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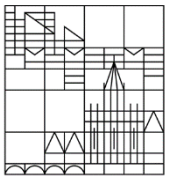

Master's Thesis

Prospects for Phasing Out Nuclear Energy in Belgium

Stakeholders, Advocacy Coalitions and a Transboundary Phase-Out Strategy

Julian Caligiuri
July 7, 2017

Student ID: 6044077 (Utrecht); 947564 (Konstanz)

Supervisor:	Prof. Dr. Gijs Jan Brandsma (Utrecht University)
Second Supervisor:	Prof. Dr. Nathalie Behnke (University of Konstanz)

Abstract

Being confronted with concerns from both inside Belgium and abroad, the operation of Belgian nuclear power stations constitutes a controversial issue of cross-border relevance. Drawing on stakeholder theory and borrowing core concepts from the Advocacy Coalition Framework (ACF), this paper offers a systematic stakeholder-centered analysis of the present policy dispute as well as an evaluation of prospects for a Belgian nuclear phase-out. It identifies key stakeholders in the decision-making process and analyzes their diverging positions and beliefs. Eight semi-structured interviews with crucial stakeholders and political insiders shed light upon the policy debate and reveal major lines of argumentation and conflict. Theoretically deduced preconditions for policy change are consequently compared to the current situation in Belgium. Results indicate that despite the Belgian Federal Government's commitment to stop domestic nuclear energy generation by 2025, this endeavor cannot be taken for granted. Further lifetime extensions of nuclear power plants appear to be a realistic future scenario under given circumstances. Although there seems to be increasing agreement on a major sectoral transformation toward renewable energies, members of the pro- and anti-nuclear coalition differ drastically in their assessment of an adequate and manageable temporal horizon for phasing out nuclear power. Based on theoretical suggestions and analytical findings, tangible recommendations for future stakeholder action to support policy change in Belgium are given.

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List of Acronyms and Abbreviations

ABVV / FGTB	Algemeen Belgisch Vakverbond / Fédération générale du travail de Belgique
ACF	Advocacy Coalition Framework
ACLVB / CGSLB	Algemene Centrale der Liberale Vakbonden van België / Centrale générale des syndicats libéraux de Belgique
ACV / CSC	Algemeen Christelijk Vakverbond / Confédération des syndicats chrétiens
BBL	Bond Beter Leefmilieu
BR3	Belgian Reactor 3
CD&V	Christen-Democratisch en Vlaams
CONCERE/ ENOVER	La concertation entre l'Etat et les Régions en matière d'énergie
CREG	Commission de Régulation de l'Électricité et du Gaz
DG	Directorate General of the European Commission
EDF	Électricité de France
EFA	Greens /European Free Alliance
ENSREG	European Nuclear Safety Regulators Group
EU	European Union
FANC / AFCN	Federaal Agentschap voor Nucleaire Controle / Agence Fédérale de Contrôle Nucléaire
FEB / VBO	Fédération des Enterprises de Belgique / Verbond van Belgische Ondernemingen
FEBELIEC	Federation of Belgian Industrial Energy Consumers
FPS	Federal Public Service
GDF	Gaz de France
GHG	Greenhouse gas
IAEA	International Atomic Energy Agency
IEA	International Energy Agency
IEW	Fédération Inter-Environnement Wallonie
MV	Mouvement Réformateur
NGO	Non-governmental organization
NRW	North Rhine-Westphalia
NTW	Nuclear Transparency Watch
N-VA	Nieuw-Vlaamse Alliantie
Open VLD	Open Vlaamse Liberalen en Democraten
ONDRAF / NIRAS	Organisme national des déchets radioactifs et des matières fissiles enrichies / Nationale instelling voor radioactief afval en verrijkte splijtstoffen
PS	Parti Socialiste
PWC	PrivewaterhouseCoopers
R&D	Research and Development
SCK•CEN	*Studiecentrum voor Kernenergie • Centre d'Étude de l'énergie Nucléaire*
SMEs	Small and medium-sized enterprises
sp.a	Socialistische Partij Anders
UNECE	United Nations Economic Commission for Europe

VBO	Verbond van Belgische Ondernemingen
WENRA	Western European Nuclear Regulators Association
WNA	World Nuclear Association

1. Introduction

Nuclear power is the backbone of Belgium's energy production and supply. About 50 percent of the country's energy mix is generated from its two nuclear power plants in Doel and Tihange (IAEA 2016b). Nuclear policies constitute an exclusive right of every European Union Member State. However, potential risks associated with nuclear power generation do not stop at national borders, but would have implications for surrounding countries as well. Especially since the discovery of hydrogen flakes in the reactor pressure vessels of units Doel-3 and Tihange-2 in the summer of 2012, concerns about the safety of Belgian nuclear installations have reached the climax, prompting foreign governments to speak out publicly against the relaunch of the two controversial reactors. "*Scheurtjesreactoren"* or *"Bröckelreaktoren"* have become familiar quotations among Dutch and German lawmakers to express worries about their common neighbor's nuclear fleet (Demol 2017; Döschner 2017). Since the reactors are being perceived as a potential threat abroad, precautions taken by governments against the risk of a major nuclear accident in Belgium – such as the purchase of respirator masks or millions of iodine pills for the local population in Germany and the Netherlands – have caught the media's attention (Hüwel 2017; The Guardian 2016). Some German municipal and regional administrations even went one step further by instituting legal proceedings against the continuous operation of Belgian nuclear stations. Additionally, citizens' movements both at home and abroad have demonstrated a great deal of creativity to make their demands being heard and exert pressure on public authorities. Organizing bicycle tours, composing songs, setting up a 90 kilometers human chain through three countries or having soccer players wearing "Stop Tihange"-jerseys in a charity match are only a few examples of these attempts to call for an effective phase-out of Belgian nuclear power plants (Aachener Zeitung 2017; Gullert 2017; Reuters 2017). This decision is nevertheless solely up to the Belgian Federal Government. Based on provisions specified in a nuclear phase-out law from 2003, the current plan intends a gradual closure of all nuclear power plants by 2025. Despite the government's commitment to respect the law, it has been subject to amendments in recent years. Lifetime extensions for the three oldest Belgian reactor blocks have been made possible, keeping them on the energy grid for another decade. At the same time, the domestic policy debate in Belgium mainly focuses on the feasibility and reasonability of the current phase-out schedule while calling into play additional lifetime prolongations of nuclear reactors beyond 2025.

This paper offers a sober matter-of-fact contribution to an emotionally charged and politically sensitive issue. After analyzing involved stakeholders and prospects for policy change (i.e. a nuclear phase-out as a major sectoral transformation), it intends to deduce tangible strategic recommendations for further actions to support the nuclear exit in Belgium; particularly from a cross-border perspective. The overarching research question can be phrased as follows: Who are the crucial stakeholders in the nuclear policy issue and the respective debate in Belgium, how are the conditions for policy change and what can be done to support it? While addressing this question, several related sub-questions will be tackled: Which are the most powerful actors in the policy process and which resources do they possess? Which positions are advocated by whom and why? Which arguments are put forward by them? Which opportunities do actors outside Belgium have to influence the decision-making process and how could a phase-out be lobbied?

The present paper provides a qualitative hands-on study which is exclusively tailored to the peculiarities of the Belgian nuclear landscape. Since *"idiosyncrasy does not offer propitious*

grounds for theorization" (Mintrom & Norman 2009, p. 651), its purpose is to take on an issue of tremendous contemporary societal relevance in the first place, rather than to comprehensively test theories and derive generalizable, universally valid claims. However, it penetrates a well-established theoretical discussion by drawing on two guiding theory streams to address the research questions: Stakeholder theory and the Advocacy Coalition Framework (ACF). Both approaches unfold special utility for the objective of this study.

1.1 Merging Stakeholder Analysis and the Advocacy Coalition Framework

Stakeholder analyses essentially build on the core idea that consideration and comprehension of involved actors' positions, interests and objectives leads to better long-term strategic decision-making. Rooted in the business management literature of the 1980s, stakeholder approaches focus on the unique situation of an organization embedded in its environment – thus providing a customizable analytical framework deviating from inflexible earlier corporate management theories (e.g. Bonnafous-Boucher & Rendtorff 2016; Freeman 1984). Accordingly, not only self-interests and formally powerful decision-makers must be taken into account, but also societal players claiming to have a stake in an issue have to be regarded for smart, far-sighted strategies and lasting success. Stakeholder-centered approaches suggest an (almost) universal basic analytical template which will also guide the structure of this analysis (Reed et al 2009): Firstly, stakeholders must be identified, their objectives and relationships determined and described (descriptive part) in order to, secondly, propose strategic recommendations for future stakeholder action (prescriptive part).

Stakeholder analyses have been successfully used to convert scientific aspirations to enlightening studies; serving various academic disciplines way beyond the field of business literature, including public sector management (Brugha & Varvasovszky 2000). However, its core asset – flexibility – also comes along with some methodological challenges left to the researcher's discretion. These configurations should be chosen with careful consideration of their meaningfulness for the issue to be scrutinized (Reed et al 2009). Conceptualizations of, for instance, stakeholder values and power can be found in the Advocacy Coalition Framework (Sabatier 1988).

For this paper's purposes, the Advocacy Coalition Framework (ACF) provides a suitable framework to flesh out a stakeholder conceptualization that is particularly suited to attend to a policy dispute. Moreover, it delivers a theory for policy change which defines testable criteria and circumstances favorable for a major policy shift.

In a nutshell, the ACF structures a political battle on the basis of rivaling policy coalitions made up of various kinds of conceivable stakeholders, such as governments, interest groups, research institutions et cetera. Involved actors are driven by firmly established belief systems which determine their value priorities, convictions and strategies. Based on their beliefs, like-minded actors team up to jointly advocate their common position. This dispute is carried out in a policy subsystem – meaning a substantive topic and associated policy participants. Coalition members do not only differ due to their belief systems, but also with regard to the resources they possess; namely formal legal authority, information, mobilizable troops, the backing of public opinion, financial resources and skillful leadership (e.g. Weible 2007).

According to the ACF, policy change may come about in three different ways: external (or internal) shocks on the policy system, a hurting stalemate or policy-oriented learning. External

shocks are (unexpected) events affecting the policy system in such a drastic way that they lead to a substantial revision of policies. A hurting stalemate constitutes a situation in which the status quo reflects a burden to all important policy participants. And most importantly, policy-oriented learning alludes to the alteration of stakeholders' beliefs as a consequence of factual persuasion by the opposing coalition over time; usually triggered by the accumulation of information and evidence in support of a policy position. Thus, changes in key stakeholders' belief systems lead to a reformation of advocacy coalitions and their power constellations to prompt policy change (Sabatier 1988, Weible & Sabatier 2007).

The ACF suggests additional theoretical concepts and circumstances that may facilitate policy change. The presence of a policy forum in which conflicting parties come together to discuss disagreements can contribute to policy learning. A mediator – or policy broker in genuine ACF-language – who is respected by all stakeholders and powerful enough to affect the policy system depicts another theoretical precondition which paves the way for conflict resolution and eventual policy change (Weible 2007; Weible & Sabatier 2007).

In contrast to other theories from social sciences, the ACF features an intergovernmental dimension and a combination of both bottom-up and top-down approaches to comprehensively understand but still simplify the complex process of policy change. While offering a set of falsifiable hypotheses, it does not merely focus on single levels of government or a theoretically predetermined succession of events, but allows for more flexibility to draw an accurate picture of the policy process – unfolding specific suitability for cross-border issues (Jenkins-Smith & Sabatier 1994).

The ACF can be regarded as one type of stakeholder analysis (Weible 2007). However, compared to other studies applying the ACF, this paper will use the concept in a rather unorthodox fashion. ACF-based works have provided insights into policy conflicts and plausibly explained policy change in diverging settings all over the globe (Weible et al 2011). Often, policy change has already occurred in these cases or alterations in coalitions' beliefs systems are observed over decades of stakeholder interaction. Policy change is therefore usually made sense of retrospectively by testing the viability of the ACF's core assumptions. Since the process of policy change is completed, practical recommendations often remain a marginal note. In this application though, policy change has not happened yet. The ACF will instead be used as a conceptual framework to structure the analysis, but also to assess the prospects for policy learning and policy change among involved stakeholders. In doing so, it emphasizes the original idea of stakeholder analyses, which is to focus on future developments and offering tangible strategic guidance for practitioners.

1.2 Structure, Method and Contribution

The theoretical basis for this analysis will be elucidated in the third part of this paper which provides a review of relevant theoretical implications from previous literature, including applications in the field of nuclear energy policies. A set of expectations about the stakeholder structure of the nuclear issue in Belgium and the ideal preconditions for policy change will be explained.

In order to make a comparison between theoretical considerations and actual empirical circumstances, deep insights into the nature of the policy conflict must be acquired. A qualitative research design was chosen as the most promising method to obtain the information necessary

to learn beliefs and arguments of crucial stakeholders in the Belgian nuclear policy subsystem and to gauge the likelihood of (a soon) policy change. To get to the bottom of the policy dispute, eight copious semi-structured interviews with heavily involved actors were conducted in the spring of 2017 in Brussels. Respondents encompassed high-ranking officials and representatives of non-governmental interest groups, university professors and other experts – covering key stakeholders and insiders both in support of and in opposition to nuclear energy in Belgium. In addition to the stakeholder interviews, various secondary sources (such as reports, position papers, public presentations, newspaper reports, (scientific) journal articles) complemented the data collection to execute a sound stakeholder analysis. The accrued information enables an up-to-date image of the prevailing stakeholder constellation.

In the subsequent analytical section, at first, actors are categorized and their positions examined. In doing so, members of the anti- and pro-nuclear coalition are identified. Policy stances of governmental stakeholders, political parties and other potentially influential actors are considered in the same context, although they might be torn and not always distinctly associated with one advocacy coalition. Next, belief systems of the two competing coalitions will be exposed. Illustrative quotes from the interviews straightforwardly provide access to the dispute while demonstrating the fundamental discrepancies between the policy antagonists. Some central disagreements on empirical beliefs and major lines of conflict are extracted and exemplified, most notably pertaining to safety and transparency issues, environmental and climate protection, the role of the national nuclear regulator and the viability of the current phase-out plan.

A closer look at strategies and used venues by involved actors as well as resources of coalition members will reveal the diversity and differences that can be found also within advocacy coalitions. Guided by the ACF assumptions, chances for policy change are presented. Special attention is given to the use and impact of information and scientific studies on the subsystem, as it represents both a coalition resource and an indicator for policy change. Another deep disruption between the anti- and pro-nuclear camp will be uncovered in this respect. An assessment of the conflict's severity in a deeply entrenched policy contest as well as the existence of a conflict mediator will provide additional implications for common ground and potential compromises between the opponents. Further individual estimations of policy change by the interviewees will conclude the analysis.

Based on these findings, nine realizable recommendations for stakeholder action to support the Belgian nuclear phase-out are presented. Legal opportunities and possibilities to influence the policy process at the European level are discussed comprehensively. Most suggestions feature aspects of cross-border influence and cooperation while clearly taking a long-term perspective with possible implications for other (nuclear) cases in Europe as well. A distinct aim to raise public awareness and gain public support will become apparent in many recommendations. Since the research design certainly faces weaknesses, several major limitations of the study are discussed in the subsequent part. A summary of the main findings is provided in the conclusion.

Before starting with theory, methods, analysis and recommendations, a factual introduction to the policy subject shall be given. Hence, the subsequent chapter helps to obtain some background information and an overview of the Belgian energy landscape and nuclear policies. A concise historical review follows, ranging from the launch of a Belgian nuclear program to the decision to phase-out nuclear energy. Recent political developments are depicted to grasp the controversy underlying the present policy dispute. Moreover, decision-making competences in

the field of energy policies and specifically nuclear affairs are outlined by explaining the distribution of responsibilities between the federal and the regional level as well as the organization of nuclear regulation in Belgium.

The contribution of this thesis is manifold. Above all, it delivers a theory-guided, systematic approach to a contentious and highly sensitive policy issue of enormous present-day relevance. An insightful depiction of the debate's controversies and disagreements enables a better understanding of the subject's complexity which is essential for meaningful decision-making. It serves as a guidance for practitioners – policy-makers and lobbyists alike – and stresses the imperative significance of stakeholder management for more reflected and far-sighted choices of action. Since no comparable study has been published so far, it may serve as pioneering work for further scientific scrutiny and hands-on stakeholder strategies.

2. Background: The Belgian Electricity Landscape and Nuclear Policy in Belgium

This chapter provides an overview and background information on the Belgian electricity landscape as well as the political development of Belgium's nuclear program. It is certainly not meant to extensively describe the Belgian energy market which can be found elsewhere (e.g. IAEA 2016a), but rather emphasizes aspects that are of fundamental importance for the subsequent analysis. These aspects encompass some basic knowledge about the Belgian electricity market, its current nuclear fleet, nuclear decision-making competences and a synopsis of crucial political developments. Hence, it is to be understood as a topical introduction to the policy field.

2.1 General Information and Nuclear Power in the Belgian Energy Mix

Without any domestic oil or natural gas production, Belgium represents a country that is reliant on energy imports. Especially since the closure of the last coal mines in the early 1990s, Belgium has become a net energy importer (IAEA 2016a). However, in its own efforts to generate power, nuclear energy has been a massive pillar of Belgian energy supply for some 40 years now. The share of nuclear power in Belgium's electricity generation made up for 51.7 percent in 2016 – number four worldwide after France (72.3), Slovakia (54.1) and Ukraine (52.3) (IAEA 2016b). This share, however, has not been stable in recent years. For decades, Belgium has had the world's second largest nuclear share in its power mix behind France. Due to irregularities and exceptional events at the nuclear power plants, the share dropped to 47.5 percent in 2014 and to 37.5 in 2013, which marked the first numbers below 50 since the early 1980s. Its all-time peak was reached in the mid-1980s when the nuclear share went up to the record number of 67.2 percent in 1986 (Schneider & Froggatt 2016). Renewable energies represented roughly 20 percent of the Belgian electricity production in 2016 (IAEA 2016a).

Reactor	Net Capacity (Effective 2017)	First Grid Connection	End of License / Closure
Doel-1	433 MW	1975	February 15, **2025** (10-year lifetime extension)
Doel-2	433 MW	1975	December 1, **2025** (10-year lifetime extension)
Doel-3	1,006 MW	1982	October 1, **2022**
Doel-4	1,033 MW	1985	July 1, **2025**
Doel Total	2,905 MW		
Tihange-1	962 MW	1975	October 1, **2025** (10-year lifetime extension)
Tihange-2	1,008 MW	1983	February 1, **2023**
Tihange-3	1,038 MW	1985	September 1, **2025**
Tihange Total	3,008 MW		

Table 1. Capacity and closure dates of Doel and Tihange nuclear power stations in accordance with current Belgian law. Source: ENGIE Electrabel (2017).

Belgium's domestic nuclear energy generation is based on seven reactors at two power stations in Doel (Flanders) and Tihange (Wallonia) with a current overall capacity of 5,913 MW in

2017 (see Table 1). The power plant near the Flemish village of Doel is located in the port of Antwerp by the river Scheldt consisting of four nuclear reactors. The four units were connected to the grid between 1975 and 1985. Likewise, the three reactors of the Tihange nuclear power plant in the Walloon town of Huy were put into operation during the same period. The river Meuse serves as cooling source for the site. Both Belgian plants combined provide work for about 2,000 employees (963 at Doel; 1,074 at Tihange). All Belgian nuclear reactors are pressurized water reactors (ENGIE Electrabel 2017).

2.2 Historical Development of the Belgian Electricity Sector and Nuclear Power Program in a Nutshell

The development of an encompassing nuclear program in Belgium can be traced back to the time after World War II. In the 1950s and 1960s, when Belgium was still a colonial empire, the country was able to manage the entire nuclear cycle from uranium production in its African mines in Belgian Congo to fuel rod fabrication, reactor development and waste treatment in the home state in Europe. In doing so, Belgium was a forerunner in the adoption of nuclear technology for peaceful civilian purposes with comprehensive investments in atomic research projects and the deployment of the prototype pressurized water reactor BR3 – *Belgian Reactor 3* – in 1962 (operational until 1987) which was the first of its kind on the European continent (IAEA 2016a; Verbruggen 2013). In 1968, Doel-1 and Doel-2 were commissioned and only one year later the first reactor of the Tihange nuclear power plant was ordered before full operation at both sites could start in 1975. The global oil crisis of the 1970s accelerated the development of further nuclear ambitions, so that by 1985 all seven current reactors could be connected to the electricity grid, generating almost 6,000 MW at that time (IAEA 2016a). In line with these expansions and due to the fact that major accidents remained unknown up to that point, *"in the decades following World War II nuclear power enjoys the full support of private and public interests, industry, science, politics, mass media, the general public"* – allowing the nuclear sector to run predominantly on self-control (Verbruggen 2013, p. 92). In the second half of the 1980s, the flourishing Belgian nuclear industry experienced first disenchantments. The Chernobyl disaster of 1986 as well as the disclosure of abnormalities in the execution of nuclear waste management have led Belgian legislators to impose stricter accountability measures. Plans to massively extent the Belgian nuclear fleet were eventually scrapped in the late 1980s, also due to an overcapacity in contracted gas imports and technological progress in other forms of electricity generation (Verbruggen 2013).

