mix.

This situation has not necessarily to be considered as an insoluble stalemate. Changes in the political leadership of the country could lead to a re-evaluation of the role of nuclear energy in France, especially when the production cost of nuclear power and the maintenance investments of the reactor park continue to rise. In the short run, however, there is little movement to be expected, as there are more pressing topics on the daily agenda of French politics.

To sum it up, there is to say that in France there is currently no energy transition in the sense of a change or diversification of energy sources. Nuclear power will still dominate the energy marked in the years to come due to the lack of immediate economic and systemic alternatives and political will. This does not mean that in the end there will be nothing to be done for implementing the goals of the transition énergétique as there are other sectors, like building and traffic, which can contribute to climate and energy efficiency targets without the need to change the current supply structure. Further research will have to monitor, if progress in these areas can be sufficient to solve France’s energy challenges.