The Nuclear Option

Why is there a differentiation between the nuclear energy policy of the Netherlands and Belgium?

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Abstract

The usage of nuclear energy has been the subject of much debate in the past and in the present. Even within the European Union, the use of nuclear energy is not without complications. For example, Belgium is almost dependent on the use of nuclear energy, while it is hardly used in the Netherlands. This distinction will be analyzed in this thesis, and an attempt will be made to provide an answer to the question: Why is there a differentiation between the nuclear energy policy of the Netherlands and Belgium? This matter was answered by looking at the trend that has been going on since Second World War and evaluating the actors involved in political and social debates using available source material. These actors are the government, environmental movements, the industrial sector, and scientists, in that order. According to the findings, there is virtually little variation between Dutch and Belgian policies. The government in the Netherlands, however, made place for environmental groups and incorporated critical voices from scientists in the decision-making process. Although the Dutch government did not follow the recommendations one-on-one, it did result in a shift in policy in Belgium, where these players had little or no impact on political processes; it even appeared that most scientists supported the use of nuclear energy. This study adds to the current debate on nuclear energy by providing insights into the potential that nuclear energy has held since World War II, but it also demonstrates where nuclear technology has shortcomings and hazards. Nuclear energy remains on the political agenda, and from the looks of it, it is there to stay.

Keywords: Nuclear, Nuclear energy, Reactor, Netherlands, Policy, Belgium, Dutch, Belgian, Chernobyl, Atoms for Peace, Environmental movements, Sustainability, Sustainable

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Introduction

> Kernenergie is een schone en stabiele energiebron. In de combinatie van verschillende energiebronnen kiezen wij daarom bewust ook voor kernenergie. Met kernenergie kunnen we de klimaatdoelen van Parijs halen, door in 2050 volledig CO2-neutraal elektriciteit op te wekken. Daarom willen wij meer kernenergie mogelijk maken in Nederland. Dat doen we onder andere door overheidssteun te verlenen en investeerders zekerheid te bieden.[1]

Nuclear energy is back on the political agenda, almost like it never left. Several political parties included nuclear energy in their election manifestos for the Dutch House of Representatives elections in 2021 because they feel it is a sustainable and fiscally responsible energy source. The benign use of radioactive materials, such as nuclear energy, is not a new phenomenon in the history of humankind. Dwight D. Eisenhower, the 34th President of the United States, highlighted nuclear potential for the future in a speech delivered at the 470th plenary assembly of the United Nations in 1953:

> The United States knows that if the fearful trend of atomic military build-up can be reversed, this greatest of destructive forces can be developed into a great boon, for the benefit of all mankind. The United States knows that peaceful power from atomic energy is no dream of the future. The capability, already proved, is here today. Who can doubt that, if the entire body of the world's scientists and engineers had adequate amounts of fissionable material with which to test and develop their ideas, this capability would rapidly be transformed into universal, efficient, and economic usage?[2]

After the bombing of the Japanese cities of Hiroshima and Nagasaki at the conclusion of the Second World War, humanity had come to realize the deadly potential of nuclear weapons.

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[1] Volkspartij voor Vrijheid en Democratie, 'Kernenergie', used from: https://www.vvd.nl/standpunten/kernenergie/ on May 24th 2021.
Translation: Nuclear energy is a safe and reliable source of energy. As a result, we make a purposeful decision to use nuclear energy in conjunction with other energy sources. We can meet the Paris climate targets by generating full CO2-neutral electricity by 2050 using nuclear energy. That is why we want to expand nuclear energy in the Netherlands. We accomplish this, among other things, by giving government assistance and giving investors with assurance.

[2] Dwight D. Eisenhower, *Atoms for Peace Speech*, Dwight D. Eisenhower's Papers as President, Speech Series, Box 5, United Nations Speech December 8th, 1953, used from: https://www.eisenhowerlibrary.gov/sites/default/files/file/atoms_Binder13.pdf, 1-9, 7.

This speech, on the other hand, draws attention to another use of nuclear power, that of a peaceful source of energy.[3] In his address, Eisenhower vowed to investigate the potential of using nuclear energy in the future, as well as how other countries may profit from this study. Furthermore, he established proposals on how international institutions could be involved such as the International Atomic Energy Agency (hereafter: IAEA).[4] The IAEA could be responsible with matters such as 'impounding, storage, and protection of the contributed, fissionable, and other materials (i.e., nuclear waste).'[5]

Although the vision for the future presented here is encouraging, this speech did not discuss the possibility of nuclear energy being sustainable, instead focusing solely on the economic advantages. No mention of its potentially sustainable nature has been made here for several reasons, the most important of which being that sustainability thought was not yet widespread at the time. On a social level, since the late 1960s, there has been widespread concern about the finiteness of fossil fuels.[6] Limits to Growth (hereafter: LTG), a Club of Rome report issued in 1972, claimed that a coming scarcity of fossil fuels will have serious repercussions for our ecosystem.[7] This report sparked citizen-led environmental initiatives in the Netherlands. Since the 1970s, these residents have banded together in organizations such as Aktie Strohalm and the Vereniging Milieudefensie.[8] In the second part of the 1970s, these groups and the activities they took were focused about nuclear energy.[9] These environmental organizations thus became political actors, influencing decision-making.

From a political standpoint, the sustainability ideal gained traction, culminating in the publication of the Brundtland Committee's report. This report, headed by former Norwegian Prime Minister Gro Harlem Brundtland, defines the term "sustainable development."[10] In this report they gave the following definition: 'Sustainable development is development that meet the needs of the present without compromising the ability of future generations to meet their own need'.[11] In terms of nuclear energy, it has been claimed that the generation of nuclear

[3] Ibidem 7.
[4] Ibidem, 8.
[5] Ibidem, 8.
[6] Duco Hellema, *Nederland en de Jaren zeventig* (Utrecht 2012), 36.
[7] Geert Verbong, *Een kwestie van lange adem. De geschiedenis van duurzame energie in Nederland* (Boxtel 2001), 13.
[8] Hellema, *Nederland en de Jaren zeventig,* 36.
[9] Ibidem, 37.
[10] Brundtland Commission, *Our Common Future* (Oxford 1987), 40.
[11] Ibidem, 40.

energy produces no greenhouse gases and consumes less land area than renewable sources such as wind and solar energy. The quicker rate of global warming has made the issue more urgent than ever, and governments are attempting to make energy production more sustainable while remaining profitable. For some, nuclear energy is the solution to their issues; for the majority, it is sustainable, and for many, it is efficient. However, there was some skepticism regarding the safety.[12]

Despite rising interest in renewable energy and the probability that nuclear energy is an excellent example of it, countries still have differing perspectives on how to use it. When the Netherlands and Belgium are compared, the policy differences are arguably most visible. The Netherlands enacted the Klimaatwet on January 1, 2020. With this legislation, the government legally committed to decreasing greenhouse gas emissions to a level that is about 95% less than 1990 by 2050.[13] This 'climate legislation' is the result of several international conferences, the most notable of which were the Kyoto Protocol in 1997 and, more recently, the Paris Agreement in 2015.[14] To minimize greenhouse gas emissions in the Netherlands, the government must modify the way the country obtains energy. Historically, the Netherlands obtained its energy from fossil fuels such as oil, coal, and, most crucially, natural gas.[15] According to Dutch statistics, ninety percent of Dutch energy is derived from fossil fuels, with only seven percent coming from renewable sources. Perhaps most shockingly, nuclear energy accounts for just one percent of overall energy use.[16]

However, the situation in Belgium is different. Considering the Dutch energy mix, one thing is abundantly evident when looking at Belgium: nuclear energy is crucial. According to Elia, the operator of the Belgian electrical transmission network, nuclear energy accounts for forty-nine percent of total energy in Belgium, while natural gas accounts for twenty-seven percent.[17] Interestingly enough, they do not mention the use of other fossil fuels, making it necessary to explain this phenomenon.

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[12] Hellema, *Nederland en de Jaren zeventig,* 38.
[13] Ministerie van Economische zaken en Klimaat, 'Klimaatwet', identificatienummer; BWBR0042394. Consulted on November 28th, 2020, from: Klimaatwet.
[14] Held, David and Charles Roger, 'Three Models of Global Climate Governance: From Kyoto to Paris and Beyond', *Global Policy* 9 (2018) 4, 527-537, yonder 528.
[15] Energie in Nederland, 'Infographic 2020: energie in cijfers', version of the 22nd of January 2020. Consulted on November 28th, 2020 from: https://www.energieinnederland.nl/feiten-en-cijfers/infographic/.
[16] Ibidem.
[17] Elia, 'Elia stelt cijfers over Belgische Energiemix 2018 voor', version of the 18th of January 2019. Consulted on November 28th, 2020, from: https://www.energie-vergelijker.be/blog/energiemix-in-belgie/.

Recently, the political debate shifted towards a more positive approach regarding the adoption of nuclear energy in the energy mix, but the question arises, why has this step not been taken earlier?[18] How and why has Belgium, which is geographically alike to the Netherlands, such a larger share of nuclear energy? Because of this, the research question during this master thesis is therefore as follows; *Why is there a differentiation between the nuclear energy policy of the Netherlands and Belgium?*

This thesis shall be placed in a broader historiographical debate regarding nuclear energy, focusing on the contexts of aversion towards the use of nuclear energy and if this lobby against nuclear energy was more successful in one country than the other. The anti-nuclear protests, according to historian Jan-Henrik Meyer, contain three major components. The first is that, while most demonstrations were focused locally, some saw everything linked to new nuclear power facilities as a worldwide issue.[19] Secondly, he explained how it was unclear which international body should be targeted for their protests against the civil use of nuclear power, but it eventually switched to the International Atomic Energy Agency (IAEA) as the most important transnational player.[20] Lastly he mentions that business, political and technical elites practically accepted nuclear power as a prime source of energy, and that they could not be persuaded to change their view.[21] With regards to this research, these aspects Meyer introduces to us shall be used in order to understand certain variables.

The above cannot be investigated without paying attention to political scientist Maarten Hajer. He interweaved the importance of a discourse analysis with environmental policy.[22] He explains that involved actors in the discission making process but also media outlets such as television and newspapers, are part of a 'discourse coalition'.[23] Within these coalitions people adopt each other's points of view. Interested parties choose the elements that appeal to them and thus formulate their views on certain matters such as nuclear

[18] Wiebes, Eric, 'Aanbiedingsbrief bij rapport over kernenergie', version of the 22nd of September 2020. Consulted on November 28th, 2020 from: https://www.rijksoverheid.nl/documenten/kamerstukken/2020/09/22/aanbiedingsbrief-rapport-over-kernenergie.

[19] Jan-Henrik Meyer, 'Where do we go from Wyhl? Transnational Anti-Nuclear Protest Targeting European and International Organizations in the 1970s', *Historical Social Research* 39 (2014) 1, 212-235, yonder 214.

[20] Ibidem, 214.

[21] Ibidem, 215.

[22] Maarten A. Hajer, *The Politics of Environmental Discourse: Ecological Modernization and the Policy Process* (New York 1995), 13.

[23] Ibidem, 13.

energy.[24] Within a coalition, framing is therefore applied to specific policy. As soon as the discourse of a coalition is leading within the debate or in society, the coalition is successful, and the definitions and elements put forward by them become practice.[25] This notion is good to use during the part of the research that focuses on the actors involved. For example, in the scientific paper 'Why nuclear energy is sustainable and has to be part of the energy mix', the writers argue that nuclear energy has to be admitted to the energy mix because of its sustainable and durable roots.[26] However, they ignore the issues raised by certain pressure groups who are against nuclear energy and solely focus on the advantages rather than the disadvantages.[27] Thus, the bigger debate in this thesis is the question; who determines policy?.