Meanwhile, the structure of the electricity sector has evolved and built tight interconnections with the French utility industry. During the 1950s and 1970s, the Belgian super-holding *Société Générale de Belgique* dominated the electricity market by controlling hundreds of utility plants. The electricity landscape became more dynamic in the 1980s and early 1990s, when several mergers of firms occurred – most prominently leading to the creation of *Electrabel* in 1990 – and *Société Générale de Belgique* lost its dominant position through the acquisition of the majority of its shares by French-based corporation *SUEZ* (ibid).

SUEZ and *Gaz de France* (GDF) merged to form *GDF Suez* in 2008, which was renamed *ENGIE* in 2015. Today, the French conglomerate *ENGIE* is the dominant actor on the Belgian electricity market through its subsidiary *Electrabel* that operates all nuclear power plants in Belgium. Electrabel is 100 percent owned by the parent company *ENGIE*. Moreover, *Électricité de France*

Belgium (EDF Belgium) holds a 50 percent stake in Tihange-1, while *EDF LUMINUS* owns a minor 10.2 percent of Tihange units 2 and 3, as well as Doel-3 and Doel-4. Nevertheless, the majority share of the latter is again owned by *EDF Belgium* (IAEA 2016a). Hence, ties between France and Belgium go far beyond research cooperation and joint ventures of several reactor units in the early stages of nuclear development in both countries (Verbruggen 2013), but the operation of Belgian nuclear power plants today is strongly affiliated with company headquarters, chiefly *ENGIE*, in Paris.

2.3 More Recent Political Developments or the Decision to Phase-out Nuclear Power

The decision to exit nuclear energy was taken by the liberal-socialist-green government under Prime Minister Guy Verhofstadt who formed a six-party coalition in the aftermath of the 1999 Belgian federal election. In January 2003 the *'Loi sur la sortie progressive de l'énergie nucléaire à des fins de production industrielle d'électricité '* was passed by the parliament. According to this law, all existing nuclear reactors had to be shut down after 40 years of operation based on their start-up dates. Since nuclear plants in Belgium were brought online between 1975 and 1985, all plants would be taken from the grid between 2015 and 2025. The three oldest reactors, namely Doel-1, Doel-2 and Tihange-1, were thus supposed to be decommissioned in 2015 (Schneider & Froggatt 2016). However, once this phase-out date approached, the idea of lifetime extensions became more outspoken by politicians and subsequent governments. Herman van Rompuy during his interim term as Belgian Prime Minister (December 2008 – November 2009) already announced that prolongations of nuclear power plants' lifetimes beyond 40 years will be made possible through a law revision soon. Nevertheless, due to the premature dissolution of the government in April 2010 and the lengthy process to form a new government after the June 2010 federal elections, respective plans were put on hold. After a new coalition government could be formed under Prime Minister Di Rupo one and a half year later in the summer of 2012, a new nuclear plan was put forward by then-secretary of state in charge of the Environment, Energy and Mobility – Melchior Wathelet Junior. Wathelet's plan suggested a lifetime extension of Tihange-1 for ten years until 2025. The remaining 1975 reactors Doel-1 and Doel-2 should, in accordance with the 2003-law, still be phased out by 2015. The plan moreover adds the notion that the exact closure date can be subject to later amendments if the country's security of energy supply is in jeopardy (Verbruggen 2013; Laleman & Albrecht 2016). The Wathelet Plan was eventually adopted in 2013 and a lifetime extension of Tihange-1 was made possible (Laleman & Albrecht 2016; Schneider & Froggatt 2016).

Fresh impetus was given to the process when the newly elected government led by Prime Minister Charles Michel took over in fall 2014. His Federal Minister of Energy, Environment and Sustainable Development, Marie-Christine Marghem, expressed doubts about the feasibility of the Wathelet Plan, questioning its execution without energy shortages during cold spells and compromising the energy security of the country (Laleman & Albrecht 2016). As a consequence, the law was once again modified in June 2015. A lifetime extension of ten years was granted to the remaining 1975 reactors Doel-1 and Doel-2, postponing their closure date from 2015 to 2025. At this point, the oldest Belgian nuclear power plant Doel-1 had already been shut down by the operator company in February 2015. The unit was then restarted when the bill was passed and the

federal nuclear regulator licensed the relaunch in the summer of the same year. The amendment furthermore committed operator Electrabel to invest EUR 700 million in upgrades of the two units as well as to pay an annual sum of EUR 20 million to a national transition fund that was set up simultaneously (Schneider & Froggatt 2016).

Table 1 depicts the current legal status on the end of operating licenses for all seven Belgian nuclear reactors. Accordingly, in 2022 and 2023 two reactors will have to be closed, while the remaining five will be phased out within the year 2025.

The reactor blocks Doel-3 and Tihange-2 have been of particular relevance in recent years. Several incidents at Belgium's nuclear power plants have additionally fueled the debate about nuclear energy generation in Belgium of which some should be mentioned here to better grasp the controversy of the underlying policy dispute. In the summer of 2012, operator Electrabel discovered hydrogen-induced flakes and crack indications in the reactor pressure vessels of both units when performing ultrasonic inspections in the plants – roughly 8,000 at Doel-3 and 2,000 at Tihange-2 (FANC 2015). Subsequently, Doel-3 and Tihange-2 were immediately taken off the grid. The Federal Agency for Nuclear Control (henceforth FANC: Federaal Agentschap voor Nucleaire Controle; or AFCN: Agence Fédérale de Contrôle Nucléaire) outlined a specific test program and requirements that should be carried out and realized before the reactors can be restarted safely. In May 2013 FANC based on a final evaluation Report concerning the reactor pressure vessels licensed the re-launch of both units which indeed went into operation again shortly afterwards (FANC 2013). However, in March 2014 the reactors were shut down again while an international expert peer review was conducted to investigate the structural integrity of the reactor pressure vessels. Eventually, in accordance with these safety reports but despite criticism from various political and academic circles the restart was again authorized by FANC in November 2015 (IAEA 2016a; Schneider & Froggatt 2016).

An unintended stop could also be observed at Doel-4, which had to be shut down due to an oil leak in its steam turbine in early August 2014. Although the incident occurred in the non-nuclear area of the facility, the repair work and replacement took more than four months until the block could be restarted before Christmas 2014. Hence, irregularities at both Belgian nuclear power plants have led to several unplanned intermittent shut-downs in recent years, causing a reduction of their availability and energy generation (IAEA 2016a). For instance, roughly 50 percent of Belgian's nuclear capacity had been taken from the grid for almost five months in 2014 and most of the year 2015 – explaining unstable nuclear energy production figures for Belgium touched upon earlier. The most recent example can be found in the operation of the reactor unit Tihange-1, which was offline for eight months between September 2016 and May 2017 due to another incident in the non-nuclear area of the facility that required specific restoration works to improve ground stability, amongst others (L'Echo 2017).

2.4 Competences in Nuclear Policy Decision-Making

This section provides an overview of competences in the policy field of energy with a specific focus on nuclear energy in Belgium. It aims to give an introduction to relevant actors that are crucial in the decision-making process concerning energy policies in general and nuclear issues in particular. The Belgian institutional structure exhibits some distinct peculiarities that should be borne in mind before the analysis.

2.4.1 Distribution of Competences between Federal State and the Regions

Belgium has a very complex system of governance in which competences are shared in many respects. In energy affairs, decision-making power is distributed between the federal state level and the three regions Flanders, Wallonia and the Brussels Capital Region. However, the Belgian federal government possesses the most far-reaching authorities, especially when it comes to nuclear energy. Above all, the federal government is responsible for ensuring the security of Belgium's energy supply. It is moreover competent for large stockholding installations, transport tariffs, electricity pricing, national energy studies, energy statistics and balances as well as the production and transmission of energy including large storage infrastructure (IAEA 2016a, Verbruggen 2013). The regions, by contrast, are in charge of developing, deploying and promoting new and renewable energy sources (save nuclear); research on and development of all energy forms other than nuclear; the promotion of energy efficiency; the public distribution of natural gas and the distribution tariffs and regional energy statistics. Although renewable energy is within the discretion of the regions, the territorial waters are administrated by the federal state, which is why there is an exemption for offshore wind energy that is solely managed at the federal level. Furthermore, despite the regions' rights in Research and Development (R&D) funding that derives from their extensive sovereignty in the policy fields of culture and education, nuclear R&D programs are reserved for the federal state (IAEA 2016a). Thus, managing nuclear power and the nuclear fuel cycle is an exclusive right on the federal level. Measures to tackle climate change as well as the implementation of climate policies in general are jointly organized by the federal government and the regional governments.[1]

This spread of competences has led to the creation of several coordinating bodies. These bodies include the monthly meeting Energy Consultation Group between the State and the Regions (CONCERE/ENOVER, established in 1992) as well as the Federal Interdepartmental Commission for Sustainable Development (1997) and the National Climate Commission (2003) that serve as forums for exchange of regional and federal energy actors (IAEA 2016a).

Another particularity in the Belgian institutional setup can be observed in the relationship between ministers and ministries on the federal level. The Belgian equivalent to ministries constitute the so-called Federal Public Services (FPS) with their respective areas of competence. The responsible federal body for energy affairs is the *FPS Economy, SMEs, Self-Employed and Energy*. For environmental issues, it is the *FPS Health, Food, Chain Safety and Environment*. However, these specific Federal Public Services are not necessarily under the direction of one minister. A Belgian minister's responsibilities are not always covered by one FPS. Instead, a certain FPS may report to more than one minister while ministers can have more than one FPS under their authority (IAEA 2016a). For instance, the responsibilities of current Minister of Energy, Environment and Sustainable Development, Madame Marie-Christine Marghem cover areas of two FPSs. Alongside the minister, there is also a Directorate General for Energy as part of the *FPS Economy, SMEs, Self-Employed and Energy* which is the key administration to implement energy policies (IAEA 2016a).

[1] Besides the European Union climate obligations, Belgium ratified the United Nations Framework Convention on Climate Change in 1996 and the Kyoto Protocol in 2002. Moreover, the Paris Agreement was signed in 2016 and ratified one year later.

2.4.2 Supervision, Regulation and Organization of Nuclear Energy in Belgium

As outlined in the previous paragraph, competences in the regulation of nuclear energy in Belgium are concentrated on the federal level. The most important public body is the Federal Agency for Nuclear Control (FANC), which is supervised by the Federal Minister of the Interior and the Federal Public Service for Interior. However, its statute determines FANC as an independent governmental body to make impartial regulatory judgments. Its overarching mission is to protect the public and environment against the dangers of ionizing radiation. Therefore, FANC's legal duties are concentrated in the field of radiation protection, nuclear safety surveillance as well as licensing and de-licensing of Belgian nuclear power plants. The federal nuclear safety authority was established in 1994. Since the Royal Decree of 20 July 2001, FANC received more regulatory competences through the transfer of responsibilities from then-competent offices within the former Ministry of Public Health and Environment as well as the Ministry of Labor and Employment. FANC inspects the safety of nuclear installations in Belgium through different processes – the most encompassing one being a series of periodic safety reviews. FANC ensures the operator's regulatory compliance with the provisions laid down in law and, based on its nuclear expertise, can propose laws to the Federal Government. As a body of nuclear safety expertise, it moreover serves as a communicator with the public and political authorities and provides information on the state of Belgian nuclear power plants (IAEA 2016a). More specifically though, since 2008 FANC delegated supervisory tasks to its subsidiary BEL V, which is responsible for carrying out inspections at nuclear facilities and conducting safety assessments (BEL V 2017).

FANC is a member of the Association of Regulators of Western Europe (WENRA) – a network of European nuclear regulatory agencies (not only from Western Europe) collaborating to improve nuclear safety. Similarly committed to the objective to improve cooperation between nuclear authorities, the European Nuclear Safety Regulators Group (ENSREG) was founded in 2007 of which FANC is also a member. WENSRA and ENSREG, for instance, coordinated the scope of the so-called 'stress test' for European nuclear power plants which was decided by the European Council and later conducted by the national regulators after the Fukushima Daiichi disaster in 2011. Being responsible for Belgium, FANC concluded that all Belgian nuclear power plants had demonstrated an adequate level of protection under extreme conditions and compiled a follow-up plan with certain measures to be implemented for the plants in Doel and Tihange (IAEA 2016a).

In contrast to FANC, the remaining federal bodies in the organizational structure of federal nuclear energy management are subordinate to the Federal Minister of Energy and the *FPS Economy, SMEs, Self-Employed and Energy* – who are generally responsible for policies related to the nuclear sector, the nuclear fuel cycle and atomic R&D. A noteworthy body affiliated with them are the Commission for Electricity and Gas Regulation (CREG) which is primarily responsible for monitoring the implementation of related laws and regulations while fulfilling an advisory role for the Federal Government and other public authorities with respect to the functioning of the electricity market. The Belgian *National Agency for Radioactive Waste and Enriched Fissile Material* (ONDRAF/NIRAS) together with its industrial auxiliary subsidiary BELGOPROCESS is the federal nuclear waste management authority. Besides its responsibility for the safe processing and storage of low, medium and high-level radioactive waste which is not processed by the nuclear industry, it also has some competences in the field of decommissioning nuclear power plants (see IAEA 2016a for details).

Lastly, the *Studiecentrum voor Kernenergie* or *Centre d'Étude de l'énergie Nucléaire* (SCK•CEN) in the municipality of Mol is the federal Belgian nuclear research center which conducts research into all kinds of topics related to nuclear energy while operating several research reactors. It thus serves as another public body of expertise which delivers information about nuclear activities by regularly publishing its research findings.

However, it should be kept in mind that prolongations of nuclear power plants' lifetimes are political decisions taken by the federal government – crucially the Minister of Energy responsible for security of supply – that need the authorization of the federal regulator FANC who supervises operators' compliance with nuclear safety provisions. Other federal bodies play rather minor or supporting roles in this process.

Summing up, nuclear energy amounts to a major share in the Belgian energy mix. The 2003 nuclear phase-out law limits the operational lifetime of power plants to 40 years, but prolongations have been made possible through reference to security of supply issues in recent years – invoking a provision in the law which allows deviations from the initial specifications in urgent cases. Lifetime extensions are political decisions taken by the Belgian Federal Government, while the national regulator FANC supervises the safety of nuclear installations in Belgium to protect people and the environment. The discovery of hydrogen flakes in the reactor pressure vessels of Doel-3 and Tihange-2 and other incidents and irregularities at Belgian nuclear power plants have caused (additional) indignation among nuclear opponents. We have identified the crucial governmental stakeholders and regulator in this chapter already, namely the Federal Government and FANC. Before conducting the stakeholder analysis and investigating prospects for policy change, the underlying theoretical framework will be presented in the subsequent chapter.

3. Theory

This section provides the theoretical basis for the analysis of Belgian nuclear policy stakeholders. As it seeks guidance from two theoretical streams, a literature review of stakeholder theory including some basic definitions precedes a description of the Advocacy Coalition Framework and its adjustment to the intentions of this paper.

3.1 Stakeholder Theory and Stakeholder Analysis

3.1.1 Roots in the Strategic Management Literature

Stakeholder analyses gained popularity in recent decades and have been conducted in a wide range of academic disciplines and contexts ever since (e.g. Brugha & Varvasovszky 2000; Laplume, Sonpar & Litz 2008). Many aspects of today's stakeholder-centered approaches find their roots in the business management literature of the 1980s (e.g. Mason and Mitroff 1981; Lindenberg & Crosby 1981). In his seminal 1984 publication "Strategic Management – A Stakeholder Approach", R. Edward Freeman introduced a new conceptual framework for strategic decision-making, subsequently triggering a lively scientific debate and a bulk of empirical studies (Donaldson & Preston 1995; Freeman & McVea 2001; Laplume, Sonpar & Litz 2008). Building on previous concepts from Corporate Planning literature (e.g. Ansoff 1965), Systems Theory and Organization Theory (e.g. Ackoff 1974) and various Corporate Social Responsibility considerations, Freeman developed an analytical approach directed at the specific situation and needs of corporations facing an ever-changing business environment. His approach was meant to address shortcomings of earlier theories that were found to be too rigid and thus unable to cope with the constant environmental instability managers are exposed to in their decision-making. In his view, *"good strategic management […] emerges from the specifics rather than descending from the general and theoretical."* (Freeman & McVea 2001, p. 14). Furthermore, while deviating from the traditional economic roots focusing mostly on rational behavior and profit maximization, Freeman (1984, p. 5) encourages to take into consideration *"any group or individual who is affected by or can affect the achievement of an organization's objective"* – potentially integrating a wide range of actors outside the firm into strategic reflections on enduring corporate success.[2] Accordingly, in order to be successful, organizations must recognize and acknowledge the (potential) influence of stakeholders and understand their needs and objectives before taking strategic decisions (Freeman 1988). In comparison to prior theories, the stakeholder-focused analysis introduced a much more flexible and anticipating approach – making it particularly promising for practitioners. Rather than merely focusing on the enterprise itself, it urges to study the firm's embedding in its unique environmental circumstances. Moreover, it stresses relationships between stakeholders and the importance of shared values for effective and lasting cooperation.

[2] Freeman (1988, p. 42) specifically charts management, owners (or shareholders), local community, customers, employees and suppliers to have a bearing on the corporation. Later the model was extended by government, competitors and civil society as well as further pressure groups such as NGOs, Environmentalists, Critics and Media that should be taken into consideration by the firm (Fassin 2009).

In doing so, a stakeholder-based approach goes beyond purely empirical descriptions, but features prescriptive elements as well: by considering factual circumstances and studying stakeholders, a business strategy suited for the idiosyncratic situation of an organization can ultimately be deduced from previous analytical findings, unfolding particular usefulness for managers (Freeman & McVea 2001).

Due to its tempting characteristics and general implications for decision-making which can be translated to different contexts, the stakeholder theory does not only unabatedly remain an established framework in strategic management research down to the present day (Bonnafous-Boucher & Rendtorff 2016) but it has also attracted interpreters and supporters from outside the business literature.

3.1.2 General Application: Advantages and Purpose of Conducting a Stakeholder Analysis

In more general terms, stakeholder analyses fulfill strategic purposes. Since earlier scholars (such as Lindenberg & Crosby 1981) have highlighted the political dimensions of management processes while proposing analytical steps that already resembled contemporary stakeholder approaches, the utility of such analyses has been embraced well beyond corporate business domains (Brugha & Varvasovszky 2000). Bryson (2004), for instance, stresses the importance of generating information about relevant actors in any strategic decision-making process, including public policy analyses. While referring to previous works on strategic decisions (e.g. Nutt 2002; Tuchman 1984), he argues that decisions fail in large part due to a lack of consideration of stakeholders' interests and available information about them. Since no organization in a shared-power world fully owns an issue by itself (e.g. Kettl 2002), effective leadership pays attention to involved or affected individuals and groups. It is thus crucial to understand what stakeholders aim at and how they are trying to achieve it. In his prominent approach to stakeholders, Frooman (1999, p. 191) suggests that researchers should ask the following questions: Who are they? What do they want? And how are they going to try to get it?

According to Bryson (2004), any strategic management process is more successful if it is based on stakeholder analyses, even going so far as to call the absence of a stakeholder analysis in public decision-making a *"dumb practice"* (p. 28). An assessment of the (political) feasibility of policy options and ideas is only possible if regard is paid to key stakeholders, their interests and relations (Bryson 2004; Eden and Ackermann 1998).

Therefore, in order to influence the status quo, it is imperative to know involved parties and to understand their characteristics, behavior, intentions, interconnections, resources as well as relevance and power in the decision-making process (Brugha & Varvasovszky 2000). This comes along with a shift from rational choice approaches focusing on formal government actors to more specifically acknowledging the important role of societal players, interest groups and other informal actors in the governance and policy-making process (ibid.). Stakeholder analyses enable us to obtain a full picture of the policy issue and to develop a better understanding of what is at stake for whom. Based on this, the present situation can be thoroughly analyzed to evaluate opportunities for influencing the future (ibid.).

However, although the general usefulness of stakeholder analyses is virtually undisputed; substantial disagreement and ambiguity in terms of how a stakeholder should be defined, what a stakeholder analysis actually is and how it should be conducted still prevail in academic circles.

