WP2
The Netherlands
Short Country Report

AUTHOR
Eric Berkers

BENEFICIARY
Eindhoven University of Technology

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Executive summary

This report belongs to a collection of 20 short country reports on the History of Nuclear Energy and Society (HoNESt, project Ref.662268). The reports tackle the complex sociotechnical system around nuclear energy. Nuclear developments, notably nuclear energy, are closely intertwined with social, economic, environmental, political and cultural spheres. Nuclear energy is also a globalized system involving transnational transfers of knowledge, materials, technologies, people and products including electrical power, medical elements, toxic wastes and other environmental hazards, materials, capacities and knowledge that must be carefully safeguarded. Nuclear energy is a complex social and technological phenomenon that influences societies but is also shaped by societies.

The short country reports are designed to assemble information and research results on the history of the relations between nuclear energy and society about all the different country cases in an accessible manner, and to document the findings with references.

The purpose of the country reports is threefold, addressing three different audiences:

1. to provide basic elements of narrative and analysis for further historical research by HoNESt researchers;
2. to provide information, context and background for further analysis for HoNESt’s social science researchers;
3. to provide accessible information on nuclear-societal relations in the various countries for the purposes of outreach and communication with stakeholders (civil society, industry, associations, policy makers, journalists).

This report focuses on the history of the relations between nuclear energy and society in The Netherlands after World War 2. This history can be summarized as follows:

After 1945 The Netherlands wanted to recapture its strong pre-war position in science as well as to modernize the country in several domains. Investing in nuclear technology was part of both. From 1950 to 1955 Dutch and Norwegian scientists together built the Joint Establishment Experimental Pile (JEEP) in the Norwegian Kjeller. Meanwhile the electricity producing sector
and Dutch industries also got attracted to the opportunities of the technology in the early 1950s. Especially after Eisenhower’s “Atoms for Peace” speech the government was determined to let parties work on nuclear energy for The Netherlands. A reactor research centre was established in 1955. Furthermore, it felt important to ripen the minds of the general public for nuclear energy. An exhibition at Schiphol airport in 1957 was a significant outcome of this aim. Both efforts proved to be successful. Albeit later than expected, the first Dutch nuclear reactor (Dodewaard) was built in the 1960s without meaningful societal questioning let alone opposition.

However, Dutch nuclear ambitions went further. Unlike Dodewaard, the main projects that were underway by that time met severe social criticism and opposition. Especially the “Kalkar-levy” in 1973 on electricity bills to finance a fast breeder reactor, gave an important impulse to the anti-nuclear movement that had already been emerging for a couple of years. Those anti-nuclear sentiments were further fed through incidents and reports of unsafe situations and problems with waste in Dodewaard and Borssele, and issues relating to the proliferation of nuclear knowledge to dubious regimes and uncertainty about the origins of Urenco’s uranium.

In the late 1970s the government responded to the broad societal resistance against nuclear energy and the deadlock this created for policy-makers by organizing a Broad Societal Discussion on energy policy. The anti-movement was most satisfied with the final outcomes. They felt also the most betrayed by the BMD as the (right-wing) government ignored its conclusions and decided to build at least two more nuclear reactors in the Netherlands. However, the incident at Chernobyl in April 1986 put a spanner in these intentions and put nuclear power on hold for about a period of 15 years.

This situation changed as global warming reached the political agenda in the late 1990s. To meet the Kyoto demands and in the meantime assure the supply of energy, nuclear re-entered the societal and political debate in The Netherlands. The discussions since then lack the fierce polarization of the 1970s and 80s. While the government expressed its support for nuclear initiatives of the electricity sector, the financial-economic crisis hampered their intentions. The nuclear accident in Fukushima in March 2011 played its role too but polls are inconclusive about the lasting and determinative effects on public opinion about nuclear energy.
1. Historical context (narrative)

1.1 Introduction to the historical context: Nuclear energy and society in the Netherlands, 1945-present

The years 1969-1973 are a turning point in the history of nuclear energy and society in the Netherlands: In these years the country became a ‘nuclear energy nation’. The first two nuclear power reactors went critical (Dodewaard and Borssele) and – by joining an international consortium – a uranium enrichment plant was built (URENCO Netherlands) (see event 2). Furthermore, in these years, the Netherlands began to participate in a fast breeder reactor project just across the border in Kalkar, West-Germany. But as these technological events proved the Dutch nuclear ambitions - and legislation and regulations institutionalized these – nuclear technology became publicly contested. Within a couple of years a mix of related technological, institutional and discursive factors and events transformed the public perception of ‘nuclear’ to an embattled reality.

In this section a narrative of Dutch nuclear history and society since 1945 is presented, with a short prologue going back to 1932. It is an overview providing the context for the showcase (section 2) and the events (section 3), in which the relation between society and nuclear is analysed on a deeper level. The post-WW2 period up to the “turning point years” 1969-1973 is divided in two sub-periods. 1945 to 1955 shows the establishment of a nuclear energy research infrastructure. In 1946 the Foundation for Fundamental Research on Matter (FOM) and the Instituut voor Kernfysisch Onderzoek (IKO) were established. The joint electricity production sector started its own research program on nuclear energy at its research centre KEMA in Arnhem from 1948 onward. To gain knowledge and experience Dutch scientists and researchers worked with Norwegians on an experimental nuclear pile located in Norway. In these same post-war years nuclear energy was framed in terms of scientific and technological progress. Strong associations were made with publicly favourable desired processes of industrialization, modernization and economic growth (Verhees 2012, 92-98) (see event 1).

A new period started in 1955. That year the Dutch Reactor Centre (RCN) was established in Petten as a collaboration between the Dutch government, the electricity sector and industrial
companies. Next to building a research reactor (at RCN) and doing research on promising technologies such as suspension technology (at KEMA) and ultracentrifuge (at FOM/RCN), researchers, policy makers, industry and the electricity sector were preparing for establishing the first nuclear energy reactor in the Netherlands. This was realized in 1969 without societal turmoil. As mentioned above, in a couple of years the general public’s attitude towards nuclear energy would change dramatically.

While some new ambitious nuclear projects came in a crucial phase, the anti-nuclear movement grew and nuclear energy became part of a societal debate. In the late 1970s the government tried to institutionalize this debate by organizing the so called Broad Societal Discussion [in Dutch: BMD]. The outcomes of the BMD were presented in 1984 and showed a majority of the population did not favour more nuclear facilities. This however did not hinder the government’s new plans for nuclear energy. What a public participation process in the Netherlands could not realize, a nuclear incident in the USSR could. The Dutch nuclear plans were frozen, marking a new period in Dutch nuclear history and society. This lasted until 1999 as nuclear energy returned as a green alternative in the Dutch energy-discussion.

1.2 Contextual narrative

Prologue: Exploring Nuclear Physics (1932 – 1945)

Key data for this period

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1932</td>
<td>Philips starts nuclear research at its Physics Laboratory (NatLab)</td>
</tr>
<tr>
<td>January 1937</td>
<td>Symposium organized by the Dutch Royal Institute of Engineers about the construction of the atomic nucleus.</td>
</tr>
<tr>
<td>Summer 1939</td>
<td>The Netherlands buy c. 10 tons of Uranium-oxide from Union Minière from the Shinkolobwe-mine in the Belgian Congo.</td>
</tr>
</tbody>
</table>

The outcomes of international fundamental scientific research on atom-fission in the early 1930s, for example at the Cavendish Laboratory at the University of Cambridge, reached Dutch physicians as well as a broader Dutch public. Newspapers and popular journals published about

\[1\] See section 5 about general remarks on used sources.
it in terms of an exciting exploration into the hidden secrets of matter and universe.² Some items mentioned possible future applications of atom fission, especially in the medical and energy domains: ‘[Scientists are] thinking of the inexhaustible amount of energy captured in the atom,’ a provincial newspaper stated early in 1932.³ Although opportunities dominated the news, the dark side of the release of energy by atom fission was sometimes also mentioned: ‘It would be possible that an input of a certain amount of energy produces a thousand times as much energy […] The economic and industrial revolution that this will bring about cannot be described. The question remains however, whether human kind will be happier, if the whole earth can be blown up by a hectolitre of water.’⁴

At the same time the public was informed about the stunning developments in (international) atomic science, more and more Dutch scientists were attracted to this field of research. For example the physics laboratories of Philips (NatLab) and the Vrije Universiteit (VU) in Amsterdam started research on nuclear physics in the early 1930s. As a technical company Philips was interested because of the technological opportunities for the artificial production of radioactive matter, including for biomedical applications (De Groot 1937, 102).

In the 1930’s discussions about nuclear science and its applications took place within the scientific community. Early in 1937 for example the Royal Institute of Engineers organized a symposium on nuclear research. Amongst the speakers were Prof. Schizoo of the VU and F.A. Heijn of Philips’s NatLab. In these years the general public was not involved in debates on nuclear topics, or, as Verhees concludes: ‘Before and during WWII, there was no coherent ‘nuclear discourse’ in The Netherlands. [] This would all change with the atomic bombardment of Hiroshima and Nagasaki in 1945.’ (Verhees 2012, 93).

³ Limburger Koerier, 07-01-1932, 6; See for an example of applications at the medical domain: A. Pirchan, ‘De genezende werking der radioactiveit’, in: De Zuid-Willemsvaart, 13-02-1932, 3e blad, 1.
Nuclear from military to civil technology (1945 – 1955)

Key data for this period

<table>
<thead>
<tr>
<th>Date</th>
<th>Event/Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>November 1945</td>
<td>First meeting of the Dutch Committee for Nuclear Physics</td>
</tr>
<tr>
<td>April 1946</td>
<td>Establishing Foundation for Fundamental Research on Matter (FOM).</td>
</tr>
<tr>
<td>1948</td>
<td>NV KEMA in Arnhem starts research on nuclear physics</td>
</tr>
<tr>
<td>November 1951</td>
<td>Start bilateral collaboration between the Netherlands and Norway in the JEEP-project</td>
</tr>
<tr>
<td>October 1952</td>
<td>FOM and KEMA sign a cooperation agreement on nuclear research.</td>
</tr>
<tr>
<td>January 1954</td>
<td>Proposal of the FOM board to build a 10 MW nuclear reactor in the Netherlands.</td>
</tr>
</tbody>
</table>

There is some discussion amongst historians about the degree of public concern about the atomic bomb in the Netherlands in the post-war years. For here it is relevant to conclude that the public perception of nuclear technology, whether strong or weak and discussed or not, got a strong military connotation after Hiroshima and Nagasaki. This connotation hampered the broader visions and plans scientists and policymakers had with the technology in (re)building and modernizing the Netherlands after WW2.

Nuclear energy had to be framed in terms of scientific and technological progress (again) and strong associations had to be made with publicly favourable desired processes of industrialization, modernization and economic growth. Scientists saw a prominent role for themselves in this (Verhees 2012, 96). While an (unofficial) campaign started to inform civil society about civil applications of atomic power and to pull the technology away from its military connotations, the Netherlands began to build a nuclear research infrastructure. Scientists, backed-up by decision makers, felt that the Netherlands had to catch-up with nuclear science, to re-establish its international position in physics it had in the early 20th century. In 1946 the Foundation for Fundamental Research on Matter (FOM) was founded. Nuclear physics became an important field of research for FOM. Together with the Municipality of Amsterdam and Philips, FOM participated in the Institute for Nuclear Physics Research (IKO) that was set up soon after in Amsterdam. The joint electricity production sector started its own research program on
nuclear energy at its research centre KEMA in Arnhem in 1948 (Van Splunter 1993, 109-122 and 144-147).

FOM and KEMA separately did feasibility studies about building a nuclear reactor in the Netherlands. FOM concluded that it was too costly for a small country like the Netherlands and that co-operation with a foreign partner was necessary. Early in 1950 this resulted in a bilateral collaboration between the Netherlands and Norway, more precisely in the building of a nuclear research-reactor in Kjeller in Norway, called the Joint Establishment Experimental Pile (JEEP) and a Joint Establishment for Nuclear Energy Research (JENER). The Netherlands put scientists and their amount of uranium-oxide - which had been purchased just before the war broke out - at the disposal of JEEP. KEMA was not happy with this because it wanted to build a Dutch nuclear reactor together with FOM and Dutch industry. Partly as a reaction to KEMA’s criticism, FOM presented plans for building two nuclear power plants in the Netherlands as a follow-up to JEEP. In the fall of 1952, a year after the opening of JEEP, FOM and KEMA signed a cooperation agreement (Van Splunter 1993, 123-143).

In the meantime the strategy to ‘uncouple’ nuclear power from military applications continued. The Netherlands, as other West-European countries, were assisted in this goal by US propaganda material, such as educational slide-shows. The attempts were successful. In the 1950s ‘the association between atomic energy and the atomic bomb [gradually] decreased in the public mind.’ (Verhees 2012, 100).

Preparation for the Nuclear Age (1955-1973)

Key data for this period

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 1955</td>
<td>Establishment of the Foundation Dutch Reactor Centre (RCN) in Petten.</td>
</tr>
<tr>
<td>November 1956</td>
<td>The Commission-Roodenburg is established to examine a possible nuclear reactor for the Netherlands.</td>
</tr>
<tr>
<td>March 1957</td>
<td>The Netherlands sign the Euratom-agreement.</td>
</tr>
<tr>
<td>June 1957</td>
<td>Opening of the exhibition ‘The Atom’ at Schiphol.</td>
</tr>
<tr>
<td>July 1957</td>
<td>Publication of ‘Nota inzake de Kemenergie’ [Memorandum on Nuclear Energy] by the Minister of Economic Affairs.</td>
</tr>
<tr>
<td>Date</td>
<td>Event</td>
</tr>
<tr>
<td>------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Spring 1959</td>
<td>Establishment of the industrial ‘nuclear’ consortium Neratoom.</td>
</tr>
<tr>
<td>March 1960</td>
<td>A delegation of the joint Dutch electricity producers (SEP) visits the US.</td>
</tr>
<tr>
<td>May 1961</td>
<td>Contract between SEP and General Electric (GE) for the pre-design of a BWR-type pile of 50 MW capacity.</td>
</tr>
<tr>
<td>February 1963</td>
<td>Law on Nuclear Energy.</td>
</tr>
<tr>
<td>January 1965</td>
<td>Establishment of the NV <em>Gemeenschappelijke Kernenergiecentrale Nederland</em> (GKN) [Joint Nuclear Energy Reactor, Netherlands].</td>
</tr>
<tr>
<td>March 1969</td>
<td>Opening of the first nuclear power plant in the Netherlands in Dodewaard.</td>
</tr>
<tr>
<td>March 1969</td>
<td>The electricity producer PZEM orders a 450 MW nuclear power plant (PWR) with the German Kraftwerk Union</td>
</tr>
<tr>
<td>November 1969</td>
<td>Establishment of Ultra-Centrifuge Nederland NV (UCN) in Almelo</td>
</tr>
<tr>
<td>March 1970</td>
<td>Signing of the Treaty of Almelo between the Netherlands, the UK and West-Germany leading to Urenco</td>
</tr>
<tr>
<td>1971</td>
<td>Founding of the anti-nuclear grassroots Werkgroep Atoom</td>
</tr>
<tr>
<td>January 1972</td>
<td>License asked for the fast breeder reactor at Kalkar</td>
</tr>
<tr>
<td>March 1972</td>
<td>Launch of the Kernenergienota [Memorandum on nuclear power policy]</td>
</tr>
<tr>
<td>September 1972</td>
<td>Establishment of the ‘Anti-Kalkar Committee’.</td>
</tr>
<tr>
<td>June 1973</td>
<td>License for the nuclear reactor in Borssele is provided</td>
</tr>
<tr>
<td>July 1973</td>
<td>The Kalkar-levy on the electricity bill is introduced</td>
</tr>
</tbody>
</table>

By the end of the 1950s nuclear power had gained ‘the cultural legitimacy’ that was needed for the successful realization of nuclear energy facilities. As a consequence the public attention to nuclear power which reached a peak in the years 1955-1957, rapidly decreased in the late 1950s and early 1960s, and more slowly in the last part of that decade. The construction of an institutional framework for nuclear facilities as well as the building of the research and commercial plants itself was accompanied by relatively little media attention. The press that showed interest was predominantly positive (Verhees 2012, 111-112).
While in the mid-1950s research - for example on ultracentrifuge technology and suspension-reactor technology - was on going in the Netherlands, plans were shaped for the actual building of reactors. In May 1957 the first working nuclear reactor appeared on Dutch soil. It was designed by the American Machine and Foundry Company and under their supervision built by the Dutch companies Comprimo and Philips. The small open-ended ‘swimming pool-type reactor’ was part of an exhibition called Het Atoom (The Atom) that can be seen as an event within the above mentioned ‘uncoupling from military’- campaign and linked nuclear power to modernity. People were invited to visit the exhibition with the reactor in a hangar at Schiphol airport. That summer, more than 700,000 people experienced the temporary exposition and took a look at a nuclear reactor. In the next six years four nuclear reactors for research and education opened in the Netherlands. Two of them appeared at the site of the Dutch Reactor Centre (RCN) in a small coastal place called Petten.