In order to provide an answer to the research question, the thesis shall be divided in approximately four chapters. The first chapter shall be an introductory chapter in which the main objective is the clarification of the background in which this research shall take place. For instance, this introductory chapter shall be used to provide insight in the international dimension of policies regarding climate change and sustainable energy. During this, attention shall be given to academic debates surrounding the degree of sustainability of nuclear energy. Furthermore, international agreements which are applicable to the Netherlands and Belgium, such as the European Green Deal will be taken into consideration.

The second chapter will examine the Belgian government's nuclear energy strategy. As previously stated, nuclear energy accounts for approximately half of the energy consumed in Belgium. Of course, the key questions are how and why. To address this, the research will concentrate on a few variables. The stakeholders engaged in nuclear energy decision-making are the first group of factors. Environmental groups, for example, have already been mentioned. In the late 1970s, several environmental organizations affected the decision-making process around the building and usage of nuclear power facilities. It will be investigated how effective these groups were in Belgium and how they affected the discussion. In addition, the scientific sector will be analyzed to see where it stands in the nuclear energy issue and whether that position has evolved. The case of Belgium will be

[24] Ibidem, 13.
[25] Ibidem, 13.
[26] Barry W. Brook, Agustin Alonso, and Daniel A. Meneley, 'Why nuclear energy is sustainable and has to be part of the energy mix', *Sustainable Materials and Technologies* 1 (2014) 2, 8-16, yonder 9.
[27] Ibidem, 15.

examined primarily using secondary literature and internet source material. Most accessible materials concentrate on the issue's political dimensions. Written policies are available to some extent on the Belgian government's website, and in the case of environmental groups, an in-depth review of literature will be undertaken.

The structure will be the same in the third chapter. The political context, the achievements of environmental groups, the industrial sector, and scholars will all be highlighted here. From 1945 onwards, the government took a positive stance regarding the use of nuclear energy, but this shifted in the 1980s. An intriguing element of the Dutch situation is that several nuclear power plants were completed, but future growth was chosen to be halted at some time. These nuclear power plants were built in the 1970s, but only the Borssele plant is still operational in 2021. Additionally, the Netherlands still maintains two operating nuclear reactors. These two are used for medical and scientific research, among other things, rather than energy generating. These are in Putten and Delft, respectively.[28] In addition to literature, many primary sources will be used to investigate this. Given the current circumstances, Dutch sources are more accessible for this thesis. A good example of the sources that will be used include the archives of the Dutch government, in particular the House of Representatives debates, and minutes or internal notes of the ministries involved. In addition, some archives of environmental organizations in the 1970s will be used. These were accessible through the International Institute of Social History (hereafter: IISH).

The results from chapters two and three will be combined and compared in the fourth and final chapter. The main actors and their roles in the overall picture will be evaluated for each variable. Emphasis is placed on which of the actors played the most essential role in policy formulation. The conclusion will return to the already addressed broad debates. The current debates in each nation will be given special consideration.

[28] Autoriteit Nucleaire Veiligheid en Stralingsbescherming, 'Kernreactoren in Nederland. Consulted on January 20th, 2021, from: https://www.autoriteitnvs.nl/nucleaire-crisis-of-stralingsongeval/kernreactoren-in-nederland.

Chapter one: Nuclear possibilities, 1930-1986

> We knew the world would not be the same. A few people laughed, a few people cried, most people were silent. I remembered the line from the Hindu scripture, the Bhagavad-Gita. Vishnu is trying to persuade the Prince that he should do his duty and to impress him takes on his multi-armed form and says, "Now, I am become Death, the destroyer of worlds''.[29]

The world first learned about nuclear power through its devastating powers when the United States destroyed the Japanese cities of Hiroshima and Nagasaki, thereby ending one of the most heinous conflicts in human history. The deployment of nuclear weapons brought about peace, but it also brought us a new menace. A bipolar world order arose, with the two new superpowers, the United States, and the Soviet Union, engaging in an arms race with arsenals of weapons capable of not only destroying the other, but also extinguishing the entire world's population. This chapter will look at how nuclear power became an appealing alternative for energy generation. The goal is to see how nuclear energy may enter the market and be employed in the generation of energy by various countries. Furthermore, the chapter will demonstrate that, in addition to national debate, there is a global debate regarding the use of this type of energy generation, in which many interests play a part. First and foremost, the focus will be on altering laws in the United States. This was the first step in commercializing nuclear energy, and it was therefore critical to its market position.

From war to benign and peaceful uses

While nuclear fission was utilized for destructive objectives, it also had the potential to be employed for more peaceful ones. It was previously stated that President of the United States Dwight D. Eisenhower alluded to the peaceful power of atomic energy and emphasized the benefits for both the world economy and energy supply, which became known as 'Atoms for Peace'.[30] Atoms for Peace is regarded as one of the starting points for the peaceful use of nuclear fission. It was part of a larger campaign known as 'Project Candor,' which aimed to improve public opinion toward the United States so that it could be seen that they, too, were

[29] Atomic Archive, J. Robert Oppenheimer 'Now I am become death', consulted on February 15th, 2021, from: https://www.atomicarchive.com/media/videos/oppenheimer.html.
[30] Spencer R. Weart, *Nuclear Fear: A History of Images* (London 1988), 156.

interested in peace rather than war.[31] The program's origins can be traced back to the 1930s, when scientists publicly explored the idea of using nuclear energy as a source of power. While this altered after WWII, when most ideas regarding nuclear power focused on military applications, the prospect of benign use never went away.[32]

At the top of the United States government, the Atoms for Peace initiative was viewed as a 'direct challenge to the Soviets near monopoly of peace propaganda', as well as a crucial step in consolidating American interests on both sides of the Iron Curtain following Stalin's death.[33] The military's stringent restrictions had to be relaxed to take the step toward 'civilian usage.' These prohibitions were enshrined in the 1946 Atomic Energy Act, which specified that it was illegal to transfer technology, expertise, and information to any government, even allies.[34] It was not until the summer of 1954 that these laws were eased, more than a year after the start of Project Candor and around eight months after the Atoms for Peace-speech given by Eisenhower.[35] These revisions provided a legal basis for private companies to pursue their own path with regards to the development of nuclear power for peaceful uses and furthermore eased the flow of information between actors involved worldwide.[36]

The relaxation of the rules that was made possible with the Atomic Energy Act, provided possibilities for scientists and companies worldwide. It paved the way for the organization of a new international scientific conference aimed to promote the 'benign and peaceful uses of atomic energy'.[37] From the beginning it was clear that the focus of this meeting was directed at the social and economic aspects and the industrial uses of nuclear energy, meaning that nuclear reactors or power plants took center stage.[38] From the 1960s onwards, the use of nuclear energy was seen as beneficial to the economy. This conviction arose on two lines of reasoning. Firstly, the construction of a nuclear reactor had a positive effect on the employment of countries. The construction of a large reactor took a long time,

[31] Ibidem, 156.
[32] John Krige, 'Atoms for Peace, Scientific Internationalism, and Scientific Intelligence', *Osiris* 21 (2006) 1, 161-181, yonder 159.
[33] Ibidem, 162.
[34] Ibidem, 165.
[35] Ibidem, 165.
[36] Weart, *Nuclear Fear,* 199.
[37] Krige, 'Atoms for Peace, Scientific Internationalism, and Scientific Intelligence', 165.
[38] Richard G. Hewlett and Jack M. Holl, *Atoms for Peace and War, 1953-1961: Eisenhower and the Atomic Energy Commission* (Berkeley 1989) 234.

which meant that new jobs could be created.[39] Second, nuclear material was seen as an opportunity replace fossil fuels, which were often more expensive to obtain and process to eventually generate energy.[40] The latter has to do with the way nuclear power plants work. In fact, these reactors work the same as other power plants, given the fact that water is heated and the steam that is released during this process is used to generate the turbines. In nuclear power plants, this process is initiated by nuclear material, while other power plants use the heating of oil, coal, or gas.[41]

The market for nuclear powerplants increased rapidly in the mid-1960s. Because of the previously mentioned relaxation of limitations, private firms were more competitive with one another, spurring innovation and lowering prices. Not only were there more orders for new reactors throughout the world, but these newer reactors were larger than their predecessors and so could generate much more energy than their predecessors.[42] It was this boom in the late 60s, early 70s that ultimately led to questions surrounding the field of safety, especially whether the current measures that had been taken also still apply to the ever-expanding power plants.[43] The first safeguard concentrated on preventing overheating and therefore protecting the core from melting, while the second safeguard focused on the potential that the core may melt, but these safety procedures should prevent the discharge of radioactive material.[44] Nonetheless, it was difficult to provide a complete assurance of safety. A confluence of factors and events can lead to a catastrophic nuclear accident. This reality was reinforced by the remnants of 'Operation Candor,' which emphasized openness to nuclear options. The public was aware of what it was and the threats it posed, and as a result, there was increasing opposition in society, which will be addressed in further detail in the coming chapters.

[39] Arthur Yip, Jessica R. Lovering and Ted Nordhaus, 'Historical construction costs of global nuclear power reactors', *Energy Policy* 91 (2016) 1, 371-382, yonder 372.
[40] Ibidem, 372.
[41] U.S. Department of Energy, 'The History of Nuclear Energy', *DOE/NE-0088.* Consulted on February 26th, 2021, from: https://www.energy.gov/sites/prod/files/The%20History%20of%20Nuclear%20Energy_0.pdf, iii.
[42] Ibidem, 27.
[43] Ibidem, 29.
[44] Ibidem, 29.

Scientific debates

In summary, there was societal opposition to nuclear energy, whereas there was considerably greater demand for other types of sustainable energy generation. This ideal was also becoming increasingly political. As previously stated, the Brundtland Committee issued a report in 1987. In this report a definition was given for sustainable development: 'Sustainable development is development that meet the needs of the present without compromising the ability of future generations to meet their own need'.[45] This definition opened the ongoing conversation surrounding nuclear energy, with main question asked: is nuclear energy a sustainable alternative? According to an opinionated research paper, a collaboration between scientists and nuclear scientists such as Dr. Barry Brook and Dr. Agustin Alonso, nuclear energy could be seen as a sustainable option. They defined sustainable as 'meeting the needs of the present without compromising the ability of future generations to meet their own needs', meaning that they used the same definition Brundtland proposed.[46] They stated that nuclear energy, specifically energy from uranium and plutonium is sustainable because the energy they generate could be enough to sustain world energy demand for at least a century without compromising future generations.[47] They specifically pointed out the environmental considerations that should be taken when talking about nuclear energy. They stated that nuclear power plants do not cause air pollution or emit carbon dioxide. They admitted that obtaining uranium is harmful to nature but noted that this risk is reduced once the commercial sector gained access to knowledge about the so-called 'fast reactors, as the name suggests, a nuclear reactor where energy can be generated faster and therefore uses less material.[48] They found support from nuclear scientist Romney B. Duffey, in his work 'Sustainable Futures Using Nuclear Energy' he explained that there is enough on the planet to use it for about three centuries. In addition, a large part of the material is located in countries that already have experience in the extraction of natural resources, so that the infrastructure is already in place and can therefore be done in a more sustainable way.[49]

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[45] Brundtland Commission, *Our Common Future* (Oxford 1987), 40.
[46] Brook, Alonso and Meneley, 'Why nuclear energy is sustainable and has to be part of the energy mix', 9.
[47] Ibidem, 9.
[48] Ibidem, 11.
[49] Romney B. Duffey, 'Sustainable Futures Using Nuclear Energy', *Progress in Nuclear Energy* 47 (2005) 1-4, 535-543, yonder 541.

