“KNOW-IT-ALL” AND “PAIN IN THE NECK”:

NORMATIVE AND OPPOSITIONAL NUCLEAR

KNOWLEDGE PRODUCTION IN POST-FUKUSHIMA

FRANCE

By

JULIE SCHWEITZER

Master of Science in International Studies
Oklahoma State University
Stillwater, OK
2011

Master of Science in Sociology
Oklahoma State University
Stillwater, OK
2013

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Dissertation Approved:

Dr. Tamara Mix

Dissertation Adviser

Dr. Duane Gill

Dr. Michael Long

Dr. Erica Townsend-Bell

Name: JULIE SCHWEITZTER

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Abstract: Understanding how knowledge pertaining to technology is created and transmitted to lay publics is central in understanding options available to stakeholders. Identifying knowledge shaping processes reveals underlying power dynamics affecting public perception and ultimately policy outcomes. Using the specific example of France's civil nuclear program, I address how normative stakeholders protect the status quo to establish legitimacy and maintain a dominant position in knowledge construction. I also consider the strategies available to other actors, including oppositional stakeholders, who possess alternative knowledge. After World War II, France made the decision to develop an extensive civil nuclear program, currently providing a large proportion of France's electricity. Closely monitored by the French government as a way to protect its energy independence and to develop technological expertise, the unique structure of the French nuclear program prevents alternatives to nuclear power from emerging. In particular, despite years of existence, the disjointed anti-nuclear movement has failed to provide long-term, efficient changes to France's energy production practices. A long history of nuclear dependence creates a context that praises nuclear energy while stigmatizing attempts to question or contest the hegemony of the nuclear industry. Catastrophic events, such as the Fukushima nuclear disaster, provide unique opportunities for oppositional stakeholders to challenge the power of normative actors and trigger an informed discussion among the public. Interactions between opposing stakeholders – or lack thereof – play an important role in influencing the balance – and the outcome – of the debate about controversial technological issues. Drawing from the literature on political opportunity structures, as well as the literature focusing on social movement tactics and the production of knowledge, I consider dynamics related to the production of knowledge about nuclear energy between various stakeholders. Using qualitative methods including semi-structured interviews and archival documents offering unique insight into the nuclear debate in France, I discuss how stakeholder groups interact and respond to each other, creating intricate dynamics that produce nuclear knowledge and convey information about what is important to know – and to ignore – about nuclear power.

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CHAPTER I

INTRODUCTION

Nuclear technology is perhaps the most controversial innovation of the modern age. From Henri Becquerel's discovery of radioactivity in 1896 to recent discussions about the Iran nuclear deal, many important events accompany the history of military and civil nuclear programs worldwide. Some events are illustrative of human progress and some are highly contentious – all have significant political, social, and economic outcomes. Nuclear technology remains closely associated with the atomic bombs of Hiroshima and Nagasaki at the end of World War II; and with major nuclear accidents such as Three Mile Island in Pennsylvania in 1979 and Chernobyl in Ukraine in 1986. The technology also represents a key component in recent discussions to mitigate the effects of climate change. In 2016, after the 2015 Paris Climate Conference to limit the impact of global climate change, the International Atomic Energy Agency (IAEA) published a report highlighting the benefits of nuclear energy in lowering carbon emissions, encouraging countries to "create a favourable environment for nuclear power expansion." (IAEA 2016:7)

Following this trend, perceptions of nuclear technology fluctuate between strong support and vehement rejection, between fear of catastrophic consequences and enthusiasm for innovative advancement. A polarizing idea in a carbon dependent world, nuclear generated electricity also

represents critical political and economic interests. An examination of perceptions, policies, and practices in France can illustrate how knowledge about a controversial technology is constructed, disseminated, and/or contested in a context that encourages the hegemonic position of the nuclear industry.

On March 11, 2011 a major earthquake, measuring 9.0 on the Richter scale, shook Japan. The resulting tsunami and remaining earthquake aftershocks disabled the power supply and cooling systems of three Fukushima Daiichi nuclear reactors. The result was the most significant nuclear event in recent history, with ongoing consequences. Fearing that a similar catastrophe could happen elsewhere, several countries including Germany, Italy, Israel, and Australia expressed concern, reluctant to develop or to continue their nuclear programs. China decided to limit the expansion of its civil nuclear program. Other countries, such as England and France, showed continued loyalty to nuclear energy. A few days after the disaster, in an article published in *Le Monde*, one of France's mainstream newspapers, former French President Valery Giscard d'Estaing addressed the consequences of the catastrophe and defended the French civil nuclear program against criticism. In the months following the Fukushima disaster, then President Nicolas Sarkozy advocated for safety tests, but reaffirmed France's nuclear ambition, asserting the normalization of nuclear energy in France even after a major nuclear accident.

France's civil nuclear program is unique because of its scope and structure. France is proud of its civil nuclear program. A major state project, nuclear technology represents a way to promote energy independence as well as international expertise. Since the beginning of the program, pro-nuclear politicians – such as former Presidents Giscard d'Estaing and Sarkozy mentioned above– encouraged the hegemony of nuclear power through narratives emphasizing both the benefits of a strong nuclear industry as "a site for articulating and negotiating the meaning of a technological France" (Hecht 2009:330). The presence of nuclear reactors is accepted as normal and embedded within France's daily life along with the risks associated with nuclear technology. Normalized risks become a familiar

part of the social system (Luís et al. 2015) and reduce people's perception of said risks (Lima et al. 2015). Nuclear accidents become normal accidents, perceived to be an inherent and unavoidable part of the system (Perrow 1984). A catastrophe like the Fukushima Daiichi nuclear disaster reflects how various political and/or economic actors navigate regulations, dismiss alarming messages, and shape accident responses to protect their interests (Perrow 2011). The response to events participates in creating "nuclear denial" (Perrow 2013:56) making normal the existence of contested technologies. Therefore, normalization of the nuclear industry in France leads to an underlying – and persistent – acceptance of nuclear power (Schweitzer and Mix 2018).

Key nuclear advocates construct powerful claims to address the benefits of nuclear energy (Bess 1995, Topçu 2011). Control of nuclear technology by a small group of individuals with vested interest in political and economic outcomes of the nuclear program leads to a particular debate structure about nuclear energy in France, whereby the French government represents one of the most prominent supporters of the civil nuclear program. Nuclear energy is sustained by politicians regardless of political ideology – with the notable exception of the Green Party. As Bess notes, "After the Chernobyl disaster in 1986, the French once again stood out among the nations of Europe: day after day, while the Italians, British, Belgians, Swiss, and Germans were issuing iodine to children or banning the sale of lettuce, the French government insisted that its neighbors were overreacting, that the radioactive cloud posed no threat, and that France, which possessed the world's most concerning network of nuclear reactors, remained fundamentally safe" (1995:931). For decades, French politicians along with key industry stakeholders participated in strengthening the civil nuclear program – sometimes to the detriment of other energy sources – shaping public understanding of risks associated with nuclear energy.

In addition to the role of the state in maintaining the dominance of nuclear power, the integrated structure of the French nuclear industry is a strong actor in promoting the benefits of nuclear power and nuclear expertise as a key component of the technological French savoir-faire (Hecht 2009).

Nuclear companies such as Electricité de France (EDF) and Areva (now Orano)[1] practice innovative strategies including developing new types of reactors and building partnerships in other countries to maintain the centrality of the industry (Topçu 2011) and to remain one of the largest electricity exporters in the world (Patel 2011). Through the years, France used its civil nuclear program to promote its expertise worldwide through agencies that combine government and nuclear industry members (Szarka 2013). Nuclear supporters construct narratives that strengthen nuclear energy while creating a context that hinders the ability of alternative viewpoints or other types of knowledge to emerge.

Catastrophic events such as Chernobyl in 1986 and Fukushima in 2011 seldom trigger long-term changes in the structure of the French nuclear industry despite the existence of an anti-nuclear movement since the early stages of the development of nuclear energy (Topçu 2011), especially because of the government's support of the civil nuclear program (Schneider 2013). Anti-nuclear activists struggle to offer an efficient expertise base and counter response despite the existence of visible anti-nuclear activity – especially from the Green party –and an organized network of anti-nuclear groups (Blanchard 2010; Topçu 2011). Regardless of the scale of the nuclear catastrophe at Japan's Fukushima Daiichi nuclear power plant and the discussions about the high risks associated with nuclear energy, France saw a re-entrenchment of its civil nuclear program. Associated with dominant narratives about the benefits of the civil nuclear program, media coverage of the nuclear debate does not provide in-depth discussions of the challenges and/or dangers associated with nuclear energy. Researchers suggest that nuclear catastrophes are not dramatic enough to trigger drastic changes from within and challenge dominant assessments about the nuclear industry (Blanchard 2010).

[1] See the discussion about Areva/Orano in the context section.

Nuclear energy in France is thus a political issue (Barthe 2009). Complex stakeholder groups interact and respond to each other creating intricate dynamics that produce nuclear knowledge and convey information about actions. Literature illustrates the complex nature of relations between people who have power and those who are contesting that power (Bullard 1994, Cable et al. 2008, Dunion 2003, McAdam 1982). Conflicts often emerge regarding the production of knowledge. Stakeholders in a debate are not equal when it comes to the visibility of their narratives. For instance, Wesselink et al. (2013:7) point out "the hegemonic influence of dominant discourse" in producing knowledge about a particular controversial issue.

Media outlets, journalists, and researchers alike tend to focus on and present the discourse of institutionalized actors to the detriment of other forms of knowledge that might provide varying understandings of central issues (Chesters 2012). Scholars argue that powerful stakeholders are more likely to disseminate specific narratives to the public while other pieces of information remain invisible promoting an hegemonic social reality where "Knowledge becomes an institutionalized aspect of society in which it is part of the taken-for-granted assumptions about how the world is understood" (Ockwell and Rydin 2006:382). Through a rhetorical process establishing what is possible, acceptable, or desirable in society, powerful stakeholders assign meaning to various issues and manage these interpretations to protect their interests (Bonds 2010). On the other hand, less powerful groups can construct oppositional knowledge to challenge hegemonic ideas and advocate for a new definition of social reality (Coy, Woehrle and Maney 2008). However, control of emerging opportunities and threats can enhance or hinder the effectiveness of knowledge production strategies. Mainstream media can play an important role in promoting specific foundations of knowledge associated with a particular issue. For instance, Dunlap and McCright (2015:317) explain that conservative media acts like an "'echo chamber' that circulates and amplifies ideologically driven claims to its audience." In turn, the unbalanced influence between powerful and disadvantaged opponents makes it more difficult for Social Movement Organizations (SMOs) to organize their

grievances into a structured movement with meaningful action (Fisher 2000) as control – or lack of control – over the knowledge associated with a particular issue empowers – or disempowers – organized groups (Buchanan 2013).

Drawing from existing literature on political opportunities, I focus specifically on the production of knowledge and resulting stakeholder dynamics in a context where counter-hegemonic ideas having difficulty existing. My data derive from semi-structured interviews with key opposing stakeholders of the nuclear energy debate in France, including anti-nuclear activists, industry representatives, and independent experts; participant observation during tours of a nuclear power plant and a housing estate for power plant employees; and archival material from newspapers, annual reports and anti-nuclear pamphlets and newsletters, and other industry documents. The aim of this project is to understand the process of nuclear knowledge production, identifying obstacles and advantages affecting stakeholders with various levels of power, experience, and access to resources. I specifically address opposing stakeholder dynamics surrounding production of knowledge, which, in turn, influences the balance of the debate and the future of France's energy program. I ask: How do political opportunities influence the context of nuclear knowledge production in post-Fukushima France? How do stakeholders such as the French government and the main nuclear companies produce and disseminate knowledge to maintain development of the nuclear industry? What choices and strategies are available to anti-nuclear activists to craft knowledge and oppose the power of the state and nuclear industry?

Energy programs are the result of carefully planned decisions that seldom involve the general public, yet they have long-lasting impacts on a country's social, political, and economic landscapes. Energy choices define an acceptable social reality regarding consumption, lifestyle options, and attitudes towards the environment. At a time when various countries question or reconsider the validity of their energy program, my project contributes to a better understanding of how stakeholders with different interests and levels of power interact in a debate about controversial technology. In particular, by

comparing and contrasting the knowledge-shaping process available to powerful actors protecting the status quo (Bonds 2010) and SMOs' oppositional knowledge production advocating for a different, more informed and just, social reality (Coy et al. 2008), this project provides insights into the on-going dynamics of opposing stakeholders experiencing changes to the broader social context. As emerging opportunities and threats weaken or strengthen opposing actors' positions in the debate, my project connects strategies of knowledge to the structure of political opportunities. Analyzing how knowledge is constructed and communicated to larger audiences can provide the necessary tools to identify underlying power networks shaping policy outcomes and to empower local groups and grassroots organizations in promoting an alternative understanding of contested technologies.

In Chapter II, I present an overview of the French nuclear context, discussing the rationale behind the development of the civil nuclear program and the current structure of the nuclear French industry. I identify key stakeholders and their role in the debate paying particular attention to the emergence of anti-nuclear contestation and highlight anti-nuclear contributions in challenging the status quo. After discussing the general nuclear context in France, in Chapter III I turn to a review of the relevant literature as I first discuss the political opportunity structure and its role in shaping controversial debates. Then I address how various stakeholders organize their claims and craft knowledge about a particular issue. Finally, I outline opposing stakeholder dynamics and the potential for groups to maintain or resist hegemonic ideas. In Chapter IV, I present my research design and analytic strategy. I discuss my data sources, identifying the strengths and limitations of my project. Based on the data introduced in the previous chapter, Chapter V presents the findings associated with the first research question. I show how powerful actors control emerging opportunities and threats in the nuclear debate in France. In Chapter VI, I further address the strategies available to powerful stakeholders to produce nuclear knowledge that maintains the hegemonic position of nuclear energy in France. I identify key rhetorical components of pro-nuclear discourse. In Chapter VII, I turn to groups who challenge the status quo and discuss their tactical choices in engaging in resistance. In particular, I emphasize how

oppositional stakeholders address power differences in producing alternative nuclear knowledge. Finally, in Chapter VIII, I summarize my key findings, highlight the main contributions of my project, and explore ideas for future research.

CHAPTER II

CONTEXT

In this section, I present an overview of the context regarding the emergence and the development of nuclear energy in France in order to better understand the mechanisms and challenges constraining France's contemporary energy decisions as well as interactions between stakeholders. I first discuss the early stages of the nuclear program highlighting the historical role of major key stakeholders with vested interested in nuclear technology. Then, I address the connection between the civil and the military nuclear programs in France, which shapes the way information about the nuclear energy is shared. Finally, I examine the current structure of the nuclear industry, current stakeholder divisions, and the anti-nuclear coalition.

The Beginning of the Nuclear Program in France

France's reliance on nuclear power started in the 1960s with the development of the civil nuclear program. While the transition towards nuclear energy sped up between 1963, with the construction of the first generation of nuclear reactors using graphite and carbon dioxide called UNGG, and 1973, when the oil crisis encouraged Prime Minister Messmer to launch a sustained construction program for 36 nuclear reactors (SFEN 2015), the origins of the French civil nuclear program are embedded in early nuclear radiation and radioactive isotope research.

Applied research and discoveries by Henri Becquerel and Marie Sklodowska-Curie, who discovered radioactivity and two new radioactive elements respectively (Radvanyi and Villain 2017) participated in rooting nuclear research into the French scientific landscape. French nuclear expertise is praised and reinforced by Marie Sklodowska-Curie, and her family's achievements and international reputation through scientific publications and various distinctions (Gasinska 2016). Weinberg (1994) explains that public belief that nuclear technologies were a French discovery encouraged a positive reception of the technology, playing a role in building public acceptance of nuclear energy. The French civil nuclear program was the next logical step in Marie Sklodowska-Curie's discoveries bringing prestige to France. Her legacy of research excellence shaped the early stages of the nuclear program. In 1945, Frédéric Joliot-Curie, Marie Sklodowska-Curie's son-in-law, was appointed the first High Commissioner for Atomic Energy at the newly created nuclear research facility, Commissariat à l'énergie atomique et aux énergies alternatives (CEA[2]). He also participated in supervising the construction of the first French atomic reactor, Zoé, in 1947.

The events of World War II left France structurally destroyed and its economy weak. Damage to cities, towns, and villages, communication and transportation lines, and industrial landscapes were greater than the destruction produced by World War I (Kyte 1946). Solutions to restore France's image and position were of great importance for politicians. As a part of recovery efforts to revive France's economy, major energy industries were nationalized (Hecht 2009). The newly developed nuclear technology appeared to be "a modern force allowing for the planning of declining territories" (Chambru 2015a:31) providing an opportunity to modernize the country after the war (Topçu 2006). The choice of the nuclear path may seem audacious in the context of post-war reconstruction, but France's history of scientific research represented a substantial asset in helping with the development of new scientific knowledge (Bounolleau and Levain 1994).

[2] A table of acronyms and abbreviations is available as Appendix A.

From a decision-maker perspective, nuclear technology appeared as a way to maintain France's role at the international level through technological prowess. After the construction of Zoé, French newspapers praised the accomplishment, with one declaring that the construction of the reactor "strengthens our role in the defense of the civilization." (Weart 1979:248).

The choice of nuclear power called for a transformation of the French industrial landscape and the expansion of research and development with the creation of two major organizations. The French government founded CEA in 1945 to oversee research on nuclear technologies while, at the same time, Électricité de France (EDF) assumed the monopoly over nuclear electricity generation and distribution (Wiliarty 2013). While the CEA remained closely connected to the state, it never depended on a specific ministry, allowing a certain amount of autonomy in its research choices (Hecht 2009). Created in 1946 and state-owned until 2004, EDF prevailed as a dominant energy actor providing electricity for 83% of the French population, despite the end of its monopoly and a change in status (EDF 2019a).

Reflecting the decision to rely mostly on nuclear power, France, through Electricité de France, started to convert energy flows into electricity whenever possible (Stuart 2017). A powerful and influential stakeholder in the early stages of the French civil nuclear program, EDF developed "their interpersonal, dialogue, and negation skills" (Dänzer-Kantof and Torres 2011:380) to access land for the construction of power plants, and persuade local populations of the benefits of nuclear energy. As such, the company makes its ambition clear early, encouraging a positive atmosphere regarding the nuclear industry.

Not only did the choice of nuclear energy have economic consequences, it also shaped town and city planning. An additional transformation of the French landscape involved the location of nuclear reactors, with the exception of Gravelines and Nogent-sur-Seine, in less densely populated and more rural areas (Meyer 2014). Construction plans involved a drastic selection of

potential nuclear sites. Contrary to coal-fired power plants, nuclear power plants require large sites with access to cool water (Dänzer-Kantof and Torres 2011). EDF was in charge of selecting production sites to host the large power plants (between 55 ha for the Tricastin location and 230 ha for the Penly location). While EDF's real estate agents bought properties, the company started a "slow persuasion effort" (Dänzer-Kantof and Torres 2011: 380) with concerned parties to come to an amicable agreement and highlight the benefits of the project. The economic and development outcomes of the power plants appealed to some local residents. Others worried about the potential negative consequences for the environment or their community. At the same time siting decisions were being made, EDF and others investigated potential uranium deposits in France and abroad (Boyle and Robinson 1981).

Managing uranium extraction became an important aspect of the French nuclear program. Beginning in 1961, the production division of CEA controlled the search for uranium deposits. France maintained up to 210 uranium mines until the end of uranium mining with the closure of the last French uranium mines in 2001 (Bretesché 2014). While France made use of its local resources, the Sahara region including Gabon and Niger became fundamental providers of uranium as well. France's involvement in uranium procurement made it the uranium extraction leader in Europe in the 1970s (Dänzer-Kantof and Torres 2011). Additionally, at the end of the 1960s, France started a European initiative of uranium enrichment which included Belgium, Italy, Spain, and Sweden. Located in Pierrelatte, France, near the Tricastin power plant, Eurodif (European Gaseous Diffusion Uranium Enrichment Consortium) was aimed at strengthening the uranium enrichment process in Europe by providing independence from the United States (Dänzer-Kantof and Torres 2011).

Both Electricité de France and the Commissariat à l'énergie atomique were important in shaping the structure of the nuclear industry and coordinating efforts to build nuclear reactors. Their joined and separate actions represented "the postwar vision of the kind of relationship between

industrial development and the state that would ensure the reconstruction of the nation" (Hecht 2009:661). In particular, EDF shaped public knowledge about nuclear energy. "While EDF has the monopoly of information and refuses any public debate, it does indeed carry out important information work with the population by multiplying information meetings in villages surrounding the location of power plants" (Chambru 2015b:35).

In addition to using science and progress to regain France's prestige, the rise of the civil nuclear program alleviated the lack of energy alternatives at a time when the dominant coal mining industry was in decline (Ball 2011). Highly dependent upon coal before the beginning of World War II, the coal industry in France was never able to recover from the war as the supply shortage combined with transportation problems hindered production (Kyte 1946). Furthermore, the absence of natural resources such as oil and gas could further increase the country's dependence on imported resources (Boyle and Robinson 1981).

The second half of the 1960s saw Electricité de France and the Commissariat à l'énergie atomique competing to impose their production methods. The industry players engaged in a war between the UNGG technology promoted by CEA and the enriched uranium technology championed by EDF (Dänzer-Kantof and Torres 2011). For economic reasons, nuclear authorities settled on a plan of action to progressively abandon the first generation of nuclear reactors. Too expensive to operate, the French designed reactors were replaced by pressurized water reactors – an American technology (SFEN 2015). Officially announced in 1974, the Messmer Plan marked the beginning of France's intensive nuclear program with the aim of building 170 reactors by the end of the century (Topçu 2008). Key decision-makers presented the choice of nuclear power as a rational decision promoting public interest and long-term benefits for France. At the 1979 Foratom Conference, CEA Chief Executive Jean Pellerin (1979:58) discussed the civil nuclear program, regarding it as "vital for the economy." An innovative focus on nuclear technology was thus perceived as a solution to a potential energy crisis, providing energy independence within a

context of increasing consumption (Blanchard 2010). At this time, nuclear power plants were recognized as promoting the public interest, highlighting nuclear energy as corresponding to a "vital necessity" for France (Dänzer-Kantof and Torres 2011:378).

Constructing Civil and Military Nuclear Technology Acceptability in France

While contemporary discussions about nuclear technology distinguish between civil and military nuclear programs, the history of the French civil nuclear program is closely associated with its military counterpart. After World War II, in addition to using nuclear power to produce electricity, France was interested in starting a program to acquire the atomic bomb (Wiliarty 2013). In fact, until the beginning of the 1960s the prevalence of a civil nuclear program over a military one – or vice versa – remained undetermined (Hecht 2009). Key stakeholders emphasized the combined benefits of developing both a military and civil nuclear program in France.

Quoted in Soutou (1994:83), then Prime Minister Pierre Mendès-France discussed the role of the government in promoting nuclear technology: "But it is not because atomic and nuclear research can have military applications that the government has the right to deprive the country of the immense scientific possibilities, of the industrial and social benefits of all kinds that [such research] could insure." Nuclear technology could provide France with both "energy independence and military defence" (Stuart 2017:32). The creation of CEA made clear France's ambitions about nuclear technology (Krige 2016) with CEA engineers actively involved in researching weapons-grade plutonium (Hecht 2009). Furthermore, under the governance of French President Charles De Gaulle, France rejected the European Defense Community Project. The treaty was designed to prevent members from developing a military nuclear program (Stuart 2017).

As part of the United States' will to shape Western European nuclear programs to secure economic interests on the continent, France emphasized the civil use of nuclear power to the detriment of military purposes. Adamant to remain in a leadership position, the United States discouraged research aiming at developing military nuclear programs by encouraging the choice between a civil or military nuclear program (Krige 2016). The current organization of the French civil nuclear program is thus the paradoxical result of, on the one hand, France's ambition for energy self-determination, and, on the other hand, other countries' influence in defining the boundaries of civil and military nuclear agendas. In particular, with the beginning of European development, European countries also participated in greatly scaling down France's initial intentions regarding the atomic bomb that could undermine European cooperation (Bonolleau and Levain 1994). Despite the fact that France later acquired the atomic bomb, the emphasis remained on the peaceful use of nuclear technologies.

If the link between the civil and military nuclear facilities and research still exists (Stuart 2017), French technocrats worked toward clearly separating both aspects of nuclear technology so that the general public would disassociate the fear of radiation and accidents with nuclear energy. There were "only" two major catastrophes during the history of the civil nuclear program worldwide (Wellerstein 2016). These events were not "catastrophic" enough – in terms of human casualties representing a more visible outcome than radioactive contamination – to question the relevance of nuclear technologies. Of course, the consequences of aforementioned accidents were long lasting, but immediate visible effects were more impactful especially to the general public. Blanchard (2010:221) explained in his analysis of the media coverage of nuclear risk that "the absence of a concrete manifestation of the damage and its health consequences can also annihilate the fears." As such, the nuclear industry was often compared to other, more deadly, industries including oil and gas or coal industries (Wellerstein 2016). The history of the French nuclear program shows that the French tend to internalize and normalize nuclear energy and its risks.

Instead, fear and stigmatization associated with the military use of the technology which remains separated – and therefore is presented as different – from its civil counterpart.

The Structure of the French Civil Nuclear Program

Currently, France's nuclear facilities include 58 nuclear reactors producing 416,800 GWh of electricity compared to 58,700 GWh produced by hydroelectric power, the second most important energy source in France. Reactors are located within 19 nuclear sites with the oldest, located in Fessenheim, put into service in 1977 and scheduled for shutdown in 2020 after years of controversy regarding its closure[3]. The newest, a new generation of reactor called EPR (European Pressurized Reactor) has been under construction in Flamanville since 2007. Originally, scheduled to begin operation in 2012, the construction keeps being delayed, leading to concerns regarding the EPR's cost and safety. The French nuclear sector is very homogeneous with a focus on a unique reactor concept managed by a single constructor and a single operator (Dautray, Friedel, and Bréchet 2012). EDF controls all 58 French reactors as well as 15 reactors in Great Britain. Despite the rise of alternative renewable sources of energy, the civil nuclear program remains the main way through which France gets its electricity with 76.3% of France's current electricity consumption coming from nuclear reactors (Stuart 2017). France is the second largest producer of nuclear energy after the United States (Costes 2015). Figure 1 illustrates the location of the nuclear power plants and reactors in France.

[3] President François Hollande promised during the 2012 presidential campaign to close Fessenheim by 2016. In 2015 the Minister of the Ecology, Sustainable Development and Energy, Ségolène Royal, clarified that the closure would happen by the end of Hollande's term in May 2017. In November 2018, President Emmanuel Macron announced that the shutdown is scheduled for the spring of 2020.

Figure 1. Map of French Nuclear Facilities (source IAEA (2018) based on EDF and CEA: https://cnpp.iaea.org/countryprofiles/France/France.htm)

As illustrated in Figure 1, in addition to power plants, France's nuclear facilities include several research and development centers, fuel cycle facilities, and nuclear waste storage sites. Through the years, the nuclear sector became the third most prominent industrial sector in France, generating a revenue of 46 billion euros (Costes 2015). According to the Société Française d'Energie Nucléaire (SFEN), an organization in charge of sharing information about nuclear energy, 2,500 companies work for the French nuclear industry employing directly or indirectly 220,000 people (SFEN 2015). Major French industrial groups such as Alstom and Bouygues also participate in the development of the nuclear industry offering their civil engineering expertise. Such a close connection between key industrial stakeholders worked to strengthen the implementation of the nuclear industry, supported by a "complex chain of facilities from uranium mining to waste disposal, from uranium conversion to reprocessing, from uranium enrichment to reactor operation over a period of 5 decades" (Schneider 2010:260-261).

As mentioned above, the main French nuclear stakeholders include historic actors such as the Commissariat à l'énergie atomique which focuses on nuclear research and innovation (CEA 2018), Electricité de France which controls the production of nuclear electricity representing 77% of its activities in 2017 (EDF 2019b), and the French government. Several ministries are closely connected to the nuclear industry including the Ministry for an Ecological and Inclusive Transition through the Department of Nuclear Safety and the Ministry of the Armed Forces through the Representative for Nuclear Safety and Radiation Protection for Activities and Facilities Related to Defense Purposes. The civil nuclear program is perceived as a government's responsibility transferred from one government to the next, from one President and his Prime Minister to the next (Pelletin 1979). The unprecedented development of nuclear power relied on almost unconditional support from across the political spectrum (Boyle and Robinson 1981), with the exception of the Green Party, which has always opposed the use of nuclear power.

Because of the role of the civil nuclear program in promoting France's international prominence, development of the industry was closely associated with political decisions. Stuart pointed out that "French nuclear power is exceptional as it has an industrial configuration inseparable from political power (Stuart 2017:28). Similarly, in his analysis of the risks associated with the civil nuclear program, Lebeau (2012) discussed necessary control by the government of key industries while Viallet-Thévenin (2015:339) showed the importance of energy companies remaining close to legislators. A limited-liability corporation under private law since 2004, EDF is still controlled at 84.5% by the French state (Stuart 2017). Areva, whose role is highlighted in the following paragraph, is also owned by the French state at 50.2%.

In addition to EDF and the French government, the current structure of the civil nuclear program reflects the role of Areva whose activities focus on uranium extraction, enrichment, and fuel cycle including transport and reprocessing (Orano 2018). Areva was created in 2001 from the merger of three historical nuclear groups Framatome, Cogema, and Technicatome. Framatome was founded in 1958 to build nuclear reactors using Westinghouse's reactor technology (International Directory of Company Histories 1998). Cogema – Areva NC in 2006 then Orano Cycle in 2018 – was created in 1976 to supervise the nuclear fuel cycle from uranium mining in France and abroad to uranium reprocessing in La Hague. A powerful actor in the nuclear industry, Cogema controlled 15% of uranium resources in the West when it was created (Dänzer-Kantof and Torres 2011:258).

The decision to merge these groups was motivated by the will to promote a strong integrated business model to strengthen competitiveness (Bonnel 2015). However, after years of financial difficulties, Areva changed its name to Orano in January 2018 and Framatome was separated from the company and sold to nuclear power plant operator EDF, resuming its former name (Le Billon 2018). Due to the timing of data collection and to stay consistent with the interviews and archival materials, I refer to Orano as Areva in this project.

Other key stakeholders include various regulation and control groups such as the Autorité de Sûreté Nucléaire (ASN) in charge of promoting safety and transparency, the Agence Nationale pour la Gestion des Déchets Radioactifs (ANDRA) in charge of nuclear waste, and the Institut de Radioprotection et de Sûreté Nucléaire (IRSN) studying and assessing radioprotection. Created in 2006 to replace the General Direction for Nuclear Safety and Radioprotection, ASN monitors the nuclear industry and reports on the state of the technology. ASN activities centered on "information, regulation and control" (Hadna 2017:125). According to its website, ASN "is tasked, on behalf of the State, with regulating nuclear safety and radiation protection in order to protect workers, patients, the public, and the environment from the risks involved in nuclear activities in France. It also contributes to informing the citizens" (ASN 2014). The French safety authority employs 483 people with a 2016 budget of 80.79 million euros (ASN 2018). Despite its self-proclaimed independence, ASN "remains an 'Administrative Authority', whose existence and operation are attached to the state" (Hadna 2017:120).