RCN was established in 1955. In this nuclear research centre the government, some large industrial and shipping companies and the electricity sector participated. Its founding had strong implications for nuclear research and development in the Netherlands. FOM, the key-player until then, lost its position in nuclear research. Also TNO, the traditional applied-research partner to Dutch industry was surpassed as it came to nuclear. Industry dealt directly with RCN on this matter. The shipping companies for example were interested because of the possibilities nuclear had as a propulsive force for ships. Also the electricity producers were a partner at the start. Soon however they decided to focus on their own project. KEMA was working on suspension reactor technology. In June 1953 it had requested a patent on this technology. When it proved that suspension technology was not a priority for RCN, the sector decided to work on the development of its own suspension-reactor at the KEMA-site in Arnheim (Lagaaij and Verbong 1998, 33-34).

RCN focused on building a high flux reactor (HFR). This American (Oak-Ridge) type research-reactor was visited by Dutch scientists on a US-tour in the spring of 1955. It was found most suitable for RCN’s planned future research. A contract was signed with US-government, necessary for obtaining enriched uranium. American firms were invited to make offers for the

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5 A movie about the opening of the exhibition at: https://www.youtube.com/watch?v=TEE-97sGNM4.
building of an HFR. Finally in November 1961 the HFR in Petten went critical. Because the realization took longer than expected, RCN had decided in 1959 to build a Low Flux Reactor (LFR) as well. This small British Argonaut-type reactor was in use a year before the HFR.

Within four years two other research-institutes in the Netherlands got a nuclear reactor. In 1963 both the Delft University of Technology got a reactor for research and educational applications as the *Instituut voor de Toepassing van Atoomenergie* in de Landbouw (ITAL) [Foundation for Nuclear Applications in Agriculture] in Wageningen. The latter was established in 1957. In spring 1961 it had signed a 20-year contract with Euratom, making ITAL a European research institute.

As elsewhere in the Western world the Suez-crisis of 1956 boosted nuclear power as a possibility for the production of electricity. In the Netherlands the expectation that atomic energy would become the main source of electricity in the coming decades was widespread among policy makers and politicians. This view was also expressed in the first memorandum about nuclear energy of the Minister of Economic Affairs (EA) in the summer of 1957. The Netherlands had to add ‘nuclear’ to its energy production range as soon as possible (Lagaaij and Verbong 1999, 40). Furthermore, because the production of nuclear energy was seen as an important economic sector in the future, EA wanted Dutch industrial companies to get involved in nuclear activities quickly. This however instigated conflicts of interest with the electricity sector (cooperating in KEMA, the VDEN and SEP),\(^6\) which wanted a free hand in the selection of partners and contractors. The reactor at Calder Hall (UK) had caught the sector’s attention as suitable for the Netherlands, though some modifications were needed.

The discovery of new gas and oil fields by the end of the 1950s –in the northern part of the Netherlands - lowered the prices of fossil fuels on the world market and the sense of urgency for nuclear energy in the Netherlands. Cheaper fossil fuels changed cost-benefit discussions in the energy domain, lowering the need for swift (and costly) actions building large nuclear reactors for electricity supply. Electricity produced by means of nuclear fission with the technology of that time, would cost 1 to 2 cents more per kWh than produced by coal-fired stations, the electricity

\(^6\) VDEN was the association of directors of electricity companies in the Netherlands. The Sep was established in 1949 as a co-operating of the 10 largest electricity producing companies.
companies calculated (Lagaaij and Verbong 1998, 38 and 40-43; Lagaaij and Verbong 1999, 42).

The changing economic context for energy did not push nuclear energy off the policy agenda entirely. The connotation of modernity associated with it, the notion that the Netherlands could not afford to lag behind with this new technology, and the efforts that were set-up to convince society of the possibilities of ‘the atom’, did not allow so. The electricity producers continued making up their minds about reactor-type, size et cetera; they visited the US Atomic Energy Commission and talked to American counterparts. Dutch industrial companies also continued preparing for the atomic age. In spring 1959 they formed the Neratoom-consortium (Lagaaij and Verbong 1999, 43-46).

In May 1961 the co-operating electricity producers (SEP) signed a contract with General Electric for a Boiling Water Reactor (BWR)-pre-design. A year later it proved that this BWR was only feasible with financial support from the Dutch government and from Euratom. Both agreed to subsidize – 10 million and 18 million guilders respectively – and by January 1965 the Joint Dutch Nuclear Power Station Inc. (GKN) was established. It planned its first Dutch nuclear energy reactor at Dodewaard near the river Waal. The eleven provincial Dutch electricity companies were all shareholders in GKN (see section 2).

In March 1969 Dodewaard started producing electricity, without much media-attention as we saw above. Dutch industry was for a large part (about 70%) involved in the building process. Philips provided the fission-elements, the Rotterdamse Droogdok Maatschappij (RDM) the reactor vessel, Stork the turbine installation and Hollandse Signaal the stainless steel control rods, to name some important contributors (Lagaaij and Verbong 1999, 53).

While building the reactor at Dodewaard, the electricity companies decided in 1966 to order a second, much larger nuclear reactor. The Sloe-area in the province of Zeeland was put forward as a suitable location. A nuclear reactor became part of the negotiations between the province and the French aluminium manufacturer Pechiney that had plans to open a plant there. This customer could guarantee an almost total utilization of the reactor’s capacity, which made it

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7 Actually the nuclear reactor already went critical in the summer of 1968.
In the spring of 1969 the electricity company of Zeeland (PZEM, that was part of GKN) signed a contract with the Kraftwerk Union, in which Siemens and AEG cooperated, to supply a 450 MW Pressurized Water Reactor (PWR). Dutch industry and the Ministry of Economic Affairs were not supportive of PZEM’s choice of the German consortium. They were stunned by the autonomous decision-making process, in which they found Dutch industrial interests ignored (Lagaaij and Verbong 1999, 57-58). For Philips, this came just before they had been denied the contract for the replacement of the fission-elements for Dodewaard, and PZEM’s decision was the straw that broke the camel’s back. Philips withdrew from nuclear activities, with the exception of its participation in Ultra-Centrifuge Nederland NV (UCN), an experimental nuclear-enrichment factory that was being built in Almelo (see event 2).

Later than planned – mainly because of some leakage-problems at Dodewaard that delayed the licensing process – the second Dutch nuclear energy reactor at Borssele went critical in the summer of 1973. Compared to the opening of the first in Dodewaard a few years before, the social climate had changed fundamentally. Discussions in the 1960s were about technological choices, about the trajectories of a nuclear energy society, including the roles of different actors involved, about cost-benefit questions, et cetera. These techno-economic issues were debated by nuclear scientists, the energy producers, Dutch construction and electro-technical industry, and economic policy makers. In spite of some harsh clashes and disturbed relationships within this scientific-professional community, these discussions led to a noiseless Dutch entrance into the atomic age. At the end of the decade there was only some local opposition against nuclear power. By 1973 however, ‘through various channels, the American concerns about nuclear power [that started in the late 1950s] had found their way to The Netherlands’ (Verhees 2012, 57-58).

Societal concerns evoked some protests against the establishment of the Borssele-reactor. Also the safety of the Dodewaard-reactor became part of a discussion outside the arena of experts. Parliamentarians questioned the safety-measures at the pile and the safety of transporting nuclear material in general. The heaviest protests however focused on three other projects that were important in preparing for the Dutch nuclear age: the above mentioned Ultra-Centrifuge Netherlands (UCN) in Almelo, the building of an experimental suspension-reactor at KEMA in
Arnhem, and the planned fast-breeder reactor in Kalkar, Germany near the Dutch border (see event 3).
Nuclear power as a contested technology (1973 – 1986)

Key data for this period

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1974</td>
<td>Establishment of the anti-nuclear ‘Stroomgroep Dodewaard’</td>
</tr>
<tr>
<td>January 1974</td>
<td>A petition was offered to parliament (3686 signatures) against a second pile in Borssele</td>
</tr>
<tr>
<td>September 1974</td>
<td>Eerste Energienota [First Memorandum on Energy]. A counter-memorandum was published by the Bezinningsgroep Energiebeleid.</td>
</tr>
<tr>
<td>September 1974</td>
<td>The first large-scale anti-nuclear power protest (10,000 participants) by mostly Dutch people at the Kalkar site</td>
</tr>
<tr>
<td>October 1974</td>
<td>Petition to Parliament calling for the end of the Kalkar project signed by 155,000 people.</td>
</tr>
<tr>
<td>March 1978</td>
<td>Large protest march in Almelo because of the expansion plans of Urenco’s uranium-enrichment facility. About 50,000 attended.</td>
</tr>
<tr>
<td>April 1979</td>
<td>Anti-nuclear energy protests in Borssele as a reaction to the Three Mile Island accident.</td>
</tr>
<tr>
<td>1980-1984</td>
<td>Brede Maatschappelijke Discussie (BMD) [Broad Societal Discussion] on energy policy.</td>
</tr>
<tr>
<td>May 1980</td>
<td>Establishment of the Dodewaard Gaat Dicht! [Dodewaard Close Down!] movement</td>
</tr>
<tr>
<td>October 1980</td>
<td>Blockades of the Dodewaard reactor by activists.</td>
</tr>
<tr>
<td>1982</td>
<td>Establishment Centrale Organisatie voor Radioactief Afval (COVRA) [Central Organisation for Radioactive Waste]</td>
</tr>
<tr>
<td>Early 1985</td>
<td>In a letter to parliament the right wing government officially rejects the BMD-conclusions.</td>
</tr>
</tbody>
</table>

The efforts ripening society to accept nuclear power by freeing it from its warfare connotations had resulted in a 15-year period of realizing a number of nuclear facilities, including two nuclear power plants. In the early 1970s plans to expand this nuclear infrastructure were still dominant amongst (nuclear) scientists, the electricity sector and the political majority. A second nuclear reactor at Borssele was considered and in 1971 the Netherlands had signed a contract with West-Germany and the UK to participate in a uranium enrichment plant (Treaty of Almelo) leading to the establishment of Urenco. With Belgium and West-Germany plans to build a fast-breeder reactor at Kalkar were concretized. Furthermore, the electricity sector wanted to expand its suspension-technology research (KSTR), to name some of the most important and far advanced intentions. The Dutch government expressed their plans of a moderate expansion of
nuclear energy in a Memorandum on Energy in September 1974: by 1985 three new reactors of 1000 MW each, should be realized.

Opposition against nuclear technology grew as well. The anti-movement broadened and went far beyond groups of worried locals. Environmental groups, critical scientists and left-wing political parties joined the concerned citizens and formed a front to the pro-nuclear lobby. Petitions were handed in, demonstrations organized and an anti-memorandum as a reaction to the government’s memorandum of September 1974 was written. The pro-nuclear movement could no longer legitimate its plans with reassuring information brochures, by associating nuclear technologies with modernity and progress, and/or by presenting favourable data and statistics. Progress itself was questioned as was the scientific and political establishment and the data they provided as arguments for their cause were mistrusted. The anti-movement got better informed. Firstly by critical scientists who joined their side and wrote well-argued memoranda and brochures, secondly because it started to build its own information- and propaganda network of which the Amsterdam based World Information Service on Energy (WISE), established in 1978, and the national Documentation- and Research Centre on Nuclear Energy - Laka (1988), were outcomes (Verbong 2000, 257-262).

The accident at the Three Mile Island Nuclear Reactor in Harrisburg in 1979 caused new demonstrations. According to Turkenburg the amount of people that were negative about nuclear energy had grown to over 80% after the Harriburg-incident. This was a growth of 30% in three years’ time (Turkenburg 2003, 47). From 1980 onward the Office on Nuclear Physics starts publishing an annual overview of malfunctions in Dutch nuclear facilities. The government responded to the broad societal resistance against nuclear energy and the polarized positions of both fronts by organizing a Broad Societal Discussion (Brede Maatschappelijke Discussie or BMD) on energy policy (see event 4). Hundreds of discussion-meetings were held. But, as Verhees concludes, in the end ‘the BMD fell short of its goal of an exchange of ideas. It functioned more as performance stage than as debating forum.’ (Verhees 2012, 132).

The results of the BMD were published in the final report of the Steering Group Societal Discussion Energy Policy in 1984. It proved that a majority of the participants did not want new nuclear reactors. The opinions about closing down the existing reactors by the government were
split in the middle. The anti-movement was most satisfied with the outcomes. However, they felt also the most betrayed by the BMD as the (Christian Democratic/ Liberal) government ignored the outcomes and decided to build at least two more nuclear reactors in the Netherlands. However, the nuclear incident at Chernobyl in April 1986 put a spanner in these intentions and put the plans on hold. It lasted until the mid-1990s though, until the government decided to abandon the idea of new nuclear power stations (Verbong 2000, 262).

Out of the large nuclear initiatives of the early 1970s, only the Urenco enrichment plant in Almelo got realized. The fast-breeder plant in Kalkar was built indeed and ready for production by 1986, but never went critical. In 1991 the project was definitively stopped. Four years later the buildings were sold and turned into an amusement park. Already by the end of the 1970s KEMA had ended its research on suspension-technology (Lagaaij and Verbong 1999, 57-59).