3.1.3 Defining Stakeholder

The term 'stakeholder' can be defined in many different ways and has caused confusion in the respective scholarly discussion (see particularly Miles 2017; also Bryson 2004; Fassin 2009; Phillips, Freeman & Wicks 2003; Reed et al 2009). Freeman's (1984, p. 5) popular definition in the original stakeholder model ("any group or individual who is affected by or can affect the achievement of an organization's objective") has been criticized for its vagueness and challenged by several authors that either broadened or narrowed Freeman's understanding of what a stakeholder constitutes – depending on the purpose of their investigations (e.g. Fassin 2009; Miles 2017; Phillips 2003; Waxenberger & Spence 2003). It is not the goal of this study to include all stakeholders that claim to have a stake in the policy issue under scrutiny. Rather, the focus should be on the stakeholders that matter for policy change. Detecting these stakeholders is subject to methodological considerations (Bryson 2004) which will be dealt with later. At this point though, it does make sense to distinguish between different stakeholders and attribute specific labels to them that will help in the analysis. Instead of using the term 'stakeholder' for any involved actor in the policy issue, Fassin (2009) suggests a categorization that differentiates between *stakeholder* (shareholder), *pressure group* (stakewatcher) and *regulator* (stakekeeper). While all reflect a specific type of stakeholder, *stakeholders* in a narrow sense are those *"with a real (or at least expected) loyal interest in the firm"* (Fassin 2009, p. 121). Pressure groups encompass stakeholders who protect the interests of a certain community, civil society or environment. Lastly, *regulators* often have no direct stake in the firm but possess influence and control that they can exert through, for example, regulations or other constraints. Besides all sorts of governments, regulators may also include other public bodies and authorities such as courts or regulatory agencies (ibid.). Due to their outstanding ability to enable and restrain other stakeholders' behavior, these stakeholders should receive special attention in policy analyses (Sallinen, Ahola & Ruuska 2011; Sallinen, Ruuska & Ahola 2013). Sallinen, Ruuska and Ahola (2013) advocate this view by arguing that governmental stakeholders are the only ones that can base their influence on law and regulations and therefore should receive a special status as they ideally represent the stake of its constituency, in particular the public stake. Their positions are moreover not stable and can change as a consequence of public opinion or elections. However, although the term itself and a special acknowledgement of regulators is useful for analytical purposes and the further distinction of stakeholders, it should be noted here that this paper does not share Fassin's (2009) and Sallinen et al's (2013) assumption that government stakeholders are necessarily impartial and independent.

3.1.4 Defining Stakeholder Analysis

What the term 'stakeholder analysis' refers to is subject to debate and can be criticized for its breadth and ambiguity (e.g. Phillips, Freeman & Wicks 2003). A useful definition for the purpose of this paper is offered by Schmeer (1999, p. 3), describing it as *"a process of systematically gathering and analyzing […] information to determine whose interests should be taken into account when developing and/or implementing a policy or program."*

Several attempts have been made to classify different types of stakeholder analyses (e.g. Donaldson & Preston 1995). It can roughly be distinguished between normative, instrumental and

descriptive approaches (Reed et al 2009). While normative analyses represent a stream with particular devotion to normative reflections on stakeholders, instrumental analyses pursue a strategic goal – typically the preservation or transformation of existing relationships. However, both approaches have to be based on a descriptive stakeholder analysis, which is to identify stakeholders and describe their relationship concerning a particular phenomenon (ibid).

Without dwelling on methodological issues at this point, a general structure of stakeholder analyses can be illustrated. Reed et al (2009) provide a graphic representation of key steps valid for (almost) any stakeholder analysis (see Figure 1). The analytical process can be divided into three major phases. Firstly, a limited context – i.e. the focus of the analysis – has to be specified. Secondly, methods must be applied to identify and categorize stakeholders and investigate their relationships. In the last step, recommendations for future activities within the stakeholder set-up should be derived from the previously obtained information and analytical findings.

Figure 1. Succession of essential steps necessary for stakeholder analyses. Adopted from Reed et al 2009; own illustration.

Based on this abstract template and its roots in the managerial literature, it can be concluded that stakeholder analyses are strategic in nature and usually work toward achieving a strategic goal. A stakeholder analysis can thus also be exploited for political purposes (e.g. Weible 2007). It helps conceptualizing the dynamics of a policy process and aims at mapping stakeholders' interests, beliefs and involvement in the issue at stake. Therefore, it might enable policy analysts, decision-makers, leaders or other stakeholders to develop strategies to attain their objectives and better elaborate on solutions to a policy issue (ibid).

However, the various possible methodological choices within the analysis are left to the researcher's discretion and depend on the purpose of the study. For this reason, a variety of approaches to stakeholder analysis have been developed in different disciplines for different purposes (Reed et al 2009).

In order to find both further theoretical and methodological guidance, the Advocacy Coalition Framework as one particular approach to stakeholder analysis will be introduced in the next section. Some important elements and basic understandings of the theoretical concept will be utilized and tailored to the needs of this study.

3.2 The Advocacy Coalition Framework

The Advocacy Coalition Framework (ACF) offers a stakeholder-centered approach that is particularly designed to analyze and explain policy change (Sabatier 1988; Sabatier & Jenkins-Smith 1999). In this section, an overview of the concept and its pivotal features is given. It should be noted beforehand that a full-fledged analysis in complete accordance with the theoretical framework developed most notably by Sabatier (1988) cannot and will not be provided by this paper. Sabatier himself, in collaboration with Weible, has recognized the often-difficult application and the *"need for a more digestible version of the ACF for public and private managers"* (Weible & Sabatier 2007, p. 123), hence also a less encompassing and trimmed down version of the Advocacy Coalition Framework can be applied without bad conscience. In fact, it has been differently yet successfully used in a variety of contexts across diverse research domains (Weible, Sabatier & McQueen 2009; Weible et al 2011). Many core considerations and assumptions of the concept are well-suited to address the present research question and should consequently be outlined at this point.

3.2.1 General Notions

The Advocacy Coalition Framework (ACF) aims at understanding policy change. Goal disagreement among central stakeholders is not only believed to be a source of dispute, but leads furthermore to the consolidation of like-minded actors within a competitive policy environment (Weible & Sabatier 2007). Thus, at its very core, the ACF suggests viewing policy-making procedures as conflicts between (adversary) coalitions pursuing different policy goals that they are actively trying to realize (Sabatier 1988). In contrast to policy analysis techniques predominantly developed in the 1960s and 1970s, the ACF offers a much more flexible approach to explain policy change. Instead of understanding policy change as a fixed succession of events (basically: agenda setting – policy formulation and adoption – policy implementation – policy evaluation and possibly reformulation) which implicates a rather hierarchical and legalistic top-down perspective with a strong focus on government initiatives, the ACF advocates a combination of both bottom-up and top-down approaches to better understand governance structures and outcomes (Jenkins-Smith & Sabatier 1994). In doing so, the framework builds on a few essential ideas:

3.2.1.1 Policy Subsystems as Unit of Analysis

The ACF focuses on policy subsystems as unit of analysis. A policy subsystem is made up of actors who are actively concerned with and engaged in a substantive policy problem. These actors seek to influence policies and governmental decisions within a determined policy area (Jenkins-Smith & Sabatier 1994; Weible 2007). Besides governments or public bodies on different administrative

levels (e.g. supranational, national or subnational) themselves; private organizations, special interest groups, associations and a variety of other relevant societal players such as academics or media representatives should be included in the analysis.[3] At this point, the ACF's identity as a form of stakeholder analysis with a special focus on policies becomes obvious. It entails a significantly more dynamic approach to policy change as compared to alternative theories from Political Science (Jenkins-Smith & Sabatier 1994). Incorporating a multitude of diverse actors does certainly not facilitate the analysis; nevertheless, it paths the way for drawing a much more accurate picture of the real-world situation. Having its roots in the study of environmental issues, especially the intergovernmental dimension of the concept allows researchers to look closely at the peculiarities of diverging administrative structures involved and the complexity of decision-making in the policy issue. As a consequence, the ACF's focus on subsystems is an appealing characteristic for approaching a policy issues with a cross-border dimension (ibid).

3.2.1.2 Policy Belief Systems as Stakeholder Motivation and Source of Conflict

The ACF helps distinguishing between different stakeholder groups through their diverging belief systems that drive their behavior. Individuals are believed to be rationally motivated but bounded by their intellectual capacities and the information they possess (Simon 1985). They are characterized by an imperfect cognitive ability to learn and different perceptions of the environment. Based on these assumptions, Sabatier conceives a three-tiered hierarchical belief system (e.g. Sabatier 1988; Jenkins-Smith & Sabatier 1994; Weible & Sabatier 2007). Accordingly, stakeholders prioritize certain values that are fundamental in their beliefs and very resistant to change. These *deep core beliefs* are usually normative in nature and capture, for example, someone's principal stance on individual freedoms or her political position on a left/right scale. Still unlikely to change rapidly, but less fundamental are *policy core beliefs*. They can be characterized as empirical beliefs that for example pertain to the seriousness and the causes of a problem. Policy core beliefs are especially interesting, because they also cover pivotal questions such as the involved actors' prioritization of economic developments or environmental protection (Jenkins-Smith & Sabatier 1994). Lastly, *secondary beliefs* describe stakeholders' preferences for the means and tools that they think are appropriate to realize their objectives.

3.2.1.3 Building Advocacy Coalitions

Based on their individual belief systems, like-minded actors group together in advocacy coalitions to champion a policy outcome. The picture of the subsystem is therefore structured by opposing coalitions, each advocating opposing policy positions. Actors within a coalition can nevertheless be very diverse and their beliefs may be more or less stable – they can change their affiliation, potentially leading to a power balance shift between the coalitions. Jenkins-Smith and Sabatier (1994) for instance hypothesize that – despite being part of the same coalition – administrative agencies usually advocate less extreme positions than their interest group allies. However, actors of similar core beliefs may coordinate their actions to convert their beliefs into actual policies and

[3] The ACF believes that public agencies and university researchers are more often than not active members in the policy subsystem that advocate a specific policy position. This is in contrast to the assumption that bureaucrats and scholars are impartial and policy-neutral (Jenkins-Smith & Sabatier 1994).

accomplish their shared objective (Weible 2007). It is assumed that within an advocacy coalition, there is consensus relating to policy core beliefs, but not necessarily on secondary aspects how to achieve the common goal (Jenkins-Smith & Sabatier 1994).

3.2.1.4 Conceptualization of Stakeholder Resources

Stakeholders are certainly not all alike. Coalition members do not only differ in terms of their policy believes, but also with respect to their influence and power. The ACF differentiates between resources that stakeholders may more or less possess (see e.g. Weible 2007):

Firstly, *formal legal authority* constitutes the formally granted authority a stakeholder or entire coalition possesses to make (binding) decisions affecting the policy subsystem. Likewise, access to legal authorities can be a source of power as well. In this regard, governments and other public agencies, but also courts and judges play an important role in the policy analysis.

Secondly, *public opinion* can serve as backing for coalition members. Opinion polls supporting stakeholders might thus be used as a major coalition resource when confronting the adversary coalition. A coalition with strong public support can claim to advocate public interests. This might be very beneficial to add value to own arguments and lobby new legislation.

Thirdly, *information* can make a difference in the policy process. It can be strategically deployed to convince decision-makers and to influence public opinion. Stakeholders might also distort or misuse information to their advantage. Possessing better information does not necessarily mean that stakeholders will be successful; however, it forces the opponent to mobilize and expend further resources to counteract their argument and might pay off in the long run.

Fourthly, the notion of *mobilizable troops* describe the possibility of stakeholders to mobilize public supporters for the policy process. In doing so, they purposefully expand the conflict to supporters from the general public that help them to achieve their policy goals.

Fifthly, ample *financial resources* are an obvious advantage for stakeholders, as they can be used to acquire other resources. Money can for example be spent to influence politicians or to finance own research institutes that generate new, alternative information that is favorable to the sponsor.

Lastly*, skillful leadership* may help to guide a coalition toward winning the policy argument. Skillful or charismatic leaders can make a difference in pushing a policy agenda and might attract and recruit additional resources to their advocacy coalition. Policy entrepreneurs have the skills to translate new developments into a political currency and receive attention by important actors which facilitates policy change (Mintrom & Norman 2009).

Summing up, the ACF offers a helpful conceptualization of stakeholder resources that can be meaningfully integrated into the analysis in order to grasp the power of involved parties and their possibilities and (legal) means to act within the policy subsystem.

3.2.1.5 Conditions for Policy Change

Representing one of its core elements, the ACF tries to make sense of policy change. Basically, it is assumed that policy change can be brought about in three different ways: *Policy learning*, *external shocks* and a *hurting stalemate* (Sabatier 1988, Weible & Sabatier 2007).

According to the concept, actors in the subsystem can learn from the input and information they receive over time. Although it is believed that stakeholders have a very selective perception of new input that favors the information which buttresses their policy beliefs and filters out those that endangers it, in some cases, the accumulation of scientific or technical evidence and findings from studies can pressurize them and lead to an alteration of their position (Jenkins-Smith & Sabatier 1994). Thus, counterevidence from science that proves an argument wrong or uncovers the faultiness of a believed causal link may lead to an enduring change of stakeholder thoughts and a revision of their policy objectives (Sabatier & Jenkins-Smith 1999; Weible & Sabatier 2007). Empirical ACF-applications have highlighted the link between scientific knowledge, learning and beliefs – being of particular relevance in environmental policy-making (Rietig 2016). This process of policy learning, however, often occurs only over long periods of time and requires clear, unambiguous evidence coming from multiple channels (e.g. Weible & Sabatier 2007). Therefore, advocates of the ACF theorize that the likelihood of and willingness to policy learning among stakeholders diminishes gradually with the severity of the conflict (Jenkins-Smith & Sabatier 1994; Kim 2012). It is furthermore more likely when quantitative evidence from natural sciences exists; rather than social sciences (ibid).

In stark contrast to policy learning which may take decades or more (Weible & Sabatier 2007), rapid change can be triggered by *external shocks*. External shocks occur outside of a policy subsystem but can have a strong and sudden impact on it. As a result, resources might be redistributed and the, up to that time, weaker minority coalition seizes power if it utilizes this input smartly. Simultaneously, the dominant coalition may suddenly recognize and acknowledge the need for policy change (Jenkins-Smith & Sabatier 1994). These exogenous effects encompass for example fundamental changes in socio-economic conditions, public opinion, elections, governing coalitions or outputs from other – but in a way related – policy subsystems (Jenkins-Smith & Sabatier 1994; Weible 2007). The emergence of external developments and policy issues such as climate change or technological advancements can put additional pressure on subsystems. Moreover, the consideration of *internal shocks* occurring within the policy system (such as disasters or major accidents) can have explanatory power for a swift policy change as well (Markard, Suter & Ingold 2016).

Lastly, a hurting stalemate labels a situation in which the maintenance of the status quo is neither beneficial nor acceptable for either party in the policy subsystem, so that both sides see a need to change something about the current situation (Weible & Sabatier 2007).

Besides these three explanations for policy change, the framework introduces further concepts and conditions that might support or facilitate policy change; namely venues, policy forums and brokers.

The ACF attributes a strong role to *venues*. Venues can simply be defined as 'institutional arenas' (Weible 2007) within which stakeholders utilize their resources to embrace the opportunity to strategically influence beliefs, policies and decision-making processes. Venues may encompass elections, public referenda or legislative decisions, but also courts, agency rulemaking and the media. Stakeholders are believed to constantly watch out for arenas in which they can promote their policies to obtain competitive advantages (Weible 2007; Weible & Sabatier 2007).

Closely related to venues are *forums*. A professional forum offers stakeholders from both sides to engage in a constructive dialog with each other (Sabatier et al 2005). Policy learning seems most likely when there is a policy forum that is both prestigious enough for all sides to incentivize

their participation and ruled by professional norms (Jenkins-Smith & Sabatier 1994). Direct exchange between conflicting parties can therefore provide a basis for mutual empathy and learning.

In such a competitive policy environment, *brokers* can moreover play a crucial role for compromise (Jenkins-Smith & Sabatier 1994). Policy brokers are mediators that can help to arbitrate between conflicting parties and reduce the intensity of the conflict. These actors typically have decision-making power und must be respected and trusted by both camps to be able to affect the policy subsystem. Brokers could for example be elected officials, high civil servants or courts (Weible & Sabatier 2007).

A concise illustration of the concept's key characteristics and assumptions is given in Table 2. Summing up the utility of the Advocacy Coalition Framework for this analysis, it can be concluded that the ACF provides a useful framework to theoretically approach the issue of this paper and tackle its research question. While maintaining a great deal of flexibility necessary for a tailor-made stakeholder analysis in multi-level policy context, it helps to structure the analysis and narrow the analytical scope by focusing on a policy subsystem and specific aspects of stakeholders (predominantly beliefs and resources) to scrutinize predict policy change.

ACF Element	Analytical Function	Explanation
Policy Subsystems	Unit of analysis providing investigative boundaries	- Actors actively concerned with and engaged in a policy problem, seeking to influence decisions within a substantive policy area - Can be governments on different administrative levels (e.g. supranational, national or subnational), agencies, private organizations, special interest groups, associations, academics, media etc.
Advocacy Coalitions	Structures subsystem actors into competing coalitions	- ACF suggests viewing policy-making procedures as conflicts between (adversary) coalitions pursuing different policy goals - Like-minded actors sharing beliefs and objectives in the policy subsystem coordinate their behavior by building advocacy coalitions
Stakeholder Resources	Conceptualizes stakeholders' power and influence within the policy subsystem	- Formal legal decision-making authority - Public opinion - Information - Mobilizable troops - Financial resources - Skillful leadership - Stakeholders make use of these resources to champion their policy objectives
Policy Belief Systems	Drive stakeholders' actions; source of conflict between coalitions	- Deep core beliefs: fundamental normative beliefs that are resistant to change (e.g. political stance) - Policy core beliefs: empirical beliefs (e.g. perception of seriousness of issue; stakeholders' prioritization of certain developments) - Secondary beliefs: Stakeholders' preferences for means and tools to realize their objectives

Exogenous shocks; internal shocks ***Policy-oriented learning;*** ***Hurting stalemate***	Explanations for policy change	- Exogenous shocks: events occurring outside the policy subsystem with fundamental impact on subsystem at stake; e.g. changes in socio-economic conditions, public opinion, elections, governments etc., redistributing stakeholder resources; internal shocks: disasters or accidents in the policy subsystem - Policy-oriented learning: alteration of stakeholder beliefs and objectives due to, e.g., the accumulation of scientific/ technical (counter)evidence; more likely if conflict is less severe - Hurting stalemate: maintenance of status quo not desirable for either coalition
Policy Venues	Stakeholder arenas	- Stakeholders seek institutional (public) arenas (e.g. elections, media etc.) to promote their beliefs and influence policies
Policy Forums	Support policy change	- Platform giving competing stakeholders opportunity to discuss policy issue; facilitates policy learning
Policy Broker	Support policy change	- Mediator with decision-making power (e.g. public officials, courts) respected by conflicting parties

Table 2. Overview of core elements and assumptions of the Advocacy Coalition Framework (ACF). Own compilation.

3.2.2 Application of the Advocacy Coalition Framework in the Study of Energy Policies

The ACF has been applied as a guiding theoretical framework for empirical analyses of energy sector policy changes in previous studies. This section demonstrates how the ACF can be usefully applied in the study of nuclear policy issues while three analyses will be introduced from which some lessons can be drawn for this paper as well.

With the explicit objective to test a couple of core hypotheses of the ACF, Nohrstedt (2009) attends to major policy changes in the Swedish nuclear energy policy between 1970 and 1991 – witnessing a gradual shift from nuclear power expansion to its phase-out while paying special attention to governmental responses following the 1979 Three Mile Island accident and the 1986 Chernobyl disaster. After trying to investigate causal mechanisms through a combination of qualitative and quantitative methods, Nohrstedt casts doubts over the significance of policy learning as presumed by the ACF. Instead, he highlights the overriding importance of partisan elite responsiveness, subsystem interactions and micro-level decision-making, which according to him constitutes the primary battleground in the policy making process – in contrast to the entire policy subsystem. Nohrstedt thus encourages to trace causal mechanisms through a focus on party politics at the highest level, hence slightly shifting the analytical perspective back to the initial focus of public policy research on governmental actors. Although challenging the ACF's generalizability, the author still embraces the ACF as a fruitful analyzing tool for many empirical endeavors, since it *"absorbs many of the explanatory variables advanced by other theories"* (Nohrstedt 2009, p. 2). The concept of policy learning as well as the focus on policy subsystems through the consideration of non-governmental stakeholders has nonetheless unfold explanatory power in many other cases and should not be discarded per se (e.g. Markard, Suter & Ingold 2016; Weible 2007). Still, his hint to give special attention to governmental stakeholder in the policy analysis should be

explicitly reaffirmed – even though this is by no means at odds with the original theoretical framework.

Hsu (2005) delivers another application of the ACF focusing exclusively on a nuclear energy project. The author examines the construction stop and later reapproval of the Lungmen Nuclear Power Plant in the northeast of Taiwan. Narrating the history of nuclear power utilization in Taiwan from the late 1970s to the early 2000s, he finds that prior to the mid-1980s, there was only one coalition dominating the policy subsystem, namely the pro-nuclear power advocacy coalition. Accordingly, democratization came along with the emergence of an anti-nuclear and environmental movement that formed an opposing advocacy coalition which influenced politicians and led to a halt of the construction project after the Taiwanese elections in 2000. However, while considering the pressure exerted by various stakeholders and other political parties, he explains why the same government only months later overturned its own decision to enable the start of the power plant. The author embraces the ACF's usefulness for his analysis but stresses the significance of existing democratic structures and the influence of actors outside the policy subsystem – mainly coming from abroad – to fuel the policy debate and support both the pro- and anti-nuclear coalition in their objectives (Hsu 2005). The lesson that can be drawn for this paper is that weight should also be given to potential influence of external factors and actors abroad. Despite the ACF's emphasis on its intergovernmental dimension, it can be very challenging to not only set topical but also geographical boundaries when defining the policy subsystem, as suggested by ACF theorists (Weible & Sabatier 2007). This becomes even more difficult in a cross-border issue with a rather fuzzy geographical magnitude – such as nuclear policies. It seems thus advisable to follow Hsu's – and others (e.g. Elliott & Schlaepfer 2001) – approach to not predetermine geographical boundaries but remain responsive to external effects.