An important actor monitoring nuclear activities, IRSN was created in 2001 to research nuclear safety in various contexts from the transport of nuclear materials to the protection of people and the environment against radiation (IRSN 2019). Of IRSN's 280 million euro budget, almost half of it is dedicated to public service (IRSN 2018). Along with ASN, the organization is part of a larger program designed to make the nuclear industry more transparent – an early grievance of the anti-nuclear movement. "The French Nuclear Safety Authority (L'Autorité de sûreté nucléaire, ASN) and its expert body, the French Institute for Radioprotection and Nuclear Safety (the Institut de Radioprotection et de Sûreté Nucléaire, IRSN), promised the public complete transparency" (Topçu 2011: 33). ANDRA was created in 1979 to take care of nuclear waste, specifically radioactive materials produced by Cogema (Barthe 2009). The role of the agency has evolved. In particular, ANDRA is now in charge of supervising the construction and management of the Centre Industriel de Stockage Géologique (Cigéo), the 500 meters underground nuclear

waste storage facility located in Bure, in northeastern France. Highly controversial, the project is estimated to cost 25 billion euros for a 100-year lifespan (ANDRA 2018).

Stakeholders such as the French government, nuclear companies, and nuclear safety and information groups play an important role in shaping the strategic developments of the civil and military nuclear programs as well as people's understanding of said programs. Since the early days of both nuclear programs, politicians saw the economic advantages that could ensue from a strong civil nuclear program. Therefore, government discourse carefully constructed the acceptance of nuclear technology. Shortly after the launch of the nuclear program, the French government initiated an information campaign "stating that an accident is 'almost impossible' in France or that the radioactivity resulting from nuclear energy is comparable to natural radioactivity" (Topçu 2006:252). However, the development of the civil nuclear program was also closely associated with scientists. Hecht (2009:684) explained that "Heads of state, ministers, and elected officials were more than happy to let engineers and managers in state-owned agencies do most of the work toward formulating a nuclear policy for France."

As such, nuclear workers and scientists have been responsible for developing and maintaining highly specialized knowledge benefiting France (see the "technologists" described by Hecht (2009), the role of the "grandes écoles" discussed by Restier-Melleray (1990), and the role of organizations like CEA and EDF presented by Topçu (2008)) in monopolizing expertise). Notable supporters of nuclear power include former President Nicolas Sarkozy and former Prime Minister François Fillion who praised the prowess of the technology (Szarka 2013). Even former President Francois Hollande, who wanted to decrease France's dependence on nuclear energy, failed to achieve his campaign promises including his plan to close down Fessenheim, the oldest operating nuclear power plant (Stuart 2017).

Therefore, in France, nuclear energy is the status quo, despite some tensions challenging the hegemony of nuclear companies. Nuclear energy is integrated into the French political, economic, and industrial landscapes. For instance, in his study about the foundation of nuclear policies in Europe, Franchino pointed out that in France people's proximity to a nuclear power plant tends to positively shape their perception of nuclear energy. "France is the only country with nuclear energy where the views of left-leaning individuals swing more widely over time than those of moderates as proximity increases" (2014:228). Arguments from prominent politicians and visible nuclear managers encourage the use of nuclear power.

The Anti-Nuclear Coalition

In a context of normalized acceptance, it is difficult for nuclear technology opponents to mobilize effectively against nuclear power. Anti-nuclear contestation paralleled early discussions about nuclear technology. Initial attacks against nuclear technologies addressed mostly the atomic bomb and its consequences. It was only with the improvement of the economy that French anti-nuclear activists shifted their focus from the military to the civil nuclear program (Topçu 2006). Early strategies and tactics focused on constructing the concept of nuclear risk for lay publics (Chambru 2014). Scientific expertise represented an important feature of emergent anti-nuclear efforts. In the 1960s, anti-nuclear activists focused on a "scientific and technical critique" of nuclear technology through a few associations pointing out the dangers associated with radioactive materials (Chambru 2015b:34). However, until 1973, anti-nuclear sentiments remained marginal (Dänzer-Kantof and Torres 2011).

With the launch of the Messmer plan in 1974, nuclear opponents started to organize their resistance to nuclear technology more effectively. In 1975, 400 scientists signed a manifesto calling for greater transparency efforts within the industry (Dänzer-Kantof and Torres 2011). At the same time, several researchers and scientists created the Groupement des Scientifiques pour l'Information sur l'Energie Nucléaire (GSIEN) with the objective of "assembling knowledge on

nuclear risks, with the aim of countering the official discourse (Topçu 2008:228). In addition to scientific groups, anti-nuclear groups developed an active resistance to the construction of nuclear reactors. In 1971, 15,000 people participated in the first major anti-nuclear protest, a sit-in in front of the Bugey's construction site (Dänzer-Kantof and Torres 2011). Throughout the 1970s, anti-nuclear groups mobilized large numbers of people (Topçu 2008). Kitschelt (1986:71) explained that "between 1975 and 1977, approximately 175,000 people rallied against nuclear power in ten demonstrations." Anti-nuclear protests also targeted uranium research facilities and uranium extraction, opposing mine openings (Bretesché 2014).

Challengers to the nuclear status quo included anti-nuclear groups and independent labs monitoring radioactivity and its effects. The main anti-nuclear network is Sortir du Nucléaire. Supported by donations, it was created in 1997 and includes more than 900 participating organizations (Sortir du Nucléaire 2018a). According to its website, the goal of the network "is to convince France to phase out nuclear power generation by: rethinking its energy policy, improving the efficiency of electricity use, and developing alternative and sustainable generation scenarios" (Sortir du Nucléaire 2018b). Greenpeace has also been involved in the nuclear debate. A highly structured group, Greenpeace's anti-nuclear actions only represent a fraction of its interests, which are divided in four categories – "Climate Change and Energy, Biodiversity and GMOs, Forests, and Oceans" (Berny 2009:380). According to their 2016 financial report, Greenpeace France includes "560 volunteer activists spread out in 29 local groups" with 13.771 million euros available for use in goal related campaigns (Greenpeace France 2016).

Other small anti-nuclear groups shared direct or indirect connections with Greenpeace or Sortir du Nucléaire. They varied in terms of strategies and tactics; some advocating for an immediate nuclear phase-out while others preferred a progressive ending to the civil nuclear program. They also varied regarding to scope; some anti-nuclear groups focused on anti-nuclear messages while others incorporated anti-nuclear rhetoric into broader environmental and climate narratives. For

instance, Global Chance was created in 1992 to "raise awareness about threats to the global environment" (Global Chance 2018a). Thanks to various publications, the association, which includes about 40 members, promoted a democratic approach to energy issues (Global Chance 2018b). As such, the anti-nuclear coalition remains diverse. Central grievances of anti-nuclear groups include nuclear waste (Barthe 2009), nuclear risks (Chambru 2014), and lack of transparency (Topçu 2008), among others. Actions vary from protests to trials (Wiliarty 2013).

The most prominent NGOs are the Association pour le Contrôle de la Radioactivité dans l'Ouest (ACRO) and the Commission de Recherche et d'Information Indépendantes sur la Radioactivité (CRIIRAD) both were created in 1986 to challenge nuclear expertise and provide an alternative understanding of nuclear technology (Topçu 2008). An active part of various nuclear work groups, ACRO "aims at offering the civil society an investigation tool capable of supplying data that are accepted by all" through the collection and analysis of scientific evidence (ACRO n.d.:5). In 2016, Association pour le Contrôle de la Radioactivité dans l'Ouest included 5 employees and about 30 volunteers (ACRO n.d.:6). Funded by public donations and employing 14 people, CRIIRAD's goals were "to give people an access to scientific information about the impact of ionizing radiations and the actual radiological contamination of their environment, to improve people's ability to participate (as citizens) to the actions and decisions in the field of environmental protection, protection of public health, the rights of future generations, to give people scientific tools in order to help them make independent preliminary assessments of radiological contamination, and to circulate information on radioprotection through a web site, leaflets and brochures, books, lectures, seminars, videos, etc." (CRIIRAD 2016). Both groups gather and analyze data to produce counter-expertise reports. Press releases and simple reports are available for the public to see while more detailed publications are only accessible for members.

Nuclear advocates and scholars identified the struggles of the anti-nuclear movement early on in the development of the civil nuclear program. In 1979, CEA Chief Executive, Jean Pellerin noted

the lack of public support for anti-nuclear actions. In reality, levels of mobilization were higher in France than in the United States but, collective action was less effective (Kitschelt 1986). The main success of opponents in mobilizing the general public was the 1977 demonstration in Creys-Malville against the construction of Superphénix. The protest against the power plant was severely repressed by the police, leading to the death of one protestor and injuring several others (Wiliarty 2013). After construction problems and malfunctions, the Superphénix power plant was shut down in 1996.

Despite continuous involvement in the contestation of the nuclear industry, especially after the Chernobyl disaster in 1986, anti-nuclear groups struggled to provide a united front complete with united solutions regarding nuclear phase-out plans. Chambru (2015a) addressed the "deliberative crisis" inherent to the anti-nuclear coalition of Sortir du Nucléaire. Differing on many key topics, the "movement" failed to appeal to a population continuously subjected to consistent messages about the benefits of nuclear power. Key challenges included the ability of the anti-nuclear movement to maintain anti-nuclear mobilization – protests after Fukushima remained limited compared to protests in other countries, especially Germany (Topçu 2011), as the movement became more fragmented. The anti-nuclear movement in France has struggled to offer a compelling alternative to nuclear power. The French nuclear context did not encourage the contestation of the hegemonic position of the nuclear industry. SMOs, not belonging to the closed circle of nuclear specialists, were ignored (Blanchard 2010). Media outlets limited the public's exposure to counter-arguments (Schweitzer and Mix 2018). From the beginning, nuclear energy opponents had to address dominant actors from a marginalized position. As depositories of alternative knowledge, anti-nuclear actors struggled to gain visibility.

This chapter presented the nuclear context in France, describing the major stakeholders involved in the debate over nuclear energy and highlighting the complex connections between these central actors. In particular, I addressed the close association between the French government and the

nuclear industry describing the early – and on-going – role of the state in shaping nuclear policies and constructing nuclear acceptance. I also discussed the structure of the oppositional movement and the role of anti-nuclear organizations in advocating for energy alternatives and trying to provide a counter-expertise challenging the hegemonic position of nuclear energy. Overall, stakeholders involved in the nuclear debate belong to three different set of actors. Following Banerjee and Bonnefous (2011) who identify three groups– supportive, obstructive, and passive stakeholders – I distinguish between normative stakeholders such as industry workers and engineers whose discourse encourages the status quo, oppositional stakeholders such as anti-nuclear groups who produce anti-hegemonic nuclear knowledge, and unaffiliated stakeholders such as counter-expertise labs and self-identified independent groups. Normative stakeholders hold a dominant position, driving nuclear knowledge production. While unaffiliated and oppositional groups' counter-hegemonic position might seem similar, both sets of actors play a different role in creating and transmitting nuclear knowledge.

In the next chapter, I address the literature relevant to my project. First, I turn to the literature addressing the importance of political opportunities in shaping opposing responses to different openings and threats. Then I address the mechanisms of knowledge production as different groups compete for control over the meaning of controversial issues as well as social movement claimsmaking processes influencing the knowledge production process. Finally, I consider literatures addressing complex interactions between social movements and their opponents, focusing on the hegemonic processes that encourage acceptance of a particular social order.

CHAPTER III

LITERATURE REVIEW

In this chapter, I discuss the relevant literature to understand nuclear knowledge production in France. I first address the importance of political opportunities in shaping openings and threats for key stakeholders. Specifically, I outline the role of political opportunities in influencing movement strategies and tactics. Then, I offer an overview of research examining how key stakeholders, including social movement organizations and institutionalized actors, construct and articulate their grievances to control the production of knowledge regarding the nuclear industry and nuclear risks, emphasizing the importance of controlling knowledge production to influence and/or maintain the status quo. Finally, I address opposing stakeholder dynamics, paying particular attention to the contestation of hegemonic discourse. I point out the importance of understanding hegemonic practices to consider legitimacy construction in a debate.

Social Movements and Political Opportunities

As explained in the previous chapter, France's current energy discussions are shaped by past government decisions and by important catastrophic events. France's example reflects the importance of various social forces in shaping contemporary debates about energy, political, or economic choices. Generally speaking, dynamics between opposing stakeholders are constrained by broader changes in the social, economic, and political landscape whereby organized collective

action is influenced by structural factors.

Social movement organizations are complex organized structures that offer a systematic response to underlying social problems. Diani (1996:7) identifies four elements associated with a social movement organization: "a) networks of informal interaction; b) shared beliefs and solidarity; c) collective action on conflictual issues; and d) action which displays largely outside the institutional sphere and the routine procedures of social life." Scholars point out the influence of social movement activists in addressing social inequality and controversial situations (see for instance Meyer 2004, Wash and Warland 1983, Zald and Useem 1987). Social movement members are instrumental in raising awareness about a particular issue, an injustice, or certain living conditions (Snow and Soule 2010). They try to mobilize outsiders to affect social change. To that end, activists articulate their grievances about their main motivations and transform them into various types of organized action (Brown and Zavestoski 2004, Brulle and Pellow 2005).

When successful in mobilizing and encouraging action, SMOs participate in connecting a social situation with policymaking. "Social movements can influence policy, alter political alignment, and raise the public profile and salience of particular issues" (Meyer and Staggenborg 1996: 1634). Activists play an active role in constructing appropriate strategies and tactics to address the issue at stake. SMO actions are constructed within the larger social context in order to mobilize the general public. "Social movements engaged in collective action aimed at influencing policy outcomes shape and adapt their strategies in light of the structure of opportunities and constraints that they face" (Gamson 2004: 249). Specifically, social movements exist – and evolve – within a specific context that influences their structure, actions, and strategies (Noakes and Johnson 2005).

As opportunities and threats emerge, social movement activists adapt their strategies to articulate their claims. In other words, SMOs do not exist in isolation; social movement activists interact

with other key actors and react to social, political, or economic shifts. Studies highlight the cultural variables that define SMO tactics. More specifically, changes in the social system can encourage or hinder organized collective action. Factors external to social movement organizations are the "structure of political opportunities" (Meyer and Minkoff 2004: 1459). Political opportunity structures (POS) are central to understanding the emergence of protest (McAdam 1982), as SMOs can take advantage of openings as they occur. Opportunities represent "options for collective action, with chances and risks attached to them that depend on factors outside of the mobilizing group." (Koopmans 1999:97). An important element of social movement research, the political opportunity structure accounts for activists' ability to act upon perceived changes in the broader context to affect social change. More specifically, Almeida and Stearn (1998:36) define POS as "dimensions of the political environment that act as incentives for people to engage in sustained collective action and attempt to exercise political leverage." Political opportunities are chances for SMOs to become more institutionalized or to transform activists' grievances into policies.

Early discussions of the concept of POS (Einsinger 1973, Tilly 1978) focus on the evolution of the openness or closure of a political system as a way to explain a social movement's activity. "The POS is considered open when there is conflict among elites and the protest actors have allies in power within the decision-making system – usually left-wing parties – and closed when they do not have them and the elites are stable" (Kriesi 1989, Piazza and Genovese 2016:291). Political process theory, of which political opportunity structures play a significant part, addresses the shortcomings of previous perspectives (such as the classical tradition and the resource mobilization model) in providing a more exhaustive understanding of social movement emergence, strategies, and outcomes. While "breakdown theory was developed to explain collective action that involves a basic rupture of the social order" (Useem 1998:235), it failed to acknowledge the rational nature of organized protests. Similarly, the resource mobilization

perspective overestimated the role of the elite in supporting social movement activities. Instead of supporting efforts to promote social change, the elite are more likely to help maintain the status quo, protecting its interests (McAdam 1982). Political process theory thus combines "the importance of resources and political opportunities" with "the subjective dimension of protest and framing" (Grasso and Giugni 2016:665) to better explore the dynamics between organized protest and the broader social context.

A multifaceted component shaping SMOs, scholars conceptualized political opportunity structures in different – and occasionally conflicting – ways sometimes contributing to the weakening and vagueness of the theory (Meyer 2004; Meyer and Minkoff 2004). Despite various operationalizations of the concept, previous studies agree on a few aspects. POS encompasses several dimensions as defined by McAdam (1996:27): "1. The relative openness or closure of the institutionalized political system, 2. The stability or instability of that broad set of elite alignments that typically undergird a polity, 3. The presence or absence of elite allies, 4. The state's capacity and propensity for repression." POS are not static (Banham and Goodin 2016); the extent to which a system is closed or open to social protest varies over time. Similarly, an event considered central to a movement's success in a particular situation might not be as influential or even irrelevant in another (Meyer and Minkoff 2004).

Political opportunity scholars are interested in understanding both internal and external elements shaping SMOs. In fact, many authors highlight the importance of external context in shaping social movement strategies (McCammon et al. 2001; McCammon et al. 2007). Studies show that different forms of power and the varying nature of stakeholders lead to different responses. A key challenge is to understand which aspects of the broader environment can shape SMOs – and in which ways they are affected (Meyer and Minkoff 2004). POS are versatile. Scholars have examined their "volatile" aspects focusing on "windows of opportunities" to define organized actions which are typically limited in scope and time frame. Also considered are "stable"

components, addressing political opportunity structure across social movements, which are more long-lasting, transcending the boundaries of a single movement (Giugni 2009:362).

Analyzing how social movement organizations adapt to POS helps provide an understanding of the influence of external forces on organized protest. Tarrow (1994:85) defines the influential external circumstances related to political opportunities as "consistent — but not necessarily formal or permanent — dimensions of the political environment that provide incentives for people to undertake collective action by affecting their expectations for success or failure." POS are central to social movement success as explained by Giugni in his study of SMO outcomes. He argues that "social movements can be effective in producing policy changes only when they can take advantage of favorable political opportunities and public opinion" (2007:70).

Understanding how social movement activists make sense of political opportunities, or lack thereof (Einwohner 2003), in deciding what actions to take, provides interesting insights into the adaptations and strategies used by social movement activists to engage with opponents. More specifically, attention to movement tactics within the context of the broader social and political system allows for a better understanding of social movement structure, as well as potential success or failure. "Focusing on practices, and on those who engage in them, identifies target vulnerabilities and strengths that create or constrain opportunity for effective social protest, and therefore illustrates elements of opportunity structures that would otherwise be hidden from view" (Einwohner 1999:182). Thus, outside actions play a role in shaping movements' strategies and tactics, and, in particular, the articulation of claims.

Traditionally represented as the main target of social movement grievances, the state plays an important role in political process theory. For instance, Della Porta (2006:11) explains that there is "a correlation between state strategies and movement strategies: the more confrontational the state strategy, the more radical the movement strategy; and vice versa, the more assimilative the

state strategy, the more moderate the movement strategy." The political opportunity structure highlights the connection between institutionalized actors and SMOs. However, one must be careful not to limit opportunities to variations in the political openness of a system. In an increasingly globalized and intricate political and economic context, other stakeholders affect POS. In particular, economic actors, "influence the state's actions and various policies and therefore routinely shape the political process that social movements face" (Logan and Molotch 1987; Pellow 2001:51). Similarly, "*global* political and economic processes" structure "the *domestic* possibilities for successful collective action" hence challenging "state-centered" approaches to studying the role of opportunities (McAdam 1996:34).

By challenging the power of the state, governmental institutions, or institutionalized entities, activists have to pay attention to the broader environment in order to recognize the existence of potential opportunities and construct their actions accordingly. More specifically, authors focus on the interaction between SMOs and the opportunities and threats emerging in society (McAdam 1982; Meyer 2004). In that regard, social movement activists are active participants in making sense of external factors. "Social movements not only seize opportunities; they make them, both for themselves and for others who may not share their interests or values" (Tarrow 1996:58). Social movement members strategically construct how they act and what they say based on political and social changes as new rules and alterations in direction can provide new possibilities for action (McAdam 1982; Skocpol 1979). For instance, using the example of the Italian Leagues, Diani (1996) links organizational resources, symbolic production, and political opportunities to better understand what conditions make mobilization more or less effective. As social movements articulate their grievances, they manage and make sense of external political opportunities and have more control over the way their organization develops and mobilizes. Shifts in the broader political structure are often the result of complex social transformations and "most citizens are not

political experts capable of discriminating between an open or closed POS" (Vráblíková 2014:210).

More specifically, decision-making processes depend on the existence of perceived opportunities (Amenta and Zylan 1991; McAdam 1982; Meyer 2004). For instance, Zhao (2004:21) stresses, "Authority relations are interactive and dynamic; people's perceptions of a state's legitimacy influence how they interact with the state, but in turn their interactions further shape their judgments of the state's legitimacy." Understanding interactions between the key stakeholders of a debate as static hinders the complexity of attitudes that are available for SMOs and their opponents. Similarly, Della Porta argues that opponents who challenge the power of the state shape their responses and the tone of their actions based on the level of control that authority figures have. Thus, "Radicalism or moderation would depend, in particular, on the response the movements meet in their environment, the reactions of the authorities, and the strength and postures of their potential allies and opponents" (2006:8). Similarly, scholars show that interactions between key stakeholders in a debate shape and reshape opportunities for action (Gamson and Meyer 1996; Meyer and Staggenborg 1996). It is thus important to analyze the relation between social movement organizations and their opponents. In particular, it is necessary to consider the dynamic nature of state-SMO – or industry-SMO – relations.

Past studies suggest that political opportunities influence social movement strategies (Noakes and Johnston 2005; Gamson 2004; Meyer and Staggenborg 1996). As such, social movement activists engage in innovative approaches to produce knowledge that challenges the status quo. For instance, Buchanan (2013) explains that activist success in protecting the forest in Ecuador is a combination of dynamic recruitment and deployment of various types of knowledge. Similarly, Piazza and Genovese (2016:291) recognize the active role of SMO activists in translating opportunities into actions: "The activists, placed in front of a set of constraints and opportunities, not only filter them into dilemmas whose strategic choices then expand or reduce these

constraints and opportunities." POS scholars thus highlight SMO agency in using the broader social context to make tactical choices.

Within the particular context of the production of knowledge, opposing stakeholder dynamics highlight how activists shape discourse to influence debate and create controversy. McCright and Dunlap (2015:308) argue that political actors contest climate change using narratives of doubt and mystification in order to prevent the implementation of new policies as the denial countermovement creates uncertainty regarding the existence of climate change by "manufacturing controversy." Similarly, Freudenburg (2005) points out the role of legitimation of privilege in combination with the delegitimation of critics in understanding how environmental problems are addressed. Perrow (2013:57) discusses the implications of nuclear denial in promoting "scientific ambiguity" regarding nuclear energy, delaying debates about alternatives. Power differences exist in maintaining the hegemony of certain narratives. Repetition and a lack of contradiction lead to the inclusion of themes into the social system, which in turn become embedded accounts (Foucault 1980; Freudenburg 2005). This illustrates how power influences the production of knowledge and how knowledge is socially constructed. Creating a dichotomy between scientists and the general public generates a "controversy that appears to exist in the eyes of the public and policymakers" (Dunlap and McCright 2015:309).

The discussion above highlights several important questions regarding the role of political opportunity structures in shaping the context for foundations of knowledge and in determining what strategies and tactics are available to social movement organizations to challenge the status quo. External forces can provide opportunities or threats that can enhance or hinder a movements' ability to successfully articulate claims especially when responding to another movement's narratives. Movement interactions play an important role in influencing the balance – and the outcome – of the debate. An important aspect of SMO rhetorical work is to control the meaning of the issue. In particular, when opposing stakeholders coexist, contradictory forms of knowledge

tend to exist side by side. Two (or more) representations of reality thus emerge, each associated with specific interests and particular outcomes. Knowledge about a controversial technology is produced among antagonists through the strategic implementation of narratives resonating within the broader social, political, and economic context.

Claimsmaking and Knowledge Production

As SMOs challenge the authority of institutionalized actors such as industry or the state, social movement members actively participate in claimsmaking. Claims represent complaints about a particular situation in an effort to change said situation (McMullan and Eyles 1999). Claimsmaking is an important element of social movement formation especially when it comes to encouraging mobilization. Best (1987) argues that rhetorical choices represent central strategic decisions regarding the discussion of and solutions to social issues. Claimsmaking is a complex process through which actors continuously work to establish the existence and legitimacy of a problem (Hannigan 1995). From professionals to journalists, various types of actors can act as claims-makers to address a social issue. More specifically, claims-makers involved in the organization of social movement actions have the ability to decide the ways they will articulate their claims. As they assemble, present, and contest, the claimsmaking process is thus on-going – constantly shaped by the evolution of the movement itself – during which social movement actors define the meaning of their action. Activists' dynamic capacity to define the boundaries of their cause, alongside strategies for action, fosters a sense of identity transcending the limits of the group (Klandermans 1992).

Unity of claims encourages bystander mobilization and enhances movement expansion. Therefore, claimsmaking mechanisms allow social movement activists to connect their protest to outsiders by combining relevant narratives (McCullan and Eyes 1999) or stimulating empathy (Best 1987). The challenge for claims-makers is to construct appropriate narratives that correspond to the circumstances and the targeted public, as not all claims result in mobilization.

Hannigan addresses the importance of relevance, stature, and familiarity of an issue in understanding why certain environmental claims resonate among the population while others do not (1995). Successfully crafted claims articulate the objectives of the movement and show the importance of cognitive and rhetorical components in the formation of social movement actions. In the case of environmental claims, scientific validation, popularization of the issue, supportive media coverage, visual and symbolic representations, financial encouragements to solve the problem, and established supports are central in formulating successful narratives (Hannigan 1995). SMOs thus define the issue at stake and, based on these definitions, attribute blame and provide alternatives through the construction of grievances (Benford & Snow 2000, Snow et al. 1986). In particular, as claims are transformed into grievances, individuals define and modify "the complex of analyses, ideas, and normative concerns - the alternative worldviews - that inspire their mobilizing efforts in the first place" (Schurman and Munro 2006:5). As such, social movement activists shape the reality of their action and construct knowledge narratives about their cause.

Following Berger and Luckmann (1966) what people perceive as real – including knowledge – is socially constructed, and should not be taken for granted. Knowledge does not exist in itself and is produced through people's interpretative work (Kaptan 2013). Knowledge production is a dynamic process involving "complex sets of social relations" (Merton 1972:10). What we come to understand about our surroundings is transmitted and shaped by our interactions with others (Boisen and Murray 2017). Coy and colleagues (2008) identify these complex dynamics in their discussion of oppositional knowledge production, whereby knowledge emerges from the constant back and forth between different groups competing to communicate their information to the public. Berger and Luckmann define knowledge as "the certainty that phenomena are real and that they possess specific characteristics" (1966:13). Knowledge can be treated as a commodity

(Moe and Müller 2018:196) and as such it can be used by actors with vested interest to protect or change reality.

As a strategic choice, controlling the knowledge production process in a controversial debate is important. Knowledge provides legitimacy to claims, especially when it comes to science and technology, because it allows the group who has knowledge to spread its ideas to large audiences, which in turn increases its power (Kinsella 1999). As such, knowledge is closely associated with authority. As Foucault explains: "We are subjected to the production of truth through power and we cannot exercise power except through the production of truth" (1980:93). Traditionally, knowledge is imposed from above (Ingham and Donnelly 1990). Foucault (2000) identifies the interconnections between political power and the ways knowledge is produced and transmitted. Knowledge is thus an important aspect of society to define norms and appropriate behavior. As a normalizing tool to encourage acceptance of certain attitudes and beliefs, knowledge can be contested and the production of knowledge seldom depends upon one stakeholder as different actors can compete for the control of knowledge (Kinsella 1999). Specifically, Coy and colleagues (2008) define oppositional knowledge production as an attempt to challenge dominant values and to define a new social reality. Constructed by less powerful stakeholders, oppositional knowledge explains either "what is" or "what could be." Addressing on-going situations, counter-informative knowledge points out the limitations of the dominant knowledge by offering additional information while critical-interpretive knowledge critically assesses the morality of the status (Coy et al. 2008, Gutman 2017). On the other hand, radical-envisioning knowledge and transformative knowledge focus on "envisioning alternative outcomes and offering practical solutions respectively" (Coy et al. 2008:5.3, Gutman 2017:56).

Conflicts can emerge between experts and non-experts but also between different groups of experts arguing for their definition of reality (Berger and Luckmann 1966). Dissent can also happen between actors who do not share the same form of alternative knowledge thus creating

competition between two or more oppositional messages (Gutman 2017). At stake is the "public interpretation of reality" (Merton 1972:19) where one group's ideas prevail and are internalized by other groups. Such "knowledge conflicts" (Ockwell and Rydin 2006) highlight the importance of power dynamics in explaining how information gets transmitted to the general public. This is especially important because prevalent discourses influence policy-making (Neumann 2005). Scientific knowledge is subject to mechanisms of social construction, whereby scientific claims-makers define the important facts and implications. Hannigan (1995:77) explains how scientists can transform "knowledge claims" into "ignorance claims" to either stimulate or prevent future research. Similarly, Perrow (2013) discusses how interested stakeholders can maintain uncertainty about controversial topics such as radiation levels, to encourage acceptance of contested technologies like nuclear energy.

As mentioned above, people to do not have equal access to all types of knowledge. Merton (1972) distinguishes between "monopolitistic access" and "privileged access" to knowledge. The latter describing instances when knowledge can be acquired by certain stakeholders "at greater risk and cost" (Merton 1972:11). Actors who control the production of knowledge are more likely to influence a debate about a controversial issue. For instance, Wesselink et al. (2012:3) explain that "environmental discourses are not neutral descriptions of a real world out there, but are in practice based on human, and thus political or partial interpretations of technical knowledge by powerful interests." It is thus important to identify "who is allowed to speak on a given topic, as well as which forms of knowledge are subjugated in the production of truth" (Stoddart 2007:205). Similarly, Boisen and Murray (2017) argue that that the production of knowledge involves power relations. It is not enough to understand what knowledge is or entails; it is important to recognize from where knowledge comes and whom it is targeting (Ingham and Donnelly 1990).

Knowledge and expertise are not an end in themselves. They are used to defend political interests (see Granjou (2003) for her overview of scientific expertise with political purposes). Elites play

an active role in defining what needs to be known about a particular topic. Technical or highly specialized concepts and technologies with strategic outcomes are especially vulnerable to such mechanisms. For instance, Bonds (2010:431) describes the knowledge-shaping process and its four components: information suppression, contesting knowledge, knowledge production, and knowledge administration. Through that process, powerful stakeholders have the ability to select, control, and ignore information to maintain a type of public knowledge that serves their interests and maintains their dominant positions. Facts, data, or other evidence that can threaten the status quo are disregarded and people who support contradictory ideas are marginalized. It is then important to address power differences to understand how dissonant voices are silenced and ignored. What is presented to, or hidden from the general public as the appropriate knowledge to have about a specific topic thus depends on the dominant actors controlling the debate.

In particular, knowledge production is associated with experts such as scientists to the detriment of social movement activists. In fact, SMOs may be seen as "knowledge-producers in their own right" (Chesters 2012:146). Individuals involved in SMOs rely on various strategies to encourage understanding of their cause. They collect data and information to support and legitimize their claims. As active knowledge producers, SMO members publish their findings in a variety of different ways including meetings, books, online articles, etc. (Arribas Lozano 2018). When in a subordinate position, militants might rely on substitute publication networks. Activists work to produce alternative viewpoints challenging hegemonic actors who can conceal alternate ideas to maintain the status quo: "We need movements to create counter-power and radical alternatives to the prevailing world order which is steeped in colonialism, imperialism and war, by building upon, and in dialogue with the intellectual/conceptual resources produced in the course of social movement activism" (Choudry 2012:190-191).