However, all are contradicted by academic engineer Joshua M. Pearce. In his paper entitled 'Limitations of Nuclear Power as Sustainable Energy Source' he indicated that the main misconception about nuclear energy is the emission of carbon dioxide. It is often said that it would cause no emissions, but this is incorrect. Pearce stated that when the full nuclear energy cycle is examined, it becomes obvious that the transport, extraction, and quality of the material all have an influence on carbon dioxide emissions.[50] He even states that this can be just as high or even higher than for power plants that run on fossil fuels.[51] He concluded more optimistic, by stating that it may be possible to generate sustainable nuclear energy in the distant future, but that a number of preconditions must first be attached to this. The two most significant ones he stated were refining the architecture of a reactor so that it cannot melt under any conditions and finding a better method for the disposal of nuclear waste, which was a hazardous procedure.[52]

Political action

While scientists continue to dispute the extent to which nuclear energy can be deemed sustainable, policymakers are under pressure to choose a course of action. The Green Deal, which was proposed by the European Commission in December 2019, is perhaps the clearest example to date.[53] One of the spearpoints that is included in this document is the supply of clean, affordable, and secure energy.[54] The Green Deal consists of several parts to achieve this goal. In line with Pearce, they also state that: 'the regulatory framework for energy infrastructure, (...), will need to be reviewed to ensure consistency with the climate neutrality objective'.[55] Although this does not only apply to nuclear energy, but it does also emphasize the importance of all possibilities being on the table, provided that the infrastructure allows it. The document also shows that attention must be paid to raw material that can be used in

[50] Pearce, M. Joshua, 'Limitations of Nuclear Power as Sustainable Energy Source', *Sustainability* 4 (2012) 6, 1173-1187, yonder 1174.
[51] Ibidem, 1175.
[52] Ibidem, 1180-1181.
[53] European Commission, 'The European Green Deal', *Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions*. Consulted on March 1st, 2021, from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2019:640:FIN.
[54] Ibidem, 6.
[55] Ibidem, 6.

a sustainable context.[56] Nuclear material is also not specifically mentioned here, but they do mention the possibility that any material that can ultimately be obtained 'sustainably', is usable and therefore important for the Green Deal.

It is reasonable to suppose that the European Union avoids identifying nuclear energy due to the stigma associated with it as well as political sensitivities. The committee keeps the option of utilizing it open, and as a result, each member state has a separate policy regarding the building and usage of nuclear power plants. Since the 'Atoms for Peace' initiative, much study has been conducted into the benign use of our nuclear expertise. Power plant building grew, particularly in the 1960s and 1970s, until safety concerns developed. Although this debate lingered, by the late 1980s, the sustainability concept had pushed nuclear energy back to the forefront. Nuclear energy develops as an energy source with both advantages and limitations, as well as several points of view. However, it is clear that there may be nuclear possibilities as soon as the right preconditions are set.

Conclusion

This chapter provided a timeline on how nuclear power went from destructive to benign use in less than a few decades. At first, the use of nuclear power for the generation of energy was pushed by United States president Eisenhower, to improve public opinion on the nation and positioning the United States as a power aimed towards global peace. Under the name 'Project Candor' a program was set up which ultimately eased the laws of the Atomic Energy Act and provided a legal basis for private companies to pursue their own path with regards to the development of nuclear power for peaceful uses and also made it possible for researchers in other nations to develop this technology.

New research meant new opinions on nuclear energy itself, and scientific debates arose. On one hand there were scientist whom agreed that the Brundtland definition: 'meeting the needs of the present without compromising the ability of future generations to meet their own needs', was applicable to nuclear energy. Many point out that there is enough uranium for at least three centuries, meaning it can be used in a sustainable way. On the other side of the spectrum there are those whom are more skeptical, their biggest critique points to the emission of carbon dioxide if you take into consideration the entire cycle to obtain nuclear

[56] Ibidem, 8.

energy. However, the main consensus proves to be that while nuclear energy has the possibility to be sustainable, several preconditions must be met, such as improved design to reactors and research into the disposal of nuclear waste.

While researchers propose to take it more slowly with the implementation of nuclear energy, politicians feel the need to take action on the matter. Perhaps the clearest example to date is the European Green Deal which has been presented by the European Commission. Main goal of this deal was the supply of clean, affordable, and secure energy. The Green Deal does not mention nuclear energy, which could be linked to the stigma surrounding it and the political sensitivity. The committee leaves the possibility of using it open and as a result there is a different policy per member state regarding the construction and use of nuclear power plants. In short, while it has been a few decades that nuclear energy became available for most nations, there is still debate and stigmatism surrounding it. Each party involved has their own interests but in general nuclear energy is increasingly accepted in the energy mix of countries.

Chapter 2: Belgian nuclear energy policy, 1944 –present

> In the event of the Governments of the United States of America and of the United Kingdom deciding to utilize [uranium] as a source of energy for commercial purpose ores obtained under this agreement the said Governments will admit the Belgian Government to participation in such utilization on equitable terms.[57]

During the Second World War, Belgium was involved in a conference between the United States and the United Kingdom. As a colonial superpower in Congo, Belgium had the largest stock of high-grade uranium available. For the United States this was an important investment to realize their plans for an atomic weapon.[58] It also provided possibilities for the Belgian government in exile, because it was in their best interests for the United States' war operations to be successful so that Belgium would be liberated. Furthermore, the Belgian government saw an opportunity to gain access to scientific knowledge about the benign use of uranium for energy in the persons of Prime Minister Herbert Pielot, Minister of Foreign Affairs Paul-Henri Spaak, and Minister of Finance Camille Gutt, allowing the country to have a strong base for further industrial progress after the war.[59] The three-nation agreement explains why, on May 11, 1956, Belgium became the third country in Europe to link a nuclear reactor to the electricity grid.[60] This new reactor did not meet with the Atomic Energy Act's requirements, but it could still be built since the agreement between the United States, the United Kingdom, and Belgium allowed the latter to have access to scientific information to utilize uranium for research and as a source of energy. This first reactor was utilized for reactor and neutron physics research, as well as radioisotope manufacturing.[61]

This chapter will concentrate on Belgian nuclear energy strategy. The Belgian government was initially supportive of nuclear energy after World War II, but this altered following the Chernobyl nuclear accident. The research will concentrate on a few variables to offer context. The first set of variables are the stakeholders engaged in nuclear energy

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[57] United States Archive, 'Memorandum of Agreement between the United States, the United Kingdom, and Belgium Regarding the Acquisition and Control of Uranium', *Foreign Relations of the United States*: Diplomatic Papers, 1944, *55D540, Box 2, Document 885 1944, 2.*

[58] Jonathan E. Helmreich, 'Belgium, Britain, The United States and Uranium, 1952-1959', *Studia Diplomatica* 43 (1990), 27-81, yonder 27.

[59] Ibidem, 28.

[60] SCK*CEN, 'Belgian Reactor 1- BR1'. Consulted on March 18, 2021, from: https://science.sckcen.be/en/Facilities/BR1.

[61] Ibidem.

decision-making; this will primarily examine the government's attitude on nuclear energy. Nonetheless, environmental organizations that attempted to exert influence in the decision-making process in the late 1970s will receive attention. It will be investigated how effective these groups were and how they affected the discussion. Finally, the stance of scientists must be considered.

Government policy 1944-present

From the signing of the agreement with the United States and the United Kingdom in 1944, it was apparent that the Belgian government supported the use of uranium for nuclear energy. Uranium was a raw resource utilized by the government during World Conflict II to fortify their position after the war. The deal between the United States and the United Kingdom was reached due to a lack of resources to conduct adequate study on the supposedly endless energy source.[62] Despite the fact that Nazi Germany occupied the Belgian mainland during World War II, Belgium kept influence through its colonial control in Africa. Since 1908, the Congo had been a colony under the control of the Belgian government, rather than the personal property of Belgian King Leopold III.[63] It technically meant that the congo would come under German rule after the fall of the government, but the colony remained under the rule of the Belgian governor Pierre Ryckmans, partly due to intervention by the British.[64]

Following the war, it became obvious to the Belgian government that the arrangement reached with the Americans was perhaps a little too premature. It was agreed that the Americans would share their research of nuclear energy for non-military applications, but the investment throughout the war years were primarily military. Furthermore, postwar politicians in America grew hesitant to disclose nuclear energy information for fear of theft or espionage.[65] The government's reaction to the 1944 agreement demonstrated that nuclear energy was a key postwar goal. Foreign Minister Paul van Zeeland made significant investments in communication with the United States, with considerable results. Scientists gained knowledge on medical treatment, owing in part to his harsher position, but large-scale

[62] Helmreich, 'Belgium, Britain, The United States and Uranium,27.
[63] Didier Gondola, *The History of Congo* (London 2002), 78.
[64] Ibidem, 87.
[65] Helmreich, 'Belgium, Britain, The United States and Uranium,29.

advancements in the field of developing a nuclear reactor failed to materialize.[66] However, because of their ownership of the uranium and the legal basis created by the signing of the deal, the government was in a good position to bargain. Furthermore, they had a crucial ally in their position: the British. The British were confident that providing assistance in the building of nuclear reactors in Belgium could not really backfire. They pointed out that Belgium was years behind the Soviets and the French in terms of innovation.[67] The British collaboration was presumably motivated by an ulterior goal. The 1944 agreement was scheduled to expire in 1956, therefore it was critical to entice the government into extending the agreement. Following the British intervention, the Americans understood that a more open stance may be a smart investment for future talks on uranium access. Because of this, the Belgian government was able to open the research reactor, known as BR-1, in 1956.[68] As a result of this, a collaboration between the Belgian and French governments was formed, with the objective of enhancing energy through the development of a nuclear reactor. This reactor was opened in 1966 in the French town of Chooz; it was technically the second reactor connected to the electrical grid, but it was the first to generate energy.[69]

The success of the Chooz nuclear reactor led to the construction of a few extra power stations in Belgium, all of which were commissioned in the period 1975-1985. First followed the power stations in Doel and Tihange that are still in use today.[70] In addition, there is another historical explanation for the position of the Belgian government regarding nuclear energy: the 1973 oil crisis.[71] Belgium had a major disadvantage compared to other countries; the country had a shortage of raw materials. Where other countries had access to natural gas, for example, this was only the case for coal in Belgium. However, coal mining is a dangerous and unprofitable way of generating energy and was practiced to a lesser extent in post-war Belgium. It therefore meant that Belgium became dependent on countries that did have access to certain raw materials, such as oil. During the oil crisis, nations that produced oil

[66] Ibidem, 29.
[67] Ibidem, 31.
[68] SCK*CEN, 'Belgian Reactor 1- BR1'. Consulted on March 18, 2021, from: https://science.sckcen.be/en/Facilities/BR1.
[69] Penny Hitchin, 'Excavating Chooz A', *Nuclear Engineering International* 55 (2010), 12-14, yonder 12
[70] Dries Gellynck, De Kernstop in België: Een Economische Analyse (Scriptie Economische Wetenschappen, Gent 2003).
[71] Mogens Rüdiger, 'The 1973 oil crisis and the designing of a Danish energy policy', *Historical Social Research* 39 (2014) 4, 94-112, yonder 100.

decided to extract less while raising the costs by around seventy percent, leading to increased prices and a worldwide shortage.[72] In order to circumvent this issue, the government decided to issue permits for building new reactors in a period of ten years, as mentioned above.