Lastly and most recently, Markard, Suter and Ingold's (2016) analysis of the Swiss energy landscape's attitudes toward a transition to renewable energies after the Swiss government's decision to phase-out nuclear energy after the 2011 Fukushima accident constitutes a unique example of a sensible ACF application. The authors examined consultation documents of a broad range of energy actors in Switzerland over a period of 12 years. Distinguishing between permanent pro-ecology and pro-economy coalitions with stable core policy beliefs, they observe a shrinking endorsement of nuclear energy – which they regard as secondary belief – also in the pro-economy coalition over time, who discovered economic opportunities of the energy transition and increasingly supported it. Markard et al (2016) thus see a change in stakeholders' belief systems that have set the course for a new socio-technical transformation shifting from nuclear and fossil fuels to renewable energies. In the tradition of major energy sector transitions during the last 200 years (Solomon and Krishna 2011) – going from wood to coal to oil to nuclear energy to natural gas to renewables – they explain that the pace and direction of this socio-technical transformation is highly dependent on public policies and mindsets of stakeholders. Despite Switzerland's still high reliance on nuclear energy, they conclude that a *"majority of actors expressed their support for the energy transition, which is a clear indication that major policy change might lay ahead"* (Markard et al 2016, p. 218). In contrast to many other ACF studies, Markard et al (2016) use the framework to analyze the current landscape in Switzerland to gauge the conditions for a successful policy change in the future. Thus, their application in some parts overlaps with the central intention of this paper while constituting a clear exemption as against other ACF applications. Generally speaking, the vast majority of ACF studies aim at explaining policy change in hindsight

– hence, their point of departure are events in the past which they are trying to make sense of afterwards. Most ACF-studies have deviated from the initial stakeholder analysis idea to serve strategic purposes and to enable advices for stakeholder action. They often do not or hardly try to deduce practical recommendations based on their analytical findings, which is precisely what this paper is striving for. It distinguishes itself from those studies as it seeks to analyze a present stakeholder constellation to assess the potential of a future policy change. The theoretical framework provided by the ACF delivers a structured approach to this analysis as well as several expectations for policy change that will be summarized in the next section.

3.2.3 Phrasing Expectations for Policy Change

Based on the theoretical considerations put forward by the ACF, several expectations can be formulated for stakeholders involved in the shut-down and maintenance of nuclear power plants in Belgium – the political frontline at stake.

Firstly, advocacy coalitions in the policy subsystem will be characterized by different belief systems with respect to the usage of nuclear energy in Belgium. Like-minded actors will group together and collaborate to achieve their policy objectives. Although there should be agreement on policy core beliefs within each coalition, there might be disagreement on secondary beliefs (strategies and tools to realize their common objective) among members of the same coalition.

Secondly, the likelihood of policy learning diminishes with the severity of the conflict. Policy learning is only likely if the conflict is moderate. Hence, if disagreement between the coalitions is too intense and there is no or few common ground, coalition members will not be receptive to counterarguments. The existence of a regular policy forum in which advocates and opponents of nuclear energy can exchange views contributes to policy learning opportunities. Moreover, the accumulation of technical evidence from (hard) science leads to a revision of policy objectives as stakeholders learn from each other over time. Clear evidence from multiple channels pointing into one direction to substantiate an argument will lead to favorable conditions for policy learning and consequently policy change.

It can be assumed that stakeholders use their resources (such as information) and seek venues to promote their argumentation and to influence the public policy debate. In doing so, they also try to win new members for their coalition. Lastly, policy change or a mediation between conflicting parties is much more likely when a policy broker respected by both the pro- and anti-nuclear coalition is present.

The analysis will try to uncover the current stakeholder constellations and to check the theoretical conditions for policy change – namely a complete phase-out of nuclear energy – currently present in Belgium. It should be revealed if existing circumstances in the Belgian energy landscape are favorable for a policy change in line with these core assumptions of the ACF. The methodological approach to do so will be explained in the next chapter.

4. Methods and Research Design

Drawing on previous theoretical reflections, this section explains the methodological approach used to address the research question. Again, the paper aims to detect the most important stakeholders in the policy subsystem, their stance and argumentation; assess the givens of a policy change (a nuclear phase-out) and derive strategic recommendations to support it. In doing so, theory should be converted into a practical and suitable research design in order to execute a sound stakeholder analysis. As already touched upon in the theory section, carrying out a stakeholder analysis means to investigate an issue through a succession of several characteristic steps (e.g. Reed et al 2009; Schmeer 1999). These steps are to be fleshed out methodologically at this stage. Hence, after defining the analytical scope, I will describe how key stakeholders in the delimited policy subsystem were identified, how data was collected and subsequently analyzed.

4.1 Delimiting the Analytical Scope – Defining the Policy Subsystem

For a start, boundaries of the analytical endeavor must be set. This means restricting the scope to a clearly defined policy context (Reed et al 2009). For a meaningful analysis, the selection and definition of a policy should ideally not be too broad and general, but pertain to a controversial issue within distinct topical borders (Schmeer 1999). This first course of action is in line with the Advocacy Coalition Framework (ACF), which coins the term 'policy subsystem' as unit of analysis – hence, actors who are actively concerned with and engaged in a substantive policy phenomenon (e.g. Jenkins-Smith & Sabatier 1994; Weible et al 2011). The policy subsystem of interest for this analysis can be defined as the stakeholders involved in the effort to phase out the two Belgian nuclear power plants in Doel and Tihange. Within this subsystem, crucial stakeholders should be traced and analyzed.

4.2 Identifying Key Stakeholders in the Policy Subsystem

Once the contextual boundaries of the policy subsystem are defined, associated stakeholders should be detected. Numerous methods can be applied to identify relevant actors (Reed et al 2009; Weible et al 2011). As an initial step, it is advisable to compile a list of all possible stakeholders that are affiliated with the policy and have an interest in the issue (Schmeer 1999). Correspondingly, a very encompassing list of stakeholders was developed based on dozens of recent (mainly Belgian and German) newspaper articles that were searched for online. This constitutes a rather convenient but still efficient method which has demonstrated its usefulness in other empirical studies as well (e.g. Elgin & Weible 2013). Virtually all actors – except for obviously insignificant ones – who expressed a direct interest in the policy and were named in conjunction with the Belgian nuclear power plants were extracted from these articles. Additionally, the International Atomic Energy Agency's 2016 country report on Belgium (IAEA 2016a) which provides an extensive overview of the Belgian energy landscape, its actors and decision-making processes was consulted to complement the list. The list included different kinds of stakeholders such as (foreign) governments, political parties, environmental organizations and various pressure groups, industry associations, trade unions and so on (this list is attached in the Annex). As it is neither

possible nor expedient to include all stakeholders in the analysis, a priority list of the most important stakeholders could be made with the additional help of experts (Chevalier & Buckles 2008; Schmeer 1999; Weible & Sabatier 2007). Therefore, informal preliminary interviews with two Brussels-based energy policy advisers were held to discuss the stakeholder list and deliberate on prioritized interview partners. Since this subjective selection might entail the risk to omit actors that are potentially influential or whose impact might be underestimated (Clarkson 1995), stakeholder analyses should be undertaken *"with a willingness to revise and learn along the way"* (Bryson 2004, p. 28). Thus, following a snow-ball technique, most of the later interview participants were asked to name other important policy actors and give recommendations for further interview partners. Their answers often enabled direct links to persons of which some were successfully recruited for interviews. However, this did not reveal stakeholders (in the sense of organizations or other entities) who were not covered by the initial list.

4.3 Data Collection

4.3.1 Interview Partner Recruitment and Interview Conduct

To gain insights into the policy subsystem and obtain first-hand information on positions, interests and influence of stakeholders, involved actors were contacted via e-mail to request interviews. Most – although not all – stakeholders replied and accepted the request to arrange interview appointments. In view of the interview partners' diversity, no uniform questionnaire was developed but each interview was prepared individually and questions were tailored to the role and expertise of stakeholders. However, some core questions were suitable for a variety of stakeholders. The prepared questions were often split in two sets, while the first part targeted stakeholders' roles, perceptions, relations, positions and strategies, the second set was made to enable insights into their assessment of future developments and/or solutions for the policy issue. All questions were open-ended, thus requiring the interviewees to not simply respond with 'yes' or 'no'-answers. Overall, eight interviews were held in the months of April and May 2017. Interviewees included representatives of two major anti-nuclear non-governmental organizations in Belgium (Greenpeace Belgium and Nuclear Transparency Watch; Bond Beter Leefmilieu), the Belgian Nuclear Forum (the association representing the nuclear sector in Belgium), ENGIE Electrabel (the operator of the Belgian nuclear power plants), the Federal Agency for Nuclear Control (FANC), two Belgian university professors (one energy and environmental economist, one professor in nuclear engineering and reliability and safety engineering) and the attorney representing the German federal states of Rhineland-Palatinate and North Rhine-Westphalia in their complaints at the European Commission and the Espoo Implementation Committee. All interview partners were high-ranking officials or representatives of their organizations and heavily involved in the policy debate – most of them for decades already. Except for one interview on the phone, all interviews were held face-to-face in Brussels or the Brussels Capital Region. Length varied between 40 minutes and two hours – while most interviews lasted around one hour. These comparably lengthy interviews offered the opportunity to discuss relevant issues in great detail. The interview language was English in all cases. The permission to record interviews was granted by all participants. A few actors (the Belgian Nuclear Forum and FANC) asked for the interview questions in advance which were consequently sent to them at least two days before the interview. To warrant

a high degree of flexibility, the prepared questions merely served as guidance that enabled deviations and more often than not enquiries or follow-up questions were posed or new questions were asked spontaneously. Again, a brief verbal explanation of the background and purpose of my project preceded the semi-structured interviews. Afterwards, interviews were transcribed verbatim and returned to the participants to double-check the content. All interview transcripts, except for one, were returned before the finalization of this paper. Participants added comments, revised parts of their answers or rectified certain statements. As some interviewees expressed serious concerns about the publication of (parts of) these interviews, a maximum amount of anonymity should be provided. Sensitive illustrative quotes in the analysis are therefore included in a way that statements cannot be traced back to individuals.

Interviews were chosen as a promising method to get in touch with insiders and to acquire insights into the policy field that go beyond official statements or secondary sources. Interview transcripts generated more than 100 pages of text which served as the main source for the later analysis. The choice of interview partners covering a wide range of outspoken opponents and supporters of nuclear energy guaranteed that standpoints and assessments from both sides of the political aisle were included in the sample. Moreover, by directly talking to involved stakeholders, the interview method is well suited to get a better understanding of the conflict's intensity which may serve as an indicator for policy learning and policy change.

4.3.2 Secondary Sources

As resources to conduct personal interviews were limited and interviews with some stakeholders could not be set up either due to time constraints or non-response, additional sources should be consulted to increase the validity of findings and cross-check information obtained from the interviews. Owing to the possibility to straightforwardly access up-to-date positions of stakeholders on their own webpages, many methodological restrictions of stakeholder analysists doing research prior to the breakthrough and omnipresence of internet information can be easily solved today (e.g. Schmeer 2000). Therefore, internet sources were additionally used to gather stakeholder positions. Position papers, newspaper articles and recent articles[4] from scientific journals constituted further sources of information to enrich the analysis. The latter especially enabled a view into the scientific discourse both generally about assets and drawbacks of nuclear energy and particularly Belgium's energy future with or without nuclear power.

In addition to that, the author was able to attend several venues in Brussels and Berlin that were dealing with the policy dispute about the nuclear power plants in Belgium. At these workshops and debates, also governmental stakeholders and representatives of the European Commission participated which provided further unique insights into the policy subsystem. The slides of their presentations were either made publicly accessible online or sent afterwards upon request.

Some organizations were furthermore contacted via e-mail to ask for a written statement on the Belgian nuclear phase-out plan – the response rate was very low though.

[4] Only articles on nuclear energy published after 2011 were included – the year in which the Fukushima Daiichi accident happened that changed the reasoning of nuclear advocates and opponents.

4.4 Data Analysis: Coding and Categorization

The bulk of data obtained from the interviews and secondary sources needed to be structured and categorized in accordance with the theoretical framework to enable a systematic, theory-driven analysis. For this reason, a coding scheme was developed. Numbers were assigned to concepts and elements of the ACF that answer the sub-questions of this thesis – such as belief systems, resources or strategies – and subsequently linked to the textual material. For example, in order to capture belief systems of both coalitions camps; statements revealing stakeholder positions, objectives and arguments in favor or against nuclear energy in Belgium were highlighted, assigned a number to and extracted from the sources. As recommendations for future stakeholder action should be distilled, further codes for an outlook and solutions to realize the phase-out were added. The full coding scheme can be found in the Annex. The coding pattern also provided the basic structure for the analysis. Sometimes, further distinctions within one category were necessary, as certain controversial topics for example in the argumentation pro or against nuclear energy in Belgium were discussed at length with stakeholders.

In most cases, the required categorization of stakeholders (e.g. Schmeer 2000) could already be made when compiling the stakeholder list, because newspaper reports used at the beginning more often than not indicated policy positions. However, interviews helped to identify stakeholders with no clear policy stance. Basically, stakeholders were differentiated based on their position on nuclear energy (member of the pro- or anti-nuclear coalition) and the type of stakeholder (governmental stakeholder/regulators/parties, shareholder, pressure group, Belgian or foreigner).

Stakeholders were grouped in coalitions to draw a map of the actor-based policy subsystem. In line with structural guidance from stakeholder analysis research, the following analysis is divided into a descriptive part (the basic stakeholder analysis) and a prescriptive part (strategic recommendations based on the descriptive part). Findings of the stakeholder analysis will be linked to key components of the ACF, namely belief systems and conditions for policy change. In doing so, illustrative quotes are used along the way to provide deep insights into stakeholders' argumentation, value priorities and individual assessments.

5. Analysis

The nuclear energy policy subsystem in Belgium can be divided into two advocacy coalitions: the pro-nuclear and anti-nuclear coalition, which are each made up of various actors. As an initial step, the ongoing nuclear energy conflict should be described and illustrated by focusing on the role, general position and objectives of the most important stakeholders. It is therefore supposed to provide a broader picture in the first place before amplifying the coalitions' argumentation and the most contentious issues in the debate.

5.1 The Advocacy Coalitions: Members and Positions on Nuclear Energy

5.1.1 The Anti-Nuclear Coalition

The rejection of nuclear power is the element that connects actors of the anti-nuclear coalition. Rather unsurprisingly, the environmental movement constitutes the core of this coalition. Interview respondents and especially nuclear energy advocates named Greenpeace and sometimes the green parties Ecolo (French-speaking) and Groen (Dutch-speaking) as the anti-nuclear champions or major opponent in the policy process. Although environmentalists refuse nuclear energy in principle, it could be concluded from the interviews that they call for compliance with the original 2003 phase-out law which limited the lifetime of all Belgian nuclear power plants to 40 years. In addition to them, the regional environmentalist movements *Fédération Inter-Environnement Wallonie* (IEW, Wallonia) and *Bond Beter Leefmilieu* (BBL, Flanders) serve as federations with a coordination function working closely together with Greenpeace Belgium (member of both regional federations) and the green parties. These actors can be considered as the major and most outspoken Belgian opponents of nuclear energy fighting and lobbying for the phase-out on the political level in Brussels. Especially Greenpeace – also as member of the European network *Nuclear Transparency Watch* (NTW) – has a long record of constantly challenging the pro-nuclear coalition on nuclear issues.

Various smaller regional grassroots movements and coalitions for actions affiliate with the coalition. Although their self-conception, role and strategies differ, they share the basic rejection of nuclear power generation in Belgium. Most prominently among these actors is, for instance, the cross-border initiative *STOP TIHANGE & DOEL* which groups together members from Belgium, the Netherlands and Germany – mostly smaller anti-nuclear and climate associations or local (green) party associations. However, despite the potential to mobilize people and attract public attention, their role in the political decision-making process can be seen as minor, based on the interview responses.

There is support coming from several (regional) governments and municipalities, mainly abroad. For example, around 90 local communities from Germany, the Netherlands and Luxembourg have jointly expressed concerns and criticized the operation of Tihange-2. The StädteRegionAachen – a merger of several municipalities around the city of Aachen in western Germany – instituted legal proceedings against the relaunch of Tihange-2 before the Belgian *Conseil d'État* after FANC authorized the restart of the unit in spite of the discovery of hydrogen flakes in its reactor pressure vessel. In a second lawsuit filed before a Belgian court of the first instance, the City of Maastricht (Netherlands), and the Municipality of Wiltz (Luxembourg) join as plaintiff to

legally enforce a shut-down of Tihange-2. The German Federal States of Rhineland-Palatinate and North Rhine-Westphalia which are bordering on Belgium have later joined the lawsuit and additionally initiated legal procedures against the lifetime extensions of Belgian nuclear units. Rhineland-Palatinate's government in its coalition agreement explicitly laid down the objective to shut down the plants in Doel and Tihange (SPD RLP 2016). The newly elected conservative-liberal coalition government in North Rhine-Westphalia very recently released (June 2017) their agreement promising to "insistently" work for the phase-out of the two Belgian plants (CDU NRW 2017).
Compared to the activity of some of their states and provinces, national governments appeared rather reluctant in their efforts to influence nuclear policies in their neighboring country. Nevertheless, in April 2016 in an unprecedented move, the German minister of the environment called for a temporary closure of reactor units Doel-3 and Tihange-2 *"until open safety questions are clarified"* (Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit 2016). The Luxembourgian government and the Dutch environment minister as well as the Dutch House of Representatives aligned themselves with this position (Bamat 2016; RTBF 2016). At about the same time, the Parliament of the German-speaking Community in Belgium approved a resolution urging the immediate shutdown of the two controversial reactors (PDG 2016).

However, it must be pointed out again that foreign or regional governments have no formal right whatsoever to interfere in the decision-making process of Belgian nuclear energy affairs, let alone induce politically the stop of the operation of a power plant.

5.1.2 Members and Basic Positions of the Pro-Nuclear Coalition

The pro-nuclear coalition is characterized by a clear endorsement of nuclear energy production in Belgium. Interviewees named the operator of the two Belgian nuclear power plants ENGIE Electrabel and the Belgian Nuclear Forum as the major and most influential lobbyists advocating in favor of nuclear energy in the policy subsystem. The Brussels-based Nuclear Forum represents 12 members which are mostly French and Belgian utility companies – including ENGIE Electrabel. It stresses the fact that it represents the whole nuclear sector while its mission is to inform and communicate on all aspects and virtues of nuclear technology (including medical purposes, propulsion etc.). The interest of the nuclear sector is thus concentrated in and coordinated by the Nuclear Forum. The Belgian Nuclear Forum is furthermore a member of FORATOM; its counterpart on the European level which unites the voice of the entire European nuclear sector. Director General of FORATOM is the former Belgian Federal Minister of Energy Jean-Pol Poncelet.

In the interview with a representative of the Belgian Nuclear Forum, it was clearly stated that it has no position on the intended nuclear phase-out until 2025 in Belgium. Asked for their stance on this endeavor: *"I have no position. What I can say: One, it's a political decision. Two, any further prolongations [of nuclear power plants in Belgium] are possible, but they will not happen without a political decision."* However, the interview with ENGIE Electrabel clearly revealed that lifetime extensions of nuclear power plants beyond 2025 are desirable from their point of view and that they will work for the achievement of this objective. This was an interesting answer, because this is not (yet) officially communicated by the company.

Another voice for the continuation of nuclear energy in Belgium are (heavy) industry associations. The Federation of Enterprises in Belgium (FEB; Fédération des Enterprises de Belgique; VBO, Verbond van Belgische Ondernemingen) representing more than 30,000 businesses across Belgium openly takes a position in which it expresses doubts that a full phase-out by 2025 would

be reasonable.[5] Additionally, Flanders' chamber of commerce and industry *Voka* as well as *Essenscia* – the federation of the Belgian chemical industry – and the Federation of Belgian Industrial Energy Consumers (FEBELIEC) were named as important forces making the case for the maintenance of nuclear power.

Members of both coalitions furthermore named scientists as their allies and supporters. The position of the three major Belgian trade unions is not evident. A representative of the anti-nuclear coalition described the difficulty to win trade unions over for their ambitions to phase-out nuclear power, since they represent the energy sector as well. A pro-nuclear interview partner saw an ally in the trade unions as they want to preserve the employment associated with nuclear energy in Belgium, but also pointed to tensions and no clear commitment on their part. The three big trade union confederations General Federation of Belgian Labor (ABVV/FGTB), the General Confederation of Liberal Trade Unions of Belgium (ACLVB/CGSLB) and the Confederation of Christian Trade Unions (ACV/CSC) are certainly not outspoken on this issue. One respondent described them as *"rather neutral"* but also questioned their importance in the decision-making process.