While different actors compete for the control over the production – and the diffusion – of knowledge, opposing stakeholders continue to build upon each other's ideas (Merton 1972).

Knowledge production seldom exists in isolation. Narratives between proponents of the status quo and their antagonists respond to each other and provide sometimes conflicting yet contradictory understandings of social reality. In fact, opponents often compete for control of the meaning of an issue. Conflicting forms of knowledge often collide, as "discourse becomes a significant site of contestation and form of resistance by social movements" (Coy et al. 2008). Ongoing interactions allow opposing stakeholders to strengthen their respective arguments and to gain leverage "to find ammunition for new fusillades" (Merton 1972:40). As such, knowledge production changes over time and reflects shifts in the broader social, political, and economic structure.

Understanding the production of knowledge associated with a specific issue thus provides insight into various actors' definitions of the problem. For instance, Peña and Gallegos (1997), Peña (2005), and Cable et al. (2005) highlight the importance of 'local knowledge' as a way to empower local communities to engage in resistance in response to environmental concerns. Similarly, Arribas Lozano (2018:452) explains that SMOs are active producers of knowledge instead of "objects to be studied." SMOs play an important role in constructing knowledge claims because SMO experiences and definitions of social reality often contradict accepted situations. The information provided by SMOs can raise awareness about overlooked issues as "there are fundamental, structurally shaped features of most people's experience in an unequal society which are not adequately addressed by hegemonic 'common sense' and which can be most effectively explored in struggles for transformation" (Cox 2014: 957). Kaptan (2013) emphasizes common sense as conveyor of knowledge in advertising agencies. However, mainstream society tends to favor a particular way to produce knowledge.

In general, technical knowledge – typically associated with powerful actors – is privileged over anecdotal knowledge, which is a characteristic of local populations including activists (Buchanan 2013). The challenge is to understand how contested knowledge becomes a policy – and which

types of knowledge receive legitimization through policy-making. This is especially challenging in a context that tends to normalize risk. Perrow (1984:60) argues that accidents become an important aspect of modern societies, pointing out the role of experts in defining risk in these conditions: "The catastrophic potential of nuclear plant accidents is acknowledged by all, but defense in depth is held by experts to reduce accident probabilities to nearly zero." Similarly, Erikson (1995) points out the contradiction between, on the one hand, the inevitability of technological failure, and, on the other hand, the sense of outrage that emerges after a technological accident. This inconsistency shows how different actors can produce different discourses.

Moreover, Ockwell and Rydin (2006) articulate the complexity of the mechanisms of knowledge production, arguing that various stakeholders can form alliances and cooperate in order to control the general definition of a controversial issue. Similarly, studies note the multifaceted nature of movements contesting scientific knowledge, specifically regarding climate change deniers (see for example McCright and Dunlap 2000, 2010), disagreements associated with taxonomic classifications (Sillitoe 2002), or the ability to produce local ecological knowledge, as seen in fisheries in Canada (Murray et al. 2005). Alternative forms of knowledge differ from the mainstream interpretation of an issue. They challenge pre-conceived ideas about social reality and participate in creating a deeper understanding of a social issue by highlighting hidden facts and including marginalized perspectives. For instance, Lawrence (2003:3) explains that the use of art forms as a way to express claims allows for the expansion of "the boundaries of how we come to know, by honoring multiple intelligences and indigenous knowledge."

More specifically, activists who introduce their own information into a debate create new opportunities for addressing social inequalities (see for instance Gutman's (2017) work about counter-memory production in Israel for a detailed discussion of a new construction of the past to promote better options for the future). As such, the production of alternative forms of knowledge

can empower underserved groups as a strategy to resist the status quo. However, powerful stakeholders can also deny grievances as illustrated with denial of claims regarding illnesses associated with nuclear energy (Cable et al. 2008, Mix et al. 2009). This on-going interaction between producers of various forms of knowledge shows the importance of power dynamics in understanding the relations between key actors in a debate, specifically in interactions between opposing stakeholders.

I make use of the literature about knowledge production to make sense of the discursive strategies pertaining to the nuclear debate in France. As normative stakeholders, the position of state and industry actors regarding nuclear energy are often intertwined. The close connection between state and industry representatives is reflected in the appointment of top executives of the nuclear industry. For instance Areva's former CEO, Anne Lauvergeon, was the personal representative of former President François Mitterrand and François Roussely was a high-ranking civil servant before seeing himself assigned to the position of EDF's CEO in 1998. As state and industry interests overlap, normative strategies to produce nuclear knowledge reflect the combined influence of both categories of actors reinforcing each other. As such, it is difficult to distinguish between the industry and the state when it comes to understanding and analyzing normative nuclear narratives.

Based on the discussion above, attempts to challenge the dominant nuclear industry reflects resistance to hegemonic discourses about energy production. As nuclear energy is presented as the "best," "most rational" choice by stakeholders with vested interests in the technology, nuclear opponents craft alternative narratives producing their own truth. While Merton (1972) encourages opposing sides to engage in an active debate to further and better understand the issue at hand and Coy and colleagues (2008) argue that oppositional knowledge encourages marginalized stakeholders to transform entrenched codes to promote a new definition of social reality, activists – and the information they provide – remain marginalized in the mainstream. Moreover,

establishing new norms and transforming social structures does not happen overnight (Coy et al. 2008). Oppositional knowledge might face extensive resistance from a system that does not account the existence of alternatives. Similar to the aggrandizement effect discussed by Caplow (1964) and Merton (1972), which highlights the sentiment of superiority coming from dominant institutionalized actors, normative stakeholders benefit from an influential position that encourages paternalistic narratives while ignoring dissonant voices. Following Merz and colleagues' (2011:479) discussion of forbidden knowledge that shows that "forbidden knowledge is produced when inquiry threatens powerful interests" and Kinsella (2004) who finds that nuclear discourse promotes the status quo through scientific prowess, I argue that oppositional knowledge is downplayed in a context that encourages nuclear know-how as a way to showcase technological expertise.

Contesting Hegemonic Discourse and Opposing Stakeholder Dynamics

As normative, oppositional, and unaffiliated stakeholders engage in various strategies to control the production of knowledge associated with nuclear energy, their actions reflect broader power dynamics embedded in the French social context. An important factor in shaping the debate over nuclear energy in France, the power relation structure influences which information is transmitted to the public and how. In particular, adversarial dynamics are impacted. Past studies illustrate that legitimate forms of authority such as the state or governmental institutions can use powerful means to reduce the impact of social movement actions (Earl 2006; Davenport 2007; Linden and Klandermans 2006). Control over the production of knowledge represents a way to limit organized resistance. Bonds (2010) further argues that controlling the knowledge-shaping process is important to create legitimacy. In this context, the pursuit of control and legitimacy is pervasive, as "elites must continuously mobilize in order to exercise the power needed to enact the policies that best suit their interests" (Bonds 2010:430; see also Domhoff, 1990). As mentioned above, institutionalized actors can alter or hide information to maintain their

domination. Agenda, power, and secrecy can be used to divert the public's attention and encourage acceptance (Bonds 2010; Boyce 2002).

As such, institutionalized stakeholders continuously define reality through "control and legitimation procedures" (Berger and Luckmann 1966: 88). Actors with power impose their own ideas and symbols on society. Their values and beliefs are reflected in the social structure (Sallach 1974). Bates (1975:351) argues "that man is not ruled by force alone, but also by ideas." Not only do those views prevail but they also tend to not be challenged by the public. According to Gramsci and his supporters, the dominant norms, behaviors, attitudes, knowledge, etc. imposed by ruling stakeholders ideologically and discursively while other beliefs and ideas are marginalized represent the concept of hegemony (Cheung and Ngai 2009, Gramsci 1992). Hegemony defines the boundaries of an acceptable social order. The dominant ideology outlines what is morally and socially desirable (Cheal 1979). In other words, hegemony constitutes "a certain way of life and thought" (Katz 2006:335) and "appears as the 'common sense' that guides our everyday, mundane understanding of the world" (Stoddart 2007:201).

Not only do ruling stakeholders articulate a series of social standards, but they cultivate public acceptance of said principles. On a macro scale, the concept of hegemony favors the maintenance of dominant and established forms of production with the support of the population. Carroll (2006:10) describes hegemony as the "organizing consent to the ruling relations of capitalism" while Burawoy (2012:203) discusses workers' "consent to a domination" under a capitalist system. These pervasive mechanisms constantly create "subjection" (Foucault 1980:97) which is internalized and accepted, furthering the divide between powerful and less powerful groups. Bourdieu (1977:4) discusses the privileges of a dominant group that has the ability to shape and transform the meaning of subordinate groups and "to impose the standards of its own perception." Therefore, less powerful actors depend upon the ruling class' definition of who they are and

marginalized groups have less control over their image. This is problematic because it reinforces power differences between various stakeholders.

Furthermore, subordinate groups might realize that their daily experiences are at odds with what constitutes the dominant understanding of the social order. Gramsci explains the emergence of a "contradictory consciousness" (as cited in Cheal 1979:110) when a collective's experience of reality comes up against the hegemonic conceptualization of said reality emphasizing contradictions. This dual consciousness (Burawoy 2012) also generates consent: people are aware of the domination and the flaws in the system but they cannot envision a functional substitute. Additionally, when promoters of hegemonic values are successful, the general public might not be aware that alternative views exist (Sallach 1974). This cultural and ideological process represents a form of social control by persuading individuals that only a specific set of values embodies what is good for a social system (Maney, Woehrle and Coy 2005).

As hegemonic values prevail, it becomes more difficult for counter-hegemonic stakeholders to challenge the existing social order and to construct opposing narratives. Because legitimacy often goes hand in hand with hegemony, efforts to dispute existing conditions might be perceived as threatening and unnecessary (Maney et al. 2005). When hegemonic principles are associated with what is "legitimate, reasonable, sane, practical, good, true, and beautiful" (Sallach 1974:41), new counter-hegemonic standards might not appeal to the public, hindering the ability of counter-hegemonic groups to challenge the status quo. For instance, when discussing social movements in Peru, Stokes (1995:7) identifies the power of the state in shaping SMO emergence through rhetorical strategies that "invade working-class consciousness and block action."

The state represents the primary vehicle for hegemonic processes. When counter-hegemonic groups directly oppose the power of the state, they can face challenges preventing them from constructing an efficient response. Dominant stakeholders have access to various methods of

social control to undermine hegemonic resistance. Carroll (2006) argues that control over subordinate groups is maintained through a combination of persuasive and coercive tactics. In particular, institutionalized actors rely on non-violent means to maintain their power advantage over their opponents (Davenport 2007; Linden and Klandermans 2006). For instance, Ferree (2005) identifies three forms of soft repression used in democratic countries: silence, ridicule, and stigmatization. The three tactics are important to weaken SMO responses. Specifically, silencing one's opponent limits said opponent's ability to gain legitimacy in the eyes of the general public. Silencing tactics exclude certain voices from the debate (Linden and Klandermans 2006). This is problematic because such strategies contribute to perpetuating hegemonic standards and give the impression that alternatives are non-existent or insignificant. Moreover counter-hegemonic ideas are prevented from resonating within larger society.

Past studies show the importance of resonance in bringing success to SMOs (Snow and Benford 1992; Noakes 2000). Koopmans (2005:164-65) notes the importance for SMO narratives and ideas to resonate within the population, emphasizing the role of resonant messages in increasing "the actor's chances to reproduce the desired message in the public sphere." Stigmatization is a widely used approach aimed to lessen the influence of actors in a debate (Crocker, Major and Steele 1998; Linden and Klandermans 2006). Differing from ridicule, stigmatization of challengers dehumanizes them, which, in turn, prevents the general population from identifying with the themes that the targeted group supports. When the general public does not identify with a cause, it is harder to mobilize new activists (Shriver et al. 2000; Snow and Benford 1988). Additionally, it is possible for authority figures to use a combination of tactics and SMOs have the ability to respond in turn.

Non-coercive tactics such as silencing, ridicule, stigmatization, and development of deference attitudes highlight power dynamics existing between government agencies and SMOs. The state has the ability to affect the visibility and the legitimacy of an actor in a debate around a

controversial issue. Control over the presence of opponents in media outlets shows that powerful stakeholders can influence the media coverage of an issue (McCarthy et al. 1996; Rohlinger 2002). Thus, Ferree (2005) argues that excluding SMOs from mass media access is a powerful tool to prevent the development of protest. Without the ability to disseminate movement claims, the rationale for certain actions and explanations surrounding the deployment of specific narratives are concealed. Mix et al. (2009) illustrate that powerful actors contesting social movement activists may prevent said activists from successfully carrying out the movement's actions. As a result, social movement claims do not make sense because the public receives biased coverage of the issue and their activities.

From the above discussion, it appears that most analysis addressing opposing tactics targeting SMOs focuses on the role of the state in opposing protest. However, the state is not the only opponent to a social movement's actions. In fact, Earl (2003:46) argues that "private actors – particularly private organizations – have an immense capacity to repress movements." Therefore, SMOs compete against various stakeholders to mobilize and achieve their objectives. In addition to opposing the power of the state, social movement activists also challenge similar groups with conflicting interests. SMOs are thus in opposition with a whole conflict system (Klandermans 1997) which includes SMO opponents and countermovements (Irons 2006).

Despite the dominant ideology shaping a society's structure and values, Stoddart (2007:208) explains: "Hegemony is always contested; we may only speak of the relative success of a particular hegemonic discourse." Reactions towards hegemonic discourse vary from compliance to resistance (Cheung and Ngai 2009). Carroll (2006:30) distinguishes between counter-hegemonic efforts promoting the collective acceptance to a different social order and anti-hegemonic work challenging the existing order while rejecting the idea "to construct a general interest." Scholars show that organizations respond differently to social control mechanisms. For instance, under increased scrutiny, employees can develop conformist, dramaturgical and/or

resistant survival strategies. Conformity reflects discipline and an ability to distance oneself from the issue. A dramaturgical response means managing emotions and behaviors to hide real feelings or goals. Resistance focuses on confronting and addressing the issue at hand (Collinson 2003).

Dominant actors engage in hegemonic processes when they want to control the social order but also when confronted by a social movement challenger (Cheung and Ngai 2009). Organized collective action can emerge to provide an alternative to the status quo. In fact, elements of hegemonic ideology can in themselves become the focus of opposing groups (Sallach 1974). Maney and colleagues (2005) identified three organized responses towards hegemonic cultural practices: 1) directly rejecting and attacking of such practices, 2) exploiting such practices to make them work in the opponent's favor, or 3) a combination of both previous tactics reflecting the complexity of opposing stakeholder dynamics. Interactions between hegemonic stakeholders and their opponents illustrate the difficulties in deciding strategies to confront the dominant ideology, especially since actors who challenge the existing social order can promote a hegemonic system of their own.

To reverse hegemonic trends, organized collective groups have access to diverse protest tools. "Repertoires of contention" refer to the series of tactical choices available to SMOs to address specific social problems (Tilly 1978, Tarrow 1998, Taylor and Van Dyke 2004). Typically, less powerful actors rely on unconventional or extra-institutional actions to challenge and articulate their grievances (Bräuer 2016, Taylor and Van Dyke 2004). As such, when defining new parameters for action, outside of the established social standards, SMOs can offer a different perspective to the dominant social order. In particular, disruptive tactics are effective in encouraging the lay public to think about a particular issue (Barnhardt 2014).

The choice of specific tactics to address an issue is intentional (Johnson and Ford 1996) and derives from the broader political structure (Rohlinger 2006). Protest is a dynamic process

emerging from the ongoing relationship between different political actors involved in a debate and the broader social context during which the protest occurs. Activists' strategic decisions reflect these ongoing interactions. Scholars highlight factors that affect the use of specific tactics such as the presence of antagonists and methods of repression, the availability of resources, the configuration of the social system and the ability to mobilize massively, and SMOs' identity traits and preferences (Boutros 2017, McAdam 1983, Polletta 2002, Polletta and Jasper 2001, Tilly 1978).

The literature about opposing stakeholder dynamics highlights the complex interdependence between various actors in a debate. Taylor, Rupp, and Gamson (2004:112) define tactical repertoires as "interactive episodes that link social movement actors to each other as well as to opponents and authorities for the intended purpose of challenging or resisting change in groups, organizations, or societies." Conflict with another movement strengthens the ties between the members of both groups as the values of the opposing movement contrast in a positive way from its antagonistic counterpart (Peleg 2000). In other words, interactions with antagonistic groups tend to reinforce people's attachment to their ideas and commitment to mobilization. Each actor thus benefits from the constant interactions with their opponents as ways to stimulate the debate and gain more control over the issue at stake (Meyer and Staggenborg 1996, Peleg 2000). As mentioned above, Rohlinger (2002) notes that opposing movements can exist within the same cultural resonance framework but some situations create opposing resonance narratives where social movement claims struggle to gain visibility. For instance, movements created by the elite, such the pro-nuclear movement, have easier access to resources to articulate their grievances (Useem and Zald 1982). Interactions between normative and oppositional groups reflect power differences in transmitting ideas about a contentious issue.

In this chapter, I reviewed the importance of political opportunity structures in understanding knowledge production. Openings and closing in the broader social context provide various sets of

circumstances for key actors in a debate. Opposing stakeholders can act upon existing opportunities to challenge or maintain the status quo and influence policymaking. However, from the above discussion, it appears that SMOs – or oppositional groups in general – can struggle to bring about social change when opposing hegemonic power. It can be difficult for actors in a marginalized position to construct visible claims and to produce their own alternative knowledge. Normative or dominant stakeholders have better control over emerging POS. Counter-hegemonic claims remain negligible, maintaining the power positions of knowledge producers and preventing an informed discussion with non-hegemonic experts.

I use the above literatures to address the process of knowledge production in the context of the nuclear debate in France. In particular, this project illustrates that the subordinate position of oppositional stakeholders, such as anti-nuclear activists, hinders their ability to produce nuclear knowledge. Normative control of POS leads to closed circumstances not conducive to social change. Narratives praising the benefits of nuclear energy dominating the French debate since the emergence of the nuclear program create a context that hinders the legitimacy of counter-hegemonic discourse despite its relevance. In turn, oppositional actors adapt their actions to account for these obstacles. Early and more aggressive attempts to challenge the hegemonic position of nuclear energy transformed into more timid resistance strategies. These highlight dramaturgical identity work among anti-nuclear activists (Collinson 2003, Cheung and Ngai 2009). French oppositional stakeholders adjust their strategies to match the obstructed context of the energy debate in France. By identifying and analyzing how opposing stakeholders make sense of the broader social context, this project highlights which strategies are available to various sets of actors to protect their knowledge and advance their position. Other theoretical perspectives (see for instance Domhoff's study of the ruling class in the United States (1967), Mills' discussion of the role of the power elite (1956), or Mizruchi's overview of interlocking directorates (1996)) highlight the decision-making power of elites. These powerful groups seldom

involve the general public, shape public perceptions, and protect specific interests. Considerations of these existing dynamics could be helpful in understanding aspects of the nuclear debate in France, especially regarding the structure of the nuclear industry itself. The hegemony literature provides a more accurate framework to understand the construction and dissemination of nuclear knowledge in France. Not only are normative stakeholders making important decisions regarding France's energy production, but they also participate in creating a sense of normalcy around the nuclear industry; defining nuclear energy as the default. The hegemonic perspective illustrates how entrenched beliefs about nuclear energy are to the point that public distrust toward the industry or the technology does not represent a threat to the existence of the civil nuclear program. In the next chapter, I review the research design for my project, describing the data collected and presenting my strategies for data analysis.

CHAPTER IV

RESEARCH DESIGN

The structure and embeddedness of the French nuclear industry makes it difficult for actors who contest the safety and benefits of nuclear power to successfully mobilize and articulate their claims. I make use of a qualitative methodological approach (Creswell 2009, Hesse-Biber 2010) to understand the complex nuances. Data derive from several sources: semi-structured interviews with key normative, oppositional, and unaffiliated stakeholders; archival material sent or given to me by participants; annual reports and other industry documents; articles from the mainstream French newspapers *Le Monde* and *Le Figaro* and online environmental newspapers*;* and participant observation during tours of nuclear power plants to provide a marketing-based understanding of normative narratives. I performed a qualitative content analysis of the interviews, systematically highlighting relevant messages (Hsieh and Shannon 2005), while using the archival documents to provide additional context to the participants' narratives thereby anchoring their responses into the broader French nuclear debate.

I conducted interviews in France, collecting data from a range of stakeholders. Participants were selected for interviews from the population of key stakeholders in the debate in France. Participants were identified through public internet listings of French anti-nuclear organizations and nuclear companies located in Drôme, Isère, Ardèche, Var, Vaucluse, and Rhône and through webpages operated by the key stakeholders themselves. Some participants were identified through other public listings associated with their occupation and/or current positions –

specifically respondents that are either anti-nuclear activists, politicians, or students and professors of the nuclear industry. Journalists who cover nuclear energy were contacted via email but did not respond. Respondent solicitation and recruitment occurred through e-mail and personal contact and followed established methods and IRB protocols (Approved IRB protocol number AS-15-114; see Appendix B). Recruitment through email is an effective way to contact potential participants who can reply when convenient for them (Redlich-Amirav and Higginbottom 2014).

Face-to-face interviews were collected in the southeastern regions of Auvergne-Rhône-Alpes and Provence-Alpes-Côte d'Azur including the Drôme, Isère, Ardèche, Var, Vaucluse, and Rhône departments, roughly south of Lyon following the Rhône River. There are four main nuclear facilities located in the region in addition to two former nuclear sites Creys-Malville (location of the controversial reactor Superphénix) and Marcoule (location of an accident in 2011 that killed one employee): Bugey (four nuclear reactors), St-Alban (two nuclear reactors), Cruas (four nuclear reactors), and Tricastin (four nuclear reactors). The proximity of several nuclear power plants as well as research centers and other associated facilities in the region imply that nuclear energy is well established. In turn, the number of nuclear sites facilitated access to various key stakeholders involved in the nuclear industry, including service providers for the main nuclear companies. Additionally, the diversity of nuclear facilities allowed contact with people involved in less well-known aspects of the field (nuclear research, education programs training nuclear engineers, etc.). When meeting face-to-face with the respondent was not possible I conducted Skype or telephone interviews with the identified key stakeholders. Skype, as well as telephone contact, has been shown to expand the boundaries of various groups of stakeholders "without decreasing the quality of the research." (Redlich-Amirav and Higginbottom 2014:11).

While face-to-face interviews represent the preferred way to record long and in-depth conversations about a specific topic, phone interviews provide quality data and represent a good

alternative when other forms of interviews are not possible or more difficult to achieve – for time and cost reasons for instance (Sturges and Hanrahan 2004). Phone and Skype interviews were useful to talk to people located outside of this key region. In particular, Paris is an important location for anti-nuclear activities from various anti-nuclear groups. Northcentral and northwestern France are also active centers for independent monitoring labs including IRSN (Fontenay-aux-Roses) and ACRO (Hérouville St Clair).

Following established protocols in sociological research, I utilized a snowball sampling technique for data collection (Berg 1988). Snowball sampling is a common sampling method used in social science research (Noy 2008). The research began with a few key informants identified through the sources listed above as well as my knowledge of the structure of the debate in my region. I then used snowball sampling to identify other pertinent respondents as this technique relies on social networks to isolate invisible participants (Browne 2005). As advised by Noy (2008:331), I did not use snowball sampling as a default sampling technique; in this project snowball sampling was used in "its own right and merit" to provide "a unique type of knowledge." The fragmented nature of the anti-nuclear coalition and the potential lack of trust towards outsiders can limit access to key respondents. A snowball sampling strategy allowed me to overcome these obstacles and to include additional subjects that I was not able to contact otherwise. For instance, I was able to interview a Greenpeace activist while I had trouble getting a reply when contacting Greenpeace through public listings. I was also able to interview less prominent but very experienced activists. For the purpose of this project, I conducted 27 semi-structured interviews with 28 respondents (13 normative respondents, 11 oppositional respondents, and 4 unaffiliated respondents identifying as neither pro- or anti-nuclear). Participants' demographics are summarized in Table 1 included below.

Table 1. Summary Demographics for Interview Participants

Position	Number	Average Age	Male/Female
Normative (N)	13	36.5	7/6
Oppositional (O)	11	59.3	6/5
Unaffiliated (U)	4	59.8	2/2

All information collected during one-on-one semi-structured interviews, with the exception of one interview conducted with two participants at the same time (U01 and U02), whether conducted in person, over the phone, or via Skype were digitally recorded. Interviews are a powerful tool to gain an in-depth understanding of a topic and its implications (see for examples Rubin and Rubin 2011; Schreier 2012). Semi-structured interviews are an important element of sociological research to produce powerful insights (Kvale 2006) as they are "strongly guided by the interviewee's perceptions, opinions, and experiences" (Cridland, Jones, Caputi, and Magee 2015:78). A standard technique in qualitative research, the interview style provides a basic interview outline, but allows the respondent to elaborate as he or she sees fit (Hesse-Biber 2007). Interviews were conducted in French and took place at a time and place convenient and confidential for the respondent. I conducted the interviews between June 2016 and March 2017.

An interview guide identifying key questions was prepared in advance (Cridland et al. 2015). Semi-structured interviews are adaptable and provide a good balance between letting the participant talk about their own experience as they see fit while, at the same time, addressing specific topics (Rabionet 2011). In this particular case, interviews were designed to highlight the key mechanisms of the production of knowledge about the nuclear industry and nuclear risk in France. Questions addressed different sections of the nuclear debate in France including power dynamics associated with nuclear knowledge and the potential strategies of different stakeholders

to articulate their arguments. Such questions highlight how opponents in a debate around a controversial technology create or navigate obstacles to maintain or challenge the status quo. Two sections of the interview outline addressed the strategies and challenges key actors make use of and experience in order to articulate and disseminate their knowledge about nuclear energy. Questions identified complex relationships between various actors to provide a better understanding of the structure of the nuclear debate in France. Similarly, the interview guide includes questions about the impact of the Fukushima nuclear disaster on the production of knowledge and the potential power mechanisms surrounding said dynamics. Other sections of the outline included a discussion of the respondent's background and personal involvement in, against, or in parallel with, the nuclear industry as well as relevant demographics. All interviews started with a "warm-up" question (Cridland et al. 2015) about the respondent's pathway to activism or current occupation. This question was designed to help establish trust and encourage participants be more comfortable about the interview process by taking about something they are familiar with. Attached is the associated IRB as Appendix B and the interview guide as Appendix C.

Interviews and participant observation

As illustrated in Table 1, respondents fall into three main categories: normative, oppositional, and unaffiliated. However, these categories are not homogenous. Tables 2, 3, and 4 included below provide specific information about each category of stakeholder and include the participants' organization or company, location, and nationality. Each participant also received a code name including a letter (N for normative, O for oppositional, and U for unaffiliated) and a number to identify individual voices in the analysis.

Table 2. Demographics for Normative Participants

Name	Company/Organization	Age	Sex	Nationality	Location
N01	Service provider	30	F	French	Cruas-Meysse
N02	Service provider	25	M	French	Marcoule
N03	Service provider	30	M	French	Lyon
N04	Service provider	26	F	French	Aix-Provence
N05	EDF	32	M	French	Saint-Alban
N06	Service provider	26	M	French	Aix-Provence
N07	Areva	48	F	French	Paris
N08	EDF	35	F	German	Cruas-Meysse
N09	Areva	57	M	French	Romans
N10	Areva	59	F	French	Saint Léomer
N11	Service provider	25	M	French	Aix-Provence
N12	Master's Program ITDD	50	M	French	Valence
N13	EDF	32	F	French	Chooz

Table 3. Demographics for Oppositional Participants

Name	Company/Organization	Age	Sex	Nationality	Location
O01	Sortir du Nucléaire	60	F	Japanese	Paris
O02	Observatoire du Nucléaire	52	M	French	St Macaire
O03	MAIN /Décroissance	63	M	French	Nogent-sur-Seine
O04	Sortir du Nucléaire	54	M	French	Paris
O05	Global Chance	79	M	French	Paris
O06	Coordination Antinucléaire du Sud-Est	65	M	French	Avignon
O07	Greenpeace	46	F	French	Paris
O08	Sortir du Nucléaire	50	F	French	Paris
O09	Green Party	64	F	French	Valence

O10	Sortir du Nucléaire	60	F	French	Grenoble
O11	Sortir du Nucléaire	59	M	French	Lyon

Table 4. Demographics for Unaffiliated Participants

Name	Company/Organization	Age	Sex	Nationality	Location
U01	IRSN	58	F	French	Fontenay-aux-Roses
U02	IRSN	55	F	French	Fontenay-aux-Roses
U03	ACRO	55	M	French	Hérouville St Clair
U04	Enfants Tchernobyl Belarus	71	M	French	Angers

Oppositional stakeholders differ in how they perceive the transition from nuclear energy. Some want an immediate nuclear phase-out while others are afraid that such a drastic transition will increase reliance on fossil fuels. They therefore advocate for an incremental dismantlement of the civil nuclear program. Some oppositional groups provide more structure and organize actions regularly, while other organizations are smaller or focus on specific forms of protest. Oppositional respondents are typically older than normative participants, reflecting the aging anti-nuclear movement. Many activists have been involved in the nuclear debate for many years and have witnessed the evolution of the anti-nuclear coalition.

On the other hand, normative stakeholders tend to be younger. Nuclear workers also have different opinions regarding the future of their industry and their assessment is less homogenous than expected, despite the presence of some recurring narratives. As illustrated in Table 2, with the exception of one respondent, all normative participants work for the nuclear industry. Despite the central role of the state in developing and overseeing the civil nuclear program, I was not able to interview government members. I contacted a local information committee (CLI) to interview a local elected representative but never received a response. Additionally, while the French

government still plays a major role in the energy debate in France, the recent status changes in the energy industry – the end of Electricité de France's energy production monopoly in 1999 and EDF becoming a limited-liability corporation in 2004 – highlight the central role of the industry in producing nuclear knowledge currently. Thus, I focused my efforts on talking with industry related stakeholders who are more: involved in day-to-day activities, aware of the inner-workings of the nuclear industry, and knowledgeable about the technology.

Representation of men and women in both categories is relatively equal: six male activists compared to five women and seven male nuclear workers compared to six women. Unaffiliated stakeholders belong to different organizations: two women working for the same institute and two men working for two different organizations. The women working for IRSN emphasize the fact that their lab was independent while both men wanted to be distinguished from anti-nuclear activism as their activity was often lumped together with oppositional actions. This again represents the diversity of stakeholders in the debate and the fragmentation of nuclear knowledge. Finally, I visited the Cruas-Meysse nuclear power plant, run by EDF, in July 2016. Located along the Rhône River, Cruas-Meysse started operating between 1984 and 1985 and includes four nuclear reactors. During the visit, I gathered documents available to the public. After the visit, I took notes and pictures outside of the power plants. Even if the visit was limited, it was informative to understand the inner dynamics of nuclear power plants as well as being exposed to public relations messages directly from EDF.

Archival documents and mainstream newspaper articles

In addition to interviewing key stakeholders, I analyzed various archival documents collected during the interview process and articles from mainstream media. Materials gathered during data collection were either given or emailed to me by participants or were published by the nuclear companies, EDF and Areva, or by ASN or IRSN. Documents provided by participants include articles, guides, as well as information pamphlets. Some anti-nuclear activists emailed me articles

and other materials they wrote for various outlets online and offline. Some anti-nuclear groups also publish a regular newsletter providing information about recent events or recommending books and articles to help better understand the debate. The artifacts illustrate the subjects' words and provide additional context and examples. Materials further show the stakeholders' strategies to disseminate nuclear knowledge through various channels.