**Nuclear power of the agenda (1986 – 1999)**

**Key data for this period**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 1987</td>
<td>The Dutch State, Ultra-Centrifuge Netherlands (UCN) and Urenco are summoned by the UN for importing Uranium from Namibia.</td>
</tr>
<tr>
<td>1990</td>
<td>Programma Instandhouding Nucleaire Competenties (PINC) [Program for the Preservation of Nuclear Competences] is launched.</td>
</tr>
<tr>
<td>1991</td>
<td>The Kalkar fast-breeder project is stopped.</td>
</tr>
<tr>
<td>April 1996</td>
<td>ECN and Mallinckrodt start the commercial production of Molybdeen (medical isotope) in Petten.</td>
</tr>
<tr>
<td>March 1997</td>
<td>The Dodewaard nuclear energy reactor is closed down</td>
</tr>
</tbody>
</table>

The Netherlands experienced relatively little consequences of Chernobyl. The plans however to build two new nuclear reactors in the short term as part of a transition towards more nuclear within the total electricity supply – despite the outcomes of the BMD – were hampered. Directly after Chernobyl the decision making process about the location for the two reactors was stopped. First, the government wanted a thorough analysis of the accident, leading to an evaluation - called rethinking or ‘herbezinning’ - about the future of nuclear energy in the Netherlands. Early in 1988 this ‘herbezinning’ was finished and several expert-organs and
stakeholders were asked for comments and advice.\textsuperscript{8} It took some time to collect. Furthermore, the government decided that additional studies about the safety of (commercial) reactor types were needed. For that reason the Minister of Economic Affairs decided in 1989 to postpone decisions about new nuclear reactors and the replacement of the two in operation.

In the same document that the Minister announced this postponement, he also emphasized that it was of the utmost importance to preserve the Dutch nuclear knowledge and infrastructure. For this reason he launched a four year Program for the Preservation of Nuclear Competences [Programma Instandhouding Nucleaire Competenties (PINC)]. The participants in the program were ECN, KEMA, The Reactor Institute (IRI) of Delft University, GKN, and Stork NUCON BV, a nuclear consulting and executive company.

In 1995 the government – a coalition of socialists, liberal-democrats and liberals – published the Third Memorandum on Energy [Derde Energienota]. It focussed on liberalizing the Dutch energy market as well a stimulating more sustainable energy in society. No decision was made about building new nuclear reactors. Yet, the minister acknowledged a lack of social support for nuclear energy in the Netherlands at the time, because of, as he called it, ‘(perceptions of) risk, radioactive waste, the problem of proliferation and a moderate competitiveness.’\textsuperscript{9} Opposed to this he noticed advantages of nuclear energy that could tip the balance in favour of it in near future. He pointed at the relatively large amounts of uranium and a zero CO\textsubscript{2} emission of nuclear energy. Also social perception on the matter could change. Because of the fluidity of these and other factors and arguments it would not be wise to take any definitive steps about the subject, he concluded (Ministerie van Economische Zaken 1996; Van Kasteren 2011, 382).\textsuperscript{10}

The Dodewaard nuclear reactor was closed-down in March 1997. Already in 1994 Dutch parliament had decided that the Borssele reactor had to be closed by 2004, three years earlier

\textsuperscript{8} Amongst them were the Commission Reactor Safety [Commissie Reactor Veiligheid (CRV)], the General Energy Council [Algemene Energieraad (AER)], the Central Council for Environmental Hygiene [Centrale Raad voor Milieuhygiëne], the Fire-brigade Council [Brandweerraad], the Health Council [Gezondheidsraad], the Coordinating Police Council [Het Coördinerend Politiebureau] and the Council for Watermanagement [Raad voor de Waterstaat]; see: Proceedings of the Dutch Parliament, 1988-1989, no. 21061.

\textsuperscript{9} In Dutch: “Kernenergie heeft dan momenteel een aantal nadelen: een beperkt maatschappelijk draagvlak wegens de (percepie van) risico’s, radioactief afval, het vraagstuk van de proliferatie en een matige concurrentiepositie.”

than initially planned. However, next to the definite stop of the Kalkar fast-breeder project (1991), the close-down of Dodewaard (1997), the accelerated close-down plans of Borssele (decided in 1994), and the postponement in decision making, there were new initiatives in favour of nuclear technology during this decade. In 1992 ECN in Petten and the US-company Mallinckrodt signed a long-term agreement for the production of Molybdenum-99 (Mo-99) for medical purposes. In spring 1996 the production started. Furthermore, the uranium-enrichment company URENCO in Almelo was licensed to expand twice. In 1992 to 1300 tons and in 1993 to 2500 tons.

**Nuclear power and the greening of energy discussion (1999 – 2016)**

**Key data for this period**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 2001</td>
<td>Negative reports about bad conduct of business and violations of safety regulations at the HFR in Petten.</td>
</tr>
<tr>
<td>February 2002</td>
<td>Temporary close down of the HFR in Petten (restart in March 2002 after examination by the IAEA)</td>
</tr>
<tr>
<td>February 2003</td>
<td>Advice to build a new nuclear reactor in Petten to replace the HFR</td>
</tr>
<tr>
<td>September 2003</td>
<td>Police raid at the ECN-site in Petten, because violations of safety and environmental laws and regulations with ECN, NRG, Mallinckrodt and GCO (the subsidiary of the European Commission).</td>
</tr>
<tr>
<td>September 2003</td>
<td>Opening HABOG at the Covra-site for storage of highly radioactive material.</td>
</tr>
<tr>
<td>August 2008</td>
<td>Temporary close down of the HFR in Petten (restart in February 2009)</td>
</tr>
<tr>
<td>2012</td>
<td>The national government and the province of North-Holland decide to subsidise a new reactor at ECN in Petten</td>
</tr>
<tr>
<td>March 2013</td>
<td>The government decides to keep the Borssele reactor open until 2033</td>
</tr>
</tbody>
</table>

The signing (1997) and ratifying (2002) of the Kyoto protocol by The Netherlands implied far-reaching measures to reduce greenhouse gas-emissions. The country still relied heavily on natural gas, oil and coal for its energy consumption (see facts and figures). As EPZ, the electricity company that owns the Borssele nuclear reactor, challenged the parliamentary decision of 1994 to close the reactor as early as 2004, the nuclear power discussion revived in the Netherlands. In 2000 the Raad van State, the highest judicial court in the Netherlands, rejected the decision and allowed the electricity company EPZ to keep the pile open after 2003.
An emergency law that was prepared to force EPZ to close-down Borssele before 2003 was withdrawn in June 2002 by the Socialist Minister who was under resignation. His argument was ‘a changed political climate’. A couple of weeks earlier the popular right-wing politician Pim Fortuyn was murdered by a radical animal activist. The murder shocked the country and the general elections that went on two weeks after the murder resulted in a huge win of Fortuyn’s right-wing party. In 2006 the centre-right wing government decided that Borssele can stay open until 2033.

The decision to keep Borssele open was in line with an opinion poll in 2005. A two-thirds majority of the participants then was in favour of extending the lifetime of Borssele. Furthermore, 47% was in favour of building new nuclear reactors, 43% voted against (Van Kasteren 2001, 382). Nevertheless the four successive coalition governments under Christian-Democrat J.P. Balkenende (2002-2010) did not take any initiatives to plan new nuclear reactors. The electricity sector however did. In 2006, Delta, one of the two shareholders in EPZ, openly speculated about plans for building a second nuclear reactor that could become critical in 2016. In 2009 it started the license-procedure for a second 2500MW nuclear power plant situated in Borssele. Delta expected the reactor to become critical in 2018. The new right-wing administration that came to government in 2010 expressed its support for new nuclear reactors, because they would contribute to reach the Kyoto goals and because they would make the country less dependent of foreign energy suppliers. ‘Permit applications for new nuclear reactors that meet the norms, will be consented,’ the coalition agreement stated.

Late 2011 Delta had to slow down its plans and license-procedure as it had problems finding investors due to the economic crisis. This crisis had also created an overcapacity in the energy market resulting in low energy prices, shaking-up the business model of Borssele 2. Furthermore – although this was not mentioned as an argument - in March 2011 the Fukushima-disaster in Japan had taken place, influencing the public perception of nuclear energy.

The delay announced by Delta late in 2011 tempted 69 academic professors in the fields of economics, environment and sustainability to write an open letter to the company asking to

11 See: https://www.kernenergieinnederland.nl
withdraw the plans for Borssele 2 definitely. Their main arguments: were that the reactor was not necessary for Dutch energy consumption, the building costs would far exceed the estimations, the exploitation would not be profitable, and last but not least, there was still no solution for the nuclear waste and this problem should not be passed on to future generations.\footnote{See *Algemeen Dagblad*, 21-12-2011.}

In January 2012 Delta announced to stop its plans for Borssele 2 all together for the time being.

Next to private plans for one or more new nuclear reactors, initiatives were taken in the early 21st century to renew two research reactors. A committee of experts did advise the Minister to replace the almost 40 years old High Flux Reactor at ECN in Petten (see event 5).

### 1.3 Presentation of main actors\footnote{See the descriptions of the events for specific actors involved in parts of Dutch nuclear history.}

#### Science and Research
- **FOM** [Foundation for Fundamental Research on Matter], since April 1946
- **IKO** [Institute for Research into Nuclear-physics], since June 1946. Participants: FOM, the municipality of Amsterdam and Philips. In 1975 IKO became part of NIKHEF.
- **Zeeman Laboratory**, Physics laboratory of Amsterdam University, since 1923.
- **Kamerlingh Onnes Laboratory**, Experimental Physics Laboratory of Leiden University.
- **Lorentz Institute**, Institute for Theoretical Physics at Leiden University, since 1921.
- **ZWO** [Organisation for Fundamental Scientific Research], finances scientific research (a.o. FOM).
- **TNO** [Organisation for Applied Science]
  - Project Group Nuclear Energy, 1965-1977
- **RCN** [Foundation Reactor Centre Netherlands], since 1955, since 1976: ECN.
- **KEMA** [joint testing and research institute of the Electricity Sector]
  - Researchers (amongst others): J.C. van Staveren, J.J. Went and H. Brinkman
- **ECN** [Energy Research Centre Netherlands], since 1976 (successor of RCN)
• NIKHEF [Dutch Institute for Nuclear Physics and High-Energy Physics], a cooperation between FOM, IKO and several universities
• NRG, since 1998 the joint nuclear facility of ECN (70%) and KEMA (see electricity sector) (30%). In 2006 KEMA sells its 30% share to ECN.
• Natlab [Philips’ central research facility]

Government actors
• Department of Economic Affairs (in Dutch: EZ): - Industrial Council for Nuclear Energy (IRK)
• Department of Education, Arts and Science (in Dutch: OKW): - Scientific Council for Nuclear Energy (WRK); and - Central Council for Nuclear Energy (CRK)
• Department of Social Affairs and Public Health (in Dutch: SZV)
• Department of Housing, Spatial Planning and Environment (in Dutch: VROM)
• Interdepartmental Commission for Nuclear Energy (ICK)
• Health Council
• Provinces of Zeeland [location Borssele nuclear reactor and COVRA], - Gelderland [location Dodewaard nuclear reactor], - Overijssel [location Urenco Netherlands], - Noord-Holland [location RCN/ECN], and - Noord-Brabant [intended location of the first nuclear reactor in the Netherlands]
• Municipality of Amsterdam [partner within the exhibition “The Atom” and involved in IKO]

Electricity Sector
• N.V. SEP [cooperating electricity producing companies]
• N.V. GKN [Joint Nuclear Energy Reactor Netherlands, shareholders were the 11 Dutch electricity producing companies], established in 1965]
• VDEN [association of directors of electricity companies]
• PGEM [Electricity company of the province of Gelderland], PZEM [Electricity company of the province of Zeeland], and PNEM [Electricity company of the province of Noord-
Industry

- Philips N.V. [electro-technical company]; - BPM/Shell [oil company]; - Staatsmijnen [Dutch State mining Company]; - Werkspoor N.V. [machine factory]; - Stork N.V.; - the ship building companies: Rotterdamsche Droogdok Maatschappij (RDM) and Rijn Schelde; - Comprimo [engineering contractor]; - VMF [joint machine factories: Stork and Werkspoor]; - N.V. Hollandse Signaalapparaten

- In 1959 a number of the above companies started to cooperate in Neratoom [consortium of companies involved in nuclear technology]. Initial partners were: Philips, Stork, Werkspoor, Machinefabriek Breda [Machine factory Breda], RDM and De Schelde. Later they were joined by the shipbuilding companies: Wilton Fijenoord and Ned. Dok- en Scheepsbouw Maatschappij, and by NUCON [Nuclear Construction] (a subsidiary of Stork), and Comprimo.

- N.V. Dwars, Heederik and Verhey (DHV) [a civil-engineering company]

- UCN N.V. [Ultra Centrifuge Netherlands], established in 1969

- Interfuel

- Van Hasselt and De Koning [a civil-engineering company]

- General Electric (USA) [developer/supplier of the Dodewaard nuclear energy reactor]

- Siemens/Kraftwerk Union (BRD) [Developer/supplier of the Borssele nuclear energy reactor]

Public actors critical or opposed to nuclear energy

- VWO [Association of Scientific Researchers]; - Stroomgroepen Stop Kalkar/Kernenergie (SKK’s); - Anti Kalkar Committees (AKK’s); - Aktie Strohalm; - Landelijk Energie Komitee (LEK);
- Vereniging Milieu Defensie [environmental organisation]; - World Information Service on Energy (WISE); - LAKA foundation [documentation- and information centre on nuclear energy], established in 1988; - Greenpeace.
2. Showcase: The Nuclear Reactor in Dodewaard

Towards a 50 MW nuclear energy reactor in Dodewaard in the 1950s and 60s
In the early 1950s the joint research institute of the electricity sector KEMA, the Foundation for Fundamental Research on Matter (FOM), and the Organization for Applied Sciences Research (TNO) discussed with the Ministry of Economic Affairs on how to organize nuclear research in The Netherlands and how to get Dutch industry involved. To the Dutch government the latter was very important as it foresaw a worldwide demand for nuclear technology in future. It wanted Dutch industry to be prepared for this. Although some large private companies such as Philips, Shell and some machine factories showed interest and willingness to invest in nuclear know how and technological development, they wanted the government to pay for a Dutch reactor and take care of the organizational framework first. In 1955 the Dutch Reactor Centre (RCN) was established. Soon after, negotiations started between the electricity producers, Dutch industry and the Ministry of Economic Affairs about a nuclear power reactor (Verbong and Lagaaïj, 2000, 239-240 and 243-245).

Late 1956 KEMA established a study group – the commission-Roodenburg - which would investigate whether a commercial nuclear energy reactor would be technically and economically feasible. The commission asked ten companies - five American, four British and one French – to make an offer (Bakker 1963, E 111). Furthermore, it asked its shareholders to pay 0.03 cents per every kWh electricity sold in 1957 and 1958, to finance the nuclear-activities. While in the Summer of 1957 the commission-Roodenburg was at work and compared reactor-types, the Minister of Economic Affairs presented the Kernenergienota. It expressed the wish of the Dutch Cabinet to realize a nuclear energy reactor in the country as soon as possible. This first reactor was expected to be in operation by 1962 and it would be followed by many. From 1975 onwards all new electricity production facilities would be nuclear, the minister noted (Ministerie van Economische Zaken 1957).

In broad outline the commission-Roodenburg agreed to the Kernenergienota. At that time the commission made plans for provincial electricity company PNEM to build a 150 MW nuclear reactor near Geertruidenberg. It was thought to become critical in 1962. Another reactor of 200
MW was scheduled to be built by the provincial electricity company PGEM near Harderwijk and connected to the grid by 1964. It took the commission-Roodenburg almost two years to present its final report. The selection process took more time than expected. The commission advised to focus on a light-water reactor (either a Pressurized Water Reactor (PWR) or a Boiling Water Reactor (BWR)) but surprisingly did not advise to accept one of the offers. Changed economic circumstances were the reason. Thanks to the discovery of new oil and gas fields the price of electricity was decreasing. For economic reasons nuclear energy was, in the late 1950s less interesting than it was in the mid-1950s. At a yearly basis a 150 MW nuclear reactor would cost six million guilders more than a conventional reactor, the Commission-Roodenburg had calculated. As a result of these figures the electricity sector decided not to buy a nuclear reactor (Lagaaij and Verbong 1999, 41-44; Verbong and Lagaaij 2000, 245-246).