5.1.3 Governmental Stakeholders and Political Parties

The Belgian Federal Government, backed by the majority of the parliament, is the decisive actor for nuclear policies which both coalitions try to influence. As explained already in section 2.4, the competences to decide on lifetime extensions of nuclear reactors is a political one – provided that the national regulator FANC technically authorizes the continuation. The current coalition-government consists of four parties: the French-speaking *Mouvement Réformateur* (MR) as well as the Dutch-speaking *Nieuw-Vlaamse Alliantie* (N-VA), *Open Vlaamse Liberalen en Democraten* (Open VLD) and the *Christen-Democratisch en Vlaams* (CD&V). Responsible for the energy mix and the security of supply is Minister of Energy Marie-Christine Marghem (MR), who has initiated the law amendments to enabling lifetime extensions of the reactors Doel-1, Doel-2 and Tihange-1, which otherwise would have been disconnected from the grid in 2015 already. Currently, the official government position is to respect the law in force which regulates a full phase-out by 2025. However, in the same context it is usually referred to a major announcement on Belgium's energy future (the 'energy pact') which is scheduled for fall/winter 2017, when Minister Marghem intends to present a vision on energy supply after consultations with the regions who are responsible for the deployment of renewable energies (Marghem 2017). Other government officials confirm explicitly the objective to exit nuclear energy by 2025.[6] The role and behavior of the Federal Government and specifically the Minister of Energy in the policy debate is nevertheless heavily criticized by the anti-nuclear coalition, which will be demonstrated later. With regard to theoretical considerations, it can already be concluded at this point that the Belgian Federal Government represents the governmental stakeholder with the sole formal legal power and authority to make political decisions on the stop or prolongation of nuclear power plants.

[5] Such as FEB's Executive Manager Olivier van der Maren in a presentation and panel discussion about the Belgian electricity landscape in the context of the nuclear phase-out, organized by the Heinrich-Böll-Foundation on March 14, 2017 in Brussels. Furthermore, FEB was named as an ally by a pro-nuclear interview respondent.

[6] Such as Jan Hensmans, Head of the General Policy & International Relations unit at the *FPS Economy, SMEs, Self-Employed and Energy* in a presentation and panel discussion about the Belgian electricity landscape in the context of the nuclear phase-out, organized by the Heinrich-Böll-Foundation on March 14, 2017 in Brussels.

When confronting interview partners with political parties, respondents from both coalitions agreed that Flemish N-VA (first party in the 2014 federal election) shows clear indications for being in favor of further lifetime extensions. MR was also linked to the pro-nuclear front by one respondent from the anti-nuclear coalition. The Flemish *Socialistische Partij Anders* (sp.a) was named as a clear opponent of nuclear energy, while the Walloon *Parti Socialiste* (PS) just as the *Open VLD* accordingly show a critical but not decisively opposed profile on the issue. Overall, party positions seem more often than not rather fuzzy and ambiguous at this point in time. Interestingly, respondents on both sides uttered that in direct exchange with politicians *"inside the room"* or *"behind the scenes"* there appear to be clear signals for future prolongations across party lines. As one anti-nuclear insider explained:

"The official line what they say to the outside world is: we will stick to the nuclear phase-out law. […] Every week I have contacts with high-ranking persons from different political parties, they all say 'yeah, but you know, it will be very difficult to close all of them in 2025 and maybe the two youngest ones [Doel-4 and Tihange-3]; we don't want it, but we will have no choice than to extent their lifetimes.'"

Figure 2 gives a simplified stakeholder overview. It must be pointed out though that the Federal Government's placement in the center does not suggest impartiality in the policy issue. It is rather meant to express its determining role in the decision-making process which stakeholders on both sides are trying to influence. The Government's position depends on the policy stance of its constituting parties which may change as a result of regularly held elections and potentially a new coalition made up of different parties. Today, N-VA and MR are members of the Federal Government, thus two parties which were classified by interviewed stakeholders as nuclear friendly.

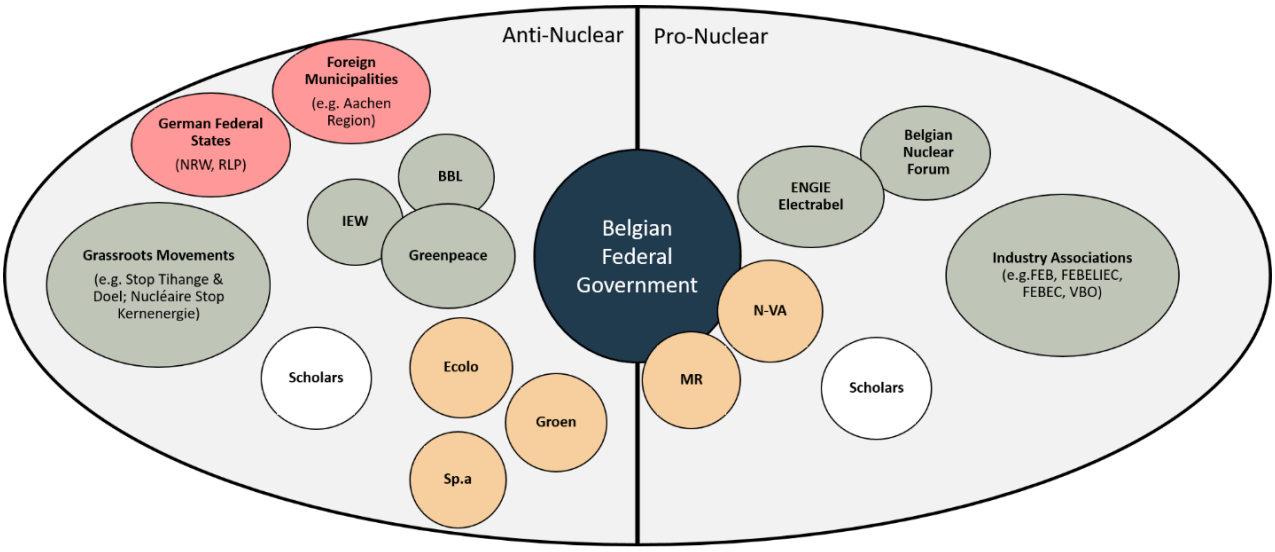

Figure 2. Simplified stakeholder overview. Colors indicate stakeholder type: Pressure group (green); political parties (yellow), foreign actors (red). Circle sizes do not represent stakeholder power.

In the next step, a closer look at the lines of argumentation used by both advocacy coalitions will follow to comprehend and compare stakeholders' belief systems.

5.2 Arguing Pro and Against Nuclear Power: Belief Systems and Major Lines of Conflict

Common basic patterns in the argumentation of the pro-nuclear and anti-nuclear coalition could be observed. To grasp coalitions' diverging belief systems, these lines of reasoning should be presented and contrasted here. In addition, some specifically controversial subjects represent the deep disruption between both coalitions in Belgium: the handling of the nuclear reactor units Doel-3 and Tihange-2 and the role of the federal safety authority FANC will receive special attention.

Interview respondents' answers mirrored the argumentation used in contemporary literature dealing with nuclear energy. A prominent point of pro-nuclear actors was the characterization of nuclear energy as a strong contributor to greenhouse gas (GHG) emission reduction targets (e.g. Kessides 2012). It was argued that renewable sources of energy are of crucial importance and must be deployed on a large scale in the future, but their still poor performance in comparison to nuclear energy was stressed as a major disadvantage. While renewables should be further developed and advanced, nuclear energy ought to remain part of the Belgian energy mix (at least) in the medium run. As the respondent of the Nuclear Forum pointed out: *"nuclear and renewables are compatible and complementary"*. Due to the still large share of nuclear energy in Belgium's electricity generation that cannot be substituted in such a short amount of time, a nuclear phase-out in 2025 would inevitably lead to a massive increase of CO_2-emissions through the (re-)activation of gas power plants and coal energy imports. A premature nuclear phase-out would furthermore eventuate in much higher electricity prices for consumers, possible energy shortages and great dependence on energy supply from foreign countries. The plan to phase-out nuclear energy by 2025 was therefore discredited and its feasibility or reasonability questioned. Nuclear energy on the other hand serves as a climate-friendly, fully deployed and dispatchable alternative which warrants energy independence and reliably low electricity prices.

"It [nuclear energy] represents more or less 55 percent of the electricity production in Belgium and so I think it's totally unrealistic to envision shutting down these plants in such a limited amount of time. […] It could be feasible, but at the same time it could be unreasonable or irrational to do it. […] If you want to keep our energy independency, you either choose gas or you choose nuclear."

"It [nuclear energy] will be available at any time you need it, no matter what weather is. And so it should be, and that's I think a key word, dispatchable. What is dispatchable? Coal, gas and nuclear. Coal and gas: CO_2-emissions; it's supposed to be out of the game. If you suppress that, you still have nuclear energy. And if you suppress all of them, you will have to multiply the storage, production and so on to be able to deal with the fact that nobody wants – I would say even the greenest out of the greenest – to say: 'ok, today no fridge.' Or: 'today fridge or television?'"

"If you want to shut them down – we are not sure about the decision – but the minister will take into account: Where will I get the 53 percent for the energy supply without an extra cost for our

people and the companies? Because they will shout very loudly, consumers as well as enterprises alike, it's rocketing through the roof."

"The point is: everything is possible, but the question is: what is the price you want to pay for the choices you want to make? […] If you look at it objectively, then nuclear should be prolonged. Because no CO_2, least cost for increasing lifetime of existing units compared to new other facilities or compared to cost-effects. […] So, if you look at these three criteria: security of supply, environment and the price – then objectively you should prolong nuclear. […] We don't believe in the long-term future of nuclear in Europe, but we believe that it can be an intermediary solution. An intermediary solution with globally the least societal costs and the most advantages. And why is this important in the intermediate period? Because we believe that in the meantime there is still a big potential for solar, for wind – on and off shore – and for the local storage batteries to decrease costs. Sometimes we say we think that we are only in the middle ages of solar. The prices in ten years will decrease and at that time it will be a third of today. […] So, if you don't want the customer to pay excessive prices for this transition and if you want to allow them to reduce consumption via efficient energy use in the houses, in the industry etc. you need time. We think nuclear is the best solution for buying time."

Security concerns were countered by comparisons or relativization. Accordingly, risks could never be ruled out entirely, irrespective of the industry branch, but can be minimized to a maximum extent in the case of nuclear energy.

"I live in the company, so that's why I said I can understand it from the outside that you are afraid. But as you can be afraid of a Boeing falling down on our heads, as you can be afraid [of] a chemical incident in the Antwerp harbor. I think in the industrial society, you cannot exclude risks but you have to reduce the risk of an incident or an accident really to the maximum."

"We have to live in the reality. In the reality in Belgium. […] The point is CO_2. I can understand the safety issue, but I do not agree with their [the anti-nuclear lobby's] position to make people completely stressful on this. […] But if you look again at the figures, […] you can see that other energy sources like gas, like oil etc. cause more damages than nuclear. My point is not to diminish the problématique of Chernobyl or Fukushima, [....] but then I will speak about gas for example. […] Germany, they replaced nuclear with few amounts of renewables and a big amount of coal. And why don't they say anything against coal? That's my question."

It must be understood that lifetime extensions are a financially attractive option for operators as against investing in other technologies or even building new power plants. Since investment costs for the construction of nuclear power plants are very high (e.g. Kidd 2013), net cash flows during the operational period can be expected after roughly 20 years of operation. *"The preferred sector practice is extracting the maximum profit out of the existing plants, by extending lifetimes until marginal expenses of ongoing exploitation equal its marginal revenue"* (Verbruggen 2013, p. 94). It is therefore rational for a nuclear plant operator to advocate further prolongations. According to the interviewees, lifetime extensions and "aging" nuclear power plants– a term vehemently opposed by one respondent – do not necessarily come along with further security risks.

"If you change almost everything, you can keep it for a long time. Because this is the situation that has taken place in the plants. Almost everything has been modified, every place refurbished at different periods. […] Actually, the plants can be operated as long as they receive a license from the safety authorities."

"There is no ending date for a nuclear reactor. If you look around us, for example in the United States, you have reactors they run for 80 years. So, you cannot say that in this country they will have to stop after 30, 40 or 50 years – and in another country after 80 years."

"[A lifetime extension of] 20 years should be possible from a technical point of view. If you invest for ten years or you invest in 20 years, it's the same investment. But that is what the technicians think. But I personally think it will not be acceptable from a societal point of view. I think that ten years is really reasonable."

In stark contrast, anti-nuclear actors mostly highlight the potential dangers of nuclear power generation for the civil society and environment. As Belgium is a very densely populated country, a severe nuclear accident could have unprecedented devastating effects not only for Belgium but also for neighboring countries. Especially the fact that nuclear power plants in Belgium are located so closely to major cities (especially Doel near Antwerp) was characterized as an imminent threat to the population. Even if the probability of a maximum credible accident might be small, it could never be excluded and the possibility of a failure of (allegedly superior Western) technology was at the latest demonstrated since the Fukushima nuclear disaster. Accordingly, such an extreme scenario would entail not only huge devastation across borders but would also mean the bankruptcy of the Belgian state as operators could only be held accountable for a fraction of the accrued damages. They pointed out that especially the Belgian reactors are overaged and their technology outdated, since they originally have been designed for an operational time of 30-40 years with expertise of the 1960s and 1970s. Meanwhile, security standards have been lowered by the federal regulator over time to make lifetime extensions possible. Critics generally point to unresolved or at least unsatisfactory solved problems with nuclear waste disposal (especially of high level radioactive waste) which remains dangerous for times beyond human comprehension (e.g. Brunnengräber & Schreurs 2015).

Respondents argued that the recent past has already demonstrated the compensability of nuclear energy in Belgium, as there were no shortages or adverse effects even when only half of the nuclear capacity was available for months. The energy independence argument by the nuclear lobby was countered by comparisons and reference to intertwined western European electricity markets in which every country at times depends on electricity imports – including nuclear champion France. Renewable energies are accordingly ready to be deployed comprehensively and security of supply issues are not to be expected, but the political will for a successful energy transition and clear signals for potential investors are missing. The nuclear energy system was characterized as "non-democratic" with little public participation while bright prospects of renewable energy deployment were often presented.

"Even without a severe nuclear accident, nuclear power creates a lot of environmental devastation – during the uranium mining process for example – but also in each and every stage of

the nuclear cycle, like uranium mining, the fabrication of uranium fuel, the use of the fuel in the nuclear power plant, the management and the treatment of the waste, the final disposal of the waste. In each and any of those steps, routinely discharges of radioactive material is taking place. And of course nuclear power is creating a high level of radioactive waste, which remains a danger – I should not say for future generations but for future civilization, cause that's the time frame we are talking about."

"The problem is that the risk can never be ruled out. And who is more acquainted with risk assessment than insurance companies? They do nothing else than calculating risks. And insurance companies refuse to cover the risk of nuclear accidents. Based on the very simple calculation or formula: risk is the probability of a nuclear accident multiplied by the consequences of a nuclear accident. And even if the probability is very small, and in some cases it may be extremely small, but it's more than zero, while the consequences certainly in Europe are so severe that for them the risk is unacceptable."

"Belgium is also the only country that has built its nuclear power plants so close to population centers – for example the city of Antwerp, with half a million people is only 10km from the nuclear power plant of Doel. Doel and Tihange are the nuclear power plants in Europe with the highest population density just around it. 30 kilometers around Doel, you have one and a half million people. 30 kilometers around Tihange you have 840,000 people living. If you go a little bit further, then you get even much more because then you have also the cities of Maastricht in the Netherlands, of Aachen in Germany and so on."

"Actually, there is no objective reason anymore – besides the fact that you might have cheaper energy with these depreciated old nuclear power plants. And that's a very important one for certain players. But besides that, you don't have any argument pro nuclear left. […] We don't see the low prices, that's the big companies. [Due to more stringent safety issues after Fukushima,] I think the fact that depreciated nuclear power plants are very cheap might be something of the past, too. And I think that's one of the most important elements that can help us also because the energy prices on the wholesale markets are really low, so the huge profits nuclear power made in the past are getting smaller […]."

More specific criticism will be seen in the next sections, who each represent a crucial subject of controversy between the two advocacy coalitions.

5.2.1 Fundamental Disagreement: Transparency Issues and the Role of the Federal Agency for Nuclear Control (FANC)

Among the most controversial subjects in the debate about nuclear energy in Belgium is the role of the national regulator FANC and associated transparency issues. Arguments of both coalitions will be contrasted to demonstrate their deep disruption and fundamental disagreement on this matter. Members of the anti-nuclear coalition massively criticize the close links between FANC and the plant operator ENGIE Electrabel. Just as his predecessor, the current Director General of FANC, Jan Bens, used to work for ENGIE Electrabel before entering the public service. He previously was the director of the Doel nuclear power station. Several individuals working today in

FANC's upper-tiers have a professional past at ENGIE Electrabel. Nuclear-opponents such as Greenpeace argue that FANC is infiltrated by former ENGIE Electrabel staff up to a point that it does not act as an independent regulator anymore. By contrast, supporters of nuclear energy as well as FANC itself argue with the necessary expertise for these positions that can almost exclusively be found within the nuclear sector. Some contrasting statements:

"The new Director General of FANC was appointed [and] once again it was someone who before was a director at a nuclear power plant and even responsible for nuclear safety […]. How can such a person afterwards become a regulator? [As a regulator] you should say 'this and that is not safe' […], that's the same thing as saying: 'I have not done my job at the time when I was director of that nuclear power plant'."	*"I feel much better to have someone knowing exactly how it goes in the nuclear power plant; having known exactly the business of a plant rather than having a pure political clown."* *"You have Jan Bens, you have a couple of people, I would say second layer, all these positions are political. But then you have experts. […] Those people are absolutely not interested in their popularity. And I'm very happy that they are working there, they are impossible to discuss with. They do their job, and that's what is important."*
"The Director General comes from Electrabel, the chairman of the scientific council of FANC is a university professor whose chair at the university is paid by Electrabel. So, the link between Electrabel and FANC is so narrow, that FANC can't simply act as an independent regulator anymore."	*"This is a completely ridiculous point. When they leave the company – and Jan Bens did not leave the company in very good relationships, I can confirm that – they know they will never come back. There is no economic link whatsoever. So why the hell would they defend the interest of their previous employer?"* *"These people have openly been identified in all who they are, there is nothing that has been hidden from the public. These people have a specific role in an advisory board which is never in any moment interfering on an operational level. […] The pond in which you can fish is very small. To find somebody who has no link whatsoever with the nuclear sector and has a clear understanding on the role of the regulator, plus has the management capacities to actually lead this organization and understand us, what the challenges are, the technical implications et cetera. It's not very easy to find such profiles."*

To demonstrate FANC's supportive role for the nuclear industry in the policy process, Greenpeace claimed that the regulator exceeded its official mandate several times in the past, especially in the authorization of the lifetime extensions. According to the Greenpeace representative, FANC lowered their safety standards to enable license prolongations for the three oldest reactors. To name only one example, it was argued that rather strict requirements for the mandatory upgrade

of reactors were diminished so that in order to receive a lifetime extension, reactors did not any longer have to be updated to a state-of-the-art safety level of modern nuclear reactors, but to the safety level of the most recent Belgian reactors. Likewise, the previously compulsory replacement of reactor pressure vessel heads was abolished in favor of a mere investigation for the necessity to do so. In addition to that, it was claimed that FANC helped the Federal Minister of Energy to legally bypass the execution of a cross-border environmental impact assessment as envisaged in the UNECE Espoo Convention, which they would have been obliged to conduct before the prolongation. Greenpeace therefore expressed concerns about the connections between government, regulator and operator at the expense of safety standards. FANC certainly denies these accusations and refers to a bulk of new safety measures that have been introduced in recent years, especially after the Fukushima accident. Prolongations are political decisions in which FANC does not interfere. However, due to their expertise on the issue, they provide information to every ministry if requested. The exploitation of this information in support of a political decision is accordingly the sole responsibility of the respective minister, while the regulator remains *"neutral, objective and impartial"* in all aspects.

"There are lots of examples how they [FANC] diminished the first requirements, because they were too expensive or technically simply not possible to realize. […] The first objective of FANC is to […] take care of the financial situation of the nuclear operators rather than to protect the people against the risks of ionizing radiation." *"If you want to extend the lifetime of your nuclear power reactor, then you need to organize an environmental impact assessment […], of course they didn't want to do that, but according to the Espoo Convention you need to do it. She [Minister Marghem] refused to do it and FANC at that moment paid a very expensive lawyers' office to write an advice about how to circumvent the requirements of the Espoo Convention. This is absolutely not the role of FANC!"* *"When you look at safety standards that are used in France, other than the ones that are used in Belgium for our nuclear power plants, we see that the safety standards here are much lower. And the lower the safety standards, the lower the costs for a lifetime extension."*	*"I know we have been criticized in the past for being too nuclear friendly. […] In all honesty, we really try to be as neutral as possible. […] Those are no arguments for us, economical or energy supply. The only argument that is valid for us: is it safe and secure?"* *"If people attack us that we are too friendly, again, you go from 'very, very, very, very strict' to 'very, very, very strict'"* *"It was correct that the environmental impact assessments have not been done. That was a political decision. It was Marghem – Minister of Energy – who decided: ok, I will lift from the existing legislation the exemption clause which says 'if it's extremely urgent, we don't have to do that'. You could say it was bogus. We ourselves did not see the urgency which would have given her the OK not to do that. But it's wrong to assume that the agency has imposed that – we don't have a say in that. It was not our decision. […] We were asked of course: "What is your advice?" […], from that advice, arguments were cherry-picked to use this for the political decision not to execute the environmental impact studies."*

Closely linked to the role of the regulator is the issue of transparency in the Belgian nuclear sector, which has been identified as another major source of conflict between the two advocacy coalitions. The need for further transparency obligations differ fundamentally between nuclear opponents and supporters. Greenpeace and other anti-nuclear organizations complain about the secrecy and the lack of transparency in the sector, while the operator and FANC argue that virtually every single incident or irregularity at a Belgian nuclear power plant is always immediately communicated.