Additionally, analysis of EDF and Areva's websites provides information regarding nuclear technology as both websites reflect the companies' vision regarding nuclear energy. I gathered data about information available to the public, including educational material, on EDF and Areva's websites. However, due to the recent changes in the structure of the nuclear industry, it was sometimes difficult to access information as some websites deleted older information. Recently created websites such as Areva's (www.orano.com) contained limited information and malfunctioning sections. I also reviewed the annual reports published by ASN and IRSN on their website. Annual reports are useful to get a better understanding of the knowledge regarding nuclear power plants that is accessible to the public. Similarly, IRSN publishes an annual activity report providing its view about a particular issue related to nuclear safety along with potential recommendations to improve the situation. Some of the reports are published in tandem with ASN. Thus, analyzing the reports published by ASN and IRSN provides a better understanding of the information available to the public as well as insights into the strategies crafted by normative actors to promote transparency and share information with the general public.

Finally, in order to provide context for the interview data, I also collected articles published in various print and online newspapers. I gathered articles from two of the main French daily newspapers *Le Monde* and *Le Figaro,* selecting the articles through LexisNexis using "nuclear" as a key word. The articles cover a six-year period between January 2010 and March 2016 in order to provide context about the situation in France as well as to take into consideration the impact of the Fukushima nuclear disaster on the production of knowledge. *Le Monde* and *Le*

Figaro are prominent French newspapers; they have the largest circulation among French general interest daily newspapers[4] with a paid circulation of over 260,000 and 300,000 respectively. *Le Monde* benefits from a strong reputation as a "newspaper of record" (Marchetti 1997:156). *Le Monde*'s coverage of controversial issues can set the tone for other media outlets as *Le Monde* is "able to influence others" (Blanchard 2010:333). Similarly, *Le Figaro* is considered a serious newspaper (Marchetti 1997). More specifically, *Le Figaro* can have an impact on the media response to a contentious debate as demonstrated by its role in the "infected blood" scandal in the 1990s during which the French organization for blood transfusion distributed blood contaminated with HIV to patients (Marchetti 1997). In addition to mainstream newspaper articles, I collected articles from an oppositional online newspaper to provide additional context regarding the publication of anti-hegemonic nuclear knowledge. Created in 1989 in a paper version, *Reporterre* sold 26,000 printed copies per month and had 4,000 subscribers until it was interrupted due to a lack of funding and switched to an online platform in 2007 (Kempf 2018). Archival documents and newspaper articles are useful in providing additional background information about the mechanisms of nuclear knowledge production among opposing stakeholders.

Coding and analytic strategy

For this project, I conducted a qualitative analysis of the main themes associated with the production of knowledge regarding nuclear energy in France. Qualitative research is useful to know "about what people actually say and do in specific places and institutions" including how relations between different actors develop (Goodwin and Horowitz 2002:35). Qualitative strategies allow for integrating people's knowledge into social research in order to provide a more complete analysis of the issue at stake. As such, a qualitative analysis of interview data is a "flexible and powerful tool to capture the voices and the ways people make meaning of their experiences" (Rabionet 2011:564) while focusing on content that is pertinent to the research

[4] http://www.acpm.fr/Chiffres/La-Presse/La-Presse-Payante/Presse-Quotidienne-Nationale

objectives (Schreier 2012). Specifically, my goal is to represent the complexity of the nuclear debate in France as experienced by the actors involved in it, through content analysis of the transcribed interviews.

Qualitative content analysis is a "systematic, rigorous approach" (White and Walsh 2006:41) used in several disciplines. It expands on the methods associated with quantitative content analysis which consists of quantifying similar ideas and concepts – whether explicit or implied – into categories for statistical analysis (Cho and Lee 2014; Hsieh and Shannon 2005). In itself, qualitative content analysis is defined as "a research method for subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns" (Hsieh and Shannon 2005:1278). The method is particularly useful to provide insight into how different aspects of an issue fit together. Coding and analysis processes are closely related in order to provide an accurate and multifaceted representation of the topic (White and Walsh 2006). Content analysis is appropriate to study the production of knowledge associated with nuclear energy in France because nuclear power is a popular topic as key stakeholders report challenges, innovations, threats, and opportunities as the debate unfolds. It is a useful tool to reflect the dynamics of information dissemination (Krippendorff 1989) and production (Riffe, Lacy, and Fico 2014), allowing for the analysis and interpretation of data (Shreier 2012) as well as rich and robust results (Elo et al. 2014).

I followed the data analysis protocol established by Cho and Lee (2014:10) by "selecting the unit of analysis, creating categories, and establishing themes." I coded the data using the software NVivo 11. First, I transcribed the interviews. Each interview was then uploaded into the software and coded separately. Reflecting the dynamic nature of the content analysis process, I then used a "deductive-dominant" qualitative content analysis approach as encouraged by Armat, Assarroudi, Rad, Sharifi and Heydari (2018:220). As noted by White and Walsh (2006), coding of qualitative data is shaped by the interview questions as well as by the answers provided by the participants.

Based on the knowledge of the literature, prior research on the nuclear debate in France, and on my notes taken both during the interviews and the transcription process, I used mainly a deductive approach to identify the main emergent themes, assigning interview data to these predefined categories (Cho and Lee 2014). I then conducted a thematic coding of the interview data. Emergent themes reflect the main topics discussed in the interviews such as strategies and tactics used by each group of stakeholders, opinions about public knowledge, dynamics of the debate, recent accidents, etc. However, I also allowed for additional themes to be included in the coding tree as necessary. Including a more inductive access into the coding process is helpful to account for "limited or fragmented" knowledge (Cho and Lee 2014:4). For instance, I included a "pathway" theme to better understand how participants ended up in their current position and "Superphénix," an anti-nuclear success, which was often used as an example to describe the inner workings of the French nuclear debate. Table 5 (below) provides a list of relevant themes used for analysis.

Table 5. Main Coding Themes for Analysis

Name	Description
	KNOWLEDGE PRODUCTION
Knowledge dissemination	References to nuclear knowledge dissemination
Public knowledge	Assessment of public knowledge of nuclear energy
Anti strategies	Oppositional strategies to produce nuclear knowledge
Pro strategies	Normative strategies to produce nuclear knowledge
Propaganda	References to propaganda messages
Jargon	References to the technical nature of nuclear knowledge
	STAKEHOLDERS
Stakeholders	
Anti **Ind** **Pro**	References to and descriptions of various stakeholders groups (oppositional, normative, and unaffiliated), together or separately
Status quo	References to the current position of normative stakeholders
Status quo anti	References to the current position of oppositional stakeholders
	STAKEHOLDER DYNAMICS
Dynamics	Dynamics between stakeholders
Inequality	Power differences between stakeholders

CHARACTERISTICS OF THE FRENCH NUCLEAR DEBATE	
Politics	Role of politics in shaping the nuclear context
Media	Role of media outlets in the French nuclear debate
Military	Discussion of the military nuclear program
Money	Cost of the civil nuclear program in France
Normalization	Normalization of the civil nuclear program in France
Secrecy	References to the secretive nature of the nuclear industry in France
Risk	References to risky nuclear technology and/or power plants
Safety	References to safe nuclear technology and/or power plants
KEY EVENTS AND ISSUES	
Accidents	
Chernobyl	
French power plants	
Fukushima	References to nuclear accidents in general or specific events
Future problems	
Mayak	
Three Mile Island	
Fessenheim	References to the Fessenheim power plant
EPR	References to the new reactor under construction in Flamanville
Superphénix	References to Superphénix
Waste	References to nuclear waste issues
BROADER PICTURE	
International	
China	References to international relations and/or other countries' civil nuclear programs
Germany	
United States	
Future	References to the future of nuclear energy in France or globally

While I read each interview transcript line-by-line, my unit of analysis is a "meaningful, undivided" entity (Chenail 2012:268) separating elements as a participant develops a complete thought. This choice reflects the importance of relevant segments for the analysis. After coding the interviews, I conducted a thematic analysis of the coded data to discuss the mechanisms of knowledge production. Thematic analysis is useful to establish and reflect on systematic arrangements in the data (Costa, Breda, Pinho, Bakas, and Durão 2016). In addition to the qualitative analysis of the interviews, I similarly conducted a thematic analysis of the archival material, newspaper articles, and documents collected during the research process. Again, I

identified the main emergent themes in the various brochures and pamphlets provided by the participants and included them to the relevant section in the analysis to support findings from the interviews – employing triangulation as a way to strengthen the findings of a qualitative content analysis (White and Marsh 2006).

Strengths and limitations

My project has several strengths and limitations. First, I was able to collect data from various sources allowing for a more complex and comprehensive analysis of the production of knowledge associated with nuclear energy in France. Interview strategies provide the ability to gain in-depth insight into the underlying mechanisms of a controversial issue while allowing different respondents to express their opinions. Interviews with a variety of stakeholders account for the complexity of knowledge production. In-depth conversations with the key stakeholders assist in identifying additional emergent themes and issues based on personal experience. Participants discuss familiar issues extensively from waste management to energy consumption offering insights into the underlying facets of the nuclear debate that might be central to some actors while being insignificant or trivial to others. I was able to interview individuals who have been involved in the nuclear debate for a long time. Their extensive experience provides additional historical context to the current structure of the nuclear debate and is helpful in understanding current dynamics between normative, oppositional, and unaffiliated stakeholders. Similarly, additional documents provided by participants offer context regarding the nuclear debate in France while going into the strategies of knowledge transmission in depth. By relying on a variety of data sources, I am able to compare and contrast the different narratives in order to provide an analysis that better reflects the reality of the nuclear debate in France. Interviews reflect a representative sample of key oppositional stakeholders as final recommendations mentioned individuals that I had already contacted or interviewed and coding showed signs of saturation.

Limitations included difficulty in gaining access to some key normative stakeholders such as EDF's communication department and ASN, highly hierarchized oppositional groups such as Greenpeace, as well as government representatives. Highly strategic industries restrict access to certain departments regarding the potentially sensitive nature of the information shared with the interviewer. In particular, major nuclear industry stakeholders might be reluctant to speak on behalf of their company. However, because of the close connection between IRSN and ASN, the IRSN interview accounts for the missing ASN interview. I also use the information emailed to me by ASN's PR department to supplement the interview data.

My interviews of normative respondents do not include government representatives. The state plays a central role in shaping the development of the civil nuclear program in France and the state and industry are often intertwined and collaborate closely. As such, they often have a similar discourse regarding the importance of nuclear technology in France. Nuclear companies engage in supporting nuclear energy at a time when efforts to reduce nuclear reliance arise within the French political landscape (see for instance Baudet and Bezat's article published in *Le Monde* in 2014 discussing support for reducing by 25% the share of nuclear energy in the energy production process). Moreover oppositional groups primarily target nuclear companies with their actions. Therefore, dynamics between opposing stakeholders of the nuclear debate in France highlight the antagonism between industry representatives on the one hand and activists on the other hand.

Another limitation of this project includes the translating process. Interviews were conducted in French and transcribed verbatim. I then translated the quotes from the interviews and the documents myself into English. My goals, which guide my translating choices, are to accurately represent the voices and stories of the respondents and to minimize content lost in translation. While I have experience translating French into English, it is challenging to translate all the nuances from one language to another, especially as respondents speak passionately about the

issue at hand. In the next chapter, I discuss my findings starting with the analysis of political opportunity structures surrounding the nuclear debate in France. Specifically I highlight how these POS shape both the dynamics between key stakeholders and the production of nuclear knowledge.

CHAPTER V

"IT IS A STATE RELIGION': CONTROLLING OPPORTUNITIES AND THREATS IN THE FRENCH NUCLEAR DEBATE

In this chapter, I discuss how political opportunity structures affect normative, oppositional and unaffiliated stakeholder groups involved in the debate over nuclear energy in France. I consider how the opportunities shape the diffusion of nuclear knowledge. Not only do interactions between opposing actors highlight power mechanisms at play in the maintenance of nuclear energy as the dominant source of energy in France, but also changes in the broader social context shape relations between key stakeholders. I ask: How have political opportunities influenced stakeholder dynamics and nuclear knowledge production in post-Fukushima France? I first outline central POS shaping the context of nuclear knowledge production in France from the creation of CEA at the end of WWII to the recent nuclear disaster in Japan. I then discuss how these POS influence stakeholder dynamics focusing on tensions and access to resources. Finally, I examine how the production of nuclear knowledge is affected by broader opportunities and threats.

"France's greatness is the atom": From energy independence to Fukushima, political opportunities in a nuclear reliant context

Historical decisions regarding the choice of energy production program in France still influences current discussions about electricity production. Acceptance of the civil nuclear program is rooted in political decisions that shaped the French industrial landscape for decades. Emerging opportunities and threats for opposing stakeholders depend on the continuous construction of support for a powerful nuclear energy regime. Regardless of their opinion regarding nuclear energy, most respondents interviewed for this project believe that historic government oversight of the nuclear program constantly constrained the energy debate. The involvement of public authorities is the primary guiding principle of the development of the nuclear industry (Dänzer-Kantof and Torres 2011). State-owned or state-affiliated entities remain prominent actors in the energy debate. Research organizations such as CEA cultivate the idea that nuclear technology is a French technology. One respondent, active in the nuclear debate since the 1970s explains: "there is a great mythology in France that nuclear energy is a French matter" (U04, Enfants Tchernobyl Belarus, unaffiliated).

It is difficult to organize an effective alternative response to the civil nuclear program because of the state's stronghold on nuclear technologies and its on-going willingness to maintain the hegemony of nuclear energy. When talking about the role of the state in promoting nuclear power, one interviewee points out that "the nuclear industry in France is like a national interest" (O09, Green Party, oppositional). Nuclear energy is more than an energy source. It allows France to stand out internationally. An experienced anti-nuclear activist explains what is at stake when it comes to the civil nuclear program: "France differentiates itself with nuclear power, in other words, it highlights that it is very good in terms of manufacturing nuclear reactors, that it knows how to manage, that it can sell nuclear reactors to all the countries that ask, etc." (O10, Sortir du Nucléaire, oppositional),

In fact, there is continuous normative support for the civil nuclear program based on many advantages provided to France as a government-supervised program. The close ties between the

state and the nuclear industry are perceived as a competitive advantage. When asked whether the close connections between nuclear companies and government is a good idea, a nuclear executive explains that "the nuclear industry as it is managed in France is rather well managed in the sense that there are only a few private companies" (N09, Areva, normative). Public management of the industry is a strength for the French civil nuclear program. As such, decisions taken by the government regarding the energy program were made with France's, and by extension its population's, best interest in mind. When talking about how the state shapes energy policies based on resource availability, a nuclear engineer rationalizes France's choice of nuclear energy: "France is not endowed with oil, very little in the end with coal, and not much with gas, I believe that the decisions that were taken in the 1970s to launch, eventually, this nuclear campaign to make France more independent of its energy exports was a rather wise decision" (N07, Areva, normative),

With the exception of the government wanting to reduce France's nuclear dependence, the political dimension of nuclear energy mostly strengthens the civil nuclear program and encourages nuclear expertise and safe nuclear practices. Normative stakeholders, in particular, never question the initial decision to start the program. As a now well-established industry, decisions to significantly reduce the civil nuclear program seem irrelevant. When asked to provide an opinion about France's energy policy, another nuclear engineer describes the challenges associated with transitioning to a different energy program, "It's complicated, in fact, to change in a few years or decades, the policy that has been conducted for almost 100 years" (N08, EDF, normative). This is especially true since France is facing some economic difficulties and people worry about future economic implications. Continuous reliance on nuclear energy would protect employment opportunities. Several respondents address the importance of the nuclear industry in terms of providing jobs, as illustrated by this quote from a nuclear engineer: "It's an employment crisis, there is a lot of unemployment, etc. If we want to shut down the

nuclear industry, there are still a lot of jobs that are created thanks to that. And that, I think we tend to forget about" (N13, EDF, normative).

When oppositional stakeholders question nuclear energy, they attack a national symbol. Opportunities provided by nuclear technology trump any attempts to address its dangerous outcomes or to envision a different energy program. Almost sacred, the civil nuclear program occupies a special place in France's economic, political, and social sectors. Oppositional and unaffiliated stakeholders alike recognize the peculiar nature of the nuclear industry describing it as a "religion" or a "state religion" (O01, O09, U03, and U04). One respondent actively involved in the debate since the 1970s addresses the untouchable aspect of nuclear energy explaining that this is why French intellectuals have historically been silent about the civil nuclear program, "We do not talk about these things. It is a state religion. If you talk, you are verging on being a heretic, it's dangerous. You are on thin ice risking to fall flat on your face" (U04, Enfants Tchernobyl Belarus, unaffiliated). The ideological work surrounding nuclear technology reinforced by the close ties between government and industry explain the lack of success of the anti-nuclear coalition. For instance, when asked about the best strategy to challenge the status quo, one anti-nuclear activist who works for a small anti-nuclear group after being fired from Sortir du Nucléaire in 2010 observes,

> We have been protesting against nuclear energy in France for decades. We had sometimes gigantic demonstrations. 70,000 people, etc. And that did not change anything. Because, well, nuclear energy in France, nuclear energy is the state, the state is nuclear energy. France's greatness is the atom, whether it is the atomic bomb or nuclear power plants (O02, Sortir du Nucléaire, oppositional).

Nuclear companies and the state work hand in hand to promote the civil nuclear program leaving little room for alternatives to emerge. Narratives challenging the benefits of nuclear energy

represent an opposition to join political and industrial efforts to maintain the nuclear industry in center stage in the larger French industrial landscape. Because nuclear energy has important economic and strategic outcomes, the different stakeholder groups recognize the role of politics in shaping energy policies and the openness of the nuclear context in France. On the one hand, normative stakeholders mostly praise the political decisions leading to the emergence of a strong civil nuclear program while, on the other hand, oppositional actors regret a closed situation arguing that conditions prevent a real debate from happening.

Emerging opportunities and threats unfold within a context that normalizes both nuclear risk and the existence of nuclear energy as a reliable and cheap source of electricity. Present in mainstream media (Schweitzer and Mix 2018), the normalization of nuclear risk is embedded in operations comparing nuclear industry to other established – and less controversial – industries. Nuclear advocates construct acceptable representations of nuclear risk to dismiss counter arguments about the dangerousness of nuclear energy In particular, normative stakeholders relay messages about the safety of their field. For instance, when asked if people mystify the nuclear industry, one technician working at the nuclear power plant in Cruas explains,

> It's true that it's a shame not to talk [about the nuclear industry] all that much. For example, you take any company, for example Lafarge[5], I do not know what happens in there. [...] When it comes to safety risks, they must have the same, more or less. But hey, it can be interesting to know what's going on (N01, service provider, normative).

Dynamics between opposing stakeholders are shaped by a context that justifies the normalcy of nuclear practices and their risks. As "acceptable risks are ultimately accepted risks" (Beck

[5] Specialized in cement, construction aggregates, and concrete and a major company, Lafarge is another major employer in Cruas.

1992:102), it becomes more difficult to challenge the relevance of the French nuclear program because normative actors and experts minimize the uniqueness of nuclear risk. POS tend to put things into perspective, leading to nuclear acceptance showing that the general public is more lenient towards other fields such as the petrochemical industry even though these industrial activities represent a risk for human health or the environment. When discussing tedious work constraints, one nuclear engineer describes the double standards applied to nuclear energy, "The petrochemical industry, we do not talk about them, but there are risks that are just as important for health. There are gases, dangerous products. However we do not make a fuss over it" (N06, service provider, normative). Similarly, a nuclear manager mentions how chemical companies are responsible for polluting the Rhone Valley releasing PCBS into the water making fish "unsuitable for consumption" (N05, EDF, normative).

It does not matter that the practices described are dangerous and harmful. The important part is that nuclear risks become commonplace because they are equivalent to mainstream industrial problems. It becomes more difficult to challenge the relevance of the French nuclear program because experts minimize what makes nuclear technology unique. One participant working for a major nuclear company points out that dangerous accidents also happen with less controversial technology: "We talk a lot about nuclear problems. We talked a lot of talk about reactor vessel problems, welding problems, accidents, and so on. These topics, they exist in all industries" (N07, Areva, normative).

Government choices in the development of the civil nuclear energy program not only allowed for the prominence of nuclear companies but also provided opportunities for connecting nuclear technology to other industrial activities which furthers the ascendency of nuclear actors. By emphasizing applications that go beyond the civil and military usage of the technology, normative stakeholders integrate nuclear energy into the entire French industrial structure. Nuclear power is much more than electricity. Nuclear technology is versatile, making it useful for various activities

not necessarily related to energy production. For instance a senior executive explains that "nuclear technology can be used for something other than killing people" (N09, Areva, normative) describing the medical and electronic applications of nuclear technology with medical targets and boosted silicon parts for computers. The nuclear manager mentioned above further explains that MRIs also use radioactive solutions which result in radioactive waste (N05, EDF, normative).

Because other industrial risks or waste rarely lead to the dismantlement of the industry held responsible for creating them, nuclear energy should be considered like any other industry in the French economic, political, and social landscape. In fact, one former nuclear executive explains that the nuclear part of nuclear energy production is very limited. The rest of the production process relies on technologies that are more traditional, "Which part is nuclear? It's the core! Which part is complex? It's the core! The rest, listen, it's all about mechanics. Metal fabrication, that's it. So with extremely drastic standards, I agree. But otherwise it's a boiler. You install a thermal [power plant], it's the same thing" (N10, former Areva, normative).

The dominant discourse that shapes the nuclear context in France defines the state of the nuclear industry as the model industry, especially when it comes to understanding and protecting against risks. The nuclear industry sets the standard as illustrated by the following comment from a graduate advisor in a nuclear engineering degree program advocating for other industries to improve their safety and their transparency. Talking about the explosion in a chemical factory in Toulouse that killed 29 people in 2001, the respondent argues that "the chemical industry should be supervised for example, as supervised as the nuclear industry is" (N12, Master's program ITDD, normative).

Comparing the nuclear industry to other accepted industries and transforming nuclear risk into commonplace occurrences further consolidates the hegemonic position of the nuclear industry

and limits opportunities to challenge the status quo. As a result, I partially disagree with Lebeau's (2012) argument regarding how difficult it is for the general public to accept nuclear risk. The French nuclear context maintains a positive image of the nuclear industry and its main actors. Oppositional actors find themselves in a difficult position when their opponents set the stage for denying counter-arguments even when events that could challenge the status quo emerge. Regardless of the context, normative stakeholders control the debate.

The 2011 nuclear accident in Japan highlights at the same time the unavoidability of nuclear catastrophes and efforts to minimize the dangerous outcomes of nuclear energy production (Perrow 2011, Perrow 2013). One of the largest nuclear catastrophes affecting the surrounding environment and population, the 2011 Fukushima nuclear disaster encouraged several countries like Italy, Germany, and Switzerland to stop their civil nuclear programs (Kennedy 2011). France, however, remains attached to nuclear energy. Despite wanting to reduce nuclear dependence, France has no plan to lower its nuclear energy production below 50% (Broomby 2014). Within the French context, the Fukushima disaster has a different meaning, simultaneously highlighting the specifics of the Japanese catastrophe itself and reaffirming France's nuclear expertise.

While, the fear of nuclear risk historically represents a central element of the oppositional discourse, magnified since the Chernobyl disaster (Labbé 2003), addressing nuclear safety with the general public remained secondary for normative actors in France. Even after the Chernobyl catastrophe, communication about nuclear energy avoided discussion of nuclear risk (Stuart 2017). When discussing the 2011 Fukushima catastrophe, normative stakeholders tend to describe the event as a natural disaster instead of a nuclear disaster associating the melting of the core and other problems in the reactors with the earthquake and the tsunami. When asked about the international consequences of Fukushima, one interviewee working for one of the main nuclear companies describes the natural character of the catastrophe,

> But, once again, when we talk about Fukushima, we talk a lot about the nuclear accident, but even so we forget to remember the circumstances under which it happened. It was an earthquake, it was a tsunami. Really, there was a natural disaster that, indeed, led to a number of drifts. Often, we forget to remember that it happened under these circumstances (N07, Areva, normative).

Similarly, another participant discussing the context of the catastrophe emphasizes how natural forces shaped the accident,

> When it comes to Fukushima, people, the general public, confuse the earthquake, with its consequences which destroyed a part of a region and which – after there was the tsunami – caused the accident. [...] But it's not the power plant that caused the whole thing. First there was an earthquake (N12, Master's program ITDD, normative).

Presenting a nuclear catastrophe as natural is important from a normative perspective. If Fukushima is caused by natural factors then nuclear technology itself is not responsible for the catastrophic and long-term consequences of the disaster. The "natural" and "technological" aspects of the Fukushima Daiichi disaster are rarely combined to understand and address new emerging risks associated with natech accidents. "A natech event is a technological disaster triggered by any type of natural disaster" (Cruz, Steinberg, and Vetere-Arellano 2006:486). Challenging the perception of natural catastrophes as inevitable, natech disasters highlight how natural events are embedded within social structures and as such these events affect industrial facilities potentially leading to technological outcomes (Gill and Ritchie 2018). As concerns about natech risks arise, updated risk assessments and management efforts could lead to greater safety and an improved stakeholder involvement (Cruz 2012; Gill and Ritchie 2018). However, these discussions remain limited (Cruz 2012; Cruz et al. 2006) and France continues to draw a

clear dividing line between natural disasters and technological disasters. Therefore, it becomes more difficult for oppositional actors to challenge the hegemony of the industry, the natural context in Japan being very different from France and natural events being perceived as "unpreventable and beyond human control" (Gill and Ritchie 2018:41). The opening provided by a nuclear disaster is transformed into an opportunity to promote the French nuclear industry.

Rationalizing the cause of the disaster participates in maintaining the hegemony of nuclear energy by distinguishing France from Japan and reinforcing the idea that nuclear energy is the right choice for France. As such, the circumstances leading to the melting core in the reactors of the Fukushima Daiichi power plant are specific to Japan. Geographic differences between France and Japan play an important role in the way the Fukushima accident is presented. Comparing and contrasting the seismic characteristics of both countries, one nuclear engineer who works for one of the main nuclear companies explains why such an accident could not happen in France,

> In fact, what happens is that, because of [the catastrophe], there have been studies that have been conducted on earthquakes and we understand that, whether we are in Japan or we are in France, we are not affected by the same amount of earthquakes. It's not the same consequences. We do not have the waves, etc. (N13, EDF, normative).

These narratives reflect a deep trust in French nuclear technology. Normative stakeholders appear confident in the French nuclear industry's ability to handle hazard events and avoid a nuclear disaster. During one interview, a respondent encouraged people to join the nuclear field, confidently expressing opinions about the natural aspect of the disaster. One former nuclear executive further describes confidence in nuclear energy: "Fukushima, I'm sorry, in France, would not have happened. Let's say because we would have reacted totally differently" (N10, former Areva, normative). Confidence in the ability to control nuclear energy is associated with

the historic idea of French nuclear know-how. Developed as a way to demonstrate France's advanced technological expertise, the current civil nuclear program represents industrial and scientific prowess by the engineers working in the industry. For instance, one nuclear engineer reinforces the concept of France's nuclear expertise when addressing the occurrence of nuclear incidents,

> It is a one-off occurrence anyway and of course, for example, Fukushima, there was a natural event, there is nothing we can do about it. Chernobyl, it is a human error because we did not know enough. In France, I think we are more serious about that so that human error does not cause what happened there (N04, service provider for EDF, normative).

While continuously arguing against the technological aspect of the Fukushima nuclear disaster, normative stakeholders point out how the catastrophe has shaped – and improved – recent nuclear safety policies. In 2012, ASN created a "national plan of action" (Niel 2013:31) to reinforce protection of nuclear reactors in France. Nuclear workers use this plan as an example to illustrate France's willingness in improving nuclear safety through the years. For instance, when talking about nuclear accidents such as Chernobyl or Fukushima, one respondent explains,

> We should talk about the fact that, indeed, there is no such thing as zero risk. But, I still think that in France, after taking classes about it, we do everything we can anyway as much as possible to avoid it happening, now and in the years to come. Nevertheless, some progress has been made in terms of safety (N02, service provider, normative).

According to pro-nuclear actors, the 2011 nuclear disaster in Japan might benefit the French nuclear industry by improving the safety and security of various nuclear facilities. When

discussing media coverage at the time of the disaster, one nuclear engineer points out the advantages of public scrutiny regarding nuclear safety,

> I think that regarding the general public it revived the global anxiety. However, I think that it was a good thing to the extent that the nuclear safety authority, and therefore the government, implemented safety policies and that re-launched the study especially with the engineering companies like ours to have safety review missions regarding power plants. I think it created jobs anyway. [...] And the fact that we ensure the safety of our power plants I think it is a positive point anyway (N11, service provider, normative).

Nuclear accidents and disasters are normalized and their causes are rationalized, encouraging public acceptance. Even in the wake of catastrophic events, the dominant discourse provides support for nuclear energy connecting innovative success to economic success (Schweitzer and Mix 2018). Along with a normative discourse emphasizing the issues with giving up nuclear energy, the normalization of nuclear risk helps reaffirm the necessary dominant position of nuclear energy and lessen the ability to engage in a debate regarding alternative sources of energy.

"I am anti-nuclear, so really, it's terrible": Tensions, control, and ridicule, in how POS influences stakeholder dynamics

Because of important economic, political, and social outcomes, the energy debate in France incites conflicts and tensions between different groups of actors. Dynamics between normative, oppositional, and unaffiliated stakeholders reflect power differences in the way participants take part in the production of nuclear knowledge. Representatives of the status quo remain in a dominant position dismissing opposing ideas. The hegemonic discourse about nuclear energy warns about inconsistent oppositional arguments merely extrapolating pro-nuclear ideas. When

asked about the issues of aging reactors and nuclear waste, the director of first year students in a graduate nuclear engineering program argues that anti-nuclear activists do not have any arguments of their own: "It's not their arguments that's the arguments of the nuclear industry. Everyone knows that nuclear waste has to be handled properly, that it is a long-term problem. This viewpoint brings nothing to the debate. Aging power plants, it brings nothing either" (N12, Master's program ITDD, normative). The French nuclear context favors the rebuttal of anti-nuclear ideas creating a system that does not set an alternative, yet valid, perspective on an equal footing.

Oppositional actors do not have access to the same areas and do not have the opportunity to talk to the same people as their normative counterparts. Normative stakeholders benefit from their institutionalized position as they can exclude their opponents from participating in certain actions. For instance, when asked about interactions with anti-nuclear groups, the director of first year students explains that the school never invites anti-nuclear experts to talk to future graduates: "We do not want them to come and teach for the Master's program. Not that they are banned from anything, but it is about having experts and not people coming to, say, try to convince anyone" (N12, Master's program ITDD, normative).

Stakeholders who challenge the status quo constantly struggle to gain access to mainstream outlets or to guarantee the veracity of their claims. The French nuclear context represents an uphill battle hindering the credibility of narratives that challenge the hegemony of nuclear energy. Normative stakeholders undermine the legitimacy of anti-nuclear narratives relying on institutional networks. Access to mainstream media is often limited. For instance, one activist describes how the dominant pro-nuclear discourse affects various institutions,

> We are dealing with an intense and permanent ideological and political struggle. […]The media, unions, political parties. In other words, all the institutionalized

> forms or organizations of society have been harnessed and/or situated themselves in backing this denigration propaganda of anything that can be considered a criticism of atomism, of nuclear power (O06, Coordination Antinucléaire du Sud-Est, oppositional).