In the Belgian government, a watershed moment occurred beginning in 1986. The Chernobyl nuclear disaster was the primary catalyst for this pivotal point. Following the catastrophe, successive governments placed a moratorium to the development of new nuclear power facilities. The moratorium, which had been in effect since 1986, was formally included in the 1999 coalition agreement. During that year's elections, 'Ecolo,' Wallonia's green party, and 'Agalev,' Flanders' green party, achieved a massive electoral profit, allowing them to join a new government.[73] Although the profit in the elections is consistent with the zeitgeist of environmental consciousness, it could not be directly connected to the desire to end nuclear power. However, this does not change the reality that these Green parties used their election success to convey their views during the creation of a new government. They pushed primarily for the shutdown of all Belgian nuclear power facilities, an issue that was later taken up by the other parties in this administration. According to the coalition agreement:

> The moratorium on the development of nuclear electricity production will be maintained and our country subscribes to a scenario in which nuclear power stations are deactivated as soon as they have been in use for 40 years. To this end, the government will consult the European Environment Agency and interview a committee of internationally recognized experts about the feasibility and implementation of this scenario.[74]

The nuclear power plants have to be shut down after 40 years of operation as a condition for closure. In the case of Belgium, this means that all nuclear power plants must be shut down between 2015 and 2025, when the age limit is met. However, the shutdown of these nuclear power reactors remained a political minefield. The broad agreement remained that they should be shut down, although succeeding administrations disagreed on the age limit of a nuclear reactor. Because of this shift in mindset, it has been unclear for the past twenty years

[72] Ibidem, 100.
[73] Gellynck, De Kernstop in België, 4.
[74] Belgische Kamer van Volksvertegenwoordigers, 'Federale Regeringsverklaring', Buitengewone zitting 14 juli 1999, 39.

when each facility was shut down. The then-government of Prime Minister Van Rompuy agreed in 2009 to retire all the nuclear power plants in 2025, more than 40 years after they were built.[75] This policy was reversed by the Di Rupo government in 2013, they decided to revert to the previous legal closure from 2015 to 2025.[76] From the Michel government in 2015, however, a line can be recognized in the policy.[77] Successive governments from that point on stuck to a closure around 2025 (see Appendix 1).[78]

The position of scientists

The position of the government with regard to nuclear energy was supported by Belgian scientists. To explain this, we have to go back briefly to the 1944 agreement. As a result of the agreement, the Americans and British were required to share their research and findings with the Belgian government.[79] This provided opportunities for local science to learn about new developments in technology. Although sharing was scarce in the early years, leaps were made in medical science, with Belgian scientists gaining access to laboratories in the United States to gather this knowledge.[80] The agreement provided the scientists with the chance to collaborate more closely with scientists from other nations, as they were entitled to the knowledge gained. It even resulted in experts from both the United Kingdom and the United States being sent to Belgium to assist Belgian reactors and extend local science.

In the years afterwards, Belgian scientists have mostly adhered to the global consensus on nuclear energy. The academic studies that were published were all favorable, mentioning numerous good side effects of nuclear energy. First and foremost, it is highlighted that profit is primarily achieved in the appropriate incentives. Nuclear energy is very profitable

[75] Bart Brinckman, 'Regering heeft deal met Suez', *De Standaard,* October 23th, 2009. Consulted on March 26th, 2021, from: https://www.standaard.be/cnt/hb2h1avq.
[76] Gijs Moes, 'België laat oude kerncentrale draaien', *Trouw,* July 5th, 2012. Consulted on March 26th, 2021 from: Kerncentrale.
[77] Belga, 'Premier Michel: Kerncentrales gaan in 2025 dicht', *Het Laatste Nieuws*, November 21st, 2017. Consulted on March 26th, 2021 from: https://www.hln.be/binnenland/premier-michel-kerncentrales-gaan-in-2025-dicht~afc1d3a0/?referrer=https%3A%2F%2Fwww.google.com%2F.
[78] Joppe Matyn, 'De Croo: ''Kerncentrales sluiten alleen als het haalbaar en betaalbaar is''', *VRT Nieuws*, November 22nd, 2020. Consulted on March 26th, 2021, from: https://www.vrt.be/vrtnws/nl/2020/11/22/premier-de-croo-kerncentrales-sluiten-in-2025-als-het-haalbaar/.
[79] United States Archive, 'Memorandum of Agreement between the United States, the United Kingdom, and Belgium Regarding the Acquisition and Control of Uranium', *Foreign Relations of the United States*: Diplomatic Papers, 1944, *55D540, Box 2, Document 885 1944, 2.*
[80] Helmreich, 'Belgium, Britain, The United States and Uranium,29.

because the production costs are always below the investment costs, they state: 'de kostprijs valt duidelijk in het voordeel van kernenergie uit. België beschikt namelijk niet over primaire energiebronnen, (…), die op een economisch rendabele manier ontgonnen kunnen worden'.[81] The 1973 oil crisis has also been mentioned earlier. The advantages that scientists perceived was that Belgium can continue to generate its own energy without relying on other nations.[82] It was estimated that several oil fields and other places with fossil fuels will become exhausted by 2030 and that alternative fuels should be sought from this time. Due to the investment in nuclear energy, this search is significantly less important in Belgium.[83] Finally, it was argued that nuclear energy was an excellent approach to minimize carbon dioxide emissions from an ecological standpoint. According to Belgian emissions statistics, carbon dioxide emissions have been nearly steady over the last three decades, which can be ascribed to the usage of nuclear energy. Emissions from the production of this energy can only be ascribed to peripheral activities such as nuclear material transport and commuter traffic.[84]

The above does not alter the fact that there is also increasing criticism of government policy. A point of attention that is often pointed out is the possibility of accidents. An unforeseen event with a nuclear power plant can have huge consequences and lead to permanent damage to nature[85]. Since the turn of the millennium, this ecological problem has increasingly entered the political agenda and is therefore central to many academic papers. In addition, attention is often drawn to the issue of nuclear waste. Nuclear waste can remain dangerous for up to 10,000 years, making it an expensive method for future generations to deposit and secure it.[86]

The position of environmental movements

Beginning in the late 1960s, a growing number of concerned individuals began to oppose the use of nuclear energy. With many Western European nations, these movements became

[81] Gellynck, De Kernstop in België, 17.
Translation: The cost-benefit analysis strongly favors nuclear energy. Belgium lacks primary energy resources that can be used in an economically profitable manner.
[82] Ibidem, 21.
[83]Michelle Impe, 'Wat ons gezegd wordt over kernenergie. Een analyse van de ideologische strategieën in het discourse van de Belgische nucleaire lobby en regering', *Tijdschrift voor Criminologie* 60 (2018) 2, 157-172, yonder 161.
[84] Gellynck, De Kernstop in België, 23.
[85] Impe, 'Wat ons gezegd wordt over kernenergie', 163.
[86] Ibidem, 163.

active in the goal of influencing government policy. These types of movements also arose in Belgium, though to a lesser extent.[87] Perhaps the largest organization in Belgium on this topic was the 'Verenigde Aktiegroepen voor Kernstop', from here on referred to as VAKS.[88] This group was founded in 1973 with the aim of preventing Belgian participation in the breeder reactor in Kalkar, Germany.[89] The foundation was established in reaction to previous successful action groups in both the Netherlands and Germany, although initial success in Belgium was limited. The strategy that was effective in the Netherlands and Germany did not work with Belgian residents, therefore VAKS shifted to a different kind of campaigning: educating the public about the dangers of nuclear energy.[90]

From the commencement of VAKS, they attempted to raise public awareness through information and activities, which was frequently met with disappointment, although the group was occasionally effective.[91] They embarked on a long-standing campaign against nuclear power, focusing primarily on the dangers of nuclear energy dependence and the destructive history of uranium, in the hope of influencing public opinion.[92] However, the first major national demonstration was a failure. In October 1977, a protest was organized in Antwerp to call attention to the development of many reactors in Flanders. The group blamed the low attendance of 5,000 demonstrators on earlier protests in France and Germany, which culminated in violence against law enforcement officers.[93] This VAKS analysis is plausible, but it is also apparent that the overall anti-nuclear lobby had negligible support in Belgium. According to a sociological research conducted by Ruud Koopmans and Jan Willem Duyvendak into the effect of anti-nuclear organizations on nuclear energy policy, there is a bigger group in Belgium advocating for the preservation of nuclear energy than one advocating for its abolition.[94] This gives Belgium a unique position that it only has to share with France.

[87] Dieter Rucht, 'The impact of anti-nuclear power movements in international comparison', in: Martin Bauer (eds.), *Resistance to New Technology: Nuclear Power, Information Technology and Biotechnology* (Cambridge 1995), 277- 291, yonder 277.
[88] Guido Steenkiste, 'We hadden gelijk', *Oikos* 57 (2011) 2, 4-10, yonder 4.
[89] Ibidem, 5.
[90] Bert Boeckx, 'Atoomenergie? Nee bedankt. Het archief van de Verenigde Aktiegroepen voor Kernstop', *Brood & Rozen* 8 (2003) 4, 60-63, yonder 62.
[91] Steenkiste, 'We hadden gelijk', 6.
[92] Ibidem, 6.
[93] Boeckx, 'Atoomenergie', 63.
[94] Koopmans, Ruud, and Jan Willem Duyvendak, 'The Political Construction of the Nuclear Energy Issue and Its Impact on the Mobilization of Anti-Nuclear Movements in Western Europe', *Social Problems* 42 (1995) 2, 235-251, yonder 12.

Compared to other countries in western Europe, these are also the two countries that were furthest in developing nuclear energy, as the same study shows that countries with a less advanced nuclear program were less favorable to the use of this form of energy generation.[95]

Despite the earlier disappointments at the Antwerp protest, VAKS continued to organize rallies, with some success. More than 20,000 people joined a protest in 1979 dubbed 'Doel Bewust Stoppen,' which advocated for the closing of the nuclear reactors in the town of Doel. Although the movement has had some success with the public, the same cannot be said for their influence in the government. VAKS attempted to encourage the government to adopt a new strategy by writing letters to ministers and those in charge of negotiating government agreements to emphasize their dissatisfaction with nuclear energy.[96] For example, they wrote a letter to Leo Tindemans, former Prime Minister of Belgium, who during the cabinet formation of 1974 had the task of exploring which government was possible. In this letter, VAKS indicated that a reconsideration was needed to complete the nuclear power stations, arguing that Tindemans knew why this reconsideration was required, insinuating that the government was aware of the potential treats of nuclear energy.[97] The organization was not taken seriously by the government due to the absence of strong and decisive reasons in this letter from VAKS. VAKS, on the other hand, was not instantly dismayed following past dismal outcomes, completely in keeping with their heritage of tenacity. They did not hesitate to remain in touch with relevant ministers in the years that followed.[98] The most significant 'success' occurred following the well-attended demonstration at Doel. Following the demonstration, an investigative report was given to each political party, which was almost immediately disregarded by the majority of them. Nonetheless, the campaign was deemed a success since many minor parties, including the green parties Agalev and Ecolo, stated that they were reviewing the results. Most major party youth organizations considered the proposals as well, prompting possible future adaptation and consideration.[99]

[95] Ibidem, 14.
[96] Steenkiste, 'We hadden gelijk', 6.
[97] Ibidem, **6.**
[98] Ibidem, 7.
[99] Ibidem, 8.

Conclusion

This chapter has highlighted the fact that Belgian policy on nuclear energy has changed over the years. Belgium had an enormous stock of enriched uranium because of their colonial possession of Congo. After long insistence, an agreement on this with the Americans and the British gave the Belgians access to scientific knowledge in the field of nuclear energy. As a result, together with the French, they connected the first commercial nuclear reactor in Europe to their energy grid. The initial success resulted in the construction of numerous nuclear reactors in Belgium, which was backed by the scientific lobby at the time. However, over time, both scientists and concerned individuals challenged government actions. A significant group of concerned individuals formed the VAKS, a nationwide organization that campaigned for a nuclear stop. Although the group had some success in enlightening the public, the government did not take their views seriously until 1986. Following the Chernobyl nuclear disaster, the construction of additional reactors was suspended, and this was enshrined in the coalition agreement reached following the 1999 elections. The same coalition agreement stated that each nuclear reactor may only operate for a maximum of 40 years, implying that all current nuclear reactors would be shut down between 2015 and 2025. This limit was stretched several times and since 2015 it has been established that all nuclear reactors would be decommissioned between 2022 and 2025. 2025. Belgian policy has changed over the years, but was mainly influenced by developments elsewhere, nature organizations and scientists had little or no influence in the decision-making process, but they did have an important informative role.