"FANC refuses to give us any more information […]. Recently, they've made an evaluation report. We asked for that report, so that we could consult independent experts for a second opinion. They refused to give it, so there's no transparency and openness and that's why we are attacking them."	*"We report openly about any incident. We have nothing to hide. […] Nobody gets exclusive information on beforehand. […] So, by being as neutral and impartial as possible, treating all parties the same way, we hope that they understand that we are indeed a neutral regulator."*
"I can fully understand that they do not publish information which may inspire potential terrorists. That's normal, of course. But even in a closed session in the parliament, parliamentarians are not allowed to get the information from those reports. And this in a normal democracy? This is not normal. If nuclear power needs this secrecy to be able to operate more or less safely, then it means that is has no place in an open democratic society."	*"Transparency appears to be bigger in Belgium than in other countries. If we have an incident, it's always, always immediately communicated"* *"There is so much more transparency in the nuclear sector compared to the chemical sector. All incidents, even insignificant incidents taking place in the nuclear power plants are in the media. […] I don't think people realize what it would mean [to have] a major accident in BASF, in the harbor of Antwerp."*

5.2.2 Fundamental Disagreement: The Handling of Hydrogen Flakes at Doel-3 and Tihange-2

Probably the most controversial and heated discussion about the safety of Belgian nuclear power plants was triggered by the discovery of hydrogen flakes in the reactor pressure vessels of reactor blocks Doel-3 and Tihange-2 in the summer of 2012. The incident led to a temporary deactivation of the two units and received extraordinary media coverage both at home and abroad, prompting actors also in neighboring countries to publicly speak out against the restart of the power plants. The handling of this incident once again revealed the fundamental disagreement and mistrust between the pro-nuclear and anti-nuclear coalition on safety issues. Electrabel and FANC vindicate the restart by referring to a thorough and transparent examination of the flakes while incorporating assessments of various experts in a lengthy review process. Members of the anti-nuclear coalition (such as the Greens/EFA Group in the European Parliament) by contrast challenged the review procedure and commissioned an alternative report on the flawed reactor pressure vessels, which concluded that the relaunch *"has to be considered as hazardous"* (Tweer 2016). The concern about potential negative effects of the discovered cracks in the two reactors is an element

which connects members of the anti-nuclear coalition. The following interview quotes once again show the essentially different assessment of the severity of the situation.

"They [Tihange-2, Doel-3] should be closed already. It's a scandal that they keep them running with thousands of cracks in their reactor pressure vessel." *"There is still uncertainty, they still don't know where these cracks come from, if they evolve, how they evolve […]. So, there is too much uncertainty and that's why we should not take any risk and we should close these two."*	*"That's not a matter of number, that's a matter of characteristics of the defects. […] It's not because you have defects in a material that it means necessarily that it's more dangerous; it might even be better, it depends on the characteristics of the defects. And at the minimum it can be said after all the studies made that the defects identified in the reactor vessels in Doel-3, Tihange-2 are neutral. […] I perfectly sleep with Doel-3 and Tihange-2 operating."* *"So, you had a full procedure. I have to say that having been involved in the first stage of this review, I can clearly tell you that I had much more confidence in Electrabel after having seen the job they did than before."* *"Nowhere in the world such a thorough examination has been done. We have been conducting hundreds of tests with more than 50 specialists, engineers, specialists in their discipline world-wide. […] The point is that when we stop nuclear assets because there is something we don't know or because there is something we don't understand, people think they are dangerous. But in fact, we only restart them once we know for sure that there is no risk."* *"Once the official authorities say 'it's ok, you can relaunch', I think the discussion is over. It's not the owner of the power plants, it's the official controller."*

Linking these positions and lines of argumentation to the theoretical considerations of the Advocacy Coalition Framework, it can be concluded at this point that both coalitions in the policy subsystem show fundamentally diverging values and (empirical) beliefs in dealing with nuclear energy and the potential dangers it entails. Nuclear energy is basically framed very differently in both coalitions. Members of the pro-nuclear coalition emphasize the importance of nuclear energy in the Belgian electricity mix and the irrationality to phase-out nuclear within the next years until 2025. The technology is presented as a remedy against climate change, dependence on foreign countries and a guarantor of steady energy supply at low prices. While the pro-nuclear coalition acknowledges the potential hazards of nuclear energy generation, risks are put into perspective and the current nuclear power fleet is declared as safe and yet indispensable. Being the decisive player for future Belgian atomic endeavors on the pro-nuclear front, ENGIE Electrabel recognizes that due to societal opposition nuclear energy production has no long-term future in Belgium but should remain part of the energy mix beyond 2025 to ensure a meaningful,

not precipitate transition to other forms of energy. Pro-nuclear actors attribute a key role to renewable energy development but do not see them ready for a full market penetration yet.

By contrast, stakeholders of the anti-nuclear coalition primarily point to the potential far-reaching risks and devastating effects of nuclear energy and the long list of incidents and abnormalities at Belgian nuclear power plants in recent years. Their core members – the environmental movement and green parties – are fundamentally opposed to nuclear energy and see the phase-out by 2025 as minimum consensus. According to them, renewable energies are sufficiently developed by now and ready to be deployed on a large scale. They criticize the tight interpersonal links between the federal regulator FANC and the minister of energy, who they believe is acting strongly in favor of the nuclear industry. Especially the discovery of hydrogen flakes at the reactor pressure vessels of Doel-3 and Tihange-2 and their subsequent relaunch has caused outrage among nuclear opponents, who perceive the two units as added security threat.

Table 3 summarizes and links these findings to the belief system scheme of the ACF. Since actors especially in the anti-nuclear coalition are very diverse, a closer look at secondary beliefs will be insightful for further distinctions.

Belief System	**Anti-Nuclear Coalition**	**Pro-Nuclear Coalition**
Deep Core Belief (normative)	Rejection of nuclear energy in Belgium	Appreciation of nuclear energy in Belgium (at least temporarily)
Policy Core Beliefs (empirical beliefs)	Environmental protection through nuclear phase-out	Environmental protection through carbon-free nuclear energy
	Belgian nuclear power plants are overaged and unsafe	Belgian nuclear power plants are updated and safe
	The nuclear sector lacks transparency	The nuclear sector is very transparent
	Renewable energies are fully developed and must be extensively deployed to guarantee a successful energy transition	Renewable energies still need time; nuclear energy delivers best (intermediate) solution
	→ Phase-out by 2025 is reasonable and manageable, preferably speed-up of phase-out	→ Phase-out by 2025 is irrational and unreasonable due to CO_2-emissions, security of supply and electricity prices
Secondary Beliefs (Means to realize objectives)	Political lobbying, media, public debates, courts, others: demonstrations, rallies, protest campaigns, flash mobs, petitions etc.	Political lobbying, media, public debates

Table 2. Contrasting belief systems of anti-nuclear and pro-nuclear coalition members.

5.3 Grasping Secondary Beliefs: Strategies and Resources to Realize Objectives

The ACF predicts that members of an advocacy coalition share common core beliefs in opposition to their adversary coalition. Nevertheless, these like-minded actors may differ in their preferences or tools for achieving their common goal(s). Moreover, it is believed that stakeholders seek various venues to push for their preferred outcome and gain further coalition members. This becomes evident when looking at the strategies of nuclear opponents. We have seen that the anti-nuclear coalition is made up of very diverse actors. This diversity is also reflected in their strategies. Their members reach from (regional) governments taking legal actions to grassroots movements organizing manifestations and protest rallies. Within the anti-nuclear coalition there can be found a wide range of actions and venues utilized which are listed in Table 3. Several more radical movements are affiliated with the anti-nuclear coalition who share basic positions with the coalition's frontrunners, but follow clearly dissimilar approaches to influence the policy process. Three statements made by interviewees representing the environmental movement get to the heart of this inner-coalition differences.

"They are more grassroots, more radical […]. To this kind of organizations, you most of the time say: 'yes, it's ok to distribute your flyers and to put in our newsletters' and so on, but we don't put our logo on it, because for example the people of the Eleventh March Movement, they had like a kind of manifesto and it was not that we were against that what was in the manifesto, but some accents, the way the language is used, it's not the way we communicate. For example, they asked for all the people working in the nuclear plant in Doel that they would have a new job at the exact same location. And then we were like: 'yeah, we understand the need for a just transition and jobs and blabla, but we look at it more from a broader perspective'. They tried to get the trade unions on board, but didn't succeed."

"Three days ago, we received an e-mail from another anti-nuclear organization in Belgium, a very small group, who said: 'look, we have here a draft for an opinion piece in the newspaper. Will you please sign it?' But it contained incorrect and exaggerated statements about Tihange-1. […] They almost presented it like the world will explode if they start up Tihange-1. I mean, it's not with that kind of arguments that you are going to settle your credibility and convince your opponents."

"Sometimes you have some messages in the media […] on fishes with three heads and stuff like that, but we won't use that, we are correct. I mean of course you can put some emotions in the way your messaging is framed, but it's based on facts, it's not that we are saying 'we will all be Frankensteins'."

As the last sentence of the first quote already indicates, nuclear opponents have expressed the difficulty to win new members for their purposes. Efforts to form ad-hoc coalitions accordingly failed because of some societal actors and organizations' refusal to be very outspoken and take a clear stance on nuclear matters in Belgium. Overall, the anti-nuclear coalition seems less coherent and much more heterogenous than their pro-nuclear antagonist. Nevertheless, in line with the theory, their diversity may entail a valuable strength: although there might be disagreement between nuclear opponents on secondary aspects, especially grassroots movements organizing protests to mobilize people can be effective as good publicity to influence the public debate. In more

theoretical terms, these mobilizable troops constitute a stakeholder resource that can exclusively be found in the anti-nuclear coalition.

Respondents of both coalitions have emphasized the importance of the public debate for any future decisions on nuclear energy. They highlighted the key role of emotions (sometimes rather than rational arguments) in the public discourse – as opposed to direct exchanges with politicians. The pro-nuclear actors explicitly saw the need to recalibrate public opinion to balance a very polarized discussion and regain confidence in nuclear energy. Besides 'classic' political lobbying with 'facts and figures' on all political levels, interviewees named participation in public debates as one important element of their strategy.

> *"So, on the political level it's based on facts and figures and showing that what we need. But at the level of public opinion we also use facts and figures, but then my colleagues from communications will say 'yeah with facts and figures you won't get people on your side'."*
>
> *"For me it's always good to trigger emotions on TV, in debates. Emotions are key for people and we cannot ignore the emotional debate. But we want to come with facts and figures to balance the debate to show that we can understand that people could be afraid. […] It's not easy."*
>
> *"After these incidents we will need to restore confidence. And today if you talk to key politicians inside the room they have the same analysis and they tell us: 'it's a political issue, the lifetime [extensions] of the nuclear power plants will only be acceptable if you regain confidence'."*

In terms of lobbying power and financial resources, the pro-nuclear lobby has a clear advantage over the environmentalist movements, as members of the anti-nuclear coalition uttered. For example, when speaking about the upcoming announcement of the Minister of Energy's 'energy pact' in which Belgium's future energy policies will presumably be determined, the ENGIE Electrabel-representative explained that *"I cannot give you all the details, but 20 of our colleagues will go and get out and discuss with stakeholders in the two or three months to come."* This may certainly indicate resources and capacities organizations from the anti-nuclear movement do not possess.

Informing about and raising awareness for assets of nuclear energy is a key element of nuclear proponents' strategy in line with public opinion poll findings which indicate much higher favorability rates for nuclear energy among those people who feel well informed about it (Bisconti 2016).

A distinct strategy was furthermore named by nuclear opponents. Generally speaking, legal procedures against nuclear power plants are a prominent channel used by the anti-nuclear coalition. The Belgian environmental movement has initiated several cases at different Belgian courts against the lifetime extensions of Doel-1, Doel-2 and Tihange-1 and the controversial reactors Doel-3 and Tihange-2 – money was for example collected through crowd funding. Other members – mainly from abroad such as the StädteRegionAachen or the states of North Rhine Westphalia or Rhineland-Palatinate – have brought suits against Belgian reactors as well. Courts therefore represent an arena which nuclear opponents make use of to champion their positions.

With regard to the ACF it can be concluded that both coalitions seek a variety of venues to influence the policy process. Inner-coalition differences in secondary beliefs can mainly be found among nuclear opponents. Public opinion is regarded as a crucial resource that both sides

try to affect while recognizing the meaning of human emotions in this process. The pro-nuclear coalition appears to have advantages in financial resources and capacities, thus lobbying power on the political level; whereas the anti-nuclear coalition with (smaller) protest organization from the environmental and anti-nuclear movement has the means to mobilize supporters and raise public awareness.

Information is a further crucial resource that will be dealt with in more detail in the next section, as it also comes along with more explicit theoretical implications for policy change.

5.4 Prospects for Policy Change

5.4.1 Conditions for Policy Change: The Use and Impact of Information

As argued in the theoretical section, information is supposed to be used by both coalitions to buttress their positions. Once more unambiguous scientific (technical) evidence accumulates to support an argument, the more likely policy learning and subsequent policy change will be.

To begin with, all actors claimed that scientific evidence and studies were in favor of their position. Accordingly, facts would speak for either of them. The scientific disagreement could not have been better demonstrated than by the entirely contradictory positions of the two Belgian university professors from the sample – both being fully convinced of their position and very persuasive in their argumentation. This supports the theoretical argument that also academics can be member of an advocacy coalition and should be taken into consideration in a stakeholder analysis.

Several studies are being used by both opponents and supporters of nuclear energy in Belgium to prove their points. References to future energy scenarios are a popular argument to either prove the fatal consequences of a premature phase-out or the feasibility of a smooth energy transition without any need of nuclear power. Studies have been commissioned by both coalitions to underline their argumentation and are often discredited based on their methodology or bias by the opposite party. To give one example, the Belgian Nuclear Forum currently promotes a study which was conducted by professional service provider PricewaterhouseCoopers. Based on three energy scenarios, the study concludes that only a combination of nuclear energy and renewables beyond 2025 will meet climate objectives, ensures price stability and warrants the security of supply (PricewaterhouseCoopers 2016). A member of the environmental lobby referred to this study in the following way:

> *"You can have a different opinion on certain things and sometimes publications and studies are a little bit biased, we all know that, but this study was really like crap. Actually, I was surprised that PWC wanted to put its name on this kind of study."*

Consequently, many studies have been published that either advocate or refute the necessity for nuclear energy after 2025. Energy scenario articles published in scientific journals predict that a nuclear phase-out in Belgium as foreseen in the 2003 law would lead to a massive increase of carbon emissions and dependency on foreign suppliers (Kunsch & Friesewinkel 2014; Rodríguez et al 2013); energy shortages must be expected without massive investments in renewable ener-

gies (Laleman & Albrecht 2016). Other studies confirm that CO_2-emissions will temporarily increase after the phase-out – because of the necessity to resort on natural gas in the transitional period – but costs of renewable energies will diminish over time while costs for the operation of nuclear power plants rise. An encompassing deployment of renewable energies is thus promoted as the most attractive and sustainable solution (e.g. Climact 2017). Other recent studies, also by the government institute CREG, are used by nuclear opponents as proof that there is no need for nuclear energy beyond the now scheduled phase-out date (ELIA 2016; CREG 2015).

"If you have studies from an independent organization that's working for the government [CREG], I think you should use these. And I think that proves that the way it is decided on our nuclear phase-out is not based on facts, it's based on lobby power."

Either way, without even trying to assess their validity, energy scenarios are always based on models and assumptions about future market conditions which can never be reliably predicted. Due to idiosyncratic developments, these kinds of studies inevitably face major limitations and more often than not have been proven unsound and inaccurate afterwards. *"Energy forecasts are notoriously unreliable"* (Duffy 2011, p. 682). The pro-nuclear university professor from the interview sample described the practice that actors automatically challenge study findings if it is not in favor of their position.

"Following that [particular studies], you had – that's what I always find at least strange – an independent study that was made. I don't know why the previous ones were not independent, I don't know what the second group was independent of, but in a way they were more in favor of the opinions of the politicians in power at that moment. And so you had that alternation between reports, studies made by groups that appeared maybe to be a bit more in favor of nuclear energy; other studies that were really starting from the idea that we should phase-out anyway. Does it affect the political decision? It depends on the opinions of the politicians [laughs]."

Studies therefore deliver arguments and information for both sides that are used to underpin their reasoning. Remarkably, the environmental economist from the interview sample heavily criticized the utility sector's attempts to influence research conduct at Belgian universities through, for instance, subsidizing professorial chairs in Belgium. He distinguished between independent scientists, who for example face difficulties to publish their articles in prestigious peer-reviewed energy journals that are dominated by industry-related editors; and scientists executing studies for their sponsors and donors.

"They [the power companies] also went to our university and they said to the head of the university: see, that person, we are willing to sponsor also a professorship for your university, but then you must remove mister X."

"You have scientists and we are called and the minister or the power [company] or another interest party says: 'I want a study and this is the outcome.' You can make the study. I had this at a time too that sometimes people came to me and I said: 'when I see what the situation is, the outcome will not be this but the opposite. I'm willing to make that study, but be sure I think the outcome will be the opposite you want'. And then they insisted and they came another time:

'no, but we want this outcome and we give double the money' and I said 'no I don't want the money, I want the study carried out independently'. So, no study."

Greenpeace argued that the acquisition of detailed technical information and counter-expertise is a crucial element in their strategy and frequently used to challenge assessments by the federal regulator FANC at eye level – although it was claimed that FANC is not responsive to it, which they again denied. Nuclear opponents have furthermore commissioned studies not only to show manageable alternatives for nuclear energy in Belgium but also to demonstrate the devastating economic and ecologic cross-border consequences of a major nuclear accident in Belgium. For instance, after the discovery of hydrogen flakes in two Belgian reactors, a study ordered by the StädteRegionAachen and executed by the University of Natural Resources and Life Sciences Vienna raised considerable public awareness. The study scrutinized the potential radiologic impact of a Tihange-2 core meltdown. It showed that neighboring countries – especially Germany, the Netherlands and Luxembourg due to westerly wind – would be heavily affected by this worst-case scenario (Arnold et al 2016).

In short, both sides have recognized the value of scientific evidence in the policy process to base their arguments on 'facts and figures'. It can be said that information is strategically used (and exploited) as a resource to underpin positions on both sides. At this time, there does not seem to be unambiguous evidence for one coalition that is not challenged by major opponents with references to other studies – which is a rather bad indicator for policy learning and near-term policy change.

5.4.2 Conditions for Policy Change: Severity of the Conflict, Policy Forums and Common Ground

Theory argues that policy change is more likely when the conflict between the two coalitions is not totally gridlocked but moderate. Policy learning only occurs if stakeholders are responsive to counterarguments and do not decline a discussion with each other. A policy forum can provide an arena to regularly exchange views and ideas.

Major stakeholders and experts were asked to describe the relationship with their counterparts in the policy subsystem and if they are regularly in contact with them. All actors affiliated with the pro-nuclear coalition criticized the extremely polarized and sometimes overly emotionalized debate as well as the dogmatic position of nuclear opponents as a major obstacle for a productive discussion on Belgium's energy future. According to most of them, nuclear opponents leave no room for compromise on nuclear matters which is why the interchange has become tough. They furthermore criticized that public discussions are always boiled down to being pro or against nuclear.

"Greenpeace […], they criticize everything. […] Our message is that we need an energy mix. We need both, renewables and nuclear. And for them: nuclear is bad on all points. And that's the problem, we cannot have a discussion."

"We try to respect them. […] It's respectful but not really friendly of course."

"If you want to have a debate between people that are totally convinced of what they say, it's more than knowledge, it's belief."

Answers from the anti-nuclear coalition resembled this assessment. Although there are forums where members of both lobbies occasionally come together (such as forums organized by CREG and the electricity transmission system operator ELIA), discussions run into difficulties. However, it was also argued that nuclear supporters contribute their equal share in emotionalizing the debate in public.

"Every time nuclear issues are on the agenda, the conclusion is very, very soon that we don't agree, so let's stop discuss it. […] It's too much an ideological discussion, it's almost not possible to have a severe debate on nuclear energy, because we have such a long history of fighting each other, it's very difficult."

Finding some common ground between the coalitions is not easy. One statement made by the ENGIE Electrabel representative can nevertheless be interpreted as a clear indicator for policy learning by the nuclear coalition in the subsystem.