Access to mainstream institutions such as media outlets is important in challenging the status quo. Silencing opponents marginalizes their position and participates in creating a context where only one version of the issue exists. Such strategies have been useful in weakening the French anti-nuclear movement which has to create its own publications to spread its messages. Typically, oppositional websites and publications do not have the same impact as mainstream media outlets. An established ecological newspaper*, Reporterre* tried "to inform about the connections between the ecological crisis, social injustices, and liberties threats" (Reporterre 2019). *Reporterre*'s current editor-in-chief left *Le Monde* in 2013 because of censorship issues regarding the coverage of key environmental issues (Kempf 2013). This situation reflects the difficulty to challenge hegemonic information in mainstream media. However, despite free access to their content and an in-depth analysis of contemporary environmental issues, the *Reporterre* website consists of 23,000 visitors per day - far behind the most popular French websites. *Global Chance* is another example of a publication that transferred from print to online after 23 years and 37 issues (Global Chance 2018a). Many oppositional groups have their own newsletters but the diffusion remains limited, as people have to undertake the process of signing up for the newsletter. Moreover, the purpose of such bulletins is different from articles published in other media outlets. Useful to keep track of a group's actions and publications, these newsletters are designed to maintain engagement, not to mobilize new members. As such, the general public remains unaware of anti-nuclear narratives written directly by oppositional actors.

While silencing strategies have been effective for decades in limiting the media exposure of nuclear detractors, institutionalized actors also actively target oppositional organizations.

Typically, radical actions such as trespassing on nuclear power plants are sanctioned and activists arrested and prosecuted. However, other forms of protest are also punished. By monitoring their actions, normative stakeholders limit the diffusion of dissenting attitudes. For example, in 2011, EDF was found guilty of spying on the environmental group Greenpeace by a French criminal court (Le Monde 2011). Relying on recent terrorist attacks to justify police searches, one anti-nuclear activist provides a recent example of how authorities undermine their antagonists,

> After, the attacks in France, last November's attacks, they placed environmentalists under house arrest [...] Just because they were environmentalists, from the green movement, they were banned. Cops came to take their computer. It had nothing to do with the attacks. But in France, we took advantage of the opportunity to block environmentalists, posing them as potential terrorists. Really unbelievable! (O08, Sortir du Nucléaire, oppositional).

Directly targeted by normative actors who tapped their electronic devices and arrested them for publishing secret documents, another respondent describes spying tactics to destabilize oppositional groups. In that case, state and industry worked together to intimidate an activist,

> It is absolutely shocking that an electricity producing company – EDF – cooperates with RG to spy on a citizen, etc., and then probably participates in a destabilization campaign since I was arrested by the DST [domestic intelligence agency]. They stole all my computers, etc. [...] I think that when the nuclear industry thinks the situation requires it, they do what they need to stop the activities that are bothering them (O02, Observatoire du Nucléaire, oppositional).

If the state believes that an anti-nuclear activist represents a threat for national security it can include their name to a national safe file. While having one's name on that file does not give law enforcement permission for arrest, it authorizes keeping the person of interest under surveillance

(Laurent 2015). Overall, threats and denial of claims tend to reinforce oppositional involvement. Oppositional actors who have been protesting continue to mobilize despite various attempts at intimidation. Activists are proud of their engagement. Facing resistance from normative stakeholders is evidence of the validity of their claims. For instance, when asked if the main nuclear companies prevent oppositional groups from organizing, one interviewee observes,

> We cannot say that they prevent me from talking since I'm talking about [nuclear energy]! I am talking about it, I am writing about it, whenever I am asked to give a lecture or debate, I talk about it. But, of course, they explain to everyone that I, for example, I am anti-nuclear, so really, it's terrible. Since I worked for the CEA it's even more terrible. I am a total traitor (O05, Global Chance, oppositional).

These strategies have the ability to prevent new adherents from joining oppositional groups. Specifically, anti-nuclear organizations have trouble recruiting young members, leading to an aging movement. At the same time the nuclear industry embarked on a large recruitment campaign with intent to appoint 8,000 new people each year between 2010 and 2020 (Basic 2018). Normative stakeholders carefully control interactions and the debate over nuclear energy altogether.

By silencing oppositional groups and excluding them from the debate, direct interactions between different groups of actors are limited – especially contacts between oppositional and normative stakeholders. Often, despite a few key actions, oppositional actors do not interfere with the life or work of normative stakeholders. When discussing how often they see activists protesting nuclear energy, an engineer explains that anti-nuclear groups are visible during rare high impact operations and usually they stay away from the power plant's premises,

> We do not really deal with them because a nuclear site is very protected. So in order to enter, you need a badge, there are security gates, metal detectors, etc.

> Not everyone is allowed in the site. It's very protected. These people, if we see them, it is generally outside, when they come to protest or things like that. But we do not have any direct contacts with them. (N13, EDF, normative)

The French nuclear building infrastructure leads to a physical separation between normative and oppositional actors. Industry workers and activists rarely meet as they interact with different social actors. In particular, the nuclear industry does not try to communicate with nuclear skeptics. One nuclear engineer recalls a time when anti-nuclear activists entered a nuclear power plant: "I never talked to them. I see them more on TV. In the end when we often see them, it's on there [media], after their actions" (N06, service provider, normative). Interactions between normative and oppositional sides of the debate are sporadic and face-to-face confrontations happen on an individual basis during major anti-nuclear campaigns or special events. One activist describes conversations with EDF and Areva working at their organization's booth during Solidays, an annual music festival. These brief meetings are superficial and do not participate in moving the nuclear debate forward. When talking about previous encounters with anti-nuclear activists, one participant who works for a nuclear company acknowledges the short nature of their exchanges: "I had been given a pamphlet in the street by Greenpeace, and then we had a little talk. They asked me what my job was, so we debated calmly, in the street. So, it was interesting. But, no, otherwise, no contact with these people." (N03, service provider, normative)

Despite limited contact, normative stakeholders continue to constrain their opponents' operations. In addition to silencing the opposition, nuclear energy advocates continue to control the debate limiting the influence of anti-nuclear actions. Oppositional stakeholders argue that their opponents co-opt some anti-nuclear groups. Co-optation happens when institutionalized actors acknowledge and accept the existence of previously excluded groups in exchange for less challenging actions. Co-optation can open new spaces of dialogue for social movements but co-

opted groups are less likely to confront their opponents directly (Gamson 1975, Jaffe 2012, Trumpy 2008).

Co-optation can be a useful tactic for normative actors to control the debate and to channel critiques. Active oppositional groups are more likely to be targeted when their influence increases. In 2010, tremendous organizational changes transformed the main French anti-nuclear network Sortir du Nucléaire after it gained momentum at the beginning of the 21st century. This reorganization and the departure of key activists altered its strategies and plan of action. Some argue that such a transformation is the result of co-optation forcing the anti-nuclear coalition to back down on key issues such as the terms and conditions of the nuclear phase-out. For instance, a former Sortir du Nucléaire activist explains,

> Without saying that we were shaking the nuclear lobby, that's a bit much – they are such powerful people – but we were starting to really get in the way. […] So everything stopped. So, there is now a very sweet and not much else network, Sortir du Nucléaire, that is conducting its little demonstration from time to time, without a lot of people, that is sending some assuaging documents about an alternative using renewable energies within 30 years and things like that. You see? Everything was pacified. (O02, Observatoire du Nucléaire, oppositional)

While anti-nuclear groups can be included in the mainstream debate, unaffiliated actors are more likely to be the target of co-optation strategies as part of research committees or work groups. While some unaffiliated actors seize these opportunities to strengthen and further legitimize their narratives as they want to "continue to work with each other" and "to stay on good terms with everyone" (U04, Enfants Tchernobyl Belarus, unaffiliated), others remain skeptical of these advisory positions. Any cooptation or attempt at institutionalizing an organization can be perceived as a threat to the integrity of anti-nuclear actions as explained by this comment from an

anti-nuclear activist: “Like ACRO, for instance, it is also part of IRSN's scientific committees. Some anti-nuclear activists accuse them of being collaborationists.” (O01, Sortir du Nucléaire, oppositional)

Nuclear expertise is traditionally associated with institutionalized nuclear organizations such as EDF and CEA until the emergence of a “counter-expertise movement” in the 1970s (Topçu 2008:226). During the early stages of France’s nuclear program, the public maintained trust for the experts who construct and control the knowledge associated with nuclear technology (Bess 1995). Early attempts to challenge official nuclear knowledge through independent labs confused normative stakeholders. The founder of one independent lab created after the Chernobyl disaster explains: “But it's a world, if you like, that has not been accustomed to a culture of transparency and was very surprised, when we started up a lab, to have a counter-power like that.” (O09, Green Party, oppositional). The presence of counter-experts could potentially challenge the position of the nuclear industry challenging their control of nuclear knowledge. Established nuclear experts thus take initiatives to maintain their dominant position.

To strengthen silencing strategies, normative stakeholders mock opposition to nuclear energy. Often without knowing their opponents’ arguments, stakeholders within the nuclear institution reject oppositional arguments criticizing the practicability of suggested alternatives. If energy substitutes are not realistic then there is no need for a debate. Normative stakeholders remain in charge of defining and delivering the current – and future – energy production in France. For instance, when asked about their opinion of anti-nuclear ideas, one nuclear engineer explains: “I think it's too direct: ‘There's something wrong with nuclear power, we have to shut down the power plant. We must stop producing and using nuclear technology’. Ok, but what are we going to do afterwards?” (N02, service provider, normative). Similarly, when asked the same question, an experienced nuclear executive expresses a similar assessment when talking about the same anti-nuclear network: “Oh, Sortir du Nucléaire. I think they are old hippies. It's always the same

thing if you like. I find them far too 'anti.' One cannot be solely 'anti' in life, you see?" (N10, former Areva, normative)

By ridiculing any form of anti-nuclear discourse – even for stakeholders who advocate for a slower energy transition – normative stakeholders continue to control the debate and group interactions. When, and how, France changes its electricity supply is an institutional decision. The energy transition will happen under conditions approved by dominant contributors who will have authority over the development of a new electricity production program. As such, normative stakeholders carefully control dynamics shaping a complex set of relationships and minimizing the role of oppositional groups. From silencing to ridicule, including feeble efforts to engage in an informed dialogue, the main actors of the French nuclear debate interact in ways that mostly reflect the dominant position of normative stakeholders. Oppositional and unaffiliated stakeholders depend upon hegemonic actors' willingness to include them in the debate and to accept controversial viewpoints. On the one hand, the nuclear industry and its representatives do not try to engage in energy debate with their opponents. On the other hand, they continue to carry on belittling strategies to weaken potential adversaries. Such dynamics maintain the status quo leaving unaffiliated and oppositional stakeholders in a subordinate position further influencing nuclear knowledge production.

"It's not the average person who is going to read the reports": POS and the production of unfamiliar and technical nuclear knowledge

Stakeholder dynamics lack reciprocity. When asked about anti-nuclear groups, several respondents involved in the nuclear industry (N01, N03, N04, N07, N08, N09, N11, N12, and U02) explained that they have no direct contact with anti-nuclear activists and a limited understanding of their arguments. While normative stakeholders do not have to be knowledgeable about their opponents, oppositional stakeholders tend to learn as much as they can about the topic to prove their legitimacy. For instance one Greenpeace activist explains that they "got their hands

dirty" reading and watching "an incalculable number" of books and documentaries to fully understand the issue (O07, Greenpeace, oppositional). Similarly, one respondent proceeded to make an extensive list of materials relevant to discussing and understanding the topic. Overall, during the interview process, oppositional participants were eager to recommend books, articles, and documentaries, or to mention their own publications. This enthusiasm in sharing resources reflects the need for oppositional stakeholders to be perceived as legitimate experts and to be credible. Because detractors often question their understanding of nuclear technology, anti-nuclear advocates need to be able to address these criticisms. Oppositional knowledge production cannot occur if the public does not recognize people who challenge the hegemony of nuclear energy as acceptable knowledge depositaries.

The nuclear industry and the government overseeing the industry receive criticism for their lack of transparency. Secrecy is an on-going problem for a high-profile dominating industry generating important political and economic outcomes. Oppositional actors argue that the nuclear industry will remain secretive despite attempts to address nuclear safety concerns. One anti-nuclear activist explains: "It's a tradition in the nuclear industry, it's the secrecy" (O04, Sortir du Nucléaire, oppositional). From uranium extraction for the atomic bomb to the cost of electricity production, nuclear companies and research facilities are reluctant to share information. The reluctance affects people's trust in nuclear technology. In 2012, according to the annual IRSN barometer assessing risk and safety perception in France, 77.7% of respondents believed that they did not know enough about the dangers of the Chernobyl nuclear fallouts. Similarly, the same barometer shows that less than a third of respondents trust EDF and Areva to communicate accurate information about nuclear energy (30.3% and 29.9% respectively) and only 11.9% believed that the government tells the truth about the nuclear industry.

Oppositional groups experienced a resurgence of popularity since the mid-1990s. The barometer published by IRSN showed that in 2016 54% of respondents believed that environmental groups

were competent to talk about nuclear technology and 56% said that environmental groups were telling the truth about nuclear technology. While these measures fluctuated over the years reaching some low points where the public did not trust environmental groups, the two indicators remained above the 50% threshold since the beginning of the 21st century (IRSN 2017). However, limited access to mainstream media lead to an oppositional lack of visibility restraining the process of knowledge production. One Sortir du Nucléaire activist addresses the group's lack of resonance in mainstream media: "the network Sortir du Nucléaire publishes more or less one press release a day and we see them very little, except in the relevant press. We see very little of these press releases in the mainstream press." (O11, Sortir du Nucléaire, oppositional)

The presence of unaffiliated stakeholders challenges the traditional dichotomy inherent to the beginning of the nuclear debate in France, transforming nuclear knowledge production. Accounting for the lack of transparency and/or visibility of various actors, unaffiliated stakeholders add another layer to the knowledge production process. In 2012, respondents to the annual IRSN barometer pointed out that the two most important qualities for an expert are: 1) technical proficiency, and 2) independence (IRSN 2012). Promoting competent non-partisan information, unaffiliated actors bridge the gap in the knowledge production process between normative and oppositional actors.

The notion of independence is an important – yet contested – corollary to the modern definition of the expert (Berrebi-Hoffman and Lallement 2009). Envisioned as an intermediate position, independent specialists are supposed to represent the "objective" truth behind partisan interests. In the context of the French nuclear debate, independent labs are created by individuals or at the instigation of the government to promote transparency and to inform the public. Assuming the role of counter-experts, they monitor nuclear emissions and assess nuclear safety thanks to independent measures. Unaffiliated actors' role and range of action vary based on the context of

their establishment, their funding, location and other factors. IRSN is more institutionalized than other labs; ACRO includes a citizen watchdog group encouraging the public to collect data.

Regardless of the scope, unaffiliated actors strongly defend their contribution to the debate. Their emergence transformed the production of nuclear knowledge. One respondent who founded an independent lab before joining oppositional groups and has been involved in the issue for a long time talks about the rewarding aspects of creating anti-hegemonic nuclear knowledge: "What is gratifying, if you will, is that when I created CRIIRAD, everyone thought that the nuclear industry was telling the truth. They realized that it was not true." (O09, Green Party, oppositional) Unaffiliated stakeholders also take pride in their independent status. Interviewed at the same time, two IRSN executives highlight the independence of their institute, describing their role in engaging in a dialogue with anyone that has "data, measures, or facts." One executive noted: "Well, we try to be very independent, because we are the safety, the information aspects of the public. They [the nuclear companies] are aware of what we do, but they are never the ones who give their approval regarding an IRSN statement. No, no, we are really independent." (U02, IRSN, unaffiliated)

Another stated:

> Yes, yes, we never answer to EDF and Areva. In terms of information, yes, we are completely independent, even if we have a budget that comes from the state. Anti-nuclear people will say that we are not independent because we are dealing with public money. It's bullshit, pardon the expression. Somehow it is convenient for them, they are going to tell you that they alone are independent. We have a public service mission, which is information. (U01, IRSN, unaffiliated)

Unaffiliated stakeholders create new opportunities for nuclear knowledge production. Nuclear companies are less likely to ignore suggestions by independent labs especially when appointed by

the state. Unaffiliated experts have the ability to directly question and confront the nuclear industry, which is not always the case with oppositional groups. Some unaffiliated experts benefit from a strong reputation. For instance, one activist who is familiar with the organization of the debate describes the legitimacy of two independent labs created after the Chernobyl disaster: "There are non-antinuclear actors such as CRIIRAD or ACRO who, in terms of radiation measures and counter-expertise, have acquired a real credibility. That is absolutely undeniable and they are recognized by the nuclear lobby as being on top of their game" (U04, Enfants Tchernobyl Belarus, unaffiliated). Such a reputation was never achieved by some oppositional groups considered too erratic by the mainstream – one anti-nuclear activist explains that they often hear people saying that anti-nuclear activists "scare them" (O04, Sortir du Nucléaire, oppositional). In a context that stigmatizes and minimizes oppositional narratives, it might be an interesting strategy to present oneself as unaffiliated in order to be accepted by stakeholders that would otherwise be reluctant to share information.

Interviewees who work for independent facilities are less constrained in their interactions. IRSN and ACRO are open about engaging with various actors, comparing data and participating in contradictory debates. The increasing importance of unaffiliated stakeholders allows for another type of nuclear knowledge to emerge. Independent reports are accessible to the public online. Oppositional websites and mainstream media use available press releases. The Nuclear Safety Authority advocates for greater nuclear safety and their public information representative explains in an email that the organization "aims at informing about the risks related to nuclear activities" and "has been working for many years to develop risk culture among the general public, by encouraging the involvement of citizens in topics related to nuclear safety and radiation protection."

Despite valuable contributions to nuclear knowledge, the presence of unaffiliated stakeholders remains controversial. While normative stakeholders interpret the existence of ASN as a sign of

maturity and an inclination towards a safe and open French nuclear industry, oppositional groups are skeptical regarding the role of unaffiliated facilities in promoting a safe energy program. The willingness of independent labs to work with the nuclear industry softens oppositional narratives. Being part of nuclear task forces or scientific committees is already accepting the rules of the game and renouncing independence. When asked if groups like ASN and IRSN are effective in challenging the lack of transparency surrounding nuclear technology, one anti-nuclear activist argues that such entities provide assistance to the system therefore protecting it,

> ASN and IRSN are part of the nuclear national structure. They are stakeholders in the nuclear industry and their role is to save the nuclear industry. Since ASN's interventions are not intended to punish. There is no sanctioning power. […] And IRSN, the strong scientific arm, adds grist to the mill, […] since they bring their expertise to also try to minimize health impacts. […] They do not act to prevent situations but to manage them. So, our viewpoint, my viewpoint, is that ASN and IRSN cannot be the independence and autonomy tools that citizens need to have in order to be able to choose a side. On the contrary, they play an integration role. Besides, they are absolutely not autonomous since they totally depend on the state and the nuclear lobby. And that the staff of these organizations are employees of one or the other. (O06, Coordination Antinucléaire du Sud-Est, oppositional)

Unaffiliated stakeholders tend to have a more nuanced approach to the issue. Smaller entities distance themselves from anti-nuclear groups emphasizing independent expertise. Oppositional actors regret that they do not use their position to take a more active stance against nuclear energy. Additionally, critics regret that unaffiliated research and expertise groups cannot enforce policies thus restraining their power. Institutionalized independent labs such as ASN and IRSN can make recommendations but cannot force nuclear companies to operate major changes.

Oppositional actors point out that counter-expertise cannot be effective if suggestions remain unanswered. “If there is no balance of power, well, you know, ASN, it may well be independent, if EDF tells them to go to hell, what do you want them to do?” (O09, Green Party, oppositional)

Ideally, unaffiliated counter-experts aim at providing data and measures to help promote better ethics in the nuclear industry. However, it would be incorrect to limit the presence of so-called independent groups to an intermediate role in the French nuclear debate. Regarding such a polarizing topic, unaffiliated stakeholders’ actions and messages reflect subjective attitudes about the technology itself and its outcomes. While individuals working with independent entities want to maintain their autonomy in order to conduct proper research, they also have their own opinions about nuclear energy. As they produce nuclear knowledge, counter-expert reports often represent a tacit endorsement for oppositional or normative ideas. Paradoxically, the more neutral and detached unaffiliated organizations try to be, the more they become associated with one or the other main antagonists. Contradictions reveal the complexity of nuclear knowledge production caught between a willingness to provide information to the public and maintaining the hegemony of a powerful technology. In general nuclear knowledge production is complicated in a country that has strategically maintained secrecy about an essential industry.

Regardless of their dominant or subordinate position in producing nuclear knowledge, oppositional, unaffiliated, and normative stakeholders alike agree that French people are not very knowledgeable and not very interested in the topic. Thus, all groups advocate for a more informed population. It might seem surprising that normative actors regret the general public apathy towards nuclear energy given their dominant position in the debate and their control of nuclear knowledge. However, this assessment is widespread across nuclear workers, engineers, and technicians interviewed for this project. Regardless of their position and their company, none of them believes that the French population is well informed about nuclear energy. For pro-nuclear participants, the lack of nuclear knowledge is detrimental to the full support of nuclear

technology. While pro-nuclear participants do not necessarily argue that French people are against nuclear energy, they say that the public focuses too much on the negative aspects of the industry, in particular its connection to the military application of the technology. One executive who works for a research facility explains: “Nuclear power is something abstract for people. And, in the subconscious, nuclear power is the atomic bomb.” (N09, Areva, normative) Another interviewee who worked for the nuclear industry for a long time describes persistent misconceptions about nuclear energy promoting a bad image of nuclear electricity,

> I think people have in mind, when we talk about nuclear power, they still talk about the bomb. Look at the number of people who talk about an atomic power plant. [...] People still believe that it’s going to explode. It's funny. Even though, we're not going to have an explosion with a mushroom [cloud]. […] And no one had the courage to explain the difference. And we are stuck with it since the war with Japan. (N10, former Areva, normative)

Alleviating nuclear misunderstandings would highlight the usefulness of nuclear power and how it benefits France on a daily basis. Better public knowledge would lead to a greater normalization of the technology. Narratives such as the ones expressed above combined with barometers showing the lack of public trust in the nuclear industry suggest the limits of the hegemony of the nuclear industry. Specifically, the general public does not internalize the nuclear beliefs disseminated by normative stakeholders. Employing the power elite model discussed by Mills (1956), power is concentrated among normative stakeholders who have the ability to make decisions regardless of public opinion. In the case of the nuclear industry in France, this results in the imposition of the civil nuclear program. Interlocking directorates of political, economic, and military authority control institutions to promote and protect their interests (Mills 1956). Normalization efforts surrounding nuclear energy focus on encouraging acceptance of the technology – but does not guarantee acceptance. This explains the discrepancy between the lack

of public support for nuclear energy and the lack of success of anti-nuclear narratives. Normative stakeholders effectively construct a reality where nuclear energy, despite its limitations, represents the best solution available[6]. The public, seeing no other available or immediate alternative goes along with normative expectations.

When talking about public knowledge of nuclear energy, normative stakeholders highlight two important elements of nuclear knowledge production. First, the information regarding nuclear power is accessible to all online with the reports published by ASN and IRSN. Public ignorance is due to people's lack of interest in understanding the technology. One engineer working as a service provider explains that ASN reports "are complicated, technical reports. So, it's not the average person who is going to read the reports. So they are accessible to them but they will not necessarily understand them." (N03, service provider, normative) Nuclear supporters attribute insufficient understanding of nuclear culture to the overall lack of interest for scientific issues.

Second, nuclear technology is a technical topic difficult to understand. Knowledge sharing might seem unnecessary if the French population is not sufficiently prepared to comprehend the specifics of nuclear technology. More precisely, addressing public knowledge implies teaching about nuclear energy to a large and heterogeneous audience that might not be interested in the nuances of such a sensitive topic. From a knowledge producer perspective, nuclear knowledge should be adaptable based on people's needs. Arguably, not everyone needs to know everything about nuclear energy as illustrated by a comment from an unaffiliated participant,

> I think the general public does not exist, that's all, and that's the mistake. It does not exist, because we are dealing with risk issues, and we are not dealing with video games, we are not dealing with yogurts, and so the general public does not

[6] The following chapter provides a longer analysis of this dynamics.

> exist. [...] What I would say is: you want to inform them, about what, how important it is in their life to be informed? (U01-23, IRSN, unaffiliated)

However, normative stakeholders – and some unaffiliated actors who developed closer ties with the nuclear industry – do not consider the historical context of nuclear knowledge production in minimizing information sharing. In a context that never relied on informed public support, sharing knowledge does not seem to be a priority. As a result of the French tradition of a "state monopoly over legitimate expertise" (Granjou 2003: 175), nuclear expertise used for political decisions continues to shape which information is transmitted and when. Nuclear advocates benefit from a privileged position to reach a large number of people and perpetuate positive nuclear messages. Educating the public about nuclear energy for normative stakeholders does not convey the same meaning as it does for groups who have been struggling to articulate their claims.

Oppositional stakeholders argue the lay publics are misinformed to maintain the hegemony of nuclear energy. The less people know about nuclear energy, the less likely they will challenge the industry, which is consistent with discussions about hegemonic control of society (Maney et al. 2005). Historically, the French public hasn't been involved in the development of the civil nuclear program as nuclear decisions were taken "by a network of government, scientific, and industrial interests" (Nelkin and Pollak 1980:129). Schneider (2010) explains that nuclear energy was not discussed in the National Assembly until 1989. Therefore, the historical lack of involvement of the general population into the development of the civil nuclear program or nuclear technologies in general participates in giving the impression that people are not interested in understanding nuclear power or the nuclear industry itself. Official narratives about nuclear energy are pervasive, encouraging nuclear acceptance and hindering the ability of anti-nuclear groups to challenge the status quo as illustrated by this comment from an anti-nuclear activist,

> The public is completely unaware. The public is brainwashed by long-lasting preconceived ideas that have been imposed on the public opinion. We have a lot of people telling us: 'Listen, it's true, you're right, it's very dangerous and all that. But hey, what can you do? First, we cannot do things differently. […]Plus, there is this very competent nuclear safety authority that oversees everything. So even if you, anti-nuclear people, are right, we think nevertheless that it's going to be fine.' And thus, these lies internalized in the public opinion ensure that almost everybody is extremely ignorant regarding the real situation of this industry (O02, Observatoire du Nucléaire, oppositional)

Dominant stakeholders create an apathy towards nuclear energy. It is difficult to engage in a dialogue when the topic does not appeal to the public. People are not interested in discussing the inner workings of the industry or its negative outcomes. For instance, when asked their opinion about public nuclear knowledge in France, one anti-nuclear activist describes the general public indifference despite the availability of information,

> Not very high level. Even though there is a lot of information, contrary to what some anti-nuclear activists say. There is plenty of information. And, it is very easy to know that nuclear energy is a disaster. [...] People do not care. In fact they are informed that nuclear energy is a disaster. [...] That's it, so they are aware of the accident, but it doesn't go any further and above all, they definitely don't want to know more. (O03, MAIN /Décroissance, oppositional)

Decades of efforts to normalize nuclear energy lead to a widespread detachment toward the issue. Carefully cultivated, indifference regarding nuclear technology weakens oppositional narratives. Individuals or groups who challenge the status quo cannot mobilize a population that is not

affected. One Sortir du Nucléaire activist declares when assessing public knowledge of nuclear energy,

> When I talk to my colleagues, there are some who are more or less informed and who understand more or less, but not too much. There are some who know it's dangerous, but who say to me: 'Listen, it's a threat. If it breaks, it breaks. We all have to die anyway. I do not want to worry about that.' There is in fact a refusal, I think, of a large part of the population to really become aware of that. (O11, Sortir du Nucléaire, oppositional)

From an oppositional perspective, normative stakeholders have been successful in convincing the general population of the special and irreplaceable nature of nuclear technology. In fact, nuclear energy opponents argue that even decision makers fail to understand the issue. Despite their influential position, they are subject to the same preconceived ideas than the rest of the population and therefore are not informed enough about the technology. When asked about ways to improve the diffusion of nuclear knowledge, an experienced activist discusses the ties between politics and energy,

> What I observe is that our rulers, our senators, who are very old people, our Congressmen, they do not know anything about nuclear energy. Nothing. And when we try to talk to them, they always answer the same nonsense. Namely that nuclear energy provides very cheap electricity and they never consider the fact that nuclear research and development have cost the nation considerable sums of money. (O10, Sortir du Nucléaire, oppositional)

Promoters of the hegemonic position of nuclear energy maintain a compartmentalized system of knowledge control. Normative information shared with the lay publics is accepted without too much resistance. More importantly, dated, incorrect, or incomplete arguments continue to be used

to justify the maintenance of the civil nuclear program. The climate of acceptance that prevails in France limits the significance of oppositional discourse. When talking about their experience as an activist, one interviewee describes the ignorant attitude of politicians deciding the future of the energy program,

> You cannot realize the very pro-nuclear ignorance of these MPs. But you're looking for one who is pro-nuclear who affirms to you that... I-do-not-want... independence, "well all the arguments ..." You ask him how a reactor works and how electricity is produced. Try. [...] Chances are they are going to tell you: "Ah, listen; I'm not a scientist, that's not my problem. I know it produces electricity." So that means, if he cannot answer you, that means he does not know that there is uranium. He does not know where this uranium comes from, he does not know this, he does not know that. But, he has a very strong position. And he is pro-nuclear. (O05, Global Chance, oppositional)

In this chapter, I discuss the role of political opportunity structures in shaping nuclear knowledge production and opposing stakeholder dynamics. I point out the power differences between normative actors with a dominant position to control emerging POS and using them to their advantage and oppositional stakeholders who struggle to engage in an informed debate. As POS changes (Banham and Goodin 2016, Giugni 2009), normative stakeholders adapt to include opportunities and threats into the hegemonic discourse. Defining interactions – or lack thereof – with other stakeholders, allow normative stakeholders to limit the opportunity for oppositional action (Gamson and Meyer 1996; Meyer and Staggenborg 1996). The presence of unaffiliated stakeholders creates additional dynamics that complicates the production of nuclear knowledge without challenging the status quo. In the next chapter, I discuss the strategies available to normative stakeholders to maintain their dominant position in the nuclear debate.

CHAPTER VI

"NUCLEAR ENERGY! GO! GO! GO!": MAINTAINING THE HEGEMONY OF THE NUCLEAR INDSUTRY THROUGH NORMATIVE NUCLEAR KNOWLEDGE PRODUCTION

In the previous chapter, I addressed the specific features of the French nuclear context and discussed the role of normative stakeholders in taking advantage of emerging opportunities to control the production of nuclear knowledge. In this chapter, I examine how the state and major nuclear companies maintain their power and which strategies they use to produce normative knowledge and information. Specifically, I ask: How do stakeholders such as the French government and the main nuclear companies produce and disseminate knowledge to maintain the development of the nuclear industry? I first discuss how normative stakeholders use the example of Germany's nuclear phase-out as a deterrent. Then I examine strategies to dismiss renewable sources of energy as a viable alternative to nuclear energy. Finally, I address the concept of "natural radioactivity" as a way to maintain the power of normative stakeholders.