This outcome was disappointing to the Ministry of Economic Affairs, which wanted Dutch industry to be stimulated by investments in nuclear energy facilities. It was also disappointing to the PNEM that had hoped to host the first nuclear reactor in the Netherlands. A third actor that was not amused was Dutch industry. Although the main contractor would be foreign, Dutch industry was meant to deliver parts of the equipment. Some enterprises were preparing to expand their activities in the nuclear sector. In the spring of 1959, just before the negative decision of SEP, a number of companies had established Neratoom (see identification of actors), aiming at developing and constructing complete nuclear reactors. The decision of SEP slowed down these ambitions.

Although this was a setback to some policy makers and stakeholders, it did not end the prospects for Dutch nuclear energy entirely. In September 1959 SEP installed a new commission – Commissie Kernenergiecentrale - to research the possibility of building a cheaper, more competitive reactor (Rietveld 1966, E 99). Cost reductions were possible if Dutch industry was able to build the entire reactor, because the wages in the Netherlands were much lower than in the USA for example. This, however, had some implications. First of all, the necessary know how had to come from abroad. For this reason a SEP-delegation visited the USA in March 1960, where they met with electricity producers, nuclear research institutes, the industry and the Atomic Energy Commission (AEC). They learned that a relative simple reactor
design – PWR or BWR – with mediocre power – between 50 and 100 MW – would be the best option. This way the Dutch electricity producers, the research institutes as well as Dutch industry were able, at relatively low costs, to learn and gather know how, which would be vital in future when larger reactors were established. Also, the Dutch delegation encountered the willingness of American companies to sell their know-how and design specifications.

SEP decided for Dodewaard, a small town of 2800 inhabitants at the river Waal, as the location for this relatively small pilot reactor. The area was sparsely populated and predominantly strictly protestant. The river Waal supplied sufficient cooling-water for the condensers of the reactor. Furthermore, about 3.5 km from the proposed reactor was an open air switch-yard station of the national electricity grid. This was important because of the plant’s intended base-load function (Wassenaar 1969, 31-32). Next to this, Dodewaard is very close to Arnhem, where SEP and KEMA were at the time working on the development of an experimental suspension reactor (SUSPOP). Asked by a newspaper about SEP’s intentions, the municipality of Dodewaard stated not to have any objections as long as ‘one can be sure that the installation will not have a deterrent effect to the population.’¹⁵

Being more self-supporting in building the reactor had implications for the Euratom-relationship. Because SEP wanted the (sub-)contractors to be Dutch, an international open tender as part of the Euratom-agreements was out of the question. This implied some secrecy and confidentiality. Finally SEP had to negotiate with potential Dutch industrial partners. There were some conflicts of interests however. As the ordering party SEP wanted to keep the decision making, especially in the early phase about the reactor-design and specifications to itself and was not willing to negotiate with a too powerful industrial consortium, such as Neratoom. On the other hand, SEP needed Dutch industry for its plans to build an economically feasible nuclear reactor. They were the only ones that were able to deliver a reactor for a competitive price, because of the relatively low labour costs and because of a freedom of tax that SEP hoped to extort from the Dutch government, when choosing Dutch companies (Verbong and Lagaaij 2000, 247).

In the end, the position of SEP proved to be strong enough to get most of its wishes realized. In May 1961 it decided – without Neratoom involvement - to order a pre-design of a 50 MW BWR

¹⁵ Leeuwarder Courant, 09-11-1962.
from General Electric (GE). That summer four SEP-engineers went to San José to negotiate and to work on the pre-design with engineers from GE. Next to the 95 million guilders that the electricity producers invested via SEP – about a quarter of this for GE’s know-how – there was other funding. Euratom cooperated financially with 18 million guilders because the reactor could also be used for research. Out of the so called Nuclear Industrial Development Fund the Dutch government subsidized Dutch companies that were involved with another 10 million guilders (Lagaaij and Verbong 1998, 106, note 53).

Negotiations with GE took a long time and were harsh (Rietveld 1966, E 103). Finally, the contract between SEP, GE and Euratom was signed in Brussels in April 1963. Six weeks before, a new law – de Kernenergiewet – had come into effect. Part of it was the establishment of three advisory councils: The Central Council for Nuclear Energy (CRK), the Industrial Council for Nuclear Energy (IRK), and the Scientific Council for Nuclear Energy (WRK). Furthermore, new tasks were allocated to the already existant Health Council. These four institutions had to safeguard the different kinds of interest associated with the application of the new technology at national level (Lagaaij and Verbong 1998, 50).

Dutch companies, partly within Neratoom, became engaged in elaborating the GE reactor proposal and the building process. Already in November 1962 two civil-engineering companies, DHV and Van Hasselt and De Koning, were appointed to advise about civil engineering aspects (Rietveld 1966, E 103; Lagaaij and Verbong 1998, 50). In late March 1963 a new SEP-delegation, then consisting of three engineers/physicians from KEMA, two of the provincial electricity producing companies PNEM and PGEM, and one of Neratoom, went to San José to continue the work with GE on the design. A rather small SEP-bureau of about 15 people, that possessed the confidential GE-information about the reactor core, was in charge of the whole process. A much larger industrial bureau was established for the actual engineering and constructing work. Philips, together with research institute RCN designed and produced the fuel-elements. RDM provided the pressure-vessel.

In the Summer of 1963 the local authorities of Dodewaard received a building permission request for a nuclear reactor as part of the public nuisance act. After consulting several parties, such as the Labour Inspection and the National Institute for the Purification of Waste Water
(RIZA), the government allowed building activities to take place in the forelands of the river Waal near Doodewaard from September 1964. That same month the Dutch government asked Euratom to look into the safety aspects of the projected reactor. In December the Euratom panel presented an almost 100 page report which was positive about the safety of the design and siting of the Dodewaard reactor. Soon after the Interdepartmental Commission for Nuclear Energy in the Netherlands - that coordinated all the other different advices regarding authorisation of the project - concluded that no further serious objections were to be expected. This was the sign for the electricity sector to decide to take off with the first nuclear energy reactor in The Netherlands. Only the issue of judicial responsibilities and possible financial claims had still to be solved. Several laws about these topics were made. Early in 1966 this was settled (Rietveld 1966, E 105; [GKN] 1965, 18). By then SEP had transferred all of its nuclear energy activities to the newly established N.V. Gemeenschappelijke Kernenergiecentrale Nederland (GKN), dating from January 1965. All 11 Dutch electricity producing companies became shareholder of GKN. The amount of shares differed and was determined by electricity production figures of 1960, meaning that the Electricity Company of the province of South Holland (EZH) was the main shareholder. From 1965 to 1968 the reactor was built. In June 1966 GKN and Philips signed a contract for the delivery of the nuclear fuel elements. On January 4th 1968 the reactor vessel arrived in Dodewaard and early April the fuel elements. A year later The Netherlands produced its first electricity generated by nuclear fission on an industrial level (Woldringh 1970, E 117 – E 118).

**Dodewaard as a contested icon of modernity in the 1970s and 80s**

The establishment of the Dodewaard nuclear energy reactor in the 1960s did not evoke societal protests. Certain aspects, such as a lack of information during the building process or the costs involved, were criticized by individuals but there was no such thing as a significant anti-Dodewaard sentiment (Abma, Jägers, Van Kempen 1981, 146-148). On the contrary, by 1970 Dodewaard was an icon of modern Holland, as were the Delta works, the new Schiphol airport and the rapidly expanding Rotterdam harbour. That would change in the decade to come.

Early 1972 Dutch newspapers reported about the discovery of little leakages in a connection to the pressure vessel of the reactor in Dodewaard. This news and the consequence that the
reactor would be out of order for inspections in the short term was initially published by the press in a neutral way.\textsuperscript{16} In the same period there were rumours about the establishment of a second much larger - 600 MW - nuclear reactor near Dodewaard. In combination with the leakages that had caused some radioactive pollution, these plans alarmed some inhabitants of Dodewaard. The town council was asked for clarifications about the rumours by the local Protestant-Christian party. Their spokesman pointed at the recent leakages and expressed the fear for a real disaster when something would go wrong with a larger reactor. The community of Dodewaard did not want to host a second reactor, he expressed. Many inhabitants had changed their opinion about nuclear energy from tractability or indifference to fear and suspicion. During the last couple of years the ignorance about the subject had disappeared, the spokesman argued. The people now knew where to get their information. He also demanded public participation in the decision making process when a new reactor would be proposed.\textsuperscript{17}

Within two weeks of this debate in the municipality council, the mayor of Dodewaard was confronted by a socialist council member about a bag of nuclear waste which had been found at the local garbage dump at February 10\textsuperscript{th}. The mayor had to admit that he knew about it.\textsuperscript{18} While the authorities were still busy trying to trivialize this mistake and the Dodewaard management offered their sincere apologies to the population, new damage was done to the image of Dodewaard and nuclear energy in general. On March 16\textsuperscript{th} 1972 national newspaper \textit{De Volkskrant} published a large article about safety issues with the Dodewaard and Borssele reactors, based on information from anonymous whistle-blowers. It had a serious impact.

First of all for a Dodewaard employee, who got sacked by the management, because he allegedly had spoken to the press. The affair also reached Dutch Parliament, were the Minister was asked to comment to the accusations and the dangers, also regarding nuclear transports. Furthermore, the leakages in the Dodewaard reactor hampered the establishment of the second Dutch nuclear energy reactor in Borssele. There, the building of the pile went smoothly, but the licensing process got delayed by the problems that had occurred in Dodewaard. Only by the

\textsuperscript{16} See for example: \textit{NRC Handelsblad}, 03-02-1972 and \textit{De Telegraaf}, 04-02-1972.
end of June 1973 would the Borssele reactor get permission to start. And in the long run, the problems with the reactor in Dodewaard and the media-attention for it were grist to the mill to the growing group of opponents of the government’s policy to enlarge Dutch nuclear energy capacity. This policy that contained the installation of 35,000 MWe (!) nuclear energy capacity by the year 2000 was expressed in a new memorandum (Nota Inzake het Kernenergiebeleid 1972, 2). As a reaction, a recently formed anti-nuclear working group that consisted of several critical scientists offered on behalf of an ecologist movement, a counter-memorandum [Antikernenergienota] to Dutch Parliament in September 1972 (Verbong 2000, 257-258).

From about 1973 onward, the nuclear reactor in Dodewaard became a frequent target for the anti-nuclear movements, as were Urenco in Almelo, the fast-breeder reactor in Kalkar, the reactor in Borssele, the KEMA-facilities in Arnhem, and ECN (the successor of RCN) in Petten. In 1974 concerns about unsafe storage of nuclear waste at the site in Dodewaard led to the establishment of the so called ‘Stroomgroep Dodewaard’. The absence or inadequacy of the licences regarding the nuclear waste storage at the Dodewaard became a main argument for opponents to the reactor in the late 1970s.

The nuclear accident in Harrisburg in March 1979 gave rise to political deliberations about the safety of both Dutch nuclear reactors. The Ministers of Social Affairs and Health Care announced a re-appraisal of procedures in reactors in which human actions were involved. Despite of severe concerns amongst several parliamentarians, a majority voted against the early closing down of the Dutch reactors, as some parties had asked for. Yet, the Harrisburg accident affected the public opinion about nuclear energy and pressure was put on the provinces of Gelderland (Dodewaard) and Zeeland (Borssele) to close down the reactors (Abma, Jägers, Van Kempen 1981, 166). But also the Provincial Government of Gelderland and the Provincial Council decided to keep Dodewaard open in May and June 1980. In the meantime the anti-nuclear movement prepared for extra-parliamentary actions.

In May 1980 the ‘Stroomgroep Dodewaard’ organized, together with other ‘Stroomgroepen’ associated within the ‘Gelderse stroomgroepen’, a two-day discussion camp about the strategy to get the nuclear energy reactor at Dodewaard closed. Up to 5000 people attended the meeting which took place seven kilometres from the reactor. At this camp the ‘Dodewaard Closes Down!’
movement was formed. It announced its intention to block the entrance gates of Dodewaard in October 1980 if the reactor was not closed by then. In the run up to this, several preventive measures were taken by the police. The demonstrations/blockades started with about 15,000 people. Due to the police measures and bad weather the activist-numbers decreased quickly and the blockades were already finished after one day.

A week of blockades and protests that were organised by the anti-nuclear movement in Dodewaard in September 1981 had a different character. There was a grim atmosphere. Employees of the Dodewaard reactor for example received intimidating letters at their home address. There were confrontations between demonstrators and the local community because the latter were angry about havocs and the blockades that hindered them. Molotov-cocktails were thrown and the riot police acted fiercely and with tear gas. The demonstrations got out of control and came to an early end as the organizers decided to break up. A scheduled final meeting in nearby Arnhem to end the protest-week continued however. It attracted several ten thousands of people and went peacefully.

In the 1980s and early 1990s several discussions took place within the national and the provincial parliaments and SEP about closing the reactor in Dodewaard, and about the costs of dismantling it. In October 1996 SEP decided to close Dodewaard in March 1997, seven years earlier than scheduled. According to SEP, this decision was taken because of a lack of nuclear energy policy, due to the growing negative societal attitude towards the subject. Yet, the main function of the Dodewaard reactor was to maintain and enlarge the know-how about nuclear energy production in the Netherlands. This was no longer necessary SEP concluded.¹⁹

3. Events

The five events that are described and analysed in this section, are selected because they mark and/or illustrate a turning point in Dutch nuclear history and society. They, together with the showcase in section 2 – reflect to a large degree the historical context and periodization made in section 1.

The first event - exhibition “the Atom” in 1957 - is one of the most explicit attempts to prepare the general Dutch public for future civil applications of nuclear technology, as a consequence of Eisenhower’s Atoms for Peace program. The Treaty of Almelo of 1970 – event 2 - shows the big - almost uncontested - ambitions in the 1960s of Dutch government, industry and science to take part in the nuclear age. A turning point in society’s attitude towards nuclear energy is demonstrated by the anti-Kalkar protests in Autumn 1974 – event 3.

Event four is the Broad Societal Discussion on Energy Policy (in Dutch: BMD) in the early 1980s. The BMD that was asked for by some grassroots movements, was a nationally - and probably internationally - unique public participation initiative with regard to nuclear energy, created by the Dutch government. The most recent event that is selected is the prolonged discussion, from the early 21st century onward until now about renewing the 40 year old High Flux Reactor (HFR) at the Energy Research Centre of the Netherlands (ECN) in Petten. Next to ‘traditional issues’ about safety, nuclear waste, costs-benefits et cetera, the event shows new elements in the nuclear discourse.

3.1 Event 1: Exhibition “the Atom” at Schiphol airport, 1957

Description of the event
In the summer of 1957 an exhibition called “The Atom” took place at the Schiphol-airport site near Amsterdam. The official opening was on Friday June 28th by his Royal Highness Prince Bernhard. He was also chairman of the Committee of Honours of the exhibition, that consisted of several Dutch and foreign celebrities. The exhibition ended September 15th 1957.