"If there had not been these green parties, there wouldn't be any energy transition at all. And now we see that energy transition is a very good thing. But you should take time – sufficient time […]. It's a question of realism, and if you have millions of customers you cannot live by dreams."

According to the ACF, policy learning is not a rapid process but usually takes many years. But this statement once again boils down to the fundamental difference in core coalition members' belief systems which still seem resiliently settled: A transition to renewable sources of energy is accepted by the operator by now. However, there is essential disagreement about the appropriate time horizon and particularly the nuclear phase-out date. Based on their core beliefs about nuclear energy and the rational arguments speaking for a lifetime extension outlined earlier, there is no indication that this view will change until 2025.

5.4.3 Conditions for Policy Change: Existence of a Policy Broker

Another theoretical element in support of policy learning and policy change is the existence of a mediator that is respected by the conflicting parties. Ideally, governmental stakeholders with decision-making power act as so-called policy broker to reduce the intensity of the conflict while trying to find a compromise.

The Federal Government, or more specifically the responsible Minister of Energy in Belgium would be predestinated for such a role in the policy process, as confirmed by some respondents. However, all anti-nuclear coalition members severely criticized Minister Marghem for being too strongly affiliated to the nuclear sector. They point to members of her cabinet who previously worked for ENGIE Electrabel and doubt her neutrality in the policy process. Compared to other ministers and (regional) governments, nuclear opponents explained their bad relationship with the minister of energy and her cabinet. Greenpeace even accuses the minister of openly lying in

her argumentation and ignoring democratic principles in the lifetime extension process of Doel-1, Doel-2 and Tihange-1. Members of the anti-nuclear coalition bluntly described her as not responsive to their arguments, thin-skinned and arrogant – hence, not showing the best preconditions for acting as a conflict mediator. Some exemplary quotes demonstrate annoyance on the part of the anti-nuclear movement vis-à-vis the responsible minister.

"Several times parliamentarians even left the meeting [with Marghem] because they said 'yeah, you can have an intellectual disagreement and then argue with intellectual arguments'. But if your arguments are just based on very clear lies, then it's impossible to have that kind of intellectual exchange of ideas."

"Misses Marghem really is executing what the utilities want. […] So, she is really dependent on advice from the power industry and she almost uncovered says 'what the power industry wants, I do'. […] If you come up with persons like Marghem, you can have prepared whatever you want, the best arguments. She just answers: 'I don't care about arguments, I care about interests.' That's all effort for nothing."

"Minister Marghem is a very strange minister. Because sometimes you don't agree with ministers, with their political views, and that's ok, but you still have a good working relationship. And that's not the case with Marghem. She's very hautaine. Also people working at the parliament complain about her attitude. There were several scandals in the press about her but she's still in her seat. It's a very strange minister […], very difficult to have discussions with. We had like one or two discussions with one of her cabinetard, which was really… I felt like I was in a bad movie."

According to the ACF, access to legal authorities and decision-makers can also be a valuable resource in the policy process, because it may facilitate policy-learning among key governmental stakeholders. In view of the poor relationship between nuclear opponents and the crucial minister who is mainly determining the future of nuclear energy in Belgium, this advantage is undoubtedly not on the side of the anti-nuclear coalition.

Unsurprisingly, many coalition members bank on courts as independent mediator and started legal procedures in nuclear affairs to affect the policy subsystem. A different mediator in the form of a governmental stakeholder that is respected by both parties is currently not in sight under the current Federal Government – which diminishes the prospects for policy learning and policy change.

5.4.4 Stakeholder Assessment of Policy Change

Based on their expertise, experience and insights into the policy and decision-making process, interview partners were asked to assess future scenarios for nuclear energy in Belgium. Respondents representing the environmental movement shared pessimistic views. According to them, a nuclear phase-out prior to 2025 would only be imaginable through legal measures or – most undesirably – in case of another major nuclear accident. In proper ACF-language, an external (outside Belgium) or internal (inside Belgium) shock on the policy subsystem could bring about policy change in the most tragic, unexpected and rapid manner – as for instance in Germany or Switzerland after the Fukushima disaster in 2011.

Under normal circumstances though, both found further lifetime extensions very likely to be implemented soon. They claimed that the government shows little (or no) ambitions to mitigate the share of nuclear power in the energy mix and – just as the operator – does not make an effort to decisively prepare the phase-out. This might again lead to a situation in which the government will argue that further lifetime extensions will be inevitable for the sake of the country's energy supply (at the latest in 2025 when five reactors are supposed to be taken off the grid within one year). They therefore mainly blame the government for (intentionally) not performing policies to enable a smooth energy transition by 2025.

The two university professors stressed the fact that there has historically been little commitment in Brussels to follow the laws introduced by predecessor governments and the phase-out law is likely to be modified again. Although new nuclear power plants in Belgium are questionable, the strong interconnection of the French and Belgian electricity landscape might lead to the construction of nuclear plants just behind the border in France to supply the Belgian energy market. However, this scenario was rejected firmly by the ENGIE Electrabel representative who referred to financial difficulties. The nuclear stations in Tihange and Chooz (Ardennes, France) nevertheless already represent joint venture plants between both countries (see also Verbruggen 2013). Nuclear energy imports from France seem likely in any case.

The Belgian Nuclear Forum and ENGIE Electrabel showed themselves optimistic that nuclear energy will remain part of the nuclear energy mix beyond the now scheduled shut-down dates.

Overall two events are crucial for Belgium's nuclear future: The announcement of the energy pact later this year[7] and, above all, the next Belgian federal election in 2019. A continuation of the present coalition government was considered favorable for their intentions to prolong nuclear energy by some nuclear supporters. The participation of (one of) the two green parties – which recent polls[8] see strengthened – in the next coalition may imply the definite phase-out.
Summing up, based on these findings, theoretically favorable conditions for policy change seem not to be met. There is no clear-cut and broadly accepted scientific evidence for one coalition's position. The accumulation of scientific information buttressing a coalition's stance does not necessarily have to change views of the opposing coalition, but can affect the position of brokers and crucial decision-makers which is an essential precondition for policy change. Moreover, the policy conflict is not moderate, but very severe with little willingness to engage in a discussion that is perceived as too polarized and ideological by major stakeholders. There is furthermore neither a mediating force in the form of a widely accepted governmental stakeholder to arbitrate between conflicting parties; nor a regular, productive policy forum in which both sides discuss respective issues.

[7] One interview partner nevertheless referred to rumors that the announcement will (again) be postponed.
[8] For an overview: https://en.wikipedia.org/wiki/Opinion_polling_for_the_next_Belgian_federal_election.

6. Strategic Recommendations for Further Stakeholder Action

Based on these findings, additional insights from the stakeholder interviews and theory on policy change a set of recommendations for actions to support a nuclear phase-out in Belgium should be inferred. Given the circumstances analyzed in the last section, an effective shut-down of all Belgian nuclear power plants by 2025 would already mean a success for the anti-nuclear coalition. Although an acceleration of the nuclear exit seems rather unlikely, several possibilities to influence the policy process especially from a cross-border perspective must be strategically considered as contributors to policy change. Undoubtedly, opportunities are very sparse, however, some of the recommendations clearly take a long-term perspective and could be preventively applied in other cases as well. The recommendations presented are not subject to normative considerations. It does not ask the question what ought to be done, but what could be done to encourage this major transformation of the Belgian energy sector.

6.1 Recommendation I: Exploit Legal Opportunities on All Levels

Actors abroad have no decision-making power to influence Belgium's sovereign right to determine its energy mix including nuclear energy generation. Cross-border implications and security concerns notwithstanding, there is no right for outside actors to inspect or even halt the operation of a nuclear power plant. Legal measures to interfere are very restricted. However, there are opportunities to *"put a spoke in the wheel"* as metaphorically described by the legal expert from the interview sample. Since given circumstances for policy learning and conflict moderation by the current Belgian Federal Government do not seem to be favorable for the anti-nuclear coalition, courts and committees with decision-making powers constitute an alternative to affect the policy subsystem for some stakeholders. There are currently several administrative and civil court cases going on which anticipate a legal order to stop the operation of Tihange-2 and Doel-3 based on (safety) provisions laid down in Belgian law – verdicts are to be expected soon.

As stressed by some interview partners, increased transparency and public participation in the nuclear decision-making process may be a key element to raise critical public awareness on nuclear energy. Legal instruments can be found in European environmental law. For the nuclear sector, both the UNECE's Aarhus Convention and the Espoo Convention can provide further leverage for nuclear opponents to intervene and guarantee more public participation (Anastassov 2014; Stražišar & Kralj 2016). Being part of EU law, the Aarhus Convention grants participatory rights in environmental decision-making and access to environmental information to the public (individuals and their associations). Accordingly, public authorities upon request have to provide related information on activities with a significant impact on the environment and must be responsive to comments, challenges and reviews made by all affected parties. Annex I of the Aarhus Convention explicitly refers to nuclear power station projects (1) and lifetime extensions (22) as activities that trigger the necessity for public participation (Article 6a, Aarhus Convention). Although there is no set procedure for public participation, it requires a minimum in effective notice, adequate information and appropriate response to public inquiries (see Stražišar & Kralj 2016).

On the other hand, the Espoo Convention demands a transboundary environmental impact assessment for certain activities and projects that affect the environment. According to the Convention, involved Parties (both concerned and affected) shall take all appropriate measures to prevent, reduce and control significant adverse transboundary environmental impact from proposed activities (Article 2a, Espoo Convention). An environmental impact assessment means a national procedure to evaluate the likely impact of an activity on the environment before the proposed activity is executed (Article 1 (vi)). In line with the Espoo procedure, the party of origin must first notify affected parties on its intended activity (Article 3(2); 2(6); 4(2)). If the affected parties want to participate in a consultation process, required documents must be submitted by the party of origin and affected parties' input must be deliberated in further actions (Article 5). Hence, in such a case, an international transboundary environmental impact assessment must be undertaken prior to a decision to authorize the proposed activity. These activities are listed in Annex I to the Convention, which explicitly includes nuclear power stations (2b of Annex I) (see Anastassov 2014).

In the course of the lifetime extensions of Doel-1, Doel-2 and Tihange-1, neither a prior notification nor an environmental impact assessment has been executed by the Belgian government. The Länder Rhineland-Palatinate and North Rhine-Westphalia have thus issued a complaint both at the European Commission (as the Espoo Convention is part of the EU's *acquis communautaire* and further specified in Directive 2014/52/EU) and the Espoo Implementation Committee in Geneva arguing that Belgium violated applicable law by not performing a transboundary environmental impact assessment in the licensing of the three lifetime extensions. The European Commission currently refers to case law (C-275/09) by the European Court of Justice arguing that an environmental impact assessment would only be necessary if 'physical interventions' are associated with the planned activity (European Commission 2013) – which is not necessarily the case in the process of a lifetime extension. In public debates, Commission representatives nevertheless acknowledge the need for clarification of this ambiguous term (Kremlis 2017). Environmentalists vindicate an environmental impact assessment due to the increased use of uranium (mining), production of radioactive waste and vulnerability to technical failure and risks of accidents that come along with the prolongation of aging nuclear plants, all having a significant (potential) impact on the environment (Haverkamp 2017). An unequivocal clarification and a clear set of rules is therefore required and desirable for legal certainty. In case of a successful complaint, the power plant operations must be interrupted until a transboundary environmental impact assessment is concluded.

Although the outcome of these complaints will not induce a nuclear phase-out, the obligation to perform an environmental impact assessment by national authorities delays and aggravates the decision-making process and further sensitizes the public for effects and risks of nuclear energy production across borders – offering nuclear opponents another venue to publicly communicate their concerns.

Legal measures thus constitute a fairly limited yet appealing opportunity to force one's way into the decision-making process and should be exploited whenever possible and promising. However, it must be considered that eventual verdicts may also strengthen nuclear proponents, which is why every lawsuit must be carefully evaluated beforehand.

6.2 Recommendation II: Contribute Information and Continue Challenging Opponents

Information is a crucial and vital resource to substantiate a policy position. Nuclear proponents base their argumentation on studies, facts and figures to prove the indispensability of nuclear energy for Belgium beyond 2025. This view must be continuously challenged by high quality counter-information and valid alternatives. The poor development and low acceptance of renewable energies is still a prevalent argument used by the nuclear lobby. Studies claiming the exact opposite must be used to tackle this position. Even though – as the analysis showed – both sides currently seem to have a steady supply of studies to buttress their conflicting opinions, it is no option to reduce these efforts. Theory suggests that the accumulation of scientific proof will lead to policy learning. Even if the anti-nuclear lobby claims that the current federal government is not responsive to such input, future and regional governments cannot disregard this information in the long run. Alternatives on lifetime extensions specifically tailored to the Belgian energy case should be highlighted to demonstrate the feasibility of the current phase-out endeavor and the long-term benefits of renewable energies for the prevention of climate change (e.g. Climact 2017). The promotion of energy efficiency and the deployment of renewable sources of energy are regional competences in Belgium. If regions deliver and implement measures on these fields, arguments for further prolongations of nuclear power plants may lose weight. Lobbying approaches must therefore inevitably focus on the three Belgian regions as well. Without much more comprehensive policy efforts to substitute nuclear power in the energy mix, a nuclear future beyond 2025 becomes more likely. Encouraging examples from other countries who successfully replaced their nuclear capacities should be stressed in the argumentation, as well as economic opportunities for investors in the transitional period.

Besides the demonstration of energy alternatives and the long-term prospects of renewables, alternative assessments of the state of Belgian nuclear power plants by independent nuclear safety experts could be used to continue challenging the federal regulators. For example, Greenpeace uncovered several shortcomings in the nuclear disaster management of the federal ministry of internal affairs which eventually required them to revise their accident plans (Greenpeace Belgium 2015). The exposure of insufficient protection measures or other grievances related to safety or nuclear waste disposal – the *"Achilles' heel"* of nuclear energy (Brunnengräber & Schreurs 2015, p. 47) – can attract significant public attention and put policy-makers under pressure. Members of the pro-nuclear lobby have stated that creating 'fear' has traditionally been the most powerful weapon of their opponents. Emotions in public debates should be reasonably triggered and always be based on facts. The ability to capably assess related information and to translate them to effective messages nevertheless needs resources and expertise – exaggerated, incompetent or inaccurate statements can come along with a loss of credibility vis-à-vis policy-makers.

6.3 Recommendation III: Push European Union Legislation – Stricter Transparency Obligations, Public Participation and a Revision of EURATOM

Competences in the field of nuclear energy at the European Union level are limited. Nuclear affairs are thus almost exclusively in the hands of the Member States. It is solely up to them to decide

on the composition of their energy mix and the generation of nuclear energy. The EU's legal capacities relating to nuclear energy are governed by the EURATOM Treaty, which essentially has been left virtually untouched since its signature in 1957. EURATOM constitutes a separate legal entity from the EU that nevertheless all EU Member States have to join. Besides some coordination efforts through WENRA and ENSREG, the operation and warranty of nuclear safety is an exclusive duty of every nuclear energy-producing Member State. However, to name a couple of recent developments, there is a common set of safety standards for nuclear installations specified in the 2009 Nuclear Safety Directive (2014/87/EURATOM) which was amended and updated in July 2014 to, for the first time, introduce technical obligations for nuclear plants in Europe (see Article 8a). Furthermore, an EU-wide framework for the management of radioactive waste and spent fuels was established in 2011 (Directive 2011/70/EURATOM), followed by Directive 2013/59/EURATOM laying down basic safety standards for protection against the dangers arising from exposure to ionizing radiation (see European Commission 2017a). As EU-wide nuclear energy policies are based on intergovernmental decision-making in the European Council, these basic common standards reflect the least common denominator leaving a great amount of discretion to the Member States who generally decide on nuclear policies and may still have very varying safety requirements for their nuclear power plants. Building on these developments, further cooperation, common safety standards and especially transparency obligations specified in new or amended directives would not only be desirable for safety reasons, but also to generate further information about the operation of nuclear power plants. The more information operators and regulators must provide, the easier it becomes to find weaknesses that can be publicly exploited. As the World Nuclear Association (WNA) states: *"trivial incidents can acquire high profile in the media"* (WNA 2015). Regardless of the actual dangerousness of these incidents, they can serve as a resource for nuclear opponents to affect the public debate. As explained in 6.1, it must furthermore be asked for a clarification of the Aarhus and Espoo Convention's applicability with regard to nuclear power plants' lifetime extensions.

It should nevertheless be considered that the establishment of a European nuclear safety authority – as sometimes debated (Epoch Times 2016) – might overall lead to the lowering of safety and transparency requirements in some countries as compared to current national regulations, if standards are to be determined by a consensus of all 28 (or soon 27) Member States.

The European Union's stance on nuclear affairs can be described as at least open-minded. The Commission currently praises nuclear energy as *"a low carbon technology and a significant contributor to security of supply and diversification"* which *"is expected to remain an important component of the EU's energy mix in the 2050 horizon"*. In its 2016 'PINK Paper', the Commission furthermore gives sympathetic consideration to lifetime extensions in Europe (European Commission 2016). This might be based on the still valid preamble of the EURATOM-Treaty which constitutes that Member States are *"resolved to create the conditions necessary for the development of a powerful nuclear industry"*. Member States that decisively reject nuclear energy (such as Austria) cannot exit EURATOM without leaving the Union. There is currently no way to a European Union membership without a strong constitutional commitment to nuclear technology – accompanied by obligations to financially support nuclear research projects. Although a primary law revision might be anything but popular these days, the momentum of the Brexit negotiation process could be used as a small window of opportunity to reform EURATOM. The United Kingdom has declared its EURATOM withdrawal separately from its notification to leave the Union – as

both represent separate legal entities (Financial Times 2017). This means that there will have to be negotiations on the exit from EURATOM in any case. EURATOM with comparably obscure institutional structures, arguably having the *"biggest democracy deficit probably of all international treaties"* as the legal expert from the sample phrased it, could be put to the test on this occasion. The introduction of more contemporary democratic elements such as participatory rights for the European Parliament whose current role is limited to consultation powers (European Parliament 2017) or the determination of a sunset clause could be brought up. A complete abolishment of EURATOM, as for example promoted by the German Greens (Deutschlandfunk 2017), would also entail the loss of basic common European security standards in radiation protection and research on the improvement of nuclear waste management; therefore – without any adequate replacement – potentially eliminating a tool to provide at least a basic level of harmonization across national borders.

Another aspect that should be considered is the clarification or even modification of European state aid rules and respective competition regulations. The European Commission has for instance approved government subsidies for the construction of new nuclear power plants in Hungary (Paks II) and the UK (Hinkley Point) under state aid rules (European Commission 2017c; European Commission 2014). For Belgium in particular, in the aftermath of the lifetime extensions of Doel-1, Doel-2 and Tihange-1, the European Commission also approved the agreements between Belgium and ENGIE Electrabel introducing an investment commitment for the operator while guaranteeing public financial compensation if the three reactors are closed prior to the granted prolongation date (European Commission 2017b).

6.4 Recommendation IV: Urge Actors to Take a (Coherent) Position

As demonstrated in section 5.1.1 and 5.1.2, many (governmental) stakeholders do not have a clear or very outspoken position on nuclear energy in general and on lifetime extensions in particular. At the domestic level, Belgian trade unions, employers' federations, other societal actors and above all, political parties should be asked to take a clear position on nuclear energy and its future role in the Belgian energy mix. Although some of these actors may be reluctant to specify their definite position on nuclear energy for tactical reasons, accumulated inquiries might pressurize them to make up their minds. A distinct stance and a clear future energy vision also sends a signal to investors to engage in replacement capacities. Nuclear energy should become a priority topic for the next federal election in 2019.

From an international perspective, various actors from neighboring countries have positioned themselves against Belgian nuclear power plants and demanded their shut-down. However, sometimes their position could be more coherent. For instance, the German Federal Government has asked for a closure of Doel and Tihange and publicly expressed concerns about the safety of Belgian nuclear power plants. On the other hand, the government justifies the supply of German nuclear fuel to Belgian nuclear reactors which is necessary for their operation (Deutscher Bundestag 2017). Similarly, the previous social democratic-green Länder-government of North Rhine-Westphalia (NRW) has been demanding a shut-down and even suing Belgium for the continuous operation of their nuclear plants. Nevertheless, it was revealed that the same government placed more than EUR 23 Million in a pension fund financing EDF and ENGIE – the operators of the French and Belgium power plants including Doel and Tihange (Le Viv 2017). Since outside

actors have little means to influence the policy process in Belgium, a more consistent position could at least enhance their credibility, underpin the seriousness of their concerns and lend weight to their demands. The newly elected conservative-liberal NRW-government has immediately stopped the sourcing through the pension fund and published their coalition agreement in which it explicitly and much more clearly stated its objective to realize the phase-out of Tihange and Doel as compared to the previous red-green government (CDU NRW 2017). Actors should be held accountable for such promises.