"Boo, German people, boo!": Dismissing nuclear phase-outs

The hegemonic position of normative stakeholders in the French nuclear debate does not encourage active knowledge production efforts. The purpose of normative nuclear knowledge is to maintain the dominant position of nuclear energy and to make sure that potential alternatives

seem inadequate. In the previous chapter, it appears that normative stakeholders control the emergence of opportunities and threats and discredit their opponents. As promoters of the status quo, they are less interested in addressing misconceptions about the nuclear industry and promoting public understanding of nuclear energy than they are in promoting nuclear expertise and a certain way to produce and consume electricity. Normative nuclear knowledge production focuses on raising doubts about the durability of non-nuclear energy production programs.

In the context of the Fukushima disaster, normative stakeholders in France disapprove of Germany's resolution to give up nuclear energy. Following the recommendations of a committee in charge of reviewing the consequences of the catastrophe in Japan for Germany, Chancellor Angela Merkel approved a plan to close down all German nuclear power plants by 2022 (Jahn and Korolczuk 2012). A large majority of the German population supports a nuclear phase-out (Glaser 2012). Germany's decision is unique and reflects long-lasting feelings of distrust toward nuclear technology. Contrary to France, where pro-nuclear narratives rapidly became embedded in the political, economic, and social landscapes, Germany's influential Green Party and successful anti-nuclear protests worked to limit the construction and the operation of nuclear reactors (Glaser 2012; Jahn and Korolczuk 2012) and maintain the prominence of nuclear skepticism. Germany's choice to give up nuclear energy after Fukushima is in line with its history of nuclear contestation and is used as an example to demonstrate the practicability of abandoning nuclear technology (Glaser 2012). In the context of normative nuclear production in France, Germany is criticized for its irresponsible decision and used to justify reliance on nuclear energy.

In France, supporters of the dominant discourse question the rationality of such a decision and often point out its negative outcomes while highlighting France's role in helping their neighbor with the resolution. Framing a nuclear phase-out negatively – especially the phase-out of an important economic partner – encourages the acceptance of nuclear energy, once again transforming a potential challenge to the status into an opportunity to reaffirm France's energy

choices. These narratives cultivate the idea that nuclear energy is a more appropriate solution to any current or future energy challenge.

Normative stakeholders blame Germany for switching to fossil fuels in order to avoid using nuclear energy. As promoters of hegemonic conditions, these dominant actors define what should be considered as a practical, levelheaded way of life (Katz 2006, Stoddart 2007). Nuclear energy is the one of the best – if not the best –solutions to climate change and increasing carbon emissions. In a context that privileges nuclear energy as a clean source of energy, Germany's decision appears irresponsible and dangerous for the environment. An Areva engineer points out that "Germany's CO2 emissions are skyrocketing since the closure of power plants in Germany (N07, Areva, normative). Moving away from nuclear energy entails negative consequences. During one interview, a nuclear waste engineer addresses Germany's nuclear phase-out and explains that France boasts about its "ultra-decarbonized energy," mocking their neighbor regarding increasing electricity prices and using coal again: "Boo, German people, boo. Look how expensive [electricity] is" (N05, EDF, normative).

The dichotomy between France and Germany is also present in mainstream media. While some journalists argue that Germany's efforts to abandon its civil nuclear program is in line with its long-term political approach to nuclear technology (Wasum-Rainer 2015), other articles point out the differences between the two countries at a time when France wants to play a leadership role in addressing global climate change. For instance, one article from *Le Figaro* published in 2015 cited an engineer explaining that France has "one of the best records among industrialized countries in the fight against global warming (with CO2 emissions per capita 80% lower than in Germany)" (de Monicault 2015).

As such, Germany's nuclear phase out is not a viable solution because relying on fossil fuels for energy production is worse than any negative outcomes from nuclear electricity production.

Specifically, from a normative perspective, coal is a polluting energy from the past, while nuclear energy represents future opportunities as illustrated by this comment from a respondent who works for EDF who finds it regrettable that Germany opts for a polluting energy source such as coal,

> Nuclear energy, for me, is the energy of the future. We are not ready to stop and, even if we wanted to anyway, technically speaking, it would not be possible because we would have to find electricity somewhere. I know there are countries that have done it. I will give you the example of Germany who said: 'We are going to stop nuclear power.' […] Not only does coal pollute much, much, much more than nuclear energy, but, on top of that, they do not provide enough electricity for their country. (N13, EDF, normative)

This comment illustrates the dual rationale behind the normative disapproval of Germany's nuclear phase out. In addition to replacing nuclear electricity with more polluting energy sources, normative stakeholders also point out a paradoxical situation regarding the current German energy production process. They explain that the country is struggling to produce enough electricity, forcing Germany to import electricity from France. As the previous respondent clarifies, Germany "stopped nuclear energy at home, but they buy nuclear electricity from France, you see, which is a bit contradictory" (N13, EDF, normative). Other respondents share a similar judgement. One executive for an Areva subsidiary explains that it is too early to say if Germany made the right decision: "Germany withdrew. Then again, we must also wait to see how it will evolve because they will still have to produce energy. Today, they actually buy some of their electricity from France" (N09, Areva, normative).

Interestingly, nuclear advocates use the example of Germany to shine a positive light on France's electricity program. In line with Bonds' knowledge-shaping process (2010) where powerful

actors shape what is important to know about a controversial topic, normative stakeholders transform a challenging opportunity into a situation that encourages the status quo. France comes to the rescue when its neighbor faces the shortcomings of its decisions. What could have been an ambitious choice to promote safer energy production in a light of a major catastrophe becomes an irrational action with potential harmful consequences for the population. Before talking about carbon emissions in Germany, one engineer who works for Areva emphasizes that France's rescue efforts when Germany needed help are important to remember,

> When we talk, we give the example of Germany, which gave up nuclear energy. There is no denying it. But we never explain that France and its ability to produce energy on the basis of nuclear technology has repeatedly saved Germany's blackout following very important gusts of wind that could have taken down the network. These are things that are not emphasized and that could be explained – that should be explained to French people. (N07, Areva, normative)

Using the example of Germany allows normative stakeholders to promote the effectiveness of the French nuclear program and to maintain a sense of national pride associated with the technology. As such, it becomes easier to brush aside energy alternatives, especially as Germany tries to interfere with France's nuclear politics, as illustrated by the following comment from a nuclear engineer,

> Recently Chancellor Angela Merkel has strongly wished or even demanded the closing of Fessenheim. It seems to me quite surprising to the extent that Germany imports a significant amount of French electricity, which is produced mainly by nuclear technology. (N11, service provider, normative)

The case of Germany's nuclear phase out is illustrative of the strategies used to maintain the energy status quo. Normative stakeholders dismiss efforts to give up nuclear energy and frame it

as an irresponsible and irrational decision. The power of hegemonic actors lies in their ability to organize knowledge to protect their dominant position. Normative narratives infringe upon anti-nuclear strategies by turning oppositional claims against the groups or individuals who make them. Similarly to the example of the Fukushima disaster, should oppositional actors want to use Germany's decision as an example to mobilize against the French nuclear industry, their opponents would already have a counter-argument. In addition, the narratives bring a positive light to France's nuclear industry and promote patriotic confidence in France's nuclear expertise. They reaffirm the necessary dominant position of nuclear energy and lessen the ability to engage in a debate regarding alternative sources of energy.

"Renewable energy has benefits, for sure, but it will never produce as much as a nuclear reactor": Strengthening the nuclear industry through criticisms of renewable energy

While Germany represents a specific limited example, normative nuclear knowledge production encompasses a broader overarching theme. Nuclear supporters strengthen the prominence of nuclear energy by invalidating energy alternatives and constructing knowledge that favors nuclear electricity as a safe and exemplary source of energy. Addressing potential "knowledge conflicts" (Ockwell and Rydin 2006) arising with the emergence of solar, geothermal, and wind energies as central players in future energy production programs, normative stakeholders deconstruct the importance and the relevance of such alternative solutions. While renewable sources of energy are viewed in many places as the ideal solution to fossil fuels, France remains behind in the development of renewable sources of energy because of the perceived role of nuclear energy in mitigating the effect of climate change. Nuclear energy advocates argue that nuclear energy – fission based nuclear power specifically – is a "clean" energy which minimizes emissions of CO2 (Rosner and Hearn 2017). Normative stakeholders argue that nuclear electricity can be a powerful ally in the fight against climate change as electricity production alone represents a third of global

greenhouse emissions (May 2017:38). In the French context, renewable sources of energy do not represent a rational solution to France's energy needs.

First, normative stakeholders contest the implementation of a comprehensive civil energy program relying on renewable sources of energy, constructing nuclear knowledge dismissive of alternative plans. Similar to Bonds' information suppression (2010), normative nuclear narratives obscure details about the structure of the industry. Even though France adapts its infrastructure to enable nuclear energy production at the beginning of the civil nuclear program, this important land transformation – and its associated consequences – remain missing from current discussions about potential energy production changes. Normative actors do not mention planning and development projects, past or present. While oppositional actors criticize Cigéo, the underground burial project for nuclear waste currently under construction, pointing out its cost and its dangerousness for local communities and noting that, "in 500 hundred years nobody would remember that [nuclear waste] is here" (O11, Sortir du Nucléaire, oppositional), normative stakeholders prefer to communicate about the shortcomings and negative outcomes of renewable sources of energy. Whether intentional or unintentional, this omission in the normative rhetorical work affirms the presence of nuclear energy, taking for granted the considerable landscape transformation required by the development of the French civil nuclear program.

In contrast, normative stakeholders want to create controversy regarding potential reorganization plans associated with new energy sources. This is similar to controversy manufacturing efforts deployed by climate change deniers identified by Dunlap and McCright (2015) and intended to instill doubt. Transitioning to renewable sources might not be achievable. Moreover, continued reliance on nuclear power does not imply a perceived radical – and negative – transformation of France's landscape. One participant, a nuclear safety engineer, explains that shifting to wind energy would mean building wind turbines everywhere, which "is not always very pretty to look at and [is] not always easy to place" (N02, service provider, normative).

Another respondent, also an engineer working for one of the main nuclear companies, points out the high number of wind turbines necessary to replace the electricity produced by nuclear reactors,

> Reducing nuclear power by 50% would mean that people have much less electricity than they currently have. And that is not possible because renewable energy, in itself, has benefits, for sure, but it will never produce as much as a nuclear reactor. To produce the equivalent of a nuclear reactor with a wind turbine, we would need I-don't-know-how-many hectares. You see that a wind turbine, on average, let's say, it produces two to three megawatts. To produce 1,500 for a reactor like ours, knowing that we have two reactors on site, so 3,000 megawatts, so we need a little more than 1,000 wind turbines. So imagine in terms of surface area what it represents. It's just not possible. We would almost need to raze France to the ground and to say: 'well, all right, we only make renewable energy, but there are no more inhabitants' (N13, EDF, normative).

The claims noted here have important implications. Normative stakeholders count on the established presence of the French nuclear network to maintain its domination. Energy alternatives are then more cumbersome and costly than the acceptance of the current structure of energy production. Especially when the expected replacement cannot produce the same output. Normative respondents mention that renewable sources of energy cannot account for the current production of nuclear energy. This type of narratives correlates with the official discourse of the French government to consolidate the presence of the nuclear industry in the public's mind. This type of normative message is part of the official government communication and is present in mainstream media. One article published in *Le Monde* a few days after the Fukushima disaster providing an overview of the reactions among the body politic includes an explanation by then Minister of Ecology, Sustainable Development, Transport and Housing Nathalie Kosciusko-

Morizet that "a nuclear phase-out would entail the use of fossil energies." (Leparmentier 2011). At a time when France is determined to be a leader in the fight against climate change, this type of discourse reveals a will to protect the hegemony of the nuclear industry. Nuclear energy provides solutions to mitigate the effects of climate change as illustrated by the following comment from a service provider for EDF: "We are independent in terms of energy only thanks to nuclear power in the end. And we also respect the Kyoto protocol thanks to nuclear power. Because the rest, solar energy and company, that's all well and good but we cannot produce as much as things stand today anyway" (N06, service provider, normative).

Fear mongering strategies are effective in maintaining the status quo and allocating power to actors who can offer protection from the disastrous transition. The message is clear: alternative sources of energy cannot replace nuclear technology. If solutions are not satisfying nor doable, then they are not worth considering. Maintaining power for normative actors amounts to denying the existence of valid alternatives to nuclear energy. For instance, production irregularities could have a negative impact on France's electricity consumption. One nuclear engineer explains that irregular production is one of the characteristics of renewable energy: "I do not see how we could give up [nuclear energy] given the intermittence issue of renewable energy" (N07, Areva, normative).

In fact, from a normative perspective, there is a long list of grievances against renewable sources of energy. Nuclear advocates argue that the contemporary discourse about the importance of renewable energies tends to hide the disadvantages. When asked about the main preconceived ideas about nuclear energy, one respondent who works as a service provider for EDF explains,

> Other forms of energy also pollute. Photovoltaics, we do not know how to recycle it. Wind power, to build it, it pollutes too. I think we forget actually. We forget that part. We focus on the fact that nuclear energy, radioactivity, it is

> dangerous and we forget that the other energies also, they consume, in the end, to produce. (N04, service provider, normative)

Additionally, normative stakeholders shift the focus on the financial consequences for the consumer. Building on the legacy of cheap electricity available in France thanks to nuclear technology, normative nuclear knowledge highlights cost transition. Solar and wind energies represent an important economic burden. Once again, normative nuclear knowledge is organized in relation to oppositional narratives reflecting the role of on-going interactions between opposing actors in competing and shaping the knowledge production process (Kinsella 1999, Merton 1972). Oppositional activists argue that the price of sustainable sources of energy keeps going down becoming more profitable, while the price of nuclear energy keeps going up. However, normative stakeholders continue to argue that nuclear electricity remains cheaper. One EDF engineer explains, "Right now, people are already complaining about the price of the electricity bill from nuclear energy, even though if we used something else, it would be three or four times more expensive" (N13, EDF, normative). One interviewee working for the nuclear industry explains how other countries' experience with renewable energy can highlight the increased cost of energy,

> Because we can see that the Germans, they had a little bit the intention of giving up nuclear energy, but after all, they reactivate coal plants, they are fighting quote unquote a little bit with renewable energy that is unfortunately intermittent. One of the major drawbacks. And especially on the wallet, the consumer's, it weighs a lot (N08, EDF, normative).

The discourse downplaying the role of renewable sources of energy in France's future energy mix exists in parallel to efforts designed to develop the importance of renewable energy in France's current energy production. In October 2016, France adopted the Energy Transition Law, which,

among other stipulations, reduces reliance on nuclear energy while increasing the percentage of sustainable energy (Stuart 2017). Despite this apparent will to alter the French energy industry, concrete actions contradict the proposed transformation of the energy mix. Obstacles, maintained by normative stakeholders such as the French government, prevent the appropriate development of alternative energy programs. When asked about the ties between the French government and the French civil nuclear program, an anti-nuclear activist identifies the role of politicians in maintaining the hegemony of the civil nuclear program. After pointing out conception problems associated with the bottom slab of the new reactor in Flamanville, the respondent explains that the French government allocated money to fix the malfunctions instead of investing in renewable energies, "The government has allocated 100 billion to reinforce these rafts, while we hoped that this money would be put in energy savings, on the one hand, and on the other hand, in renewable energy" (O10, Sortir du Nucléaire, oppositional). There exists a paradox between the official discourse regarding renewable energies and actions to implement change that continuously maintain the dominant position of the nuclear industry.

Even when normative stakeholders interviewed for this project believe in the role of renewable sources of energy in France's future energy mix, they do not envision that reliance on nuclear energy will decrease significantly in the following years. People within the nuclear industry feel confident that the energy future of France involves nuclear power. When talking about the next five or ten years, one respondent who is a business manager in the nuclear industry emphasizes the future of nuclear energy,

> Well, renewable energy yes, solar and hydraulic, and wind. I think that, I do not know, they will reach, I would say, an asymptote, so I do not know, 20% of the electricity production. And it will take a completely different approach, yeah, to change the main energy which is nuclear energy. We would need the will but

> also time. It will not happen overnight. But I do not think it's going to be in the next 10 years (N03, service provider, normative).

It is more difficult for oppositional narratives to resonate when normative stakeholders portray alternatives to the status quo in a negative light. In a nuclear reliant context, normative actors downplay the role of renewable sources of energy in becoming a viable solution for France's future energy needs. Normative accounts construct a set of circumstances with nuclear energy as a cornerstone. Even with a programmed decrease in nuclear energy dependence, the nuclear industry intends to maintain its influential role and to remain involved in the decision making process. Normative stakeholders' ability to maintain control of nuclear knowledge production relies on promoting France's perceived nuclear expertise. Normative nuclear knowledge reflects a dedication to appeal to sentiments of national pride underlying France's prowess in understanding and mastering future energy challenges. Additionally, normative stakeholders continue to normalize all the aspects of nuclear technology, including the most controversial ones such as radioactivity.

"Radioactivity emissions from nuclear power plants, are extremely low"": Opposing notions of artificial radioactivity and natural radioactivity

Control over the meaning of emerging opportunities and threats allows normative stakeholders to communicate the careful management of nuclear risks. While not detrimental to the development of the French civil nuclear program, radioactivity represents a point of contention as it can lead to serious health problems. Marie Sklodowska-Curie died of leukemia related to her continuous exposure to radioactive elements (Gasinska 2016). Chernobyl is officially associated with 40 radiation related deaths and 4,000 radiation related cancers (Dänzer-Kantof and Torres 2013). Normative nuclear knowledge shifts the focus to natural radioactivity as a dangerous – irrevocable – component of human life. Another important aspect of the maintenance of the hegemonic position of nuclear energy deals with the emphasis on natural radioactivity. Normative

stakeholders use the fact that radioactivity can be found in nature to justify the legitimacy of the civil nuclear program. Since radioactivity is a naturally occurring phenomenon, there is no reason to fear it and France's nuclear engineers understand and control radioactivity. Normative stakeholders explain that radioactivity produced in the nuclear power plant is even safer than natural radioactivity because artificial radioactivity originates in a more controlled environment as illustrated by the following comment from an EDF engineer discussing radioactivity produced by nuclear power plants,

> When we compare it with the natural radioactive dose we receive when we go for a hike in the mountains or things like that, we still receive a lot less. It's very, very safe as a facility, and, as a result, if we compare to doses that are received during a hike in the mountains, for example, at high altitude where there is natural radioactivity, people will receive a lot more radioactive doses than us (N13, EDF, normative).

The fact that radioactivity is found in nature contributes to the acceptability of nuclear technologies. In 2000 the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) explains in a report that people are exposed far more often to natural radioactivity – namely cosmic rays and particles from the earth's crust – than to man-made radioactive materials arguing that "ionizing radiation from natural sources is a continuing and inescapable feature of life on earth" (UNSCEAR 2000: 84). Similarly, medical imaging's reliance on radioactive particles legitimizes nuclear energy by minimizing the relevance of fear arguments. Comparing radiation produced by nuclear power to the use of x-rays reinforces dismissal of the harmful effects of nuclear technology (Perrow 2013). Building on these examples, normative stakeholders employ their version of nuclear knowledge to minimize the existence of nuclear risks while displaying confidence in nuclear technology. It also makes it more difficult to attack nuclear energy without calling into question other technological

advancements or natural phenomenon. For instance, another respondent who studies nuclear safety points out the continuous presence of radioactivity,

> Natural radioactivity represents a large part of the total radioactivity, I am tempted to say, even larger than artificial radioactivity. Radioactivity emissions, for a start, from nuclear power plants, are extremely low. The maximum doses that workers can receive are lower than doses of natural radioactivity that could be absorbed by going for a walk on paths where there is radon getting away. […] There are also ways to treat cancer with radioactive stuff. Of course, it's never a good thing. [...] It is not lethal at all but it is a non-negligible dose of radioactivity that enters the body. And, what I wanted to say, it is a lot more toxic, we'll say, that's not really the word. It's a lot more ... You get a lot more radiation by doing a chest X-ray than by working in a nuclear power plant (N02, service provider, normative).

Narratives encourage the dominant position of nuclear energy because they associate what happens inside nuclear power plants – which people do not always understand – with a natural phenomenon that the general public never questions. Normative stakeholders rely on the public's lack of knowledge to select the type of information to share. Use of this strategy also negates potential debates about nuclear alternatives because getting rid of nuclear energy will not make radioactivity disappear. In general, nuclear advocates have a paternalistic attitude toward individuals who challenge nuclear energy, especially when they point out the dangerousness of radioactivity. One participant who works with radioactive waste claims that it can be more dangerous to be exposed to natural elements than it is to be exposed to man-made radioactivity,

> Overall, there are risks, but it's the same thing as if we stay, I do not know, two weeks in scorching heat, well, we see that there are effects on the body. Yeah,

> great, great! Same thing if you're in the snow, well, you're all naked, well, you're freezing, that's it, great, wow, thank you! However, well, if you go in the snow, if you get dressed with your boots, when you go home, unless you didn't have enough layers, and well, in theory, you don't get frostbite. Maybe you got cold during the day, but you're not going to die (N05, EDF normative).

Even though the respondent further explains that this analogy should be treated cautiously and does not apply in every situation, it still conveys the idea that French nuclear technology is carefully managed and that risk is negligible. In particular, the idea that manufactured radioactivity is restricted reinforces the notion that nuclear energy is safe. It is then easy to contest oppositional knowledge that questions radioactive emissions thus reverting to irrational fear rationales employed to dismiss anti-nuclear arguments. When talking about radiation level measurements outside of power plants, one nuclear engineer claims that people can mistake natural radioactivity for artificial radioactivity leading to misinterpretations about danger,

> Sometimes they measure natural radioactivity, but they won't put things into perspective. They are going to say, "Oh, I measured something next to the power plant, it surely comes from the power plant." We cannot always prove that it does not come from the power station but, we know very well that in some materials or in some places, in France, there is the presence of natural radioelements. And simply, sometimes, we measure them. But that does not mean that the power plant spits things in large quantities (N08, EDF, normative).

Such normalizing discourses about radioactivity are not a new phenomenon. They are part of a long-lasting process of nuclear denial where stakeholders with vested interests in the technology minimize nuclear risks. Conflicting messages about radioactivity and its effects represents “a

handy excuse for continuing business as usual" (Perrow 2012:65) constructing acceptance around a dangerous uncertainty.

This chapter highlights how normative stakeholders rely on key narratives to present a positive image of nuclear energy, encourage public support, and maintain the development of nuclear programs. An extension of normative stakeholders' ability to control the POS, normative nuclear knowledge production does not try to promote a new, informed way to discuss nuclear energy and its implications. Instead, it is aimed at protecting the status quo and anchoring the presence of the civil nuclear program into the French social, political, and economic landscape. Consistent with Bonds (2010) knowledge-shaping process, normative stakeholders suppress, contest, and administer knowledge. Through the confident, technical, and sometimes exaggerated messages conveyed by normative stakeholders, the French nuclear industry remains in a dominant and unchallenged position. Discourse about technological prowess and confidence in controversial technology is inherited from the early stages of the civil nuclear program, strengthens the status quo, and reinforces the idea of France's technological expertise. It becomes more difficult for anti-nuclear activists to win the hearts and minds of the general public and to successfully construct anti-nuclear knowledge that resonates within the France's population. In the next chapter, I address the choices and strategies employed by oppositional stakeholders and activists to respond to the diffusion of normative nuclear knowledge.

CHAPTER VII

"IT'S NOT EASY TO CONVINCE PEOPLE": CHOICES AND STRATEGIES TO OPPOSE THE POWER OF THE STATE AND NUCLEAR INDUSTRY

In this chapter, I discuss the choices and strategies available to oppositional stakeholders to challenge the status quo and provide alternative nuclear knowledge. The specific French nuclear context makes it very difficult for oppositional groups to disseminate information efficiently. In addition to a historically subordinate position, anti-nuclear groups do not agree on the strategies to employ to offer an alternative solution to nuclear energy. Disagreements within the anti-nuclear coalition make it difficult to organize large-scale collective actions. In this chapter, I argue that anti-nuclear activists do not necessarily try to win the hearts and minds of the population as much as they continue to fight for what they believe. I ask: Given existing dynamics, what choices and strategies are available to anti-nuclear activists to oppose the power of the state and nuclear industry? First, I address key strategies to develop counter-hegemonic knowledge: using legal actions, developing narratives emphasizing the need to reduce energy consumption, and attacking the myth of energy independence. Finally, I explain how oppositional stakeholders continue to mobilize in a context that does not encourage anti-hegemonic nuclear knowledge.

"We are not able to convince anyone": A coalition midway between optimism and frustration

Fragmented and subject to inside tensions, the oppositional movement struggles to present a united front against nuclear companies. Activists disagree on the timeline and the methods to achieve a nuclear phase-out. People wanting an immediate removal of all nuclear facilities encounter resistance from other individuals who accuse them of using fossil fuels to transition from nuclear energy. The French nuclear energy context places oppositional groups in a difficult and weaker position from the beginning. Nuclear opponents never had the upper hand, mobilizing reactively rather than proactively. However, internal disagreements weaken the movement's ability to produce alternative nuclear knowledge. In particular, when conflicts affect larger and more organized oppositional groups, hostility invalidates their credibility in the debate.

In 2010, the major internal crisis that unfolded within the Sortir du Nucléaire network led to structural issues with the emergence of competing organizations. Divided activists spent less time addressing nuclear issues than arguing for control of the oppositional movement. One unaffiliated respondent who works closely with anti-nuclear groups addresses the on-going contentious situation: "The Sortir du Nucléaire network has been in a state of internal crisis for five years and I am under the impression that some activists have put more energy toward fighting each other instead of fighting against nuclear power" (U03, ACRO, unaffiliated). It is difficult to focus on producing and circulating alternative nuclear knowledge when oppositional stakeholders are busy solving their disagreements. Activists themselves suffer the consequences of a fragmented oppositional coalition. When asked about changes needed within the anti-nuclear movement, one Global Chance activist shares his concerns about the repercussions of the pernicious atmosphere prevailing among oppositional organizations,

> I would ask them to calm down! Because within the anti-nuclear movement there are many internal quarrels. That's exhausting. Because, for a start, when you have difficulties like that with the adversary, with nuclear promoters, it's

> quite infuriating to see that half of the exchanges are about accusations of this or that. Or someone who is not respectable or who wrote something or other (O05, Global Chance, oppositional).

Constant tensions can hinder the movement's ability to win the hearts and minds of the population. The French nuclear context is not conducive to the inclusion of alternative information into the debate and it has affected the behavior of oppositional actors. In fact, after several decades of unsuccessful actions and stigmatization, activists are on the defensive. Their marginalized position leads them to distrust the system of knowledge production. Because they cannot participate in an informed debate, oppositional actors isolate themselves and sometimes reject the debate altogether. One Sortir du Nucléaire activist clarifies that activists "have been in the minority for so many years, most have become completely aggressive" (O01, Sortir du Nucléaire, oppositional). Anti-hegemonic nuclear knowledge production thus also depends upon oppositional stakeholders' propensity in taking an active role in the French nuclear debate. Suspicious of attempts to engage in a discussion, activists internalize continuous claim denial and legitimacy disputes coping out of the discussion. When asked if the anti-nuclear movement was victim of a campaign designed to undermine its credibility, one Greenpeace activist explains how oppositional actors struggle to communicate, discrediting their own argument:

> Anti-nuclear activists have a real big flaw. […] They did what I did with you right away. They are annoying. For the general public anyway, they are insufferable. They are completely insufferable. They do not know how to go back to basics, to the simplest arguments. In fact, they have too many arguments (O07, Greenpeace, oppositional).

Oppositional stakeholders remain realistic about producing information that challenges the status quo. A significant number of oppositional actors interviewed for this project have been active in

the anti-nuclear struggle for a long time. Experienced activists are not optimistic about the future and the evolution of the anti-nuclear coalition. As oppositional stakeholders battle to organize, finding effective ways to produce alternative nuclear knowledge becomes more difficult. One Sortir du Nucléaire activist acknowledges these obstacles: “We are not able to make ourselves seen. So, there are not a lot of us for a start, but how to circulate information? It's complicated” (O11, Sortir du Nucléaire, oppositional). Overall, oppositional stakeholders are pessimistic about their ability to bring about change. The long-term normative control over the production of nuclear knowledge has long-lasting effects on mobilization. Despite creative efforts to produce alternative information about nuclear energy, anti-hegemonic nuclear knowledge is not ideologically significant. This illustrates the difficulty in resisting hegemonic definitions of acceptability, when people do not perceive alternatives as rational options to the status quo (Maney, Woehrle and Coy 2005, Sallach 1974). For instance, one interviewee who started to mobilize against nuclear energy around the time of the deadly protest in Creys-Malville in 1977 expresses frustration about anti-nuclear activism,

> We are not able to convince anyone. In other words, I am completely hopeless. I must say that our entire group is too because we are growing older, because the young people who will take over - namely those who are between 20 and 40 years old - have not understood that electricity produced by nuclear power is a poisoned chalice for thousands of years. So we do not know what to do now and we are really terribly discouraged. (O10, Sortir du Nucléaire, oppositional)

Because normative stakeholders were successful in imposing their definition of nuclear technology, moral imperatives do not affect the public’s perception of nuclear energy. This illustrates the paradox of the French oppositional movement where nuclear contestation revolves around financial components instead of moral arguments. One Observatoire du Nucléaire

respondent explains that public mobilization will not affect policy-making; instead, the cost of electricity production itself will lead to changes in the French energy program:

> I am not saying that it's useless to protest, I do it myself as often as possible. But it is objectively not that detrimental to the nuclear industry. It is an industry that, either way, is now at the end of the cycle, on its last leg. So, again, as I told you, it will not come to an end in a few weeks or months. It is in, probably, a few decades, but it's something, it's a phenomenon that is irreversible. (O02, Observatoire du Nucléaire, oppositional)

Several participants share that viewpoint. Normative control over the French nuclear context prevents anti-hegemonic groups from affecting change in their own terms. Instead, anti-nuclear groups depend upon normative stakeholders' mistakes to be successful. This does not stop oppositional stakeholders from mobilizing but collective organized actions such as protests and marches, according to many, are not the best way to challenge the status quo. Instead, the demise of the nuclear industry will come from the industry itself and its ever-increasing costs as illustrated by the following comment from an oppositional politician who argues that moral narratives are ineffective in mobilizing the public opinion, yet is hopeful because of the increasing cost of the nuclear industry,

> We were supposed to make 4th generation reactors, they are still not released yet! It costs a fortune! So it's through money. The nuclear industry will come to an end because of money. There is, it will come to an end based on rationality, it will not come to an end based on accident risks, it will come to an end in relation to the money that it costs (O09, Green Party, oppositional).

The current organization of the French energy production system is reaching a critical point. Oppositional stakeholders are not responsible for this situation. Overall, they are pragmatic about

their role and the future of the debate in France. Oppositional stakeholders recognize that it is difficult to win the hearts and minds of the population in a context that never allows effective anti-hegemonic knowledge to emerge. Activists disseminate non-conventional information that might not help mobilizing bystanders. Nuclear knowledge can be dry and overwhelming which does not help with recruiting people.

Although they are facing many obstacles, oppositional groups are invested in the cause. They believe in mobilizing against nuclear energy. Despite the frustration of fighting against a more powerful opponent, oppositional stakeholders are proud of what they achieve even if it is not a nuclear phase-out. One anti-nuclear activist reminds others about the importance of being involved to prevent more catastrophes: "The anti-nuclear movement might be proud perhaps of having avoided accidents through warning. And, also, of avoiding the worst too. So, it also means that we were able to save something" (O01, Sortir du Nucléaire, oppositional). As such, oppositional actors continue to pose a constant resistance, challenging the power of the state and nuclear companies through various strategic choices.