Type of event
Public communication process
Case history
In a meeting with the president of the Amsterdam Chamber of Commerce in the summer of 1953 G.H. Knap, an Amsterdam-based business-journalist, proposed to organize an international exhibition to promote the commercial function of the city of Amsterdam. Atomic energy and its applications would be a suitable subject, for it greatly impressed people’s imagination in those years. The Chamber of Commerce agreed and so did the municipality. Preparations began for an exhibition initially called “The Atom Amsterdam”. From the start of these preparations, Dutch nuclear scientists were involved (Van Lente 2008, 150).

In July 1955 the plans were announced at a press conference at the Royal Dutch Academy of Sciences. The idea was to organize an exhibition for a broad public about the peaceful applications of atomic energy. The “Atom”-exposition was initially planned for May 1957. Contributors to the exhibition that had already been contacted included the United States, the United Kingdom, France, Canada, Belgium and Norway. Plans to have a reactor at work in the exhibition were not mentioned. Furthermore, funds still had to be raised. A foundation was established to take care of the organizational aspects.20 These preparations resulted in an exhibition in a newly built hangar at Schiphol airport. It was subsidized by the municipality of Amsterdam for 6.5 million guilders.21 The location choice of Schiphol had two reasons: the exhibition space could quickly be reused as a hangar for parking airplanes, and secondly, it was hoped that more visitors would be attracted, because Schiphol was during the summer months a tourist-attraction by itself.

The highlight of the exhibition was a working open-end ‘pool-type reactor’, that the Dutch Ministry of Education, Arts and Science had purchased for apparently one million guilders. After the exhibition it would move to Delft Polytechnic High School (now Delft University of Technology) as a research reactor. The Dutch Reactor Centre RCN (established July 1955) and Delft Polytechnic High School shared the responsibility for operating the reactor, that produced 10 kW of power and that was designed by the A.M.F. Atomics Inc., a subsidiary of the American

20 De Telegraaf, 08-07-1955, 3.
21 http://www.kernenergieinnederland.nl/node/607
Machine & Foundry Company in New York. Dutch company Philips provided the electronic measuring, regulating and safety system (Van Tol 1957, 253-265).22

**Goal(s) and means**

The initial goal of the exhibition was promoting the city of Amsterdam. *Atomic energy functioned as an icon of modernity*, attracting a lot of potential visitors. In the years towards realization of the exhibition the goal evolved towards creating ‘a *healthy atmosphere* for decisions Parliament had yet to take about nuclear energy.’ (Van Lente 2008, 150). So promoting Amsterdam as a commercial capital was no longer the main goal but promoting nuclear energy was. Already at the 1955 press-conference the intention was expressed that the exhibition would be as ground-breaking as the Amsterdam aviation-exhibition ELTA of 1919 had been. The mayor of Amsterdam emphasized in his announcement speech that the exhibition of 1919 heralded a new era in air traffic. The upcoming exhibition should in his view herald the new ‘atomic era’.23 Note that within a week after the opening of the exhibition the Dutch Minister of Economic Affairs, presented the Nota inzake Kernenergie [Memorandum on Nuclear Energy] (July 3th 1957), that proposed a quick transition in the Netherlands towards nuclear energy.

Dutch public should be made acquainted with nuclear technology and the Netherlands had to be made ‘atomic minded’ by linking nuclear energy to modernity (Verbong and Lagaaij 2000, 239). Therefore the exhibition also showed other symbols of technological progress like a big electronic calculator and modern kitchen equipment. The message that was carried was that all the needed energy for technological devices that would ease modern day life had to be nuclear.

In the official visitors guide it said: ‘It is to us, the generation of 1957, to determine the future of tomorrow's world. Our future: atomic energy!’ (Verhees 2012, 106).

Another important goal was to get Dutch industry (more) interested in nuclear technology. Therefore an international informative conference was held at the Royal Institute for the Tropics in Amsterdam at the start of the exhibition an (26 – 29 June). This was a follow-up of a conference in Paris (1-6 April 1957) and meant to inform staff-members from public and private companies as well as representatives of employers- organizations and trade unions about the

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22 Here also a description - in Dutch - of the reactor.

23 See: De Telegraaf, 08-07-1955, 3.
possibilities of nuclear energy. After this international opening-conference, three conferences were organized during the exhibition about industrial applications of nuclear energy. The conferences were jointly organized by Foundation “The Atom”, RCN and the energy-commission of three Dutch Employers’ Associations.

These conferences were meant to raise interest amongst Dutch industry for the production of nuclear technology. Speakers were a.o. J.P. Kruseman, director of the KNSM (a shipping company), ir. W.A. De Haas, deputy-secretary of NV Philips and member of the board of RCN, Prof. dr. J.M.W. Milatz, director of RCN, Prof ir. L.H. de Langen, director of the Algemene Kunstzijde Unie, dr. ir. R Houwink, and Prof. F. Boon. At the last conference there was also a plea for a permanent exhibition about Atomic Energy. The companies and organizations that financially warranted for the exhibition (which was not needed because of the success) were asked to donate that money to this permanent institution.

Identification of actors:
The main promoters of the event were the Chamber of Commerce and the municipality of Amsterdam and (mostly Amsterdam based) companies, varying from shipping companies, mechanical industry, insurance companies and electricity companies. These and probably other companies financially warranted for the exhibition that was largely paid for by the municipality.


24 See: Het Vrije Volk, 05-08-1957, 2; Algemeen Handelsblad, 05-09-1957, 4; Java-bode, 13-08, 1957; De Tijd, 03-08-1957.
* Members of the Committee of Honours (ere-comité) of the exhibition were, amongst others: - HRH Prince Bernhard of the Netherlands (chairman); - Lewis L. Strauss, chairman of the Atomic Energy Commission of the US; - Ambassadors of several western countries.

* In June 1957 the Foundation “The Atom” consisted of (amongst others): - mr. D.A. Delprat, Amsterdam Chamber of Commerce (chair); - Mr. A.A. Land (secretary); - C.P.G. van den Handel (2nd secretary); - Ir. L. Vos, (member).

Other Actors involved in the 1957 exhibition ‘The Atom’:

- Ministry of Education, Arts and Science → paid for the nuclear reactor
- Ministry of Economic Affairs → nuclear energy memorandum / energy transition
- Amsterdam Tourist Office → promoting the exhibition, also abroad
- Delft University of Technology (by then still Polytechnic High School) → operating the reactor and owner of it (after the exhibition)
- the Dutch Reactor Centre RCN in Petten → operating the reactor, co-organizing attached conferences
- Associations of employers → involved in co-organizing attached conferences
- Schiphol Airport → facilitating and owner of the hangar-building after the exhibition
- Engineering company Comprimo → involved in constructing the reactor
- Electro-technical company Philips → involved in constructing the reactor
- Media → covering the event. There was a lot of media-coverage in newspapers, including special-issues, and magazines (see also below).

The exhibition was a public communication process at a national level (the impact at international level seems limited). With 750,000 visitors it reached almost 5% of the population directly and many others indirectly via different media. Furthermore the organizers tried to get certain groups especially interested for the topic, for example the financial world. Members of the Dutch Society for Stock Exchange (Vereeniging voor den Effectenhandel) were invited to the
exhibition. They were welcomed with speeches that emphasized the opportunities for investing in nuclear technologies.\footnote{25}{See ‘De beurs en Het Atoom’, in *Algemeen Handelsblad*, 26-08-1957, 6.}

**Perception, meaning and interpretation of the event**

With the mentioned number of visitors the exhibition was seen as a success. In a recent documentary, visitors remembered their enthusiasm and their fascination viewing the reactor. Especially the bleu glimmer of the reactor was an impressive sight. Furthermore, the exhibition stimulated youngsters to study nuclear physics and nuclear technology.\footnote{26}{See the documentary at http://www.npogeschiedenis.nl/andere-tijden/afleveringen/2004-2005/Geloof-in-kernenergie.html, [retrieved 01-07-2016].} The exhibition also generated a lot of attention from the contemporary press. The day before the opening a national newspaper published a four pages special about nuclear energy.\footnote{27}{See *Algemeen Handelsblad*, 27-06-1957, 9-13.} Another newspaper called the exposition without doubt ‘one of the most important post-war events in Amsterdam.’\footnote{28}{See *Het Vrije Volk*, 06-08-1957.}

The exhibition is seen as very important in Dutch nuclear history. Not only as a successful attempt to link nuclear to peaceful applications and modernity, but also as a proven advertisement of Dutch capabilities in this domain. It was no longer an abstract technology that stood far away in place and time. For this it was important that under supervision of the American Machine & Foundry Company Dutch engineering company Comprimo and electro-technical company Philips had manufactured the reactor on Dutch soil. This Dutch involvement was therefore emphasized in the visitors guide (Verhees 2012, 107-108). Historians do not agree about the meaning of the exhibition in relation to ‘a prevailing mood of fear and confusion’ in the 1950s or even a causal relation with the upcoming anti-nuclear movement in the early 1970s (see Van Lente 1998, 54 and 154; Verhees 2012, 96; Verbong and Lagaaij 2000, 238-239))
3.2 Event 2: The Treaty of Almelo, March 4th 1970

**Description of the event**

On March 4th 1970 the Governments of the Netherlands, West-Germany and the UK signed a treaty concerning cooperation in developing and exploiting the gas-ultracentrifuge-procedure for producing enriched uranium.

**Type of event**

Decision making process, without public consultation or participation

**Case History**

From late 1954 Jakob Kistemaker at the FOM-laboratory in Amsterdam started working on ultracentrifuge technology to enrich uranium as an alternative to diffusion technology. About 1957 FOM had ideas to cooperate internationally in ultracentrifuge research. Possible partners were the West-German company Degussa and the American company General Electric. The Scientific Advisory board of RCN, who paid for the research at FOM, was positive about cooperation but wanted results first, making the position of the Dutch stronger in the negotiation process (Lagaaij and Verbong 1998, 60-61; Kistemaker 1991, 8-14).

In April 1960 the Minister of Economic Affairs appointed a commission to study the possibilities of nuclear technology for Dutch industry. This Commission was positive about the ultracentrifuge project and was asked by the Minister to do further research into the economic and technical possibilities of the project. In two (secret) reports it concluded that an ultracentrifuge industry would be economically interesting for the Netherlands, if the performances of the centrifuge could be further improved. The research funds were raised but because the US-government in the meantime had declared ultracentrifuge technology and research as classified, FOM stopped its research and RCN took over from July 1st 1962 (Kistemaker 1991, 18-19; Lagaaij and Verbong 1998, 62; Verbong and Lagaaij 2000, 253-254).

In 1965 the research-project ended. The Industrial Council for Nuclear Energy (IRK) that was established in 1962 to look after the interests of Dutch Industry with regards to nuclear technology, and the Scientific Council for Nuclear Energy (WRK), urged RCN-to do an evaluation of the project. The evaluation-commission advised RCN in February 1962 to continue
the research for four more years, despite disappointing results so far. Nevertheless if the upcoming research would be successful a large experimental ultracentrifuge factory by 1970 would be possible, the commission concluded in February 1966 (until then 11 million guilders were invested in research) (Lagaaij and Verbong 1998, 62-63 and 82).

For political reasons the project got obstructed in 1965 and 1966. Cooperation with West-Germany bounced, because the Dutch Minister of Foreign Affairs had objections proliferating ultracentrifuge knowledge. This hampered also the decision-making about the advice for continuing the research-project. A new evaluation commanded by the Ministry of Economic Affairs was done in summer 1967 (Kistemaker 1991, 21-22). About the same time it became clear that due to several projected nuclear initiatives in Europe and the US the need for enriched uranium would legitimate investments in large industrial enrichment facilities. So in 1967 the French proposed to the European partners in Euratom a substantial enlargement of their diffusion-factory in Pierrelatte. However the UK and West-Germany were also aiming at building an enrichment facility. The latter however was bound by international agreements after WW2 and was not allowed to produce key-materials for atomic weapons on its territory. The trump-card that the Netherlands had was its technological knowledge about ultracentrifuge (estimated to be 3 to 4 years ahead to West-Germany). Because of competitive arguments, the Netherlands did not want to share this knowledge within Euratom. The most interesting option for the country would be cooperation with West-Germany (Lagaaij and Verbong 1998, 84).

At a conference in October 1968 in Torino, Italy, the Netherlands announced its plans to build a 25 tonne uranium separation plant (Kistemaker 1991, 23). The next month negotiations started with West-Germany about forms of cooperation. As soon as the US heard about these negotiations, they were eager to get the UK involved in the talks (Tolsma 2004). By March 1969 the three countries came to an agreement. This agreement was officially confirmed on March 4th 1970 in the Treaty of Almelo. As a result of the treaty, the Uranium Enrichment Company ltd. (URENCO) was established in the UK. A ‘Joint Committee’, with representatives of the
governments of the three countries, supervises aspects of safety, security, export of technology and products, non-proliferation and related issues (Kistemaker 1991, 25-26).

In the initial phase every country would build its own ultracentrifuge test plant, all with different types of ultracentrifuge technology. Dutch participant in URENCO was Ultra-Centrifuge Nederland NV (UCN) in Almelo. This company was established in November 1969. The West-German test plant arose on Dutch soil as well to bypass the countries international ban on producing key-materials for atomic weapons. Both Dutch and German test-plants had a capacity of 25 tons a year. The UK test-plant in Capenhurst had a capacity of 50 tons a year. By the end of 1973 UCN Almelo produced its first enriched uranium. In the Autumn of 1977 the production plants in Almelo and Capenhurst started to produce enriched uranium at a commercial base, in August 1985 the German plant followed (Bannink and Diehl 2014,13-14).

**Identification of actors**

Actors involved in ultracentrifuge-technology research, 1954 – 1970:

- FOM-laboratory: Research up to July 1962 under supervision of prof. J. Kistemaker.
- Reactor Research Centre Netherlands (RCN): pays for the research at the FOM-laboratory. In July 1962 it took over the research-project from FOM.
- Werkspoor N.V.: providing machines and equipment to the project.
- Staatsmijnen: subsidises the materials-research and supervision of the project.
- Phillips N.V., involved in the research and in supervision of the project at FOM/RCN.
- Comprimo, an engineering contractor, involved in the research at FOM/RCN.
- Delft University of technology, involved in supervision of the uc project at FOM.
- University of Utrecht, involved in supervision of the uc project at FOM.
- University of Leiden, involved in supervision of the uc project at FOM.

**Note:** The electricity companies were (in the 1950s) sceptical about the project. They found it economically not feasible (Lagaaij and Verbong 1998, 58).

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Evaluating commissions concerning the Ultracentrifuge technology:

- Commission to study the technical and economical evaluation of the ultracentrifuge project in 1960 (Commission-Tromp), reports in 1961 and 1962:
  - Sub-commission on economy: Van der Pols (chair), Bogaardt and Went
  - Sub-commission on technology: Members: J. H. de Boer (chair). He was director of the Laboratory of the state mining company Staatsmijnen, and chair of the Scientific Council for Nuclear Energy and the Central Council for Nuclear Technology. Other members: specialists from Philips, Werkspoor, RCN, TNO and Comprimo
  - Sub-commission on patent-situation

- RCN-Commission to evaluate the progress of the Ultracentrifuge project installed 1965, report February 1966:
  - Instigator: Industrial Council for Nuclear Energy (IRK) of Min. of Econ.
  - Instigator: Scientific Council for Nuclear Energy (WRK), of Ministry of Education
  - Chair: Prof. H.W. Slotboom, director of Shell-laboratories in Amsterdam

- Commission to evaluate the research ultracentrifuge research project installed by the Ministry of Economic Affairs, summer 1967, (report was classified). Executed by Shell.