Lobbying approaches should therefore also target (federal) governments inside neighboring countries to be more outspoken and take a clear stance on nuclear energy not only at home but also at the European level to reconfigure respective policies. Although NRW represents almost 18 million people (roughly 6.5 million more than Belgium), its opinion carries less weight than that of sovereign states. Despite cross-border implications and a clear position opposing nuclear energy at home, EU Member States have been very reluctant in official statements to speak out against nuclear issues in neighboring countries. As one insider expressed regarding a revision of EURATOM:

> *"It's time Germany takes the lead here! […] Austria [being openly opposed to nuclear energy in the Council] was too long the beaten dog here in Brussels. People make jokes about Austria, make fun, and that is all lobbied through DG Energy. […] There is also pressure needed from within Germany."*

6.5 Recommendation V: Build Coalitions, Seek New Members and Deploy Resources Wisely

According to the ACF, engaging in alliances can make weak parties stronger and their voice being heard. Members of a coalition championing one common objective can share and coordinate resources to more effectively influence the policy subsystem. Efforts to collectively engage in the policy issue can clearly be observed in the anti-nuclear coalition, but there is certainly room for improvement. Due to the diverse nature of nuclear opponents who essentially share a common goal but use very different strategies to realize it, forming coalitions can be a balancing act. Close collaboration with certain rather radical grassroots movements must be considered very carefully in order not to forfeit credibility in the political arena. However, these actors can be an asset in the policy battle. Mobilizing people through manifestations, human chains and other forms of protest may be a valuable resource to get good publicity and pile the pressure on decision-makers, but must be deployed wisely and only if large attendance is certain.

Attempts to collaborate across borders can be seen among citizens' movements and political entities alike. On the political level, local governments, administrations and mayors have consolidated to make common cause. Recent attempts to team up supraregional alliances are an important further step. For example, the *Allianz der Regionen für einen europaweiten Atomausstieg* founded in 2016 on the initiative of Upper Austria brings together European regions (including six German Länder) to promote a European nuclear phase-out. The group works on joint declarations but is still in its infancy with very loose structures, mainly German-speaking members, few public attention and no chairmanship up to this point. Theory suggests that skillful and charismatic leadership may help to attract additional resources, gain publicity and recruit supporters for their coalition.

6.6 Recommendation VI: Always Be Aware of the Issue's Sensitivity

Nuclear affairs are a very delicate issue. Respective policies are a sovereign right of every EU Member State. Any attempt of foreign involvement can trigger indignation and effective counter-criticism. Members of the anti-nuclear coalition in unison confirmed the impact actors abroad can have on the domestic policy discussion in Belgium– for instance through official statements. However, another interview partner for example described the outrage within Belgian government circles caused by a study presented to Belgian Minister Marghem by former NRW-environment minister Remmel. The study commissioned by the NRW government at the University of Aachen tried to prove that a swift Belgian nuclear phase-out is achievable without energy shortcomings. Therefore, political interferences by foreign actors must be cautious, well considered and most importantly not expressed in an overbearing manner. Two quotes from the interviews give an impression of the sensitivity of the issue.

"What he [NRW-Minister Remmel] presented as a possibility to get out quickly of nuclear is in fact only a solution for problems inside Germany. […] We don't accept other countries giving us lessons, especially if you look at their CO_2- emissions. We have far better results. So, we should not be dictated how to conduct our energy policy. […] They should be aware that the impact of these coal and lignite plants with a concentration along the borders is very important for Belgium, if you look at small particles for example."

"The German regulators should not come into our power plants to dictate the Belgian regulator what to do, or to do double the work. […] They can come and have a look in our Belgian plants – not to control us, but to be informed by the regulator about the situation. […] The Germans definitely don't have to give us lessons in independency of regulators."

6.7 Recommendation VII: Foster Bilateral, Multilateral and European Energy Cooperation

Improved energy interconnection lines between Belgium and neighboring countries can counter the fears of a power blackout and support the nuclear phase-out. Increased competitiveness across national borders may benefit enterprises and households alike. If there is cheaper energy obtainable from various sources, big industries have fewer incentives to support domestic (nuclear) energy production – which is currently the case and may aggravate the phase-out. Belgium as an extremely densely populated country with comparably limited opportunities to expand for example onshore windmills and sparse resources to comprehensively deploy other forms renewable energies (e.g. water turbines) needs intensified cooperation to satisfy its energy demands without nuclear energy, especially in a transition period. A better energy interconnection with high-voltage lines facilitates energy imports in both directions to countries' mutual benefit.

Concrete plans and projects are in progress and should be supported. The ALEGrO-interconnector project which currently is at the planning stage to link Germany and Belgium will help integrating renewable energies to the Belgian energy market while stimulating the security of supply (ELIA 2017). A second interconnector is under consideration by the German Federal Government (Deutscher Bundestag 2017) and should be brought to fruition. Furthermore, local energy projects such as the *Energie-Modell-Region Maas-Rhein* in the trinational bordering region

of the Netherlands, Belgium and Germany could have a contributing effect (Euregio Maas-Rhein 2014).

6.8 Recommendation VIII: Use Existing Forums and Support the Creation of New Ones

In theory, a regular forum in which opposing parties can swap ideas on nuclear policies should be used to persuade (governmental) stakeholders and facilitate policy change. This might be more complicated in reality, as interview respondents witnessed, but is nevertheless worth striving for as it can at the same time constitute an opportunity to obtain further information on the policy issue – which in any case could be a valuable resource. Furthermore, international forums such as PENTALATERAL which aims to strengthen the electricity market integration between Belgium, France, Germany, Luxembourg and the Netherlands can reinforce interconnection capacities and help realizing Recommendation VII.

The recently founded German-Belgian Nuclear Commission establishes another working relationship between German and Belgian nuclear regulators to exchange information concerning nuclear affairs, based on a bilateral treaty. The first meeting between competent administrative bodies (including FANC) from both countries will be held in June 2017. The German States Rhineland-Palatinate and North Rhine-Westphalia are participating on this platform. Agendas, possible working and expert groups are still to be determined (Deutscher Bundestag 2017) – leaving scope for further configurations. This offers another source of information and the possibility to exchange views.

6.9 Recommendation IX: Do Not Take Legislative Compliance for Granted

Laws are not cast in stone for good. Experience from recent past (see section 2.3) has exemplified the low commitment of several (not only the current) Belgian governments to stick to the 2003 phase-out plan. Law amendments have followed, invoking the clause which allows postponing the plants' end date in case of security of supply problems. A law stipulating policy change does not necessarily mean actual policy change. The policy battle is not over until all provisions are ultimately enforced. As an interview respondent from the environmental movement self-critically warned:

> *"Never underestimate the power of the nuclear lobby. […] In 2003, when the nuclear phase-out law was voted, there was an almost complete demobilization of the anti-nuclear movement. Because they said 'yeah, we've won! There's a nuclear phase-out law!' and we all recognized that you can't close the reactors immediately. Most of them would have liked that they would have been closed sooner than by 2025, but they said 'ok, now the fight is won and we can concentrate on other things'. That was a big mistake."*

7. Limitations and Directions for Future Research

Just as every other study, also this paper faces limitations. A major drawback is its time horizon. Policy-oriented learning does not happen quickly. The ACF suggests a time perspective of ideally one decade or more to grasp the evolving structures of a policy subsystem and to observe policy learning processes over time (e.g. Weible et al 2011). This study only offers a snapshot in time which may already be outdated soon. It would have been interesting to see how stakeholder positions have changed and slightly converged with the passage of time – for example with regard to the acceptance of renewable sources of energy.

Although media constitute a crucial and powerful driver of public opinion in nuclear affairs and many of the recommendations deduced from the analysis target the public debate, there was no explicit analysis of the media's role in the policy process. This subject was discussed with some interview partners, who stated that the media scene essentially reflects the stakeholder environment: some of their representatives are rather in favor, some are rather opposed to nuclear energy. They were neither counted as an ally nor as an opponent of one coalition by any stakeholder interviewed. Both sides instead complained about the media's unquestioned usage of "facts" introduced by their opponents and the oversimplification of information. It might have been possible – just as with university scholars – to detect journalists that could be classed with one coalition, but was not found to bring added value to this paper. However, again here, the evolution of media coverage or the quantity of critical articles on nuclear energy would provide tremendously telling insights into the policy debate and might indicate a tendency for future public opinion.

Moreover, Belgian legislators were found to be the decisive actors in the policy process, but no interview was conducted with them. In line with Nohrstedt's recommendations (2009), focusing on the center of formal political power could enable further insights and reveal tides for future decision-making. Therefore, additional interviews with lawmakers from several parties would have been enriching to better comprehend which factors will determine their eventual decision. In addition to that, regional differences between Flanders and Wallonia were largely neglected. Lessons could be drawn from a closer look at regional structures, local stakeholders, and populations around the two nuclear power plants.

Another limitation that applies to virtually all stakeholder analyses is the reliance on subjective assessments in the identification and categorization of the most important actors (e.g. Frooman 1999). Omitted or underrated stakeholders can never be ruled out. More sophisticated but time-consuming techniques could have been applied to methodically remedy these concerns (see Reed et al 2009). In addition to that, codifying and analyzing qualitative data and linking it to theoretical considerations is inevitably subject to the researcher's interpretation and limited capacities.

This analysis paid only little attention to relationships within coalitions and the level of cooperation between coalition members. Investigating the strength of ties between stakeholders, for instance through a social network analysis, could have yielded further interesting implications for advocacy coalitions and the policy subsystem (Prell, Hubacek & Reed 2009). Attention could

also be drawn to the fact that actors within the subsystem do not collaborate despite similar belief systems (Lodge & Matus 2014).

Even though some recommendations derived from the analysis might be applicable to other cases as well, findings remain highly tied to the unique situation in Belgium. They do certainly not qualify for generalization or theory-building – especially because a theory has been applied which aims to explain policy change while in the investigated case no policy change has taken place yet. Nonetheless, this overdue attempt to systematically approach, categorize and analyze stakeholders involved in Belgian nuclear policies may serve as a starting point and impulse for future scientific and hands-on endeavors.

8. Conclusion

Facing the heated controversy about a Belgian nuclear phase-out, this paper offered a stakeholder analysis focusing on crucial actors in the respective policy dispute in Belgium. It furthermore aimed to uncover the probability of a soon policy change – meaning a major sectoral transformation permanently leaving behind Belgian nuclear power generation – as well as to give strategic recommendations to lobby a nuclear phase-out. More specifically, it asked the sub-questions which positions are for what reason advocated by whom and which possibilities do actors – including actors abroad – have to affect the policy process. In order to approach these objectives and address the research question, stakeholder theory and the Advocacy Coalition Framework were consulted for theoretical, methodological and analytical guidance, offering a conceptualization of stakeholder resources and theorized preconditions for policy change to be confronted with the reality in Belgium.

In accordance with theoretical reflections, the policy debate could be split into two opposing camps: the pro-nuclear and anti-nuclear coalition. Among nuclear opponents, a very diverse group of stakeholders was identified reaching from grassroots movements and NGOs to political parties and foreign governments. The two Belgian green parties and environmental organizations were found to be the central players championing a phase-out within this coalition. On the other hand, the pro-nuclear coalition is essentially made up of the nuclear plant operator ENGIE Electrabel, the Belgian Nuclear Forum which is coordinating lobbying efforts of several (mainly utility) companies from the nuclear sector; and industry associations. Only few Belgian parties can be clearly associated with one coalition, while most do not seem to have unambiguous stances on the issue at stake yet. The Belgian Federal Government is the decisive actor to direct and determine the future of nuclear energy in Belgium. However, despite their commitment to exit nuclear energy by 2025, doubts about the eventual execution of the existing phase-out plan are pervasive among all important stakeholders.

Borrowing the underlying concept from the ACF, differences in stakeholders' belief systems were exposed. Similarities in the argumentation among stakeholders within each coalition became apparent. Nuclear opponents principally object to nuclear energy and stress the security risks and environmental devastation linked to nuclear energy production. While according to them an aging Belgian nuclear fleet increases security risks, renewable energies and other substitutes for nuclear energy are ready to be deployed extensively to warrant a smooth energy transition by 2025. On the contrary, nuclear advocates emphasize the major share of nuclear power in Belgium's energy mix. A nuclear phase-out in 2025 would entail grave security of supply problems, energy dependence on foreign countries and increasing prices. The importance of renewable energies is clearly acknowledged; however, they still face major drawbacks as compared to nuclear power which is praised as a safe, reliant, carbon free and rational solution for Belgium – at least in the medium run. Since further lifetime extensions do not come along with bigger security risks, the phase-out date should be postponed for a reasonable energy transition. These fundamental differences in values and empirical beliefs was further exemplified by dwelling on two major lines of conflict in the Belgian nuclear debate: The handling of hydrogen flakes in the reactor vessels of units Doel-3 and Tihange-2 as well as the role of the federal regulator FANC in the policy process inclusive of respective transparency issues.

In line with assumptions from the ACF, coalition members essentially share core beliefs and agree on basic objectives, but may differ regarding their strategies to accomplish the common goal. This was observed in the anti-nuclear coalition whose heterogeneous members choose very diverging means to affect the policy subsystem while exposing less strategic coherence than their pro-nuclear counterparts. Nevertheless, this is not necessarily a liability, because the capacity to mobilize people by, for example, certain protest campaigns may raise public awareness and exert pressure on policy makers which also represents a valuable ACF-resource. Financial resources and lobbying power seem however to the credit of nuclear proponents.

The impact of (scientific) information received special attention in the analysis, as it constitutes a key resource for policy learning. Major stakeholders may be persuaded if research – especially in environmental issues – clearly points into one direction substantiating the argumentation of one advocacy coalition. It can be said that a myriad of studies is still delivering mixed and contradictory findings with no unambiguous evidence to foster the decisive policy learning among governmental stakeholders. On the contrary, studies – usually energy scenarios showing either the dispensability or indispensability of nuclear energy for Belgium – have been constantly brought forward by both coalitions to buttress their position and are reflexively discredited by the opposing coalition for being biased. Scholars can thus be found in both coalitions.

Other theoretical preconditions for policy learning and policy change seem not to be met either. As indicator for the severity of the conflict, stakeholder saw few common grounds for discussion due to fundamentally different or dogmatic positions on nuclear energy. A governmental mediator as well as a regular policy forum in which supporters and opponents can constructively exchange ideas is not present. Nuclear opponents do not have a well-established relationship with the decisive minister in charge of nuclear lifetime extensions; therefore reducing opportunities for policy learning of governmental stakeholders.

Consequently, theoretical prospects for a soon policy change seem bleak. Beyond that, stakeholders from both coalitions see further lifetime extensions as a very realistic future scenario under given circumstances; on condition that no sudden external or internal shock hits the policy debate. The Advocacy Coalition Framework helped explaining why policy change did not happen up to this point. Although there might have been changes in the belief systems of pro-nuclear stakeholders over the last decades (presumably in the principal acceptance of renewable energies), there is still the firmly established conviction on their part that nuclear energy represents an auspicious technology for Belgium's energy supply beyond 2025. This is not an obvious finding. Unlike, for example, Swiss core energy stakeholders who seem to have changed beliefs and increasingly accepted the governmental nuclear phase-out schedule (Markard et al 2016), pro-nuclear industry stakeholders in Belgium did not warm up to back the government plans for a nuclear exit by 2025 by now, but see a lucrative and vital chance to postpone legally set shut-down dates.

Despite the limited possibilities to influence the policy process – especially from abroad – a set of strategic recommendations was presented. Legal opportunities should be exploited as firstly, an alternative mediation of the conflict as well as, secondly, a potential measure to enforce obligations of public participation in the decision-making process for further lifetime extensions. Constantly challenging opponents by demonstrating the viability of the phase-out plan; pushing EU legislation for stricter transparency obligations; urging torn stakeholders to take a stance on

the issue; increasing collaboration within the anti-nuclear coalition; seeking new coalition members; using and building policy forums and fostering international energy cooperation are some suggestions elaborated in this context. These recommendations largely resonate with the ACF, as they hint at strengthening stakeholder resources (more information; winning the support of public opinion) and other conditions that could bring forward policy change (stronger coalitions, policy forums). Gaining public support appears to be of overriding importance for both coalitions and was expressed by virtually all stakeholders as determining factor for the future of nuclear energy in Belgium. The result of the next federal election in 2019 will be crucial for further developments, as it might come along with an incisive change of decisive governmental stakeholders.

Although some basic ACF-assumptions about coalitions' characteristics – such as disagreement on secondary beliefs within advocacy coalitions – can already be confirmed by this analysis; core hypotheses on policy change can only be put to the test after policy change has occurred in this case.

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Annexes

Annex I – Stakeholder List

Stakeholder Name / Group	Description	Stakeholder Classification
ENGIE Electrabel	Operator of Belgian NPPs	Shareholder
FANC / AFCN **Federaal Agentschap voor Nucleaire Controle** **Agence Fédérale de Contrôle Nucléaire**	Federal nuclear safety authority under supervision of Federal Minister of the Interior	Governmental stakeholder / regulator
BEL V	Subsidiary of FANC	Governmental stakeholder / regulator
Belgian Federal Government	2014-2019: N-VA, MR, Open VLD, CD&V Federal Minister for Energy, Environment and Sustainable Development: Marie-Christine Marghem (MR)	Governmental stakeholder
Belgian political parties	N-VA CD&V Open VLD sp.a Groen Vlaams Belang PS MR cdH Ecolo DéFI PP PVDA/PTB CSP ProDG PFF Vivant	Governmental stakeholder / parties
CREG **Commission for Electricity and Gas Regulation**	Federal electricity and gas regulator	Governmental stakeholder / regulator
Federal Public Services (FPS)	FPS Economy, SMEs, Self-Employed and Energy FPS Health, Food, Chain Safety and Environment	Governmental stakeholder

Federal Planning Services	Handle ad hoc matters that require coordination between several FPSs, like the Sustainable Development PPS	Governmental stakeholder
BFP **Bureau Fédéral du Plan**	Government-based economic research center	Governmental stakeholder
SCK•**CEN**	Belgian nuclear research center	Governmental stakeholder
Elia	Electricity transmission system operator	Governmental stakeholder
Regierung der Deutschsprachigen Gemeinschaft Belgiens	Sub-regional government	Governmental stakeholder
STORA **Studie en Overleg (berging) Radioactief Afval Desel** **Study and Consultation Group Radioactive Waste in Dessel**	Non-profit association composed of organizations and residents of the municipality of Dessel, monitoring nuclear affairs, especially nuclear waste	Pressure group
Belgian Nuclear Forum	Federation of the Belgian nuclear sector	Pressure group
FORATOM	European Atomic Forum	Pressure group (international)
European Nuclear Society		Pressure group (international)
North Rhine-Westphalia Government	German state government	Foreign governmental stakeholder
Rhineland-Palatinate Government	German state government	Foreign governmental stakeholder
Saarland Government	German state government	Foreign governmental stakeholder
StädteRegionAachen	German municipal governments	Foreign governmental stakeholder
Allianz der Kommunen "Dreiländerregion gegen Tihange"	Association of roughly 80 local communities	Foreign governmental stakeholder
Greenpeace Belgium		Pressure group
BBL **Bond Beter Leefmilieu**		Pressure group
IEW **Fédération Inter-Environnement de Belgique**		Pressure group
Nucléaire Stop Kernenergie		Pressure group
11 Mart Beweging		Pressure group
GreenLeft		Pressure group
Friends of the Earth		Pressure group
WWF		Pressure group

World Wildlife Fund		
NTW **Nuclear Transparency Watch**		Pressure group
Climaxi **Beweging voor Klimaat en Sociale Rechtvaardigheid**		
AAA **Aachener Aktionsbündnis gegen Atomenergie**		Pressure group (Germany)
AntiAtomBonn		Pressure group (Germany)
Initiative 3 Rosen e.V.		Pressure group (Germany)
IPPNW **International Physicians for the Prevention of Nuclear War**		Pressure group (international)
Stop Tihange & Doel		Pressure group (international)
Milieu Front Eijsden		Pressure group (Netherlands)
Lëtzebuerger Aktiounskomitee géint Atomkraaft		Pressure group (Luxembourg)
Allianz der Regionen für einen europaweiten Atomausstieg		Pressure group (international)
Belgian industry associations	VBO Essenscia FEBEG FEB FEBELIEC Voka	Pressure group
Belgian trade unions	ACV/CSC ACLVB/CGSLB ABVV/FGTB	Pressure group
IAEA **International Atomic Energy Agency**	Affiliated with UN, but autonomous	
NEA **Nuclear Energy Agency**	Specialized agency within OECD	

Annex II – Data Analysis Coding Scheme

ITEM	CODE
Stakeholder self-understanding, role in the policy process	0
Stakeholder position, objective	1
Arguments pro nuclear energy in Belgium (Belief System I: policy core beliefs)	2+
Arguments against nuclear energy in Belgium (Belief System I: policy core beliefs)	2-
Strategies to realize objectives (Belief System II: Secondary beliefs)	3
Relationship between pro- and anti-nuclear coalition (severity of the conflict)	4
Resources I: Information, studies, expertise etc.	5
Resources II: Venues and others	6
Stakeholders' allies	7
Broker, mediator; Relationship with governmental stakeholders	8
Policy forum	9
Actors abroad	10
Outlook: Assessment of future developments	11
Solutions to realize policy change	12
Other interesting remarks	99
Other stakeholders named	A(ctor)