Chapter 3: Dutch Nuclear Energy Policy: 1945-present

In this chapter, Dutch policy on nuclear energy will be discussed. First and foremost, attention will be paid to the government's policy; it will emerge that the Dutch government has seen nuclear energy as a potential future energy source since the late 1940s, and that it attempted to promote developments with foreign authorities. Later, it becomes apparent that the government's stance has shifted, with nuclear technology falling further out of favor. The position of environmental organizations in the Netherlands, which have been very successful in influencing public opinion and thus opposing nuclear energy policy, is linked to the aforementioned shift. It will also be investigated how successful they were in adapting national policy. Finally, it will consider the role of scientists and the industrial sector in the nuclear energy debate and whether nuclear energy is a viable option.

Government policy 1945-present

> Mocht men er in slagen een methode te vinden om naar believen de kernenergiën van uraan of thorium in een voldoende snel tempo te ontgrendelen dan zijn de consequenties welhaast niet te overzien, maar het is duidelijk, dat ze een geweldig gevaar voor het welzijn der volkeren in zich bergen, ook al zou men er niet direct in slagen uraan of thorium houdende explosiemiddelen van tot nu toe ongekende kracht te vervaardigen (dit zou inderdaad technisch nog wel eens een veel moeilijker opgave kunnen wezen dan het probleem om de kernenergie op vreedzame wijze af te tappen)'.[100]

This statement was made by the Dutch Minister of Foreign Affairs Eelco van Kleffens in a report on the negotiations he attended on behalf of the Dutch government with representatives from the United States and The United Kingdom, during the summer of 1945. In the negotiations it was agreed that the American and British governments would obtain the

[100] Archief van het ministerie van Buitenlandse Zaken (further: ABZ), Blok I, 1945-1954, Dossier 813.33, Deel I, Aantekening Van Kleffens, ± 4 augustus 1945.
Translation: 'Should one succeed in finding a method of unlocking at will the nuclear energies of uranium or thorium at a fast enough rate, the consequences are almost incalculable, but it is clear that they are a tremendous danger to the well-being of the peoples. Even though one would not immediately succeed in producing uranium or thorium-containing explosives of hitherto unprecedented power (this could indeed be technically a much more difficult task than the problem of peacefully tapping nuclear energy)'.

right to purchase Dutch thorium, a raw material that could be used for nuclear purposes.[101] It emerges that Van Kleffen believed that it would take decades before research is sufficiently advanced that thorium could actually be used for military or energy-generating purposes, but less than two days later it turned out that he had underestimated the developments surrounding nuclear research after the detonations of the first atomic bombs on Japan.[102]

Van Kleffens had been Minister of Foreign Affairs since 1939, which meant that he had strong relations with the responsible ministers of the United States and the United Kingdom during the Dutch government's exile in London.[103] Despite the fact that it previously emerged that Van Kleffens had underestimated developments in the nuclear sector, the Dutch delegation was larger than just the minister himself. Hendrik Anthony Kramers and Johannes van den Broek accompanied Van Kleffens. Kramers was a scientist who specialized in atomic physics. He had learned a lot as a pupil of one of the world's most prominent atomic physicists: Niels Bohr. Kramers was a professor of theoretical physics at Leiden University at the time of the negotiations.[104] Van den Broek served as Minister of Finance in Gerbrandy's second cabinet from 1942 to February 1945. During the negotiations, he was president of the Billiton society, a mining company that mined tin and ore in Dutch colonial areas.[105] Since one of the raw materials mined by his company was monazite, mineral rich in thorium, he had a strong interest in the talks with members of the governments of the United States and the United Kingdom and hence became involved.[106]

It was important for the American and British delegates that the treaty's negotiations be kept strictly secret. As a result of this, van Kleffen's negotiating space was restricted because, after a constitutional amendment in 1938, parliament had to be briefed about international treaties.[107] In order to circumvent this requirement, the agreement that was made was not called a treaty but an agreement, which meant that parliament did not have to be informed.[108] After about a month of negotiating, a variety of points were decided upon in

[101] Cees Wiebes and Bert Zeeman, 'Nederland en het Manhattan-project. De geheime thorium-overeenkomst uit 1945', *BMGN- Low Countries Historical Review* 106 (1991) 3, 394-420, yonder 394.
[102] Ibidem, 394.
[103] Ibidem, 398.
[104] Ibidem, 399.
[105] Loe de Jong, *Het Koninkrijk der Nederlanden in de tweede wereldoorlog XI, Nederlands-Indië* (Leiden 1986) 394.
[106] Wiebes and Zeeman, 'Nederland en het Manhattan-project', 399.
[107] Ibidem, 399.
[108] Ibidem, 400.

the agreement's seven clauses. The most critical clause for the British and Americans was clause two, which decided that the Dutch government would restrict monazite and thorium exports to countries approved by the United States and United Kingdom.[109] Furthermore, it was decided in clauses three and four that exports to these nations must be at least 200 tonnes per year, valued at £3 per tonne. This agreement could be extended six times for a three-year term, taking the total length to twenty-one years. Besides this, the Dutch government retained the right to hold a portion of the extracted monazite for scientific study or peaceful industrial applications. The government had to include the two countries in this because they would be checking to see if the application was not too hazardous or threatening for international stability.[110]

The agreement permitted the Netherlands to continue its nuclear energy advancement. As a result of this, the Dutch government, in cooperation with the Norwegian government, opened the Kjeller power station in 1951.[111] While it was not directly controlled by the Dutch, the government had made significant investments in it with the expectation that one day it would have its own nuclear power plant on Dutch territory.[112] Some issues had to be resolved since the initiative was a collaboration between the two nations. The primary question was which nation would have the final say on the day-to-day business in the Kjeller power plant. However, cooperation between the Netherlands and Norway probed fruitful and free of conflict.[113] It was determined that the Kjeller Institute's Board of Directors would be made up of three Dutch and three Norwegian physicists, each with a vote on how things should be handled. Furthermore, it was decided that the board's director would either be Dutch or Norwegian, demonstrating the equal distribution of influence between the two countries. Finally, they accepted that the board's scientists would obey the same laws and regulations as their counterparts from the other country, implying that domestic law would be omitted[114]

When the Senate passed the bill on funding and constructing nuclear reactors in 1954, it was decided that the state would pay fifty percent of the costs for the development of a

[109] Ibidem, 419.
[110] Ibidem, 420.
[111] Gunnar Randers, 'The Dutch-Norwegian Atomic Energy Project', *Bulletin of the Atomic Scientists* 9 (1953) 10, 369-371, yonder 369.
[112] Ibidem, 369.
[113] Ibidem, 369.
[114] Ibidem, 370.

nuclear plant.[115] This brought the Dutch desire to realize its own nuclear power station one step forward. It did not take long after the passage of this law for the building of the first two nuclear power plants in The Netherlands to begin. The reactor center in Petten was the first nuclear power plant to be constructed, with construction beginning in 1955. The Petten reactor was commissioned in 1960 and used as a low-flux reactor. A low flux reactor is a small research reactor that extracts neutrons generated by nuclear fission for later science investigation.[116] The facility was also used as a high-flux reactor a year later. A high-flux reactor enriches uranium to a high degree to do research into its various applications. In Petten, for example, research into the medicinal application of radioactive fuel was undertaken, as well as research into nuclear energy production.[117] In the years since, the Netherlands has constructed seven nuclear power plants.[118] Three of these are nuclear reactors, one of which, the Borssele nuclear power plant, is currently producing nuclear energy.[119] As a result, the first law on nuclear power plant funding and operation was to be expanded as such that there was a legislative and legal framework for their eventual commissioning. The Nuclear Energy Act was passed by Royal Decree in the Netherlands on February 21. The legislation was introduced by the government as:

> Alzo Wij in overweging genomen hebben, dat het wenselijk is op het gebied van de kernenergie en de ioniserende stralen een regeling te treffen, in het bijzonder ter bevordering van een goede ontwikkeling op het gebied van de vrijmaking van kernenergie en de aanwending van radioactieve stoffen en ioniserende stralen uitzendende toestellen, zomede ter bescherming tegen de hieraan verbonden gevaren.[120]

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[115] Kernenergie in Nederland, 'Wet tot financiering en bouw kernreactor' version 25 April 2021. Consulted on 25th of April 2021 from: https://www.kernenergieinnederland.nl/node/585.

[116] Natuurkunde.nl, 'De Lage Flux Reactor in Petten', version 25 April 2021, consulted on April 25th, 2021, from: https://www.natuurkunde.nl/opdrachten/616/de-lage-flux-reactor-in-petten.

[117] European Union Science Hub, 'High Flux Reactor' version 25 April 2021, consulted on April 25th, 2021, from: https://ec.europa.eu/jrc/en/research-facility/high-flux-reactor.

[118] These seven are: Kerncentrale Borssele, Kerncentrale Dodewaard, Hoger Onderwijs Reactor Delft, Kernreactoren Petten, Biologische Agrarische Reactor Nederland Wageningen, ATHENE Eindhoven en de Kema Suspensie Test Reactor Arnhem. Three of these are still commissioned in 2021; Borssele, Petten and Delft.

[119] Autoriteit Nucleaire Veiligheid en Stralingsbescherming, 'Kernreactoren in Nederland' version 1 May 2021, consulted from: https://www.autoriteitnvs.nl/nucleaire-crisis-of-stralingsongeval/kernreactoren-in-nederland.

[120] Wettenbank Overheid.nl, 'Kernenergiewet' version 1 May 2021. Consulted on May 1st, 2021, from: https://wetten.overheid.nl/BWBR0002402/2018-10-16.

Translation: We have considered that it is desirable to make provisions in the field of nuclear energy and ionizing radiation, especially to encourage good production in the release of nuclear energy and the use of radioactive materials and devices that emit ionizing radiation, as well as to protect against the associated risks.

This legislation addressed several issues. To begin with, it was illegal to export fissile materials or ores within or outside of Dutch territories without a permit from the relevant ministry. A permit was also required for any installation where nuclear energy could be released, stored, or processed. In essence, the entire manufacturing and distribution of nuclear energy has been limited and regulated by the government.[121] Successive governments continued to encourage the use of nuclear energy. Despite this, societal opposition began taking flight in the 1970s. However, the energy memorandum of 1972 talked optimistically about the future of nuclear energy. In this energy memorandum, then-Minister of Economic Affairs Harrie Langman stated that nuclear energy will account for nearly half of overall energy generated in the Netherlands by 2000.[122] To meet this target, the minister estimated that thirty-five nuclear power reactors would have to be built in the Netherlands.[123]

Likely, this policy would have been in place for years, but it was altered in the aftermath of two nuclear disasters in other countries. The American nuclear incident on Three Miles Island in 1979 was the first failure for the approach at the time.[124] This accident in the US state of Pennsylvania caused a nuclear reactor meltdown, which had serious effects for the emission of radioactive material into the atmosphere. Personnel proved to be inadequately equipped to respond actively, but it also revealed the vulnerability of nuclear energy use.[125] However, significant change in policy in the Netherlands occurred only a few years later, in 1986, when the biggest nuclear accident in human history occurred at Chernobyl in the Soviet Republic of Ukraine. The fourth reactor of the Chernobyl nuclear power station exploded on April 26, 1986, sending a substantial amount of radioactive material into the atmosphere. Although the Soviet Union first sought to keep the tragedy hidden, once radioactive material was discovered in nations such as Sweden and Germany, they were obliged to divulge.[126] The nuclear calamity was unfathomable, yet the nearby areas were only evacuated after more than 24 hours. Radioactive radiation was detectable throughout the whole continent of Europe, and Chernobyl remains uninhabitable to this day[127].