Participants in Ultra-Centrifuge Nederland NV (UCN), Nov. 1969:

- The Dutch state (55%); - the National Mining Company [DSM] (10%); - Shell (10%); - Philips (10%); - Rijn Schelde (7.5%); - Verenigde Machinefabrieken NV (VMF) (7.5%)

Board of UCN NV, Nov. 1969

- Th.P. Tromp (Philips), chairman; - H. Hoog (Shell), vice-chairman; - L.G. Wansink, J.A.M.Molkenboer and O.W. Vos (the Dutch State); - K. Over (Staatsmijnen); - A. Meyer (Verenigde Machinefabrieken); - J. Bout (Rijn Schelde); - E.L.Kramer and R.W.R. Dee (ECN)
Organizations cooperating in the ‘Almelo Information Bulletin’ (opposed to expansion of UCN/URENCO), Oct. 1977:

Landelijk Energie Komitee (LEK) [National Energy Committee]

- A cooperation between:
  - Vereeniging Milieudefensie (an environmental organization)
  - Stroomgroep Stop Kalkar/Kernenergie (an anti-nuclear group)
  - Aktie Strohalm (an anti-nuclear group)
  - NIVON (Dutch branch of the International Friends of Nature)
  - VWO (Association of Scientific Researchers)
  - Gezamenlijke Energiekomitees Zuid Nederland (cooperating Energy Committees in the South of the Netherlands)
  - PPR (small left-wing political party)
  - PSP (small left wing pacifist political party)
  - Brazilië-komitee [Brazil-Committee]
  - XminY beweging (movement for the support of social movements worldwide)
  - Kerk en Vrede [Church and Peace]
  - CLAT (Organization for solidarity with Latin-America)

Perception and meaning of the event

With the Treaty of Almelo and the establishment of URENCO the Netherlands gained a substantial role in the worldwide fuel chain for nuclear energy producers. In 2013 URENCO Netherlands possessed the second largest uranium enrichment capacity in the world with 5,500 tSWU/y. URENCO (in total) had a market share of about 30%. 46% of its customers are within the USA, 37% in Europe and 17% in the rest of the world (Bannink and Diehl 2014, 15 and 20).

At the 40th anniversary of the treaty in 2010 URENCO itself concluded that it had ‘realised the original vision of the Treaty of Almelo, becoming a model of international co-operation ensuring a safe, secure and commercially attractive supply of nuclear fuel for the peaceful production of nuclear power.’

In about 1970 there was some resistance to the ultracentrifuge project, the building of UCN and the signing of the Treaty of Almelo. Young scientists in the Northern part of the country, who were members of the socio-critical Association of Scientific Researchers protested against the plans. A ‘working group Ultracentrifuge’ was founded by young scientists in Groningen and Twente. They published a critical report in 1970 (Verbong and Van Selm 2001, 42). Out of this group ‘Urania’ – a group very critical towards nuclear energy – resulted in the same year. Five days after the signing of the Treaty a small group of about 50 people demonstrated in Almelo against it. In May 1970 there is also a demonstration against the Treaty at an annual encampment of a socialist youth organization (ANJV) that took place in Almelo (co-incidentally).

Early in 1971 Wim Klinkenberg, a Dutch journalist and communist, published a book about the history of the ultracentrifuge, in which he accused Dutch scientist Kistemaker of cooperating with Nazi-scientists (Klinkenberg 1971). This publication led to questions in Dutch Parliament and articles in newspapers and magazines.

As the anti-nuclear movement grew - especially after ‘Kalkar’ in 1974 - protests against URENCO also became louder. The opening of the UCN production plant in Almelo in 1977 and with licensing procedures for expansion of the capacity at the table, the anti-nuclear movement started focusing on preventing UCN/URENCO from expanding. A number of anti-nuclear organizations jointly published an ‘Almelo-information bulletin’ in October 1977. Part of the bulletin was a concept-manifesto, containing 11 arguments against expansion that can be summarized by: 1. Nuclear energy leads to proliferation of nuclear arms; 2. Expansion does not lead to growth of employment in the region; 3. Only West-Germany needs expansion and profits because of an export-contract the country had signed with Brazil. This way Brazil gets knowledge to build an atomic bomb and West-Germany gets access to Brazilian natural uranium and can safeguard its own nuclear energy program; 4. Brazil is a military dictatorship, entangled in an arms race with Argentina. It is not in the interest of stability in Latin America; 5. Brazil did not sign the Non-Proliferation Treaty (which is not-effective after all); 6. It can lead to expansion of nuclear energy in (dictatorial) third world countries, which is not in the interest of the people; 7. It can lead to West-Germany as a third European Atomic Power; 8. Expansion of URENCO stimulates more nuclear energy in the Netherlands, the UK and West-Germany, which is undesirable as long as there is no nuclear-waste solution; 9. It leads to undesirable safety-
measures in society and measures of monitoring and control of people, transports and objects; 10. Policy makers should stimulate energy saving and development of alternative energy sources; and 11. The money should be invested in research into alternative energy sources.

The Information Bulletin also announced a demonstration to be held in Almelo. This protest mars against the expansion plans of URENCO’s uranium-enrichment facility took place on March 4th, 1978. About 50,000 attended and gained a lot of media attention but had little effects as Almelo was expanded.

As the Treaty of Almelo lasted for 10 years (article 15) the three parties involved could end the agreement from 1981 onward. The anti-nuclear movement used this momentum to urge the Netherlands to end its participation in URENCO. It was argued that the Treaty had proved its failure in prohibiting proliferation of uranium enrichment knowledge to dubious states and regimes. They pointed at the ‘Khan’ espionage-affair. Working with FDO Stork, Pakistani Abdul Kahir Kahn had access to crucial knowledge about ultracentrifuge technology at UCN. This knowledge was used for the Pakistani atom bomb program and probably also sold to other countries. Also the contract between URENCO-Germany and the Brazilian Government to deliver enriched uranium was seen as a failure of the non-proliferation aim of the Treaty.

Another argument that became important in the societal perception of URENCO was the origin of the Uranium. In the 1970s and 80s West-German mining companies were active in Namibia, a country that was occupied by South-Africa under the Apartheid-regime. By its URENCO connections the Netherlands also took part in this ‘contaminated’ business, according to opponents, and should end it as soon as possible (De Beer 1988, 124-135). In May 1985 the Executive Committee of the Council for Namibia of the United Nations accused the Netherlands of violating article 1 of the Namibia-decree that prohibits Uranium-imports from Namibia. In September 1987 the Dutch State, UCN and URENCO were summoned by the UN for importing Uranium from Namibia. The trial was adjourned sometimes and ended with South-African...

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32 See for example a special issue (‘Belicht’) about UCN and the Treaty of Almelo of Allicht, the journal of the cooperating anti-nuclear Energy-committee’s in the South of the Netherlands (about 1981), digitalized by Laka, see: http://www.laka.org/docu/tijdschriften/allicht/allicht01-02k.pdf (retrieved 11-7-2016)
withdrawal from Namibia in 1990. Nevertheless the opaqueness of the uranium-chain and the circumstances and consequences of uranium mining in especially African countries are arguments URENCO-critics use these days. Others point at financial speculations with uranium prices, leading to undesirable transports (to and from Tenex-Russia) and storage of uranium, in which URENCO played a role (Bannink and Diehl 2014, passim; Crezee 2016).

3.3 Event 3: Opposition to fast breeder reactor at Kalkar

Description of the event
In the autumn of 1974 about 10,000 Dutch protested at the Kalkar-site, just across the Dutch-German Border, against the building of a fast breeder reactor, a co-operation between Germany, Belgium and the Netherlands. Some weeks later the Dutch Parliament was offered a petition calling for the end of the Kalkar project. It was signed by 155,000 civilians.

Type of event
Public participation process

Case history
Fast breeder reactors that can ‘breed’ new fuel while producing power were seen as a very promising new reactor type in the 1960s. Dutch research-institutes TNO and RCN started respectively in 1961 and in 1962 research into technology for these types of reactors, especially the possibilities of Natrium for cooling. In 1962 also NV Neratoom joined in. Neratoom was a joint-venture of Dutch companies working together at the nuclear field (see identification of actors). In 1965 The Netherlands reached an association agreement for three years with Euratom that paid 40% of the costs of the research. In the contract it was agreed that, because of the scope and importance of fast breeder reactors for European energy-supply, Euratom-countries would cooperate in research and development (under the Euratom-umbrella). Therefore the Netherlands started talks with West-Germany and France. The latter asked for a

33 See also: http://www.greenpeace.nl/campaigns/archief/kernenergie/wat-is-kernenergie/kernenergieketen-van-grondsto/uraniumwinning/ (retrieved 11-7-2016)
(too) big Dutch financial contribution. Germany was more cooperative (Van den Bosch 2006, 74-75).

From 1966 onward Dutch, German and Belgian (and Luxemburg) government-representatives talked about jointly developing and building a fast-breeder reactor (bypassing the Euratom wish to work together with all six Euratom countries in building a fast breeder reactor). After some political hiccups in the Netherlands - Dutch interim-government in February 1967 decided to withdraw from the project, but the letter to the partners was never sent (!) – the newly elected right-wing government continued the cooperation and the preparations started. In January 1968 a German-Belgium-Dutch industrial consortium (INB) was established for developing and building a prototype fast breeder reactor. The Dutch contribution was mainly cooling technology, pumps, heat exchangers and steam kettles. The German, Dutch and Belgian electricity companies formed a consortium (SBK) that was the principal-commander of the project. The project-management was with the Projektgruppe Schnelle Brüter (PSB), located at the Kernforschungszentrum in Karsruhe, Germany. The PSB was since 1966 extended with representatives of all involved parties. Germany, Belgium and the Netherlands participated in the project on a 70-15-15 formula. This meant that the involved electricity contributed 84, 18 and 18 million DM. In May 1973 a fourth partner got involved (for 2 million DM): the British General Electric Generating Board (Verbong and Lagaaij 2000, 254; Van den Bosch 2006, 83-84).

The reactor was initially projected in the German city Weissweiler, near Cologne. But because the area was too densely populated (over 40,000 within a circle of 10 km) and there was a higher risk of earthquakes, no permit was provided by the federal state. During 1971 it became public that the reactor would arise in Kalkar close to the Dutch-German border near Nijmegen, leading to protests of locals. In Kalkar the Bürgerinitiative [Civil Initiative] ‘Interessegemeinschaft gegen radioactive Verseuchung’ was founded on 11 June 1971 by worried civilians. The ‘Interessegemeinschaft’ organized a first larger protest-meeting in a local bar in Kalkar at January 20th 1972. Two weeks later, on February 4th 1972, the Dutch government officially decided to take part in the project. Government-committees of the three countries signed the agreement on March 7th. That same month a public hearing was organized in Kalkar, which was accompanied by protests of locals and petitions (8500 signatures were gathered against the
The Board of the Catholic church in Kalkar that owned the ground where the reactor was projected allowed the SBK to do test-drillings.\textsuperscript{34} In spite of protests of local farmers, who rented lands from the board of the church, and of the board itself, the building of the plant started on April 24\textsuperscript{th} 1973 (Van den Bosch 2006, 89-90). The estimated costs for the project had raised over 1.5 billion DM, of which the Netherlands had to pay 212 million. By 1969 the total costs for the project were estimated at 740 million (Verbong 2000, 261). While in Germany the protests against Kalkar were fairly local/regional, in the Netherlands ‘Kalkar’ became the key target of a national anti-nuclear movement.

To finance the Dutch contribution to the experimental fast breeder reactor in Kalkar the Dutch government decided to a 3\% increase of the electricity-bill of every citizen. This ‘Kalkar levy’, mentioned as such on the actual electricity bill sent to customers, ‘\textit{led to societal outrage and resulted in the emergence of many small local groups that either opposed the levy or the project.}’ (Verhees 2012, 118). Many civilians (encouraged and supported by the local groups) acted disobediently and refused to pay for the levy. As a consequence, they were threatened with disconnection from the electricity-grid, which was sometimes executed. To inform and help each other, local groups got connected and a national protest organization Stop Kalkar was formed (LSSK, see below). A bit earlier also left-wing political parties had organized themselves in their anti-Kalkar protest (AKK). This up-scaling of the anti-nuclear protest movements to a national level resulted in the first large-scale anti-nuclear power protest. At September 28\textsuperscript{th} about 10,000 mostly Dutch protesters gathered at the Marketplace in the German village of Kalkar. About three weeks later, October 22\textsuperscript{th}, Minister R. Lubbers of Economic Affairs was presented 155,000 signatures on a petition that demanded a Dutch withdrawal from the Kalkar-project.

\textbf{Identification of actors}

Dutch actors involved in research about fast-breeder technology, especially Natrium cooling (from 1961 onward):

- The Netherlands Organization for Applied Scientific Research (TNO)
- Reactor Centre of the Netherlands (RCN), established 1955

\textsuperscript{34} See also: \url{http://www.kernenergieinnederland.nl/faceted_search/results/Kalkar?page=1} (retrieved, 2-7-2016).
• NV Neratoom, an industrial consortium focused on nuclear technology, established in May 1959, members (see section 1.3).

The Internationale Natrium-Brutreaktor-Bau-Gesellschaft (INB), the German-Belgium-Dutch Industrial consortium, involved in the development and building of the fast breeder reactor in Kalkar, established January 1968: - Siemens/Interatom (Germany); - Belgo Nucléaire (Belgium) and Neratoom (Netherlands).

The Schnelle Brüter Kernkraftwerksgesellschaft (SBK), the German-Dutch-Belgian cooperating electricity companies, the principle of the project ‘Kalkar’: - Rheinish Westphälisches Elektrizitätswerk (RWE) (German), 70% participation; - Synatom (Belgium), 15%; - the Dutch Samenwerkende Electriciteits Producenten (SEP), 15%; In May 1973 extend with: General Electric Generating Board.

In the project-managing Projektgruppe Schnelle Brüter (PSB), nuclear research centres from Germany (Karsruhe), the Netherlands (Petten) and Belgium (Mol) were represented.

Other actors in decision making:

• The German Federal State of Nordrhein-Westphalen (licencing)
• The Reaktor Sicherheits Commission (RSC), The German advisory council on security of nuclear energy (licensing)
• The board of the Catholic church in Kalkar (owner of the land, were the reactor hat to arise)

The demonstrations in September 1974 were jointly organized by the Landelijke Stroomgroep Stop Kalkar (LSSK) (established spring 1973) and the Anti-Kalkar-Komitee (AKK) (established 1972).

• LSSK was the national umbrella organization of the local 'stroomgroepen' that opposed the Kalkar Levy and the project. These local ‘stroomgroepen’ were often established by environmental groups. There were about 80 local ‘stroomgroepen’. From late 1973 the LSSK organized meetings in Utrecht (Van den Broek and Meijen 1977, 6).
• The AKK was a cooperation of the political parties that had voted against the Kalkar levy in Parliament. It was an initiative of the Progressive Party of Radicals (PPR), a left-
wing political party with roots in the Catholic Peoples Party (KVP). The parties that joint the AKK were the Socialist Party (PvdA), the Communist Party (CPN), the Liberal Democrats (D’66) and the Pacifist-Socialist Party (PSP). The AKK distinguished itself from the LSKK because it did not want to encourage citizens to civil disobedience, by not paying (part of) the electricity bill. Local staff-members of the Communist party formed the backbone of most AKK-groups.