"The best enemy of nuclear power is the nuclear industry itself": Lawsuits and reduced consumption as central elements of oppositional tactics

Over the course of the existence of organized anti-nuclear contestation, oppositional groups have relied on various strategies to mobilize against the nuclear industry and to disseminate counter-hegemonic nuclear knowledge. Demonstrations at nuclear sites or in cities represent an established form of protest. In 1977, 70,000 protesters join the demonstration against the Creys-Malville power plant. After the Chernobyl disaster, anti-nuclear groups benefited from a renewed interest in addressing nuclear risks. More recently, Sortir du Nucléaire organized a series of human chain events to protest the Fukushima disaster. In 2012, the one-year anniversary march to commemorate the catastrophe mobilized 60,000 people which "is not huge, but it was still a success media-wise" (O11, Sortir du Nucléaire, oppositional). Currently, the Cigéo project

located in north-eastern France is a source for anti-nuclear activist mobilization. These demonstrations allow oppositional actors to position themselves in the public sphere but often meet with limited success due to the marginalized situation of anti-nuclear forms of protest in France (Chambru 2014). One Sortir du Nucléaire activist acknowledges the limited outcomes of traditional forms of protest, "It's true that protests in their current form, I'm a little tired of them too. Namely, there are not enough of us, it does not carry enough weight. Even the one in Flamanville, there were only 5,000 people" (O08, Sortir du Nucléaire, oppositional). In a nuclear reliant context, the challenge is for oppositional actors to organize strategically in how they produce information to overcome the normative control over the production of nuclear knowledge.

Other forms of oppositional knowledge include publications in mainstream or specialized media outlets via interviews and articles. Once again, counter-hegemonic narratives struggle to make their way through. Journalists from mainstream media are more likely to convey messages that support nuclear energy (Schweitzer and Mix 2018). This is where the normative efforts to control emerging opportunities and threats plays an important role. Because normative stakeholders delegitimize oppositional arguments, individuals and groups who circulate this information are not taken seriously. Their knowledge is not perceived as being "expert" knowledge of the issue. For instance, one experienced activist discusses the importance of the expert in addressing controversial topics, emphasizing control over the information provided to the population: "There is such a devotion to […] the famous experts that we constantly hear about. If there is not an expert who appears on the 8pm news several times and who says what we say, things won't get moving" (O06, Coordination Antinucléaire du Sud-Est, oppositional). Independent media outlets are useful tools to overcome the lack of access to mainstream media and anti-hegemonic actors rely on this approach to spread alternative nuclear knowledge. Unaffiliated and oppositional stakeholders alike – especially smaller unaffiliated labs and organizations who have less ties with

dominant institutions – create and try to gain access to new information channels. However, independent media outlets might only provide limited exposure to oppositional narratives. One respondent who understands the inner-workings of the media industry explains using the online independent newspaper Mediapart to describe its organization but also acknowledges the limitation of the strategy, "I was able to publish several small pieces, but the problem of Mediapart is that it has the efficacy of virtual reality. Of course, articles remain [available], if you search for them, you will find them. But we know that past three or four days or 15 days; no one will read your speech" (U04, Enfants Tchernobyl Belarus, unaffiliated). While designed to provide alternative knowledge about a wide range of social, political, or economic issues, independent media does not represent the main platform through which the general public receives its information, ultimately limiting the resonance of anti-hegemonic discourse.

Therefore, oppositional actors continue to develop new tactics to raise awareness about the nuclear industry and to provide alternative information about nuclear energy. In light of their struggle to mobilize and spread their ideas, anti-nuclear groups decided to focus some of their efforts on suing nuclear companies for their wrongdoings. This strategic choice provides an opportunity for oppositional stakeholders to face their opponents in an environment that normative stakeholders are less likely to control. Several respondents mention this strategy as a way to point out malpractice inherent to the industry. This type of action helps in confronting EDF and Areva's misconduct and allows oppositional activists to have their claims legitimized by a courthouse when successful. One anti-nuclear activist who has been an active part of the anti-nuclear coalition for a long time explains why she supports such legal actions,

> What the Network does and what I also approve of is to take legal action. When a nuclear reactor lets out a lot of tritium, for example, much more than it has the right to, and that anti-nuclear activists manage to measure it – and now we are still well equipped to do that –when we are able to know it, in general, we take

> actions in courts. And we had the pleasure of winning last January (O10, Sortir du Nucléaire, oppositional).

Suing nuclear companies is not a spur-of-the-moment decision. It entails gathering evidence, collecting information about the concern, and being involved in the process for an extended period. Actions in courts challenge the "irrationality" and "much ado about nothing" stigmas created by normative stakeholders that affect the perception of oppositional actions. Using the legal system to dispute normative nuclear knowledge reflects a willingness to engage in activities to garner credibility for a movement that lacks public validity. When oppositional stakeholders carry legal actions against the nuclear industry, it sends a clear message that anti-nuclear activists are committed to confront the nuclear industry and that they are confident in their claims. In addition to validating oppositional knowledge, legal actions benefit the movement itself. When the nuclear industry is sentenced, it sends an encouraging message to actors dedicated to the production of nuclear knowledge. At the end of an interview, one experienced Sortir du Nucléaire activist expressed a desire to end on a more positive note explaining that legal actions can help in raising public awareness: "There was a trial, so maybe now there is a civic awakening regarding this issue, too. So, yes, maybe, yes. One must not be completely pessimistic" (O01, Sortir du Nucléaire, oppositional).

Actions in courts also participate in bringing visibility to oppositional groups through mainstream media relaying trials when talking about nuclear companies. The space dedicated to oppositional actions remains limited but anti-nuclear actors are presented as fully-fledged participants in the debate. For instance, one article from *Le Figaro* published in 2015 cites the Sortir du Nucléaire spokesperson presenting the group's grievances for suing EDF (de Mallevo 2015). Although several oppositional actors point out the benefits of such a strategy in terms of raising awareness regarding overlooked aspects of the nuclear industry – namely the day-to-day problems affecting the energy production process – some anti-nuclear activists want to be realistic about the long-

term outcomes of these lawsuits. They argue that while important, the outcome of legal actions remain limited especially in addressing systemic issues. By itself, suing nuclear companies cannot change the structure of the industry nor can it challenge the dominant position of nuclear energy. One activist who is in charge of a small anti-nuclear group describes their own experience with lawsuits,

> I personally pressed charges against Areva at the High Court of Chalon-sur-Saone, near Le Creusot forges, where all these pieces were messed up and falsified. I think that it's important to do this kind of thing, but I absolutely do not think that it is what is going to knock down the nuclear industry. It can be used to educate the public opinion, if we manage to ensure that there is a trial and that it is properly handled by the justice system – the jury is still out on this one. But, as for me, I consider that the best enemy of nuclear power is the nuclear industry itself (O02, Observatoire du Nucléaire, oppositional).

Legal actions are a useful tool and a rational strategic choice to expose construction and production flaws unveiling problems and misconduct within the nuclear industry, but it also reflects power differences between the normative and oppositional stakeholders. Even when found guilty, nuclear companies remain in a position of power allowing them to ignore their conviction and continue their prior course of action. When asked about the need to communicate more about nuclear energy, a prominent figure of the anti-nuclear fight points out that successful oppositional actions, including lawsuits, never led to any significant transformation of the status quo,

> At first, when I created CRIIRAD, I proved the lie, I showed them that there was plenty of contaminated food, mushrooms, stuff, things. So what? Do you think it gave me more votes for the environmental movement? You see? We had debates.

> We could see people who were lying. And we took them to courts. They were indicted. So what? It's terrible (O09, Green Party, oppositional).

Legal actions against nuclear companies provide new opportunities for oppositional activists who can challenge nuclear companies directly without the influence of the state. Lawsuits allow oppositional knowledge to appear alongside normative narratives. In particular, this strategy is important in addressing specific problems associated with the nuclear industry. Government actors are less likely to interfere with the process. This strategy is consistent with Pellow's (2001) argument that economic actors play a more important role in POS. Oppositional stakeholders do not position themselves ideologically anymore; they try to utilize the economic sphere. The courtroom setting encourages a careful analysis of the situation and the facts and legitimizes oppositional information. Lawsuits might not change the future development of nuclear energy in France but it illustrates the ability of oppositional group to maintain an on-going fight challenging the status quo and informing lay publics about important – and potentially missing – information about nuclear companies. Actions in the legal system also reflect the redefinition of oppositional actions. Most of the anti-nuclear coalition have abandoned radical actions to engage in milder, slow-paced actions. Activists suing nuclear companies fits the larger context for a decades-long opposition that faced many obstacles to disseminate information to the public.

In addition to lawsuits to address malpractice, oppositional groups develop narratives challenging important energy myths: the price of electricity and energy independence. For a long time France benefited from low electricity prices (Schneider 2010, Szarka 2013) and EDF warned against a reduced nuclear program leading to increased electricity prices and energy imports (Schneider 2013). However, activists dispute the allegedly bargain rates of nuclear electricity. When asked about the main misconceptions regarding nuclear energy, one radical ecologist who participated in anti-nuclear protests in the 1970s and has been involved in many anti-nuclear groups explains that the civil nuclear program is very expensive at "190 billion euros for the program" and

because of that the nuclear industry is “in deep shit” (O03, MAIN /Décroissance, oppositional). An important part of oppositional narratives focus on the price of electricity production as maintenance costs keep increasing. This illustrates the ability of the anti-nuclear movement to mitigate its message. Between compliance and resistance (Cheung and Ngai 2009, Collison 2003), anti-nuclear activists adapt their narratives strategically to provide a middle ground for contestation. In other words, because they are aware of how the hegemonic framing of nuclear energy, oppositional stakeholders – and unaffiliated stakeholders disapproving of the current structure of the nuclear industry – adopt a less ideological stance. Anti-hegemonic nuclear narratives thus are designed to appeal to anyone who is concerned with energy consumption or energy prices.

Understanding the implications of challenging the status quo in a nuclear reliant society, oppositional actors move away from “emotional” arguments associated with the fear of the technology to focus on the economic consequences of the current energy production process. They abandon critical-interpretive arguments to focus on a counter-informative approach to knowledge production (Coy et al. 2008). Given contemporary social, political, and economic changes, this tactical choice is more likely to resonate among a public who might be concerned about saving money or reducing its energy consumption. For instance, one Sortir du Nucléaire activist who started to mobilize after the Fukushima disaster explains that discussions about the monetary repercussions are more effective in engaging people than health or environmental considerations,

> Strangely, it's not health, it's not pollution that stops nuclear energy, in the end it's the economic problems. That is what has the biggest effect. Now we know that [with] the EPR for example that they want to build, electricity will be 30% more expensive than for wind-powered [electricity]. So that's true that, as a result, it restores optimism a little bit (O08, Sortir du Nucléaire, oppositional).

Oppositional stakeholders abandon their historical positions to adopt a more pragmatic approach to protest. Activists do not disavow their convictions; they continue to believe in moral arguments against nuclear energy. However, they adapt the way that they present the issue to outsiders. Challenging nuclear energy is not about being able to show the dangerousness or talk about the risks of nuclear technology – instead it is about money. Activists argue that the financial argument has the potential to resonate not only among lay publics but also among policy-makers in charge of important economic decisions.

The important part of this oppositional claim is to show that an industry that encourages energy consumption "is no longer profitable" (O01, Sortir du Nucléaire, oppositional). As part of their claims regarding the price of nuclear energy, oppositional stakeholders argue that French people have been consuming too much energy for decades because of nuclear electricity. They explain that in addition to switching to a different energy source, France should significantly decrease its energy consumption. Once again, this idea is based on a civic approach to the issue, downplaying any ideological implications. This anti-hegemonic narrative emphasizes the idea that the nuclear industry has encouraged heavy energy consumption to consolidate its importance. However, at a time of a global awareness regarding the impact of human activities on the environment, overconsuming becomes harmful and expensive. Alternative nuclear knowledge addresses the hegemony of nuclear energy through a dual environmental and monetary perspective. Therefore, oppositional strategies include a push towards reduced energy consumption as illustrated by the following comment from a Global Chance activist,

> You also have a bunch of electricity savings that require very little investment. So it's really feasible. Not only in an environmental protection or opposition to nuclear power mindset. But also money savings. Energy savings in general, by the way. You reduce your material dependence but also you reduce your bill. And to the extent that electricity prices will increase, since it will be necessary to

> pay for all these slip-ups in the nuclear industry, you would be well advised to reduce your consumption (O05, Global Chance, oppositional).

Through that rhetorical work, oppositional actors contend that one does not have to be "anti" nuclear energy to question the existence and the development of the French civil nuclear program. Anti-hegemonic nuclear knowledge highlights the nuclear industry's misconduct. The fact that nuclear companies were on the brink of bankruptcy at the time of the interviews (leading to Areva rebranding itself in January 2018) supports oppositional arguments of secrecy and lack of transparency. In a context of increased electricity prices, nuclear companies continue to lie about the true production cost. Thus, oppositional groups continue to challenge the nuclear industry and to point out fallacies in the dominant normative perspective of nuclear energy. Reducing energy consumption in France is possible and contesting the low cost of nuclear electricity is a central element to oppositional narratives. It reflects a will to attack an historical rhetorical argument encouraging acceptance of nuclear energy. Overall, oppositional stakeholders use and transform normative narratives to inform the public about nuclear energy.

"We had set foot in a spiral and it was irreversible": De-normalizing nuclear energy

While normative stakeholders deploy extensive efforts to explain that the nuclear industry is like any other industry, oppositional groups argue that nuclear technology can never be a non-controversial industry. While nuclear advocates rationalize the existence of nuclear risk, anti-nuclear opposition reveals the unique hazardous nature of the nuclear industry. In particular, oppositional nuclear knowledge raises awareness about the multitude of incidents and accidents happening, including in French nuclear power plants. Often missing from normative narratives which focus on technological prowess, these threats illustrate the normalization of nuclear energy in France. As a strategic choice, anti-hegemonic actors draw attention to overlooked accidents and try to reinstate the meaning of nuclear incidents. One Global Chance activist shares concern due to a series of problems occurring in the French nuclear power plants,

> I am extremely worried about safety issues for example. I think it's not going well at all. There are incidents, or even accidents. When you see what happened in Paluel[7]. The steam generator that crashes inside the reactor, that falls down, come on! That is unacceptable! There are currently technical difficulties that are extremely alarming (O05, Global Chance, oppositional).

These accidents are evidence that nuclear officials have lied about their ability to control the technology. Oppositional stakeholders try to bring attention to missing information regarding on-going safety matters. Relying on counter-informative knowledge (Coy et al. 2008), the goal of activists is to address missing components in the normative discourse. Oppositional knowledge is organized around the idea of raising awareness about the reality of the nuclear electricity program, which entails challenging decades of official narratives singing the praises of nuclear energy. As such, oppositional actors have to spend a lot of time and energy contesting well-established narratives. One interviewee highlights the dichotomy between the official discourse of technological prowess and the reality of nuclear energy production,

> Seen from the outside, we get the impression that the nuclear industry is the best of the best technology, but they tell us that sometimes they end up in a situation where they have to seal off pipe leaks with pieces of rags soaked in oil. In other words, they say they are in a position to tinker with pieces of string, with rags, to prevent the tragedy from taking place. They cannot always do that. There are incidents; there are nearly 800 nuclear incidents in France, per year. It is no small achievement, really! (O06, Coordination Antinucléaire du Sud-Est, oppositional).

Oppositional actors actively challenge official narratives establishing French nuclear expertise. They want to dissociate nuclear energy and nuclear proficiency to encourage a shift in public

[7] Nuclear power plant located in Normandy. The incident mentioned here happened in April 2016.

support for the technology. Evidence contesting the existence of a highly developed nuclear knowledge could help bring about social change. For instance, one Sortir du Nucléaire activist who participates in anti-nuclear meetings and actions explains,

> The French are bad at nuclear technology. They know very well how to use the American technology. Very well quote unquote. That is to say that all the power plants in France are French and the EPR is, at first, a Franco-German technology. And then the Germans saw that it was really shitty and they stopped. And so it's just French [technology] now and, in fact, they are not ready, they cannot do it (O08, Sortir du Nucléaire, oppositional).

Once again, it is not an easy task to challenge official narratives about the brilliance of the French nuclear program. Especially, when the information is not well known or popular. Several respondents emphasize the obstacles they face in trying to oppose the power of the nuclear industry. They argue that people are excluded from the debate and that it can be difficult to spread important information. One Greenpeace activist who has a detailed understanding of the nuclear industry observes that the secretive nature of the French civil nuclear program makes it hard to raise awareness about some aspects of the topic as illustrated by the following comment,

> Today, when you talk about nuclear energy, if I'm talking about the transport of nuclear waste, I imagine you are aware of it, but, it's a state secret so we do not have the right to talk about it. We can be questioned for that, we can have problems, just for the reason to talk about it. Everything that is transport for example, it is classified. Sorry... not secret state[8]. Classified. Top secret (O07, Greenpeace, oppositional).

[8] In French the expressions are similar: secret d'état (state secret) and secret defense (classified).

Such an uncommon standing within the French industrial landscape complicates attempts to engage with the general public and to provide alternative information. Mobilizing against nuclear energy is a tenuous process even in the context of nuclear disasters. While people are willing to organize for a short period, the opposition movement has failed to maintain popular involvement. Oppositional stakeholders engage in complicated claimsmaking to counter normative statements. In particular, anti-nuclear groups have to navigate risk narratives when catalyzing events are not enough to challenge the status quo. As anti-nuclear narratives point out the dangerousness of nuclear energy, counter arguments make radiation commonplace. Several respondents emphasize how normative stakeholders normalize nuclear contamination. First, one participant explains that the lay public remains apathetic,

> Chernobyl, Fukushima, everyone saw pictures. As far as the disaster is concerned, they know about it. Everyone knows that nuclear power can cause accidents. It's even the official theory. This is what is new in France. Incidentally, the government is preparing for a catastrophe. What they want to do is make people live in a contaminated area. In contaminated areas. But people do not give a damn. People do not give a damn (O03, MAIN/Décroissance, oppositional).

Oppositional activists have to deconstruct long-lasting accepted narratives. A time-consuming endeavor, it has consequences on what choices remain available. Since nuclear technology is designed to last, oppositional stakeholders have to be able to account for various complicated and difficult to address scenarios. A very important aspect of the anti-hegemonic rhetoric about the uniqueness of nuclear energy is associated with the long-term consequences of the technology. Nuclear waste storage is an ongoing conversation and oppositional stakeholders raise awareness about the irreversible nature of radioactive waste. They argue that people might not realize the extent to which radioactive waste is going to affect France in the future. Discussing reasons to mobilize against nuclear energy, one Greenpeace activist explains “it was the fact that we had set

foot in a spiral and that it was irreversible" (O07, Greenpeace, oppositional). Shifting from counter-informative knowledge to radical-envisioning and transformative forms of knowledge, oppositional stakeholders address future options. They argue that discussions about nuclear energy should focus on the future since France is stuck with nuclear waste for centuries.

Nuclear energy cannot be just like any other source of energy because it requires a plan for safe and long-term waste management. Radioactivity is also a problem that is overlooked too often. Combined together, these elements have catastrophic consequences for people and the environment. Anti-nuclear activists challenge the notion of nuclear safety by addressing lasting dangerous outcomes. For instance, one Sortir du Nucléaire activist observed the following when talking about the future of the nuclear debate in France,

> The atmosphere is rotten since the first atmospheric tests in the 50s. So I'm not optimistic because the radioactivity that was produced, that one, we have to take care of it now. Well, it's going to take centuries, and so we know there is no social stability that lasts for centuries. So, inevitably, there will be zones – there are already several – zones that are completely screwed, where it would be necessary to evacuate (O04, Sortir du Nucléaire, oppositional).

Anti-nuclear activists also believe that France is too confident about its ability to develop nuclear reactors. In its will to become a nuclear expert, France has made some mistakes, which can be costly. When talking about the current development of the civil nuclear program, one Global Chance activist compares the development of nuclear energy with the disastrous French invasion of Russia in 1812 by Napoleon, which ended with France's crushing defeat,

> Clearly, we went too far with the nuclear technology. We overdid it. We wanted to go too fast. Above all, we wanted to have it all over the world by selling EPRs, even before we got an EPR working in France. You cannot do that ... You have a

> product; you test it in the most favorable conditions, namely at home with your own means. So there were too many mistakes, always Napoleonic in nature. That is to say, we charge, we charge. Well, but here we are, roughly, at the level of the Russian retreat. So it is imperative that it does not turn into disaster (O05, Global Chance, oppositional).

This chapter illustrates that the anti-nuclear coalition adapts to better address current issues associated with nuclear energy. Oppositional nuclear knowledge production reflects activists' willingness to play a role in challenging normative ideas about France's energy choices despite obstacles. French oppositional nuclear knowledge production focuses on counter-informative, radical-envisioning and transformative narratives neglecting moral arguments associated with critical-interpretive knowledge (Coy et al. 2008). This is consistent with the history of the French anti-nuclear coalition, which has failed to mobilize effectively on moral and ethical accounts in the past and the normative control over the meaning of the French nuclear technology. Continuously addressing the present situation as well as future alternatives, oppositional stakeholders thus strategically abandon ineffective and pointless claims.

However, anti-hegemonic resistance is limited due to conflicts between anti-nuclear organizations. Unsuccessful in influencing policy-making for several decades, oppositional actors have a different angle of attack. The fight is not ideological anymore. Anti-nuclear activists do not challenge the existence of civil nuclear programs on moral grounds. Instead, they shift their focus to legal and economic aspects. As they appear to have lost the ideological "battle" for the control of knowledge over nuclear energy, oppositional actors focus on tangible aspects of the technology with direct effect on people, appealing to pragmatic popular concerns. At a time when the nuclear industry is on the verge of reaching a turning point with pressing questions regarding the role of nuclear energy in helping with future energy needs, strategies to promote alternative nuclear knowledge remain limited in affecting change. At the same time, oppositional

stakeholders make use of normative narratives to engage in alternative knowledge production. Opposing well-established normative messages highlights the anti-nuclear coalition's commitment to knowledge diffusion in a context of overall economic hardships.

CHAPTER VIII

CONCLUSIONS

Production of nuclear knowledge in France is multifaceted, reflecting complex dynamics between key stakeholders of the debate. Powerful institutionalized actors control the mechanisms of knowledge production and nuclear knowledge available to the public is incomplete despite efforts by oppositional and unaffiliated actors to challenge the status quo. The three different categories of stakeholders – oppositional, normative, and unaffiliated – represent diverging and often incompatible forms of nuclear knowledge, as they compete to gain public support. The hegemonic position of normative stakeholders allow them to control the debate without deploying massive communication efforts. Efforts to resist official nuclear discourse through counter-informative, radical-envisioning and transformative knowledge production (Coy et al. 2008) can open new opportunities for debate regarding the future of energy production in France. However, oppositional knowledge does not necessarily threaten normative knowledge-shaping processes (Bonds 2010). Normative stakeholders communicate and act to maintain the dominant position of the nuclear industry for electricity production, enforcing and enacting a decision to preserve nuclear reliance.

Overall, political opportunity structures tend to benefit normative stakeholders even when catastrophic or dangerous events happen: the Fukushima disaster and Germany's decision to give nuclear energy are transformed to celebrate France's technological prowess. This illustrates the

difficulty for social movement activists to act upon perceived opportunities or threats (Einwohner 2003) when they are in a weakened position. Historical dependence on nuclear energy, negative framing of alternative forms of energy, and inadequate public understanding of nuclear technology work against the oppositional and non-institutionalized unaffiliated stakeholders as a lack of resources prevents them from addressing central issues. All sides are critical of the public's nuclear knowledge but provide contradictory analysis of the lack of public understanding, further illustrating the inertia of the French nuclear debate. Figure 2 summarizes the relationships between the different categories and highlights the conceptual outcomes of their respective positions.

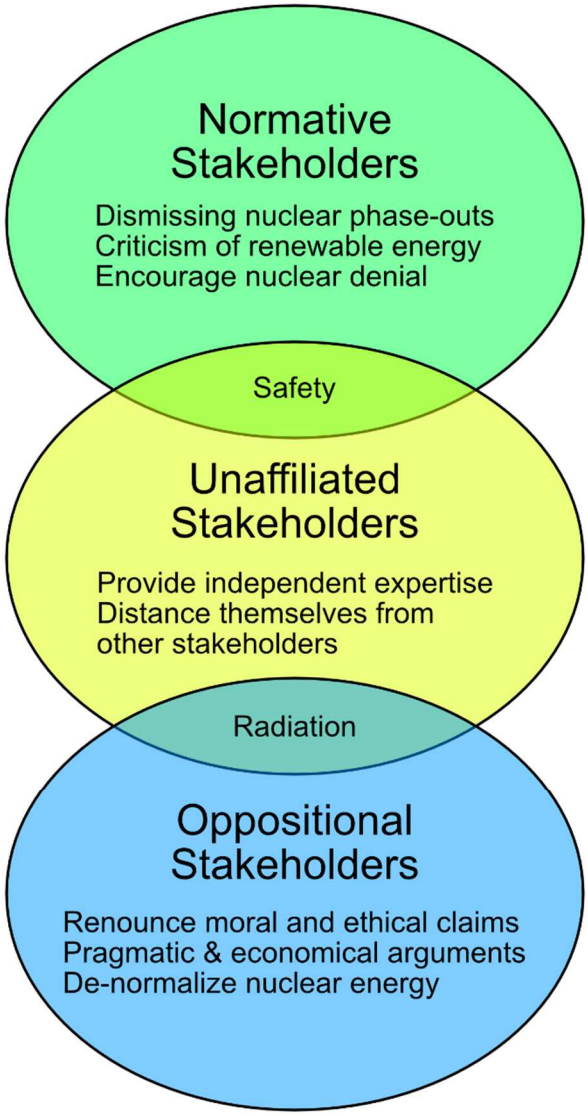

Figure 2. Nuclear Knowledge Production Tactics for Stakeholders of the French Nuclear Debate

Normative stakeholders benefit from a dominant position and continue to dismiss attempts to challenge the status quo. Their use of narratives inspired by early pro-nuclear messages highlights the fact that their position hasn't changed in decades. They continue to promote France's technological prowess and to present nuclear energy as the best solution to future energy needs. The presence of organized oppositional groups is not threatening enough to encourage normative actors to develop new and innovative messages. Mechanisms of knowledge production are minimal among nuclear advocates. Through skilled rhetorical work suppressing or transforming oppositional arguments, normative stakeholders continuously shape the perception of nuclear energy. The nuclear industry and the government continue to rely on old pro-nuclear narratives to encourage public acceptance and normative stakeholders explain that the French population does not really want to learn more about the industry. Recent efforts to promote the French civil nuclear program include an emphasis on the normalization of radioactivity and the fact that the nuclear industry is similar to many other well-established industries, emphasizing the importance of nuclear denial in France; downplaying the negative outcomes of nuclear technology (Perrow 2013).

On the other hand, the status of the opposition movement remains mainly unchanged. The oppositional movement has never had the upper hand in the nuclear debate and even major events such as the Fukushima disaster do not provide organizing opportunities for oppositional actors to address nuclear risks. Because of their marginalized position, anti-nuclear adherents tend to organize reactively, rather than proactively relying mostly on counter-informative knowledge to communicate. Abandoning their historical moral critique of nuclear energy, oppositional stakeholders engage in discussions about the future of energy production in France. The POS dimensions are more detrimental to oppositional stakeholders. Normative control over emerging opportunities and threats prevents anti-hegemonic actors from leveling the playing field. The context of energy production in France represents an uphill battle for oppositional activists who

persistently have to oppose the power of the state and nuclear companies to provide an alternative understanding of nuclear technology. Individuals opposing nuclear power are aware of these uneven dynamics but the solutions to address the lack of visibility are limited. Additionally, the anti-nuclear coalition struggles to maintain unity or even to appear willing to acknowledge diverging anti-nuclear trends. Internal tensions weaken oppositional knowledge production as activists focus on addressing internal tensions. In turn, they are less likely to mobilize successfully and continuously. However, oppositional stakeholders remain dedicated to their cause. After decades of existence without major achievements, activists want to acknowledge small achievements in challenging the status quo even if these changes will not radically transform the structure of the energy industry.

The lack of success affected oppositional strategies and tactical choices. Consistent with the literature about claimsmaking (Best 1987, McCullan and Eyes 1999), anti-hegemonic actors are dedicated to finding relevant ways to gain external support. Even without being able to control the POS, they continue to construct alternative narratives about nuclear energy contesting normative claims (Hannigan 1995). However, oppositional stakeholders seem to accept the idea that they lost the ideological battle and prefer to focus on less radical but more tangible actions. Many activists are pessimistic about the future of the debate. Factors beyond their control will decide the future of the energy program in France. Without complying with the system or resisting it aggressively, nuclear opponents found a middle-ground position. Oppositional arguments then adapt to represent a more pragmatic vision of the future of the energy production in France.

Unaffiliated actors try to bring balance to the debate but struggle to find their unique position – and their distinctive voice – in the debate without being associated with either normative or oppositional groups. Unaffiliated nuclear knowledge claims to provide unbiased insights into the inner workings of the nuclear industry but the structure of the civil nuclear program itself makes

it difficult to remain completely separated from normative and/or oppositional stakeholders. Despite efforts to promote independent knowledge, unaffiliated stakeholders make both the production of nuclear knowledge and interactions between opposing stakeholders more complicated. In particular, labs and independent experts who work closely with the nuclear industry strengthen the position of normative stakeholders. On the other hand, counter-experts weaken oppositional knowledge by refusing to align with oppositional groups. This further participates in the fragmentation of anti-hegemonic voices which can make it more difficult to challenge the status quo.

The failure of oppositional groups to provide an alternative perceived as legitimate by the majority of the population is embedded within strong control mechanisms highlighting the close ties between the French government, the nuclear industry, and scientific research about nuclear technology. In turn, normative narratives participate in making a "non-nuclear France impossible" (Hecht 2009:13). The political and economic context surrounding the development of the French civil nuclear program led to a shift in anti-nuclear tactics. After unsuccessful attempts to challenge the status quo, "anti-nuclear politics became less militant and less extra-institutional" (Wiliarty 2013:289). As such, the lack of success of the oppositional movement as a whole in terms of affecting policy-making through effective nuclear knowledge production should not be attributed to internal tensions or failure to adapt to the broader social, political, and economic context. Power differences regarding access to information play an important role in explaining the current shape of the nuclear debate in France. Because they have to dedicate a lot of their time to actions challenging the status quo, oppositional stakeholders might be limited in their ability to organize efficiently to bring about social change. As they focus on winning the hearts and minds of the population, they struggle to translate their narrative work into support and eventually into policymaking. However, as the French nuclear industry is facing new challenges regarding aging power plants and future energy needs, oppositional stakeholders might have a new role to play in

guiding the transition towards new energy sources. Normative stakeholders might maintain control over nuclear knowledge and the development of France's future energy program. However, anti-hegemonic actors might be instrumental in limiting the role of nuclear energy in future energy mix. The transformation of ideological narratives into economic messages might benefit the transition into a new – and more balanced – energy debate.