[121] Ibidem.
[122] *Nota Inzake het Kernenergiebeleid,* zitting 1971-1972, 11 761, yonder 2.
[123] Ibidem, 2.
[124] Verbong, *Een kwestie van lange adem,* 17.
[125] Ibidem, 17.
[126] Nigel Hawkes, *Chernobyl: The End of the Nuclear Dream* (London 1986), 45.
[127] Ibidem, 47.

It was no longer justifiable for the government to develop new nuclear power facilities beyond that point, even if it was still viewed as a viable future generating alternative. It wasn't until 1994 that the government was compelled to change its strategy when a resolution by GroenLinks (green party) Member of Parliament Marijke Vos was voted by a majority of parliament obligating the cabinet to dismantle the nuclear power plants within 10 years.[128] In accordance with this, the Kok administration agreed to bring forward the closing of the Borssele nuclear power station in 2004, to meet the desires of the House. However, the planned shutdown prompted multiple lawsuits from parties, including nuclear power plant employees. The Raad van State agreed with the employees in a groundbreaking ruling in 2000 that the government's withdrawal of the nuclear power station's environmental permit had not been adequately proved, hence the plant could not be closed in the previously desired timespan.[129] This ruling was then used by the next prime minister, Jan Peter Balkenende of the Christian Democratic Party, to extend the commissioning of the Borssele powerplant until 2033.[130] This was subsequently backed up by naming the Kyoto Protocol. That protocol was enacted in 1997, and it expanded on the 1992 United Nations Framework Convention on Climate Change.[131] In this treaty, states committed to reduce their greenhouse gas emissions to curtail global warming.[132] In 2006, it became evident that the goal could not be met without the usage of nuclear energy. As a result, the government at the time chose to reverse the previously scheduled closure and commit to using nuclear energy to comply with international accords on renewable energy, a policy still in effect till this day.[133]

The position of Environmental Movements

The legal embedding of nuclear power was a rational result that was influenced by both the Dutch government's mindset and propaganda supported by the American government, both

[128] *Verslag der handelingen van de Tweede Kamer der Staten Generaal (further: HTK)* 1994-1995, 16 226, nr. 18.
[129] Arjen Schreuder and Floris van Straaten, 'Kerncentrale Borssele open of dicht. Discussie over sluiting lijkt opengebroken' version 25th of February 2000. Consulted on May 24th, 2021, from: http://retro.nrc.nl/W2/Nieuws/2000/02/25/Vp/03.html.
[130] Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, *Staatscourant van het Koninkrijk der Nederlanden* 136 (2006) pag. 29, 1-6, yonder 1.
[131] Christoph, Böhringer, 'The Kytoto Protocol: A Review and Perspectives', *Oxford Review of Economic Policy* 19 (2003) 3, 451-466, yonder 451.
[132] Ibidem, 452.
[133] NOS, 'Kerncentrale Borssele blijft mogelijk langer open', version March 10th, 2020. Consulted on May 26th, 2021, from: https://nos.nl/artikel/2326559-kerncentrale-borssele-blijft-mogelijk-langer-open.

of these approaches were meant to reinforce citizens' trust in nuclear energy, a direct aspect of Project Candor mentioned in chapter one.[134] The United States used a variety of images to persuade people all over the world of the benefits of nuclear power, focusing on the background of each nation. As pictured below, one of the images used by the United States in the Netherlands depicts the storage period of potatoes. It is believed that radioactively irradiated potatoes can be preserved for two years without sprouting. In another picture the focus is on nuclear energy's therapeutic applications, implying that some severe diseases may be cured with more study.[135] In addition, a picture of the possible alternative use of radioactive material has been attached in Appendix 2. A nuclear vehicle, a car that operates on nuclear energy rather than gasoline, is shown here in a cutting-edge design for the period.

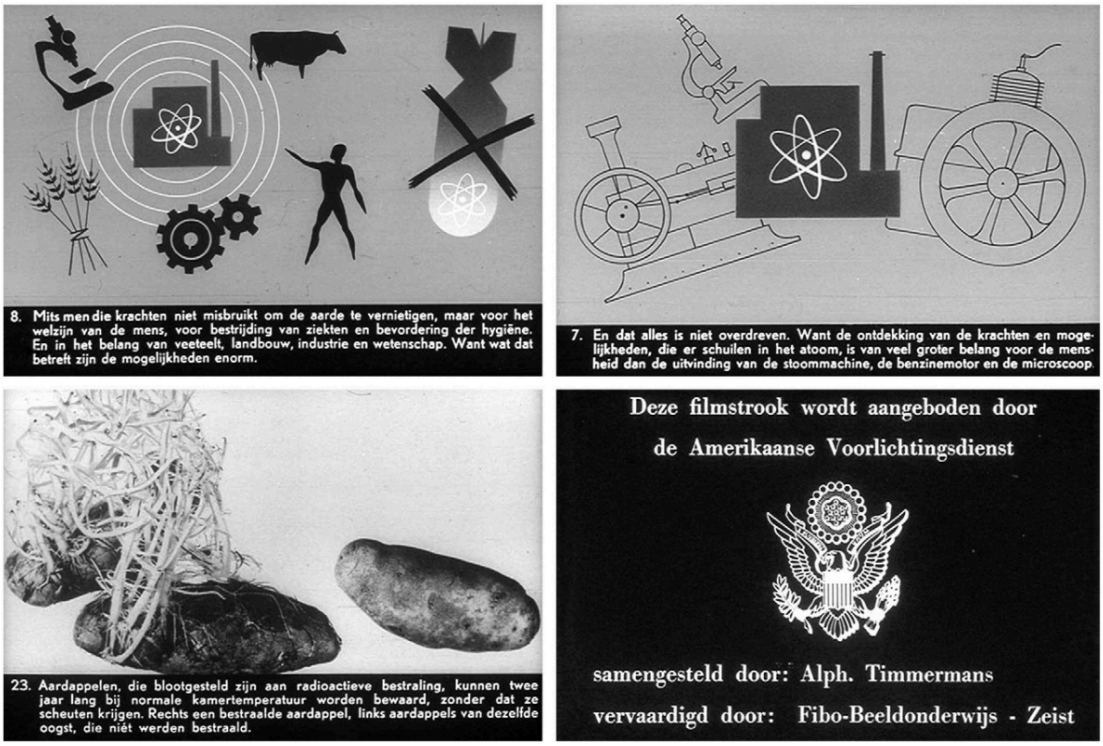

Image 3.1: Examples of images that were used to convince citizens of the peaceful use of nuclear power.[136]

[134] Frank W. Geels and Bram Verhees, 'Cultural legitimacy and framing struggles in innovation journeys: A cultural-performative perspective and a case study of Dutch nuclear energy (1945-1986)', *Technological Forecasting & Social Change* 78 (2001) 6, 910-930, yonder 917.
[135] Ibidem, 918.
[136] Ibidem, 918.

The 1950s campaign was considered a success by the pro-nuclear energy lobby. The findings of a survey done by the Reactor Centrum Nederland, a foundation whose objective was to promote the peaceful use of nuclear materials, were released in the 1970s. According to the poll, there was no majority opposed to the usage of nuclear energy, with the great majority of respondents claiming neutrality on the matter.[137] It is, however, a reasonable assumption that the party conducting the survey may or may not have been prejudiced to some level because the Netherlands certainly had a substantial anti-nuclear energy lobby and this lobby proved to be substantial.

The preponderance of scholars relates the quick growth of this movement to the so-called Kalkar levy.[138] Decisions on the energy transition had to be taken almost quickly after the first Den Uyl government gained office in 1973. Borssele's nuclear reactor was finished, but a permit had not yet been received, therefore it had not yet been placed into service. Within a month, the government issued a permission, making commissioning a reality.[139] The Kalkar levy, implemented by the prior government of Barend Biesheuvel, was a more politically complicated matter. The Kalkar levy was a three percent surcharge added to each resident's current energy bill to support the escalating expenses of the nuclear power station in the German town of Kalkar. The Netherlands opted to tax the population to pay for the finance, which sparked widespread discontent among people, even among those who previously had no position on nuclear energy.[140] The criticism of the fee fueled the expansion of the primary Dutch anti-nuclear energy protest movement known as the *antikernenergiebeweging* (from here: AKB).[141] In order to fulfill their objective, the AKB took a less cooperative stance than the other environmental movements. As a result, they were less likely to consult with the government and more likely to engage in actions such as demonstrations.[142] The AKB's aim in the early years was primarily to educate the public about the dangers of nuclear energy. They accomplished this primarily via the use of easily distributable materials such as buttons, posters, and door-to-door pamphlets. Following the

[137] Kernenergie Nederland, 'Bijna helft geen mening over kernenergie', version May 26th, 2021. Consulted on May 26th, 2021, from: https://www.kernenergieinnederland.nl/node/767.
[138] Hellema, *Nederland en de Jaren zeventig,* 38.
[139] Verbong, *Een kwestie van lange adem,* 61.
[140] Ibidem, 62.
[141] Wim van Noort, Wim, *Bevlogen bewegingen: een vergelijking van de anti-kernenergie-, kraak- en milieubeweging* (Amsterdam 1988).
[142] Hein-Anton van der Heijden, 'De milieubeweging in de twintigste eeuw', *Belgisch Tijdschrift voor Nieuwste Geschiedenis* 34(2004) 3, 445-483, yonder 459.

Kalkar levy, the AKB capitalized on the populace's displeasure by organizing demonstrations, for example, near the Dodewaard nuclear power station, but also in lesser-known locations. According to historian Duco Hellema, the first big action against nuclear energy occurred in 1977 in Almelo to block the enlargement of the Urenco ultracentrifuge facility.[143] In addition, there was a protest in Kalkar. More than 10,000 of the 40,000 attendees had traveled from the Netherlands to express their views. A second action in Almelo drew 50,000 people, the vast majority of whom were Dutch. The Kalkar levy was repealed because of this more drastic approach among other things. The development of power plants, however, remained government policy, much to the chagrin of the AKB and other environmental organizations.[144] Following the Three Mile Island nuclear disaster and the Chernobyl accident, this dissatisfaction was translated into more action.[145]

The government understood that they needed to hold broad discussion to ascertain how society felt about the use of nuclear energy. It resulted in the establishment of the *Brede Maatschappelijke Discussie* (from here: BMD). [146] The BMD was the result of significant collaboration with many players, each of which had a viewpoint on nuclear energy. The BMD's declared mission was:

> De vastlegging en evaluatie van de meningen over de energieproblematiek in het algemeen en het kernenergievraagstuk in het bijzonder en een beschrijving en beoordeling (te geven) van de plaatsgevonden maatschappelijke discussie. [147]

The BMD was divided into three phases, each of which focused on a distinct perspective that may have played a role in the context of social discourse. The public broadcaster was enlisted to enlighten the public and invite them to a wide-ranging conversation to reach the broadest potential audience. More than 1.7 million individuals watched it, accounting for a sizable portion of all television watchers.[148] The BMD lasted over three years in total, with a final report issued in January 1984 urging the government not to develop additional nuclear power

[143] Hellema, *Nederland en de Jaren zeventig,* 38.
[144] Ibidem, 38.
[145] Ibidem. 39.
[146] Verbong, *Een kwestie van lange adem,* 105.
[147] Ibidem, 105-106.
[148]Ibidem, 106.

plants.[149] This suggestion has proved to be still relevant and may be ascribed in part to the efforts of environmental groups.