- End 1975 the AKK was dissolved (Van den Broek and Meijnen 1977, 7).

**Perception and meaning of the event**

The Dutch participation in the (expensive) Kalkar-project - and the Kalkar levy as a result of this - boosted the anti-nuclear movement in the Netherlands (Abma, Jägers and Van Kempen 1981, 149; Verbong and Van Selm 2001, 40-48)). The costs of the project, the levy that was introduced, the civil disobedience to which it led, and the reaction to this by the electricity companies (warnings and disconnection from the grid) caused a lot of media-attention and discussions on radio and TV (Verhees 2012, 118), which, in its turn, had a mobilizing effect. An increasingly broader public began to judge nuclear energy as a controversial issue. The number of people willing to take action (for example by being disobedient, taking part in protest marches, or signing an anti-nuclear petition) grew. Research shows that between 1973 and 1975 the number of people that were worried about nuclear energy increased substantially (Verbong 2000, 261).

In retrospect, the Kalkar levy is judged as the biggest mistake the pro-nuclear lobby could have made. It reinforced the anti-nuclear movement, which was by 1973 still relatively small. The LSSK announced 1975 as the ‘year against nuclear energy’, generating a lot of attention for the subject. During 1976 and 1977 a number of anti-nuclear demonstrations would take place, such as:

- 17th January 1976: in Dodewaard, where the first Dutch nuclear energy reactor was established in 1969. (several hundred attendants)
- Late Jan., early Feb. 1976: in Borssele and surroundings. Here the second Dutch pile was established in 1973 and another was planned. (several hundreds of attendants)
• Early February 1977: in the province of Groningen, protesting against nuclear waste storage in salt-domes in the province. (about 5000 attendants)
• April 1977: in Almelo, where UCN, the Dutch nuclear enrichment facility was established between 1970 and 1973. (about 10,000 attendants)

The growth of the anti-nuclear movement also originated problems within the movement, especially after the Kalkar-demonstration of 1977. Discussions about goals, strategies, action-methods et cetera resulted in conflicts and schisms (Van den Broek and Meijnen 1977, 6-10; Van den Bosch 2006, 179-185; Abma, Jägers and Van Kempen 1981, 150-158).


Description of the event
In the late 1970s the national government decided to organize a societal debate on energy matters: the Broad Societal Discussion on Energy Policies. A steering committee was installed to organize this debate and report to the government the outcomes of it. Many discussion-meetings all over the country took place. Early 1984 the steering committee presented its end-report. The main conclusion was that a majority of the Dutch people did not want new nuclear reactors.

Type of event
Publication participation process

Case history
In 1974 the Minister of Economic Affairs R. Lubbers of the centre-left-wing cabinet-den Uyl (1973-1977) published a Memorandum on Energy [Eerste Energienota], containing the intention [beginselbesluit] to build three new nuclear reactors. This decision met societal opposition. In the procedure the public had a say in the decision regarding the impact on the location. But at these participation-meetings the growing anti-nuclear movement in the Netherlands (see also
the Kalkar-event) that had organized and included critical scientists and a growing amount of left-wing politicians, questioned the need for nuclear energy at all. Middle ground organizations, starting with The Dutch Reformed Church, encouraged the government to start a societal discussion about the desirability of nuclear energy. This idea was soon embraced by others such as the Federation of Dutch Labour Unions (FNV) and the Association of Dutch Municipalities (VNG) (Hagendijk and Terpstra 2004, 13-14).35

The formation of a new cabinet after the elections of 1977 was difficult. Although not the main issue, nuclear energy divided the political parties. There was serious political and societal impasse regarding energy matters and especially the role of nuclear energy. While opposition grew, others such as right-wing parties (Christian-democrats, liberals), leading policy makers at the Department of Economic Affairs, important parts of industry and the electricity sector still favoured nuclear energy. The oil crises in that decade emphasized the need for a firm energy policy and choices to be made to ensure the countries energy supply (Verbong 2000, 261).

During the attempts to form a centre-left-wing coalition-cabinet of Christian-democrats, socialists and liberal-democrats in the fall of 1977, it was agreed that the government would take initiatives to organize a broad-based societal discussion about the applications of nuclear energy.36 The forming of this cabinet failed however and a centre-right-wing cabinet (Christian-Democrats and liberals) was formed. It would be in place until 1981. Facing the above mentioned stalemate when it came to energy policy, Minister Van Aardenne of Economic Affairs (liberal) announced his intention (’agreement in principle’) to organize a broad societal discussion. He did so in a policy-letter of July 17th 1978. He asked the Energy Council [Algemene Energie Raad] to present a format for the consulting-project. In August 1979 the Dutch Parliament received a report from the Minister about the plan of the BMD [’opzet nota’].

According to this report the BMD would start in the autumn of 1979 as the third part (about nuclear energy) of the Second Memorandum on Energy [Tweede Energienota] was published by the government. The end-report about the project was expected in the fall of 1981.37

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However, it took until mid-July 1980 before the third part of the Memorandum was made public. In the meantime the ‘opzet nota’ was discussed in parliament in February 1980. Only at July 28th 1981 a steering committee was installed by Queen Beatrix, marking the actual start of the BMD.

The BMD was split up in two phases: an ‘information phase’ from September 1981 until October 1982 and a ‘discussion phase’ from January 1983 until December 1984. The first phase consisted of consulting specialist, stakeholders and the broad public, which was encouraged to express its opinions through a full-paged ‘bulletin’ in all large newspapers. The information that was gathered, was divided by the steering group into four topics: 1) costs of nuclear energy, 2) the structure of the electricity provision, 3) risk analysis and perception, and 4) processing and storing of radioactive waste. The information phase would end with four different scenarios for social-economic, energy and environmental policies. All over the country 13 controversy hearings about these topics were held. The scenarios functioned as input for the discussion phase. At the end of the first phase the steering committee published 50,000 copies of an extensive progress report, which was summarized ‘newsletter’-edition of 1.1 million copies (Hagendijk and Terpstra 2004, 28).

In the ‘discussion phase’ the four scenarios were discussed in hundreds of moderated discussions all over the country. Three kinds of discussions took place: 1) local discussions organized by municipalities (1811 meetings), 2) organizational discussions, organized by non-governmental organizations (1120 meetings), and 3) school debates. With about 62% of all the questionnaires that were distributed, filled in, the participation was quite impressive (Hagendijk and Terpstra 2004, 31). Nevertheless, for different reasons the discussion phase and therefore the entire BMD was judged all but a success (see below).

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38 See the interim-report of the Steering Committee, called Energie. Te belangrijk om alleen aan de deskundigen over te laten [Energy. Too important to leave to specialists alone] (1983), (for the scenarios see 157-158).
Goal of the BMD
The formulated goal of the BMD was ‘to involve the public in opinion-making on energy problems in general and the problem of nuclear energy in particular, based on information that is as complete as possible and checked on reliability.’\(^{39}\) In 1979 the Minister of Economic Affairs emphasized however that there should be no doubt that the final decision had to be made by government and parliament. In 1980 Prime Minister van Agt even announced in public that he was convinced about the necessity of nuclear energy for the Netherlands, and that the BMD was only necessary to convince the Dutch public on this.\(^{40}\)

Identification of actors
Middle ground organizations plead for a BMD in the mid-1970s. The initiatives came from:

- The Dutch Reformed Church;
- The Federation of Dutch Labour Unions (FNV);
- The Association of Dutch Municipalities (VNG)

Involved in organizing the BMD:

- The Ministry of Economic Affairs (financer of the BMD and primarily responsible)
- The Ministry of Healthcare and Environment (co-signer of the ‘opzet nota’)
- The Ministry of Social Affairs (co-signer of the ‘opzet nota’)
- The Ministry of Housing and Spatial Planning (co-signer of the ‘opzet nota’)
- The Common Energy Council (AER) (Algemene Energie Raad (AER)) (consulted by the Ministry of Economic Affairs about the layout of the BMD)
- Initiative Energy Discussion Group (Initiatiefgroep Energiediscussie)
  - This group consisted of oppositional members of Parliament and members of the anti-nuclear movement. They wrote a note with a procedure and layout for a new form of civil participation in decision making. The AER proposal for a layout drew heavily on this not note of the Initiative Group (Hagendijk and Terpstra 2004, 14-15).

- Steering group Maatschappelijke discussie Energiebeleid, members:

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\(^{40}\) *Trouw*, 14-06-1980.
The steering group was carefully composed with proponents, opponents and doubters of nuclear energy. There were five political denominations represented in the Steering group. There were scientific staffs to the Committee’s disposal (Hagendijk and Terpstra 2004, 17).

In the ‘information phase’ the Steering group gathered information and views about the topic from nuclear specialists, stakeholders and critics. The work on two of the four scenarios that were elaborated in this phase of the BMD had already started before 1981:

- The Centre for Energy Savings worked on the ‘Scenario for preservation of environment and welfare’ (using an economic model of the Foundation for Economic Research [Stichting SEO])
- The Ministry of Economic Affairs worked on the so called ‘Reference-scenario’ (using the economic model of the Central Plan Bureau (CPB). Also the other two scenarios used this model).
The Steering group consulted 260 institutes and groups in total about their opinion on energy issues. Amongst them were energy producers, energy researchers, and anti-nuclear organizations. Furthermore, organizations were subsidized to further develop their views on energy policies. For example the industrial consortium for nuclear technology Neratoom was subsidized for 1.7 million guilders.

The anti-nuclear movement was divided about contributing to the BMD (see meaning and perception below). It split the umbrella organization Anti Kernenergie Beweging (AKB) in two. Amongst the bigger organizations that joined were:

- The Landelijk Energie Kommittee [National Energy Committee] (LEK)
- The Werkgroep Energie Discussie [Working Group Energy Discussion](WED)
  - It was however very critical about the biased-character of the scenario-approach and refused to organize discussion-meetings following the format of the steering group on the ‘discussion-phase’.
- Milieu Defensie [Environmental Defence]

In the discussion phase the steering committee approached municipalities, as well as organizations that took part in the information phase and schools to organize local discussion meetings.

Perception, meaning and interpretation of the event.
The BMD met a lot of scepticism at the start. Many right-wing politicians did not want such a form of public participation about the topic. Left-wing politicians and the anti-nuclear movement had doubts about the fairness of the process and the way the government would take care of the outcomes. These doubts had several grounds. For example The Initiative Energy Discussion Group pleaded for an ‘open start’ of the BMD, but the Ministry wanted its Second Memorandum on Energy as a point of departure for the discussions. Also statements e.g. from the Prime Minister as mentioned above did not contribute to faith in an open debate. Some activists were afraid that the BMD was ‘a clever tactical move to take the wind out of the sails of the anti-nuclear movement.’ (Hagendijk and Terpstra 2004, 15-16).
Some measures were taken by the Steering group to overcome this scepticism from the anti-nuclear movement. One was broadening the scope of the BMD to opinions about the already existing nuclear facilities. Another was quitting the government Memorandum on Energy as a starting point for the discussion. Nevertheless, scepticism remained among anti-nuclear activists. Other actions of the Steering group however stirred up the distrust. For example the subsidizing instrument. The fact that the industrial consortium Neratoom and the right-wing liberal party VVD - that was no proponent of the BMD – were subsidized, while the anti-nuclear WED (see above) received only have the amount it had asked for, were seen as examples of a prejudiced steering group (Hagendijk and Terpstra 2004, 24). Also the fact that some groups were and others were not invited to the ‘controversial discussions’, as well as the changed procedures during these meetings, caused sometimes crabbedness and distrust.41

Hagendijk and Terpstra conclude that during the ‘discussion phase’ a wide gap revealed itself between the ‘broad social discussion’ and the ‘Broad Social Discussion’. The issues the broader public wanted to debate about, were not represented in the four scenarios-discussions. The way the steering group tried to manage things lead to irritations. Middle group initiators, such as the FNV and the VNG, did not cooperate in the discussion phase in the way the steering group wanted. Participants with scepticism from the start, such as the WED, refused to organize discussions about the scenarios. Also new societal issues, such as fast growing unemployment, the stationing of nuclear missiles in the Netherlands, and, amongst students, a new system of study-finance, distracted the attention from societal groups and the public rapidly. Furthermore, the new right-wing Government, seemed to take even more distance from the BMD (Hagendijk and Terpstra 2004, 35).

The conclusions of the BMD were clearly in favour of the anti-nuclear movement. The discussions had proved that the majority of the participants did not want new nuclear reactors. An immediate closure of the two existing reactors (Dodewaard and Borssele) was however not desired. Anti-nuclear organizations as the WED and the LEK, that were cooperative but sceptical about the BMD from the start, were pleasantly surprised by this outcome. Now it was

the pro-nuclear lobby’s turn to criticize the way the steering committee had operated. After a short pause, the government nevertheless, decided in January 1985 to reject the conclusions of the BMD and planned for new nuclear plants. It was backed up in its decision by the AER, who also rejected the conclusions of the BMD. This of course endorsed the anti-nuclear movement in its opinion that the Government together with nuclear industry already had decided in favour of nuclear energy and that the BMD was just window dressing. Except for some indignation with certain participants in the BMD, the Government’s rejection of the conclusion did not lead to large protests (Verhees 2012, 133-134; Hagendijk and Terpstra 2004, 38-39).

In retrospect, the BMD is seen as a failure. There was little exchange of ideas. Verbong states that the BMD was a result of the 1960s desire for more openness and public participation in decision making. However, in the early 1980s the opinions about nuclear energy were so polarized in society that genuine discussions about the topic were impossible (Verbong 2000, 262). Using comparable arguments, others qualified the BMD a very expensive opinion-poll (Van Hengel 2007). Furthermore, the conclusions were rejected by political decision makers, confirming or even enlarging the gap between politics and society.

3.5 Event 5: Renewing the High Flux Reactor at ECN in Petten

Description of the event

News of safety problems with the High Flux Reactor (HFR) at NRG in Petten from 2001 onward, led to advice to the Deputy Minister for the Environment to renew the HFR. That year the research reactor was over 40 years old and at the end of its life span. From the advice of the task force until the present day there is discussion about replacing the HFR with a new up-to-date reactor called Pallas.

Type of event

Decision making process, with forms of public consultation and participation

Case history

Late in 1961 the High Flux Reactor (HFR) for research purposes at the Dutch Reactor Centre (RCN) in Petten went critical. The HFR was based on the Oak Ridge Research Reactor. On July
25th of that year the Netherlands had agreed to hand over the HFR to Euratom as part of their Gemeenschappelijk Centrum voor Onderzoek (GCO). Euratom paid 40% of the cost. RCN became judicially and organizational responsible for the HFR. The capacity of the reactor was gradually enlarged from 20 MW thermal power to 30 MW in 1966 and to 45 MW in 1970. Until 2005 the reactor worked with high enriched uranium (HEU) supplied for by the US, and thereafter with low enriched uranium (LEU).42

Since 1972, due to an overcapacity of ‘national’ nuclear research facilities in the Euratom-countries, the HFR did not participate in any common European research-projects. The Netherlands, West-Germany and Belgium) took over the costs for the exploitation-of the HFR, in a so called additional Euratom-program.43 In the mid 1970’s the left-wing government decided to broaden the scope of RCN. The institute was also entrusted research into other energy sources and in 1976 RCN was transformed to Energy Research Centre of the Netherlands (ECN). Nuclear research within ECN faced difficult years, especially because of budget-cuttings and a deadlock in decision making (see event 4). Non-nuclear research at ECN rose from 7% in 1975 to over 30% in 1979 (Verbong, Berkers and Taanman 2005, 14-23).