Political opportunities influence the context of nuclear knowledge production in post-Fukushima France, with an emphasis on normative stakeholders' ability to control emerging opportunities and threats. Political opportunity structures play an important role in shaping organized protest (Gamson 2004; McAdam 1982), providing openings for social movement organizations to influence policy making (Giugni 2007; Noakes and Johnson 2005). The ability to have authority over the meaning of shifts in the broader social, political, and economic context limits challenges to the hegemonic position of nuclear energy in France.

Stakeholders such as the French government and the main nuclear companies produce and disseminate knowledge to maintain their dominant position. As normative stakeholders engage in knowledge production, their goal is not to try to inform the public about nuclear technology. Instead they impose their view without consulting other actors as discussed for instance by Foucault (2000), Ingham and Donnelly (1990) and Kinsella (1999). In turn normative knowledge production provides a definition of a preferable reality (Katz 2006; Stoddart 2007). Nuclear energy becomes an integral part of the French industrial landscape despite reservations regarding safety and/or costs. Normative stakeholders minimize potential "knowledge conflicts" (Ockwell and Rydin 2006) between their hegemonic view of nuclear energy and their opponents'. The choices and strategies available to oppositional actors to craft knowledge and oppose the power of the state and nuclear industry are limited Oppositional stakeholders rely on extensive claimsmaking (Hannigan 1995) to challenge normative nuclear knowledge, but their weakened position hinders their ability to affect policy making through knowledge production. In discussing

normative and oppositional strategies of nuclear knowledge production, I compared and contrasted the knowledge-shaping process available to normative stakeholders discussed by Bonds (2010) to the oppositional knowledge production examined by Coy and colleagues (2008) identifying how these two approaches to knowledge production work in relation to each other. In particular, I identified how the knowledge-shaping process can hinder oppositional stakeholders' ability to provide an acceptable alternative. Furthermore, I tied knowledge production to the structure of political opportunities explaining how openings and threats can constrain opposing stakeholder dynamics. As debates regarding the future of energy production – and consumption – arise globally, understanding how knowledge is produced and which voices are heard is central in encouraging more informed participatory debates.

Future research can further discuss the contribution of unaffiliated stakeholders, paying particular attention to their role in shaping policy outcomes. Additionally, future discussion can address mobilization issues among oppositional groups. As identified in this project, anti-nuclear activists are in a weakened position and have difficulty mobilizing new members. New research could further explore the issue, identifying potential connections between the role of a hegemonic industry in precluding successful action and the aging of a movement that struggles to appeal to younger generations. Identifying dynamics internal to oppositional groups can help in better understanding their weakened position and can provide insights into addressing power differences. Another avenue for future research includes addressing the role of the public in the debate and the variation in public attitudes. An important component of the status quo, the public remains mostly apathetic toward nuclear energy, despite apparent nuclear skepticism that highlights the role of closely organized elites in imposing decisions about energy sources. It would be useful to further explore the role of the power elite (Mills 1956) and interlocking directorate (Mizruchi 1996) in shaping stakeholders dynamics. It is also important to discuss the French nuclear debate in relation to other hegemonic situations comparing and contrasting

oppositional groups in France with movements such as the Civil Rights movement and the Occupy Wall Street movement in the United States, among others. Comparative analysis of anti-hegemonic movements would provide a better understanding of successful counter-hegemonic strategies. Finally, future research can compare and contrast the French nuclear debate to other countries as they decide to continue or abandon their civil nuclear programs in order to better understand how different sets of stakeholders make sense of emerging opportunities and threats.

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APPENDICES

APPENDIX A

List of Acronyms and Abbreviations

ACRO	Contrôle de la Radioactivité dans l'Ouest (Organization for Radioactivity Control in Western France)
ANDRA	Agence Nationale pour la Gestion des Déchets Radioactifs (National Radioactive Waste Management Agency)
ASN	Autorité de Sûreté Nucléaire (Nuclear Safety Authority)
CEA	Commissariat à l'énergie atomique et aux énergies alternatives (Alternative Energies and Atomic Energy Commission)
Cigéo	Centre Industriel de Stockage Géologique (Industrial Centre for Geological Disposal)
CRIIRAD	Commission de Recherche et d'Information Indépendantes sur la Radioactivité (Commission for Independent Research and Information about Radiation)
EDF	Electricité de France (Electricity of France)
EPR	European Pressurized Reactor
GSIEN	Groupement des Scientifiques pour l'Information sur l'Energie Nucléaire (Association of Scientists for Information on Nuclear Energy)
IAEA	International Atomic Energy Agency
IRSN	Institut de Radioprotection et de Sûreté Nucléaire (Institute for Radioprotection and Nuclear Safety)

ITDD	Ingénierie Traçabilité et Développement Durable (Engineering in Traceability and Sustainable Development)
PO	Political Opportunities
POS	Political Opportunity Structure
SFEN	Société Française d'Energie Nucléaire (French Nuclear Energy Society)
SMO	Social Movement Organizations

APPENDIX B

Oklahoma State University Institutional Review Board

Date:	Thursday, December 10, 2015
IRB Application No	AS15114
Proposal Title:	Production of Nuclear Knowledge in Post-Fukushima France
Reviewed and Processed as:	Exempt

Status Recommended by Reviewer(s): Approved Protocol Expires: 12/9/2018

Principal Investigator(s):

Julie Schweitzer
416 W Maple Ave Apt 17A
Stillwater, OK 74074

Tamara Mix
460 Murray Hall
Stillwater, OK 74078

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

▣ The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1.Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval. Protocol modifications requiring approval may include changes to the title, PI advisor, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms
2.Submit a request for continuation if the study extends beyond the approval period. This continuation must receive IRB review and approval before the research can continue.
3.Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of the research; and
4.Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Dawnett Watkins 219 Scott Hall (phone: 405-744-5700, dawnett.watkins@okstate.edu).

Sincerely,

Hugh Crethar, Chair
Institutional Review Board

Attachment A: Informed Consent Document

Project Title:	Production of Nuclear Knowledge in Post-Fukushima France
Investigators:	Julie Schweitzer, Ph.D. student in Sociology at Oklahoma State University.
Purpose:	The purpose of this research is to examine the production of knowledge in France after Fukushima as well as to address the key stakeholders' strategies to shape the debate over nuclear energy.
Procedures:	Your participation primarily involves a semi-structured, audio-recorded interview expected to last for approximately one half-hour to no more than three hours. This will consist of questions regarding the extent of your involvement with the nuclear industry or the French anti-nuclear movement, your thoughts and opinions regarding the debate over nuclear energy in France, and your motivations for engaging in said debate. At the end of the interview I will ask you some basic demographic questions and to see any relevant, archival documents such as flyers, mission statements, pictures, or other materials pertaining to your activities in the nuclear debate. If necessary for clarification, you may be contacted at a later date for a brief follow-up interview. Your participation is voluntary and you may choose not to answer any single question or set of questions at any time. You may choose not to have this interview audio recorded, in which case I will take heavy notes reflecting our conversation.
Participation Risks:	There are no known risks associated with this project which are greater than those ordinarily encountered in daily life.
Benefits:	This research will provide several benefits. First, it will give you a chance to discuss your involvement with the nuclear conversation and to consider your impact on local communities, the environment, and local and regional nuclear policy. Second, it will help to identify the strategies surrounding controversial technologies and the potential for permanent change.
Confidentiality:	The records of this study will be kept private. Any written results will discuss group findings and will not include information that will identify you. Research records will be stored on a password protected computer in a locked office and only researchers and individuals responsible for research oversight will have access to the records. Audio files will be

transcribed after each interview and then erased. Identifying information on all archival materials will be removed following analysis.

It is possible that the consent process and data collection will be observed by research oversight staff responsible for safeguarding the rights and wellbeing of people who participate in research.

Compensation: There is no compensation associated with participation in this research project.

Contacts: If you have any questions about the research, please contact Julie Schweitzer, Department of Sociology, 405 Murray Hall, Stillwater, OK 74078, 405-744-8118, or julie.schweitzer@okstate.edu, or Dr. Tamara Mix, Department of Sociology, 460 Murray Hall, Stillwater, OK 74078, 405-744-6125, or tamara.mix@okstate.edu

If you have questions about your rights as a research volunteer, you may contact the IRB Office at 223 Scott Hall, Stillwater, OK 74078, 405-744-3377 or irb@okstate.edu

Participant Rights: Your participation is voluntary, you are free to end participation in this research project at any time without reprisal or penalty, and you are free to refuse to answer any question or set of questions if you choose.

Attachment B: Informed Consent Document in French

Nom du projet:	Production of Nuclear Knowledge in Post-Fukushima France
Chercheurs:	Julie Schweitzer, étudiante en doctorat de sociologie à Oklahoma State University.
But:	Le but de ce projet est d'examiner comment le savoir sur le nucléaire est produit en France, après Fukushima et de mettre en lumière les stratégies des principaux acteurs du débat sur le nucléaire.
Procédures:	Votre participation consiste principalement à participer à interview en tête-à-tête enregistrée. La durée de l'interview est entre 30 minutes et trois heures. Elle est constituée de questions au sujet de votre implication dans une organisation anti-nucléaire ou dans l'industrie nucléaire, votre opinion au sujet du débat sur le nucléaire en France et vos motivations qui vous poussent à vous engager ce débat. A la fin de l'interview je vous poserai quelques questions démographiques et demanderai à voir tout document relatif à mon sujet d'étude et à votre engagement susceptible de pouvoir m'aider. Il est possible que je vous contacte plus tard pour vous demander quelques précisions supplémentaires. Votre participation est volontaire et vous pouvez choisir de ne pas répondre à une question à n'importe quel moment. Vous pouvez refuser que cette interview soit enregistrée auquel cas je prendrai des notes durant notre conversation.
Risques liés à la participation :	Il n'y a pas de risques associés à ce projet plus importants que ceux rencontrés dans la vie de tous les jours.
Bénéfices:	Ce projet de recherche est associé à plusieurs bénéfices. Tout d'abord, il vous donne une chance de parler de votre implication dans le mouvement anti-nucléaire ou dans l'industrie nucléaire et de considérer votre impact local sur l'environnement et la politique nucléaire de la France. Ensuite, il aidera à identifier les stratégies utilisées dans les débats autour d'innovations controversées ainsi que le potentiel pour affecter le changement.
Confidentialité:	Les enregistrements seront gardés privés et confidentiels. Tout résultat écrit traitera des résultats généraux et ne contiendra aucune information

permettant de vous identifier. Les archives telles que les réponses à l'interview et les notes seront stockées dans un ordinateur protégé dans un bureau de l'université et seuls les membres de l'équipe de recherche auront accès aux données. Les fichiers audio seront retranscris après chaque interview puis effacés. Toute information permettant l'identification des participants sera effacée lors de la synthèse.

Il est possible que le processus de collection de l'information soit supervisé par un membre de l'équipe de recherche en charge de la protection des données et des droits des participants à des projets de recherche.

Compensation: Il n'y a aucune compensation associé à la participation à ce projet de recherche.

Contacts: Si vous avez des questions, vous pouvez contacter Julie Schweitzer, Department of Sociology, 405 Murray Hall, Stillwater, OK 74078, 405-744-8118, or julie.schweitzer@okstate.edu, ou Dr. Tamara Mix, Department of Sociology, 460 Murray Hall, Stillwater, OK 74078, 405-744-6125, or tamara.mix@okstate.edu.

Si vous avez des questions à propos de vos droits en tant que participant volontaire à un projet de recherche, contactez IRB Office au 223 Scott Hall, Stillwater, OK 74078, 405-744-3377 ou irb@okstate.edu

Droits de participation: Votre participation est volontaire, vous êtes libre d'achever votre participation à tout moment sans conséquence et vous êtes libre de refuser de répondre à une ou plusieurs questions.

Attachment C: Script for contact through mail and email

Dear _____,

My name is Julie Schweitzer, and I am a graduate student in the Sociology department at Oklahoma State University. My interests center on the nuclear debate, and I am currently conducting research regarding the production of nuclear knowledge in France. I came across your contact information through the (name of listing or affiliation) and was hoping you would be willing to talk with me about your involvement with [either the anti-nuclear movement or the nuclear industry] as well as your sentiments about the nuclear debate in France.

The purpose of this research project is to examine how the main actors involving in the nuclear debate control the production of knowledge. This research will explore strategies and the challenges of [either anti-nuclear organizations or the nuclear industry] in order to better understand the structure of the debate.

Your participation in this study would consist of a one-on-one interview lasting for approximately one half-hour to no more than three hours. If you would be interested in participating, please respond to this letter/email by contacting me through email at (julie.schweitzer@okstate.edu), or on my personal cell phone, 0682404103, at your earliest convenience. Please know that any information gathered during the research process will remain private and confidential, and that your participation in this study will benefit the understanding of the production of knowledge about controversial technology.

I appreciate your time and interest, and I look forward to hearing from you.

Sincerely, Julie

Attachment D: Script for contact through mail and email in French

Cher _____,

Je m'appelle Julie Schweitzer et je suis étudiante en sociologie à Oklahoma State University. Je m'intéresse au débat sur le nucléaire en France, et je travaille actuellement sur un projet de recherche sur la production du savoir autour du nucléaire. J'ai trouvé les informations pour vous contacter sur le site de [nom de l'organisation] and j'espérais que vous accepteriez de me parler de votre implication [dans le mouvement anti-nucléaire ou l'industrie nucléaire] ainsi que de votre opinion à propos de la situation du nucléaire en France.

L'objectif de mon projet de recherche est d'examiner comment les différents acteurs du débat sur le nucléaire contrôlent la production du savoir. Ce projet explore les stratégies et les défis rencontrés par [les organisations anti-nucléaires ou l'industrie nucléaire] dans le but de mieux comprendre la structure du débat.

Votre participation à ce projet consisterait à une interview d'une durée approximative de 30 minutes (pas plus de 3 heures). Si participer à ce projet vous intéresse, merci de répondre à cette lettre/ cet email en me contactant soit par email (julie.schweitzer@okstate.edu), soit sur mon portable (0682404103) pour fixer un rendez-vous à votre convenance. Soyez assuré que toute information collectée durant ce projet de recherche restera confidentielle et privée ; votre participation dans ce projet sera bénéfique pour mieux comprendre comment le savoir associé à une technologie contestée se développe.

Je vous remercie d'avance pour votre intérêt dans ce projet et je me réjouis d'avance de recevoir votre réponse.

Cordialement.

Julie Schweitzer

Attachment E: Script for contact through telephone in English

Hello, may I please speak with _____?

My name is Julie Schweitzer, and I am a graduate student in the Sociology department at Oklahoma State University. My interests center on the nuclear debate, and I am currently conducting research regarding the production of nuclear knowledge in France. I came across your contact information through the (name of listing or affiliation) and was hoping you would be willing to talk with me about your involvement with [either the anti-nuclear movement or the nuclear industry] as well as your sentiments about the nuclear debate in France. May I first tell you more about this research project before you decide to participate or not?

The purpose of this research project is to examine how the main actors involving in the nuclear debate control the production of knowledge. This research will explore strategies and the challenges of [either anti-nuclear organizations or the nuclear industry] in order to better understand the structure of the debate.

Your participation in this study would consist of a one-on-one interview lasting for approximately one half-hour to no more than three hours. Please know that any information gathered during the research process will remain private and confidential, and that your participation in this study will benefit the understanding of the production of knowledge about controversial technology. If you would be interested in taking part in my research project, could we arrange a time and place to meet? If you would like some time to think about participating or more information regarding my research intentions, I would be more than happy to send along some materials for you to look over.

I appreciate your time and interest, and I look forward to hearing from you. Thank you for your time.

Attachment F: Script for contact through telephone in French

Bonjour, puis-je parler à _____,

Je m'appelle Julie Schweitzer et je suis étudiante en sociologie à Oklahoma State University. Je m'intéresse au débat sur le nucléaire en France, et je travaille actuellement sur un projet de recherche sur la production du savoir autour du nucléaire. J'ai trouvé les informations pour vous contacter sur le site de [nom de l'organisation] and j'espérais que vous accepteriez de me parler de votre implication dans [le mouvement anti-nucléaire ou l'industrie nucléaire] ainsi que de votre opinion à propos de la situation du nucléaire en France. Puis-je tout d'abord vous en dire plus sur ce projet avant que vous ne décidiez si vous souhaitez y participer ou pas ?

L'objectif de mon projet de recherche est d'examiner comment les différents acteurs du débat sur le nucléaire contrôlent la production du savoir. Ce projet explore les stratégies et les défis rencontrés par [les organisations anti-nucléaires ou l'industrie nucléaire] dans le but de mieux comprendre la structure du débat.

Votre participation à ce projet consiste à participer à une interview d'une durée approximative de 30 minutes à pas plus de 3 heures. Soyez assuré que toute information collectée durant ce projet de recherche restera confidentielle et privée ; votre participation dans ce projet sera bénéfique pour mieux comprendre comment le savoir associé à une technologie contestée se développe. Si vous êtes intéressé, pouvons-nous décider d'un lieu et d'une date pour se rencontrer ? Si vous avez besoin de plus de temps pour considérer votre éventuelle participation ou si vous voulez plus d'information concernant mon projet de recherche, je serai heureuse de vous envoyer des documents pour vous éclairer.

Je vous remercie d'avance pour votre intérêt dans ce projet et je me réjouis d'avance de recevoir votre réponse.

Attachment G: Verbal consent narrative in English

The purpose of this research project is to examine how the main actors involving in the nuclear debate control the production of knowledge. I will ask you about the extent of your involvement with [name of the organization], your thoughts and opinions regarding the nuclear debate in France. I would also like to collect some basic demographic information about you.

The records of this study will be kept private. Any written results will discuss group findings and will not include information that will identify you. Research records will be stored on a password protected computer in a locked office and only researchers and individuals responsible for research oversight will have access to the records.

Your participation is voluntary and consists of a one-on-one interview audio-recorded interview lasting for approximately one half-hour to no more than three hours. You are free to withdraw your consent and participation in this project at any time, without penalty. There is no penalty for refusal to participate. You are free to refuse to answer any question or set of questions if you choose. There are no known risks associated with this project which are greater than those ordinarily encountered in daily life.

Based on the information I just provided you, do you agree to participate in my research project?

Attachment H: Verbal consent narrative in French

L'objectif de mon projet de recherche est d'examiner comment les différents acteurs du débat sur le nucléaire contrôlent la production du savoir. J'aimerais que vous me parliez de votre implication dans [nom de l'organisation], de votre avis au sujet du débat sur le nucléaire en France. J'aimerais aussi réunir quelques informations à caractère démographique à votre sujet.

Les enregistrements seront gardés privés et confidentiels. Tout résultat écrit traitera de résultats généraux et ne contiendra aucune information permettant de vous identifier. Les archives telles que les réponses à l'interview et les notes seront stockées dans un ordinateur protégé dans un bureau de l'université et seuls les membres de l'équipe de recherche auront accès aux données.

Votre participation est volontaire et consiste à une interview enregistrée d'une durée approximative de 30 minutes à pas plus de 3 heures. Vous êtes libre d'achever votre participation à tout moment sans conséquence. Il n'y a aucune conséquence à votre éventuel refus de participer. Vous êtes libre de refuser de répondre à une ou plusieurs questions. Il n'y a pas de risques associés à ce projet plus importants que ceux rencontrés dans la vie de tous les jours.

En fonction des informations que je viens de vous communiquer, acceptez-vous de participer à mon projet de recherche?

APPENDIX C

One on One Interview Guide in English

1. **Context question: "So if we could, I would like to start with how you first became involved in the nuclear industry [either as an activist or as a worker/educator]…"**

    - When and where did you start [campaigning against nuclear energy/working for a nuclear company]? What are the main reasons that motivated you to [engage in anti-nuclear activism/work for a nuclear company]?

    - Does your family have a history in [anti-nuclear activism/working in a nuclear company]? Are you a member of a political party? If so, which one?

    - What are your sentiments regarding your experience with the nuclear industry as [an anti-nuclear activist/worker/manager/educator]?

    - What are the main characteristics of the [anti-nuclear movement/nuclear industry]? Would you encourage other people to join [the anti-nuclear movement/the nuclear industry]? Why?

2. **Fukushima: "Now I would like to you to please describe the influence of the nuclear catastrophe of Fukushima on your activities…"**

    - Did Fukushima modify the type of activities in which [name of the organization] was engaged? If so, how? In what activities were you involved before Fukushima? Do you feel that there is more pressure on your activities since Fukushima?

    - Did the attitude of the government and/or the nuclear industry/the anti-nuclear industry changed since the Fukushima disaster? If so, how? What is your opinion of Francois Hollande's attitude regarding the nuclear industry?

    - Germany vs. France? Japan vs. France?

    - Do you think the situation in Iran influences civil nuclear programs around the world? If so, how?

    - Do you think that Fukushima should influence France's policy regarding nuclear energy more than Chernobyl did? Would you consider that Fukushima and Chernobyl have similar consequences for France?

3. **Production of knowledge: "I would like to ask you a few questions regarding the structure of the nuclear industry and your opinions about the debate over nuclear energy…"**

    - How does [name of organization] participate in creating/spreading knowledge about nuclear power?

- To what resources do you have access to spread this knowledge? Is it enough? If not what would make the situation better?

- In your opinion, who are the main actors/institutions that build the general knowledge about nuclear energy?

- Is this knowledge enough? What is missing? What can be improved?

- Do you think that people in France are well informed about nuclear energy? Are there power differences in the way that knowledge about nuclear energy is produced? How does it affect the actions of [your organization]?

- In your opinion did the situation regarding the production of knowledge changed since Fukushima? If so how?

- What is the role of the French government in controlling/managing the production of knowledge associated with nuclear energy?

- What type of relation does [name of organization] have with media outlets (newspapers, television, etc.)? What are your sentiments about the media coverage of the nuclear industry, locally or nationally?

4. **Strategies and support: "Could we talk a little bit about the strategies and the levels of support of [name of organizations]…"**

    - What is most difficult about [working at name of organization/campaigning in name of organization]? What is the most rewarding aspect of what you do?

    - How do you perceive the nuclear industry in [department]? In France? In the world? Where do you see the nuclear industry 10 years from now?

    - What type of support received the activities conducted by [name of organization]? Has support (financial, members, etc.) changed since Fukushima?

    - How does the general population react to your activities? Do you ever receive criticism from your relatives and relations about your engagement? How would you describe the public's perception of the [the nuclear industry/ the anti-nuclear movement] and its actions? In your opinion where does these attitudes come from?

    - Do you think that the [nuclear industry / the anti-nuclear movement] should modify its actions and/or strategies to address the issues associated with nuclear energy?

    - In your opinion what are the "best" strategies to raise awareness about the [nuclear energy\ anti-nuclear movement]?

    - What are your sentiments regarding your experience as an [anti-nuclear activist/member of the nuclear industry/nuclear instructor]?

5. **Opposition, challenges, and anti-nuclear framing: "Now I would like you to please describe the opposition your organization encounters in its activities…"**

    - What is your opinion of the current organization of the [nuclear industry/anti-nuclear movement→ ask about the other side]? As a [occupation] what are the main challenges that you are facing in opposing nuclear companies/in addressing the claims of the anti-nuclear movement?

    - In your opinion, what are the main issues associated with nuclear energy (e.g. environmental risk, health risk, etc.)? Do you think that your [organization] efficiently address these issues?

    - What type of opposition do you receive from other key actors? Do you interact with these actors? Why or why not?

    - What are the main misconceptions about [name of organizations]? Where do you think these misconceptions come from?

    - Do you think that the government and/or the nuclear industry are engaged in a campaign and activities to discredit anti-nuclear organizations' activities?

6. **Demographic Information: "Could I please ask a few questions to get some specific background information about you?"**

    - Age

    - Gender

    - Relationship status

    - Occupation

    - Hometown

    - Educational Background

Is there anything that you feel we did not address and would like to talk about, are there any previous points you would like to expand on, or do you have any comments you would like to make before we end our interview together?

One on One Interview Guide in French

1. **Contexte : "J'aimerais commencer cette interview, si vous le voulez bien, par vous demander comment a commencé votre participation [au mouvement anti-nucléaire ou à l'industrie nucléaire… "**

    - Où et quand avez-vous commencé à [travailler dans le nucléaire ou militer contre le nucléaire] ? Quelles sont les principales raisons qui ont motivées votre engagement ? Est-ce qu'un membre de votre famille [est également engagé dans la lutte anti-

nucléaire/travaille pour le nucléaire] ? Etes-vous membre d'un parti politique ? Si oui, lequel ?

- En tant que militant anti-nucléaire, avez-vous toujours été membre de [nom de l'organisation] ? Si oui, comment avez-vous entendu parler de [nom de l'organisation] ? Si non, avez-vous été membre d'une autre organisation ?

- Quelles sont les principales caractéristiques [de l'industrie nucléaire/ du mouvement anti- nucléaire] ? Est-ce vous encourageriez d'autres personnes à rejoindre [l'industrie nucléaire/le mouvement anti- nucléaire] ? Pourquoi ?

2. **Fukushima : "J'aimerais s'il vous plait que vous me parliez de l'influence de la catastrophe nucléaire de Fukushima sur vos activités…"**

   - Est-ce que Fukushima a modifié le type d'activités conduites par [nom de l'organisation] ? Si oui, comment ? Dans quel genre d'activités étiez-vous engagé avant Fukushima ? Pensez-vous recevoir plus de pression depuis la catastrophe au Japon ?

   - Est-ce que l'attitude du gouvernement ou de l'industrie nucléaire ou du mouvement anti- nucléaire a changé depuis Fukushima ? Si oui, comment ? Que pensez-vous de la politique de François Hollande en matière de nucléaire ?

   - Allemagne vs. France ? Japon vs. France ?

   - Pensez-vous que la situation en Iran influence le nucléaire civil dans le monde ? de quelle manière ?

   - Pensez-vous que Fukushima doit influencer la politique française en matière de nucléaire plus que ne l'a fait Tchernobyl ? Considérez-vous que Tchernobyl et Fukushima aient les mêmes conséquences pour la France ?

3. **Production du savoir : « J'aimerais vous poser quelques questions au sujet de la structure de l'industrie nucléaire ainsi que votre avis au sujet du débat sur le nucléaire… »**

   - De quelle façon votre organisation participe-t-elle à la création/diffusion du savoir sur le nucléaire ?

   - A quels types de ressources avez-vous accès pour diffuser ce savoir ? est-ce assez ? si ça ne l'est pas, qu'est-ce qui pourrez améliorer la situation ?

   - A votre avis, quel(le)s sont les principaux(les) acteurs ou institutions qui construisent le savoir du le nucléaire ?

   - Est-ce que ce savoir est suffisant ? Quels sont les éléments manquants ? Comment peut-on améliorer la situation ?

- Pensez-vous que le public en France est bien informé sur le nucléaire ? pouvez-vous identifier des écarts de pouvoir au sujet de la production du savoir sur le nucléaire ? De quelle façon cela affecte-t-il les actions de votre organisation ?

- A votre avis, est-ce la situation au regard de la production du savoir a changé depuis la catastrophe de Fukushima ? Si oui, comment ?

- Quel est le rôle du gouvernement en matière de contrôle / management de la production du savoir associé à l'énergie nucléaire ?

- Quel type de relation est-ce que votre organisation entretient avec les médias (journaux, télévision, etc.) ? Quelle est votre opinion au sujet de la couverture médiatique de l'industrie nucléaire, au niveau local et national ?

4. Stratégies et support : "Pouvons-nous aborder les stratégies et les différents types d'aide que [nom de l'organisation] reçoit…"

- Qu'est-ce qui est le plus difficile dans ce que vous faites ? Et le plus gratifiant ?

- Comment est-ce que vous percevez l'industrie nucléaire en [département] ? En France ? Dans le monde ? Comment voyez-vous le mouvement anti-nucléaire dans dix ans ?

- Quel genre d'aide reçoit [nom de l'organisation] ? Est-ce que la situation a changé depuis Fukushima ?

- Comment réagit le public aux actions conduites par l'organisation ? Vos proches et relations vous adressent-t-ils des reproches au sujet de votre engagement ? Comment décrieriez-vous la perception du public de votre organisation et de ses actions ? Qu'est-ce qui influence cette impression ?

- Est-ce que vous pensez que [l'industrie nucléaire / le mouvement anti- nucléaire] doit changer sa stratégie pour répondre aux problèmes associés à l'énergie nucléaire ?

- A votre avis, quelle est la meilleure stratégie à adopter pour sensibiliser le public [à l'industrie nucléaire / le mouvement anti-nucléaire] ?

- Quelle est votre opinion au sujet de votre engagement [dans l'industrie nucléaire / le mouvement anti- nucléaire] ?

- Quels types d'action conduit [nom de l'organisation] pour lutter contre l'énergie nucléaire ? Dans quelles activités êtes-vous engagé en tant qu'activiste ?

5. Opposition, challenges, and couverture anti-nucléaire : "J'aimerais maintenant que vous me décriviez les critiques que rencontre votre organisation…"

- **Quelle est votre opinion au sujet de l'organisation actuelle [de l'industrie** nucléaire / du mouvement anti- nucléaire → question sur l'autre acteur] ? En tant que

[métier], quels sont les principaux challenges que vous rencontrez au regard de votre opposition [au mouvement anti- nucléaire / à l'énergie nucléaire] ?

- A votre avis, quels sont les principaux problèmes associes avec le nucléaire (par exemple risques environnementaux, de santé, etc.) ? Pensez-vous que votre organisation fait face à ces problèmes ?

- Quels types d'opposition recevez-vous de la part des autres acteurs du débat ? Avez-vous beaucoup de contacts avec ces acteurs ? Pourquoi ou pourquoi pas ?

- Quelles sont les principales fausses idées à propos de votre organisation ? D'où viennent-elles ?

- Pensez-vous que le gouvernement ou l'industrie nucléaire sont engagés dans une campagne de discréditation envers les activités conduites par le mouvement anti-nucléaire ?

6. **Informations démographiques : "Puis-je vous poser quelques questions à propos de votre situation ?"**

   - Age
   - Gender
   - Relationship status
   - Occupation
   - Hometown
   - Educational Background

Il y a-t-il autre chose dont nous n'avons pas parlé que vous voulez porter à mon attention ? Voulez-vous ajouter quelque chose sur l'un des points que nous avons abordé ou bien avez-vous un dernier commentaire à faire avant que nous concluions cette interview ?

VITA

Julie Schweitzer

Candidate for the Degree of

Doctor of Philosophy

Dissertation: KNOW-IT-ALL AND PAIN IN THE NECK: NORMATIVE AND OPPOSITIONAL NUCLEAR KNOWLEDGE PRODUCTION IN POST-FUKUSHIMA FRANCE

Major Field: Sociology

Biographical:

Education:

Completed the requirements for the Doctor of Philosophy in Sociology at Oklahoma State University, Stillwater, Oklahoma in May, 2019.

Completed the requirements for the Master of Science in Sociology at Oklahoma State University, Stillwater, Oklahoma in 2013.

Completed the requirements for the Master of Science in International Studies at Oklahoma State University, Stillwater, Oklahoma in 2011.

Completed the requirements for the Master of Science in Management at Burgundy School of Business, Dijon, France in 2010.

Completed the requirements for the Bachelor of Science in Business at Burgundy School of Business, Dijon, France in 2008.

Experience:

Graduate Teaching Associate; Sociology Department, Oklahoma State University, Stillwater, Oklahoma, 2013-2019.

Graduate Teaching Assistant; Sociology Department, Oklahoma State University, Stillwater, Oklahoma, 2012-2013