The Position of Scientists and the Industrial Sector

Earlier in the chapter, the name Johannes van den Broek was briefly mentioned. Van den Broek, unlike Minister van Kleffens, took a more tough stance during the negotiations regarding the thorium-deal with the United States and the United Kingdom.[150] He was apparently knowledgeable of the uranium agreement struck by the Americans and British with the Belgian government in 1944. He attempted to obtain access to the substance of this treaty on the first day of negotiations, to further formulate his own position. He also requested to be kept informed on technological advancements in uranium and thorium research.[151] Representatives from the United States and the United Kingdom responded negatively to these requests. While van den Broek was unable to achieve these two goals, the Dutch negotiating position improved as a result. To foster goodwill, the two countries agreed to allow the Netherlands to maintain the ability to unilaterally terminate any extension of the deal without seeking international support.[152] It was also revealed that atomic scientist Hendrik Anthony Kramers was part in the talks. This demonstrates that the industrial sector as well as scientists were heard during the decision-making process.

For some years, however, the role of scientists in political decision-making had been diminished, but this began to change in the mid-1970s. The formation of the *Bezinningsgroep* in 1974 was a significant indication of this. The formation was the result of an effort by the Werkgroep Kernenergie, with the support of Science Policy Minister Boy Trip and is closely associated with the anti-nuclear energy movement in the Netherlands.[153] The Bezinningsgroep began with seventeen members, all scientists who were skeptical of the government's overall energy strategy, but especially of the intentions to build thirty nuclear power reactors.[154] This group's declared goal is to 'promote a greater understanding of the social consequences of energy supply', which they accomplished by publishing the so-called

[149] Ibidem, 106.
[150] Wiebes and Zeeman, 'Nederland en het Manhattan-project', 400.
[151] Ibidem, 400.
[152] Ibidem, 401.
[153] Verbong, *Een kwestie van lange adem,* 46.
[154] Ibidem, 65.

Bezinningsnota.[155] This reflection paper advocated for further studies into nuclear energy and advocated a five-year reflection period to assess the usefulness, feasibility, and desirability of nuclear power plants.[156] Although the Bezinningsgroep was closely affiliated with environmental defense and other action organizations, it should be emphasized that it was not an action group. It was an academic platform where scientist could express themselves to the government.[157] The entire goal of the Bezinningsgroep was to reach compromises and to generate discussion. However, the Bezinningsgroep did have activist tendencies as became evident with the publishment of a second Bezinningsnota.[158] The members of the Bezinningsgroep spoke out in a more public fashion in this letter, which was released on January 31, 1976, in the daily newspapers *Trouw* and *NRC Handelsblad*.[159] Previously, they addressed and lobbied directly to politics itself, but when their opinion was not taken seriously into consideration, the Bezinningsgroep petitioned a broader part of the populace. More than 1,200 scientists signed the statement, titled 'Leden van de Tweede Kamer, geef ons het voordeel van de twijfel'.[160] The letter urged Members of Parliament to thoroughly evaluate the Bezinningsgroep' earlier comments in order to determine if nuclear energy should truly be the future's energy source. This more activist posture eventually yielded the desired result, with a cabinet resolution delaying the building of additional nuclear power facilities.[161] Nuclear energy remained a prominent topic in the societal conversation of energy, and the five-year period of reflection became ten years. Following the nuclear tragedy at Chernobyl, the discussion was put on hold for the time being, and the construction of new power plants became a topic of debate for the new millennium.[162]

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[155] Bezinningsgroep Energie, 'Over BG', version May 29th 2021. Consulted on May 29th, 2021, from: https://www.bezinningsgroepenergie.nl/over-bg.
[156] Ibidem.
[157] Verbong, *Een kwestie van lange adem,* 65.
[158] Ibidem, 65.
[159] Ibidem, 65.
[160] International Institute of Social History, 'Leden van de Tweede Kamer, geef ons het voordeel van de twijfel'. Consulted on May 29th, 2021, from: IISG.
Translation: Members of the House of Representatives, give us the benefit of the doubt.
[161] Bezinningsgroep Energie, 'Over BG', version May 29th 2021. Consulted on May 29th, 2021, from: https://www.bezinningsgroepenergie.nl/over-bg.
[162] Ibidem.

Conclusion

This chapter focused on the stance on nuclear energy from the Dutch government, environmental movements, and scientists. At first it highlighted that the Dutch government came to an agreement with the United States and the United Kingdom involving the use and the monopoly of purchase of Dutch thorium. These negotiations were aided by the main thorium mining company's owner and the Dutch leading nuclear scientist. The deal allowed the Dutch government the liberty to pursue additional nuclear energy advancements. Until two nuclear disasters happened in the 1970s and 1980s, government policy remained favorable about the utilization of nuclear energy. The House of Representatives eventually approved a resolution in 1994 requiring the government to shutter the existing nuclear power reactors within ten years. This was one of the outcomes that environmental groups were able to attain via their initiatives. The AKB was effective in the Netherlands because many people were aware of the dangers of nuclear energy. The AKB was furthermore successful in forcing a public debate known as the BMD, and the final report urged against the building of additional nuclear power facilities. Furthermore, there was the possibility of a scientific dialogue through the formation of the Bezinningsgroep. They were able to influence politics because of their open approach and readiness to compromise. As a result, Dutch policy was vulnerable to change and was affected by persons and groups both inside and outside the decision-making process.

Chapter 4: Similar but different

The nuclear energy policies of Belgium and the Netherlands have been reviewed in the previous two chapters from the perspectives of the government, environmental organizations, scientists, and the industrial sector. In the following chapter, the findings will be summarized, then they will be juxtaposed and compared, after which an analysis will take place on how the differences can be explained and elucidated.

During the research of Belgian and Dutch policies, it was discovered that just a few elements are substantially dissimilar. The table below depicts the key commonalities and variances that have all contributed to policy divergence.

Table 4.1

Variable	**Belgium**	**The Netherlands**
Agreement with international powers about nuclear material?	Yes, solely governmental	Yes, but with input from scientists and industrial sector
Access to other energy sources?	Yes, coal	Yes, natural gas
Approval of scientists for the use of nuclear energy?	Yes, stuck to the main academic line of positive thought	In the initial phase yes, but from the 1960s onward not anymore
Criticism from political parties regarding policy	Yes, mostly left-wing from the 1990s onwards	Yes, broad range center, center-right and center-left from the 1970s onwards
Influential environmental movements	No, focus on informing the population	Yes, able to organize actions almost immediately
Government policy disadvantageous for population?	No direct negative impact on the average citizen	Yes, levying extra tax on electrical bill

What was remarkable was that, at the conclusion of Second world war, both countries signed secret agreements (independently) about the utilization of radioactive material by the British and Americans. Through their colonial territories in the Congo and Indonesia, both nations held a considerable amount of radioactive raw materials. The primary distinction was that Belgium could supply Uranium, whilst the Dutch government could supply the less well-known thorium. In the negotiating process, there are also disparities. The Belgian government at the time dispatched a group made up entirely of politicians, led by Foreign Minister van Zeeland. However, the Dutch government received backing from the academic and industrial sectors, in addition to politicians, to take a well-considered position in the negotiations. However, it is reasonable to say that the Belgian government obtained a superior arrangement. This can be attributed to two major factors. The first is that they had access to scientific research for the benign applications of radioactive material because of the agreement. The Dutch government, on the other hand, was given the authority to undertake its own research. The longevity of the agreement is the second factor to consider. Indonesia unilaterally proclaimed independence immediately after World War II, making thorium supply more onerous. Because the Congo did not get independence until 1960, Belgian governments could thus benefit from the accord for a longer period.

Another distinction is the scientists' positioning. It has come to light that many scientists were optimistic about the utilization of nuclear energy. In both the Netherlands and Belgium, this was the situation. In Belgium, experts indeed continued down this route, pointing out that, in consideration of the 1973 oil crisis, Belgium would stay energy independent using nuclear energy. The circumstance was different in the Netherlands. It was essentially in the 1970s that there was increased opposition to the use of nuclear energy, culminating in the formation of the Bezinningsgroep. Because the Minister of Science Policy was engaged in its formation, this group of scientists was able to influence decision-making.

Furthermore, this group of scientists had ties to environmental movements in the Netherlands, but not in Belgium. It became evident that environmental movements in Belgium were at a disadvantage, attributable in part to a lack of information about the drawbacks of nuclear energy. As a result, neither politicians nor the public took these movements' claims seriously. In the Netherlands, a considerable portion of the populace was already aware of the dangers of nuclear energy, and there was also widespread discontent with government policy. This was mostly owing to Germany's decision to levy an additional tax to pay for the Kalkar

reactor, whereas Belgium and Germany opted to do so directly from state coffers. As a result, the populace in Belgium was not directly taxed using nuclear energy, ensuring that it did not necessarily matter to the populace. This is evident in the turnout of the demonstrations that were organized, which was relatively low. This contrasts with the Dutch case, where bigger numbers of people were organized, as seen by the Kalkar demonstrations. The 1990s saw the greatest similarity between the two countries. Both nations determined to phase out nuclear energy in the coming years and postpone the building of new reactors indefinitely. For the Netherlands, this was a solidification of the nuclear moratorium that had been in place since the 1970s. This was a new direction for Belgium's nuclear energy policy. Following the Chernobyl nuclear tragedy, the Belgian government came to the realization that nuclear energy has harmful features. Because of the success of the social discussion, this insight was already dominant in the Netherlands.

Aside from the topic of why there is a difference in nuclear energy policy between the Netherlands and Belgium, the question of who decides policy played a part as well. Maarten Hajers' discourse coalition had an essential importance in this. It is unclear whether the policy was genuinely chosen by a discourse coalition. The Dutch case demonstrates that the government considered a variety of viewpoints. Initially, these ideals were comparable to official policy, but as time passed, space was provided for opposing viewpoints. However, this did not imply that politicians immediately adopted it, but they did take note of it. In the case of Belgium, the government was the primary discourse inside the policy. The main obstacle for environmental movements was that their viewpoint was not shared by the government, scientists, or a major portion of the people. As a result, policy was primarily developed based on one vision, and it proved difficult to break through it. Although both nations began their nuclear energy futures in almost the same way, the modest distinctions in the years thereafter have turned out to be quite substantial and mostly inherent to each country's political environment.

Conclusion

This paper tried to show the differentiation between the nuclear energy policy of the Netherlands and Belgium by delving deeper into the decision-making processes of the government, environmental organizations, scientists, and the industrial sector. During this research it has been discovered that there are just some slight differences between the policies of the Netherlands and Belgium, yet these variances resulted in substantial discrepancies as seen in chapter four.

During the beginning of the first chapter the progress in research with regards to nuclear energy was taken into consideration. This chapter revealed that United States President Dwight D. Eisenhower was the primary initiator of a benign use of nuclear materials. The formal title of the program aimed to promote the benign use of nuclear material came to be known as 'Project Candor', which ultimately eased the laws of the previous Atomic Energy Act and provided a legal basis for private companies to pursue benignant developments for nuclear power and furthermore provided a legal basis for foreign scientist to conduct their own research. It was mentioned that the acquittal of previous legislation meant that the research on nuclear power was accelerated and generated more discussion within the academic debate. First there were scientist who agreed that the definition for Sustainable development as formulated by a committee that came to be known as the Brundtland committee, since it was chaired by former Norwegian Prime Minister Gro Harlem Brundtland, was applicable to nuclear energy. The Brundtland committee defined it as: 'Sustainable development is development that meet the needs of the present without compromising the ability of future generations to meet their own need'.[163] These scientists stated, among other things, that there were enough raw materials for nuclear energy without creating a shortage for future generations, thus making it an apparent viable sustainable source for development with regards to sustainable energy. However, they are repudiated by scientist who stated that while generating nuclear energy may be sustainable, this may be nullified when one looks at the entire cycle to obtain nuclear energy. They specifically pointed out that the transport, extraction, and quality of the radioactive material would have an impact on carbon dioxide and thus negate the sustainable promise of nuclear energy. Following the position of

[163] Brundtland Commission, *Our Common Future* (Oxford 1987), 40.

scientists, the chapter focused on the current European situation surrounding nuclear energy. The European Green Deal, announced by the European Commission in 2019, received special attention. Main goal of this deal was the supply of clean, affordable, and secure energy. The Green Deal does not mention nuclear energy, which could be linked to the stigma surrounding it and the political sensitivity. The committee leaves the possibility of using it open and as a result there is a different policy per member state regarding the construction and use of nuclear power plants.

The second chapter examined the Belgian nuclear energy policy. For this, the positions of the government, environmental organizations, and scientists were examined from 1944 to the present. The chapter showed that that the Belgian policy for nuclear energy has changed from a more positive stance on nuclear energy to a total phasing out of its use in just a few decades. Belgium had an enormous stock of enriched uranium because of their colonial possession of Congo. After long insistence, an agreement on this with the Americans and the British gave the Belgians access to scientific knowledge in the field of nuclear energy. As a result, the Belgians, together with the French, connected the first commercial nuclear reactor in Europe to their energy grid. Ultimately, several reactors were built on Belgian territory, which was welcomed not only by many scientists, but also by many citizens. However, over time, government policies were criticized, both by scientists and concerned citizens after more became clear about the potential risks associated with the use of nuclear energy. It resulted in the formation of the VAKS, an acronym for 'Verenigde Aktiegroepen voor Kernstop,' a national organization that fought for the permanent cessation of nuclear energy usage. At first, this group had little to no impact in their mission, which has been attributed to the fact that citizens were frequently unaware of the detrimental effects of nuclear reactors. For this reason, VAKS switched to a different way of campaigning: informing the population about the disadvantages of nuclear energy. This changed in 1986 following the Chernobyl nuclear disaster. After this, more citizens became critical about nuclear energy and the government was forced to halt the construction of more reactors which was anchored in the coalition agreement after the 1999 elections. The same coalition agreement also included that each nuclear reactor could have a maximum operating time of 40 years, this meant that all operational nuclear reactors would be closed between 2015 and 2025.

The third chapter used the same research process as the previous, but this time for the Dutch case. On the outset, Dutch nuclear energy policy was comparable to Belgian policy in

many aspects, but a key difference was the political culture and decision-making procedures, as described in chapter four. First and foremost, attention was drawn to a treaty signed by the Dutch government, represented by Foreign Minister Eelco van Kleffens, with the United States and the United Kingdom. This agreement involved the use and the monopoly of purchase of Dutch thorium by the United States and the United Kingdom. The presence of the main thorium mining company's owner and the support from the Dutch leading nuclear scientist aided the political negotiations. The deal allowed the Dutch government the liberty to pursue additional nuclear energy advancements. Following this, the government commissioned the Kjeller nuclear power station in Norway, which served as a model for the seven nuclear power stations that would eventually be built on Dutch soil. Surprisingly, only one of them is utilized for nuclear power generation; the others are mostly intended for medical research. Until the late 1970s, nuclear reactors were a viable option for the government to generate energy, but there was emerging discontent in society. The Antikernenergiebeweging was successful in their mission to inform people about and mobilize them against nuclear energy, aided by the governments fatal discission to levy taxes to fund the construction of the Kalkar reactor. In line with this was the influence from the Bezinningsgroep, a platform where scientist tried to affect political decision-making by calling for reflection and further research. Following the Chernobyl nuclear tragedy, the Netherlands' nuclear energy development was placed on hold, and it was even decided to shutter the power stations in 1994. However, in recent years, this has been reversed, and nuclear energy has returned on the political agenda in 2021.

In the fourth and final chapter the information retrieved about Belgium and the Netherlands were summarized, juxtaposed, and compared, after which an analysis took place on how the differences could be explained and elucidated. It has been discovered that there are only minor differences in government policies. However, these seem to be considerable distinctions. The fundamental reason for the policy divergence is that the Dutch government considers the perspectives of other stakeholders such as scientists and environmental movements while these sectors in Belgium do not receive that much attention. Even so, the scientific sector in Belgium kept a positive approach towards nuclear energy for a longer period, mainly focusing on the benefits rather than the shortcomings. Although the government supported the use of nuclear energy, opposing viewpoints were considered, resulting in a delayed adoption of nuclear energy. It is unsurprising that the difference is mostly due to the success of environmental movements and critical scientists' discourse, but

it is astonishing that this has had such a significant influence. Already in the introduction, it was evident that nuclear energy accounts for forty-nine percent of total energy in Belgium but only one percent in the Netherlands. The fact that this is the case owing to the influence of only a few influential groups in the decision-making process demonstrates how effective the polder model could be.

It has become evident that the utilization of nuclear energy in a national setting is still extremely complicated. In both situations, it became evident that both governments approached the research and use of nuclear materials with optimism. In the case of the Netherlands, optimism continued until the mid-1960s, when internal discussion shifted. This was also the case in Belgium following the 1986 Chernobyl nuclear accident. However, in recent years, nuclear energy has climbed to the forefront of both governments' list of concerns. In Belgium, the consensus is that the existing power plants should be decommissioned by 2025, however in the Netherlands, there is talk considering building a new nuclear reactor to meet international climate and sustainability targets.[164] Nuclear energy is mostly opposed by left-wing parties in the Netherlands. However, with only 36 of the 150 seats, these parties remain in the minority. It leaves a vast majority of parties wanting to further investigate the possibilities of nuclear energy, although some do have additional conditions, such as more research into the sustainable character, which is consistent with the Brundtland definition. However, it is feasible that the premise of the Netherlands' largest party, that nuclear energy is clean, stable, and carbon neutral, will be utilized in future political debates and embraced by a significant majority of parliament.

In summary, history has proven that nuclear energy policy is prone to change and that policies are frequently altered by subsequent administrations. Furthermore, it has appeared that many more stakeholders are active in guiding and influencing the social discourse, with environmental organizations playing a key role. Nuclear energy will stay on the agenda for the foreseeable future since the benefits and disadvantages have not been thoroughly explored and substantiated, culminating in the commissioning of new reactors based on incomplete research and disagreement in academic, political, and social debates. It is a distressing truth that sustainability appears not to be an important requirement for nuclear energy

[164] NOS, 'Waarom het in deze campagne plots veel over kernenergie gaat' version March 1st 2021, Consulted on May 24th, 2021, from: https://nos.nl/artikel/2370856-waarom-het-in-deze-campagne-plots-veel-over-kernenergie-gaat.

commissioning, but that international aims are the most significant. Perhaps it is time to form a new committee, Brundtland 2.0, to specifically examine the benefits and drawbacks of nuclear energy and its role in the energy transition.

Appendixes

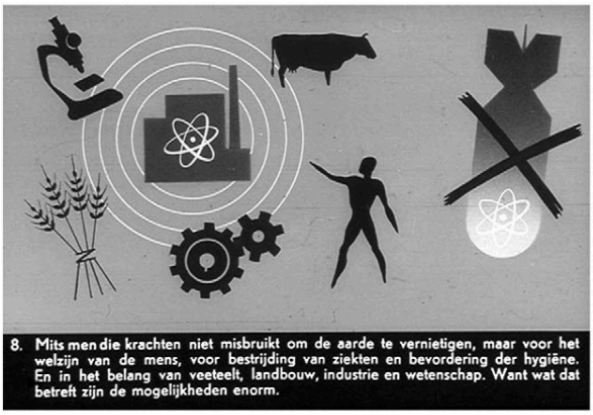
Appendix 1

Nuclear reactors in Belgium and their expected date of closure.[165]

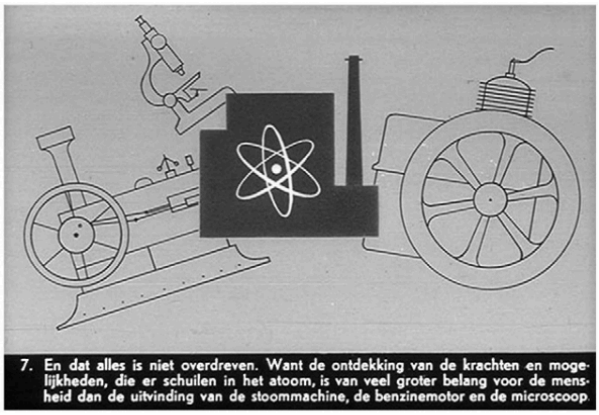
Nuclear reactor	Commissioning	Closure according to the 1999 coalition agreement	Closure as decided by the Van Rompuy-government (2009)	Closure as decided by the Di Rupo-government (2013)	Closure as decided by the Michel-government (2015 →)
Doel 1	1975	2015	2025	2015	2025
Doel 2	1975	2015	2025	2015	2025
Doel 3	1982	2022	2022	2022	2022
Doel 4	1985	2025	2024	2025	2025
Tihange 1	1975	2015	2025	2025	2025
Tihange 2	1983	2023	2023	2023	2023
Tihange 3	1985	2025	2025	2025	2025

[165] Federaal agentschap voor nucleaire controle (FANC), 'Kerncentrales in België'. Consulted on March 26th, 2021, from: https://fanc.fgov.be/nl/dossiers/kerncentrales-belgie.

Appendix 2

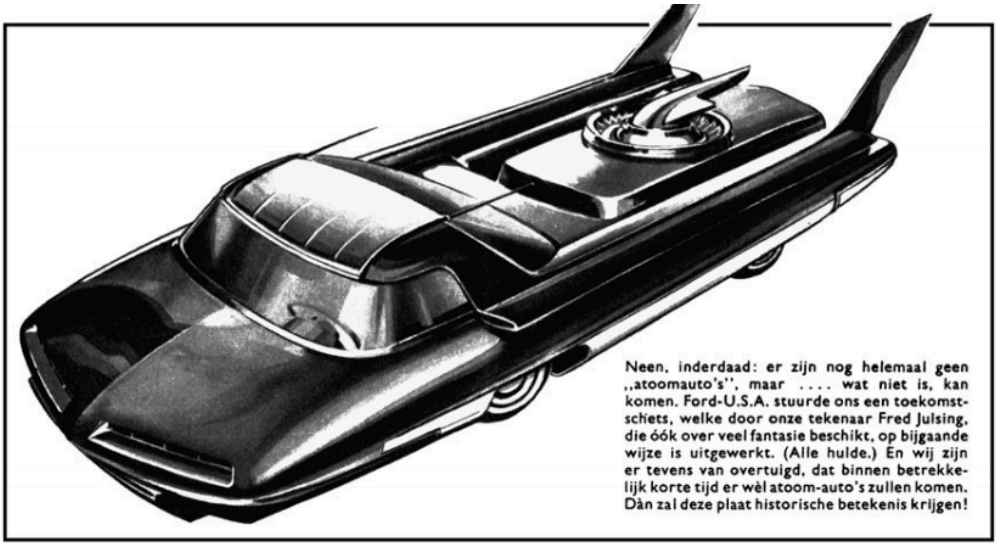


8. Mits men die krachten niet misbruikt om de aarde te vernietigen, maar voor het welzijn van de mens, voor bestrijding van ziekten en bevordering der hygiëne. En in het belang van veeteelt, landbouw, industrie en wetenschap. Want wat dat betreft zijn de mogelijkheden enorm.



7. En dat alles is niet overdreven. Want de ontdekking van de krachten en mogelijkheden, die er schuilen in het atoom, is van veel groter belang voor de mensheid dan de uitvinding van de stoommachine, de benzinemotor en de microscoop.

23. Aardappelen, die blootgesteld zijn aan radioactieve bestraling, kunnen twee jaar lang bij normale kamertemperatuur worden bewaard, zonder dat ze scheuten krijgen. Rechts een bestraalde aardappel, links aardappels van dezelfde oogst, die niét werden bestraald.



Examples of images that were used to convince citizens of the peaceful use of nuclear power.[166]

[166] Geels and Verhees, 'Cultural legitimacy and framing struggles in innovation journeys', 918.

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