In October 1979 ECN published a report with its views about the future of the HFR: Nederland en de HFR. By then (1980) the European Commission contributed about 7 million guilders to the HFR, The Netherlands and West-Germany together, about 33 million guilders. The Dutch contribution to the HFR was fully paid out of funds for energy research from the Ministry of Economic affairs. The HFR was used for research by the Netherlands (33%), West-Germany (45%), the joint European Program (GCO-P) (7%), and for the (commercial) production of (medical) Isotopes (7%) (Verbong, Berkers and Taanman 2005, 134-143). 8% of the use was not specified. The Dutch government reconsidered its contribution to the HFR in the early


1980s. Because of this reconsideration the necessary replacement of the 21-year old reactor vessel was postponed. Finally in 1985 the reactor vessel was replaced.

By 1990 the research at the HFR was still to a large degree (approx. 80%, 75 million guilders each) financed by the Netherlands (Ministry of Economic Affairs) and Germany. The additional financing was from European research-programs and a growing part from third-party research. The production of medical isotopes in the meanwhile had increased to 15%. In 1992 a new program for the HFR was established that would last until 1995. On March 30th 1992 ECN and the US-company Mallinckrodt signed a long-term agreement for the production of Molybdeen-99 (Mo-99). Mallinckrodt sells Technetium-99 (a MO-99 isotope) for medical purposes. The production of Molybdeen at ECN started in April 1996. For ECN these commercial activities of the HFR became very important, especially because Germany decided to gradually withdraw from the HFR (Verbong, Berkers and Taanman 2005, 136). In 1998 ECN decides to accommodate all its nuclear activities at the Nuclear Research and Consultancy Group (NRG), partly owned by ECN and by KEMA, the research facility of the electricity sector. In 2006 KEMA sold its share to ECN, making NRG an integral subsidiary of ECN.

In the Autumn of 2001 negative reports about bad conduct of business and violations of safety regulations at the HFR appeared in the press. The responsible Minister asked for an inspection by the Kern Physische Dienst (KFD). Early in February 2002 the Minister decided to close down the HFR temporarily (until March 2002), not because the situation is unsafe but to give NRG time to put things in order, it is communicated. Furthermore the Minister decided to ask a workgroup to advise about the importance of the HFR for the supply of medical isotopes. The workgroup presented its report in February 2003. It recommended the building of a new reactor ‘in Europe’ as a replacement for the HFR, ‘preferably at a location that possess also the other production facilities.’ The commission legitimated this recommendation because this way a total

44 Proceedings of the Dutch Parliament, Tweede Kamer (1981), 17014, nr. 4, 4; See here for more details about the research at the HFR by 1980.
dependency of Canada and South-Africa for certain medical isotopes in case of closure of the HFR is avoided.\textsuperscript{47}

In September 2003 a police raid took place at the ECN-site in Petten, because the Public Prosecutor expected violations of safety and environmental laws and regulations with ECN, NRG, Mallinckrodt and GCO (the subsidiary of the European Commission). It proved that Euratom could not be prosecuted because of international law. Shortly after, in December 2003, Euratom/NRG (the license-holders) asked for a new license for the HFR because they planned to convert from high-enriched Uranium (HEU) to low-enriched Uranium (LEU) as fuel. This was desired for by the US since the late 1970s. In January 2005 NRG obtained this new license for the HFR and in 2006 the HFR began operating on LEU.

Already in 2004 NRG had announced its ideas for a new, HFR-replacing reactor called ‘Pallas’. In June 2005 an information meeting for neighbours of NRG is organized about ‘Pallas’. Amongst other arguments, NRG pointed to economic spin-off and stimulation of employment for the region. One of the opponents of the new ‘Pallas’ reactor, who spoke at the information evening, was Diederik Samsom, since 2003 member of Parliament for the Dutch labour-party PvdA.\textsuperscript{48} He had studied nuclear physics at Delft University. In 2012 Samsom became the leader of the PvdA. Despite opposition, NRG launched the tender for the building of the new Pallas reactor in February 2006. Two years later, in February 2008, three consortia were invited to present a ‘conceptual design’ for the planned new Pallas reactor in Petten.

From August 2008 until February 2009 the HFR was closed down temporarily because of problems with the cooling system. Although the problem was not solved in February 2009, NRG got a special permit to restart the production of medical isotopes, because other producers had planned maintenance stops, and the worldwide supply of medical isotopes was endangered.


\textsuperscript{48} See: http://www.kernenergieinnederland.nl/ (retrieved 16-07-2016)
From November 2012 and June 2013 and from November 15th 2013 and February 15th 2014 the HFR was again out of use because of problems and precautionary measures.\footnote{For the special permit see: \url{http://www.kernenergieinnederland.nl/files/20090212-beschikking.pdf} (retrieved 16-07-2016); for the problems from 2012 onward see: the NRG-publication ‘De ontwikkelingen bij NRG, de markt voor medische isotopen en het vooruitzicht op PALLAS’ (June 2014).}

In November 2009 NRG a report that was in fact the procedural start for the new Pallas reactor. Argentinian-Spanish combination INVAP-Isolux was chosen to build the reactor. The plan was to build a reactor with an adjustable thermal power from 30 to 80 MW. It was however not clear by then where the reactor would be sited: most likely in Petten or in Vlissingen (near Borssele nuclear reactor). Initially it was hoped that the Pallas-reactor would be the first privately financed and commercially exploited reactor in the world. But because not enough interested partners were found NRG had to turn to the national and regional governments for funding the first stage (in February 2010 negotiations with INVAP-Isolux were cancelled because of this). Meanwhile preparations went on. In the Spring of 2011 for example inhabitants and entrepreneurs in the region were invited to two meetings with landscape-architects to browse about fitting the new reactor in the coastal landscape.

In January and July 2012 the national Government and the Province of North-Holland agreed to pay 40 million euros each for the Pallas reactor. In December 2013 a Foundation for the Preparation of the Pallas reactor [Stichting Voorbereiding Pallas-reactor] was formed, taking over the preparation work from NRG. At their website (\url{http://www.pallasreactor.com}) information and updates of the Pallas-project are published (also in English).

**Identification of actors**

Members of the workgroup to advice the Minister about the HFR in relation to the production of medical isotopes (Feb. 2003), representatives of:

- the Ministry of VROM (Ministry of Housing, Spatial Planning and Environment);
- the Ministry of VWS (Ministry of Health, Well-being and Sports);
- the Ministry of EZ (Ministry of Economic Affairs);
- the Ministry of the Dutch Association of Nuclear Medical professionals (NVNG).

Actors involved in replacing the HFR in Petten:
• Euratom, owner of the HFR (and until 2005 co-license holder)
• NRG, license-holder and operator of the HFR (Until December 16th 2013 ‘Pallas’ was a project under the NRG-umbrella)
• Foundation ECN Nuclear, shareholder of NRG
• Stichting Voorbereiding Pallas-reactor; Foundation that took over the Pallas-project from NRG on December 16th 2013.
• Ministries involved in licensing (they all signed the special production-permit for 2009-2010): - VROM (Housing, Spatial Planning and Environment); - VWS (Health, Well-being and Sports); - EZ (Economic Affairs); - SZW (Social Affairs and Employment); - V and W (Traffic and Watermanagement); - LNV (Ministry of Agriculture, Nature and Food quality) and Justice
• Province of North-Holland, licensing and co-financing of the Pallas reactor
• Kernfysische Dienst (KFD), inspection of the safety of the HFR.
• INVAP-Isolux, Argentinean-Spanish constructing combination, initially chosen to develop and build the Pallas reactor
• Tractebel Engineering (GDF Suez) is appointed Owner’s Engineer of ‘Pallas’
• LAKA-Foundation, opposes the replacement of the HFR and ‘Pallas’

Perception and meaning of the event

Updating or replacing the HFR in Petten and the building of the Pallas reactor is strongly legitimized by proponents because of the reactor’s role in the worldwide supply of medical isotopes. The availability of isotopes for medical diagnostics and therapy would be endangered if the HFR would not be replaced. Opponents however criticize the nuclear production of medical isotopes, arguing that cyclotrons can produce radioisotopes as well, much cheaper and without creating a nuclear waste problem. Furthermore the decentralized production with cyclotrons is claimed a better assurance for the supply of medical isotopes as centralized production in nuclear reactors. By publishing factsheets and counter-reports, especially the LAKA Foundation tried and tries to prevent policy makers from replacing the HFR with the Pallas reactor. Possible private investors in Pallas are also acted upon, mentioning the uncertainties and the possible saturation in the market for nuclear produced medical isotopes in
the long run, and therefore the feeble business case Pallas is built on. With the creation of a website (http://pallasproject.nl) and a Pallas-newsletter by the LAKA Foundation, preventing the replacement of the HFR seems a spearhead for the anti-nuclear movement in the Netherlands nowadays.

4. Facts and figures

4.1 Data summary

- In 2017 there is one operating nuclear power reactor in the Netherlands, located in: Borssele. It produces yearly about 4 billion kWh or 3% of Dutch electricity production.
- The Netherlands imports nuclear energy from France and Germany.
- In 2009 plans were presented to build a second reactor in Borssele. These were put on hold in 2012. Now there are no plans for new nuclear reactors.
- The closure of Borssele is scheduled for 2033.

4.2 Key dates and abbreviations

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1946</td>
<td>Establishing FOM</td>
</tr>
<tr>
<td>1951</td>
<td>Start bilateral collaboration between the Netherlands and Norway in the JEEP-project</td>
</tr>
<tr>
<td>1955</td>
<td>Establishment of the Foundation Dutch Reactor Centre (RCN) in Petten.</td>
</tr>
<tr>
<td>1957</td>
<td>The Netherlands sign the Euratom-agreement.</td>
</tr>
<tr>
<td>1957</td>
<td>Exhibition ‘The Atom’ at Schiphol.</td>
</tr>
<tr>
<td>1957</td>
<td>Publication of the Memorandum on Nuclear Energy.</td>
</tr>
<tr>
<td>1963</td>
<td>Law on Nuclear Energy.</td>
</tr>
<tr>
<td>1965</td>
<td>Establishment of the GKN.</td>
</tr>
<tr>
<td>1969</td>
<td>Opening of the first nuclear power plant in the Netherlands in Dodewaard.</td>
</tr>
<tr>
<td>1969</td>
<td>Establishment of UCN in Almelo</td>
</tr>
<tr>
<td>1970</td>
<td>Signing of the Treaty of Almelo between the Netherlands, the UK and West-Germany leading to Urenco</td>
</tr>
<tr>
<td>1971</td>
<td>Founding of the anti-nuclear grassroots Werkgroep Atoom</td>
</tr>
<tr>
<td>1972</td>
<td>License asked for the fast breeder reactor at Kalkar</td>
</tr>
<tr>
<td>1972</td>
<td>Kernenergienota [Government Memorandum on nuclear power policy]</td>
</tr>
<tr>
<td>1972</td>
<td>Anti-Kernenergienota [Memorandum against nuclear power policy].</td>
</tr>
<tr>
<td>1973</td>
<td>Opening of the second nuclear power plant in the Netherlands in Borssele.</td>
</tr>
<tr>
<td>1973</td>
<td>The Kalkar-levy on the electricity bill is introduced</td>
</tr>
</tbody>
</table>
1974 Establishment of the anti-nuclear ‘Stroomgroep Dodewaard’
1974 Eerste Energienota [First Memorandum on Energy]. A counter-memorandum was published by the Bezinningsgroep Energiebeleid.
1974 The first large-scale anti-nuclear power protest (10,000 participants) by mostly Dutch people at the Kalkar site
1978 Large protest march in Almelo. About 50,000 attended.
1980-1984 Broad Societal Discussion on energy policy.
1982 Establishment COVRA
1990 PINC is launched.
1991 The Kalkar fast-breeder project is stopped.
1996 ECN and Mallinckrodt start the commercial production of Molybdeen (medical isotope).
1997 The Dodewaard nuclear energy reactor is closed down
2003 Police raid at the ECN-site in Petten, because violations of safety and environmental laws.
2003 Opening HABOG at the Covra-site for storage of highly radioactive material.
2008 Temporary close down of the HFR in Petten (restart in 2009)
2012 The national government and the province of North-Holland decide to subsidise a new reactor at ECN in Petten
2013 The government decides to keep the Borssele pile open until 2033

Abbreviations:

BMD Broad Societal Discussion on energy policy
COVRA Central Organisation for Radioactive Waste
ECN Energy Research Centre Netherlands
FOM Foundation for Fundamental Research into Matter
GKN Joint Nuclear Energy Reactor Netherlands
IKO Institute for Nuclear Physics Research
4.3 Map of nuclear power plants and facilities

Figure 1 – A map of closed-down and active nuclear facilities in The Netherlands. The nuclear power reactor for energy still in production is the PZEM-reactor in the South-West.
### 4.4 List of reactors and technical, chronological details

<table>
<thead>
<tr>
<th></th>
<th>GKN Dodewaard</th>
<th>PZEM/EPZ Borssele</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Construction start</strong></td>
<td>01 May 1965</td>
<td>01 July 1969</td>
</tr>
<tr>
<td><strong>First criticality</strong></td>
<td>24 June 1968</td>
<td>20 June 1973</td>
</tr>
<tr>
<td><strong>First grid connection</strong></td>
<td>18 October 1968</td>
<td>04 July 1973</td>
</tr>
<tr>
<td><strong>First commercial operation</strong></td>
<td>26 March 1969</td>
<td>26 October 1973</td>
</tr>
<tr>
<td><strong>Permanent shutdown</strong></td>
<td>26 March 1997</td>
<td>-</td>
</tr>
<tr>
<td><strong>Planned operation until</strong></td>
<td>-</td>
<td>2033</td>
</tr>
<tr>
<td><strong>Reactor Type</strong></td>
<td>Boiling Water Reactor (BWR)</td>
<td>Pressurized Water Reactor (PWR)</td>
</tr>
<tr>
<td><strong>Design/ Model</strong></td>
<td>General Electric</td>
<td>Siemens/ Krafwerk Union</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Siemens AEG) 2-loops</td>
</tr>
<tr>
<td><strong>Design Net Capacity</strong></td>
<td>54 MW&lt;sub&gt;e&lt;/sub&gt;</td>
<td>495 MW&lt;sub&gt;e&lt;/sub&gt;</td>
</tr>
<tr>
<td></td>
<td>Since 2006: 510 MW&lt;sub&gt;e&lt;/sub&gt;</td>
<td></td>
</tr>
<tr>
<td><strong>Thermic power</strong></td>
<td>183 MW</td>
<td>1365 MW</td>
</tr>
<tr>
<td><strong>Owner</strong></td>
<td>BV GKN (cooperating electricity companies)</td>
<td>PZEM (provincial electricity company)</td>
</tr>
<tr>
<td></td>
<td>Since 1990: NV EPZ (owned by DELTA and RWE)</td>
<td></td>
</tr>
<tr>
<td><strong>Building costs</strong></td>
<td>Ab. 140 million guilders</td>
<td>Ab. 250 million guilders</td>
</tr>
<tr>
<td><strong>(Co)Financers</strong></td>
<td>-cooperating electricity companies</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-Ministry of Economic Affairs (11.5 million + 5 million tax-restitution)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-Euratom (18 million)</td>
<td></td>
</tr>
<tr>
<td><strong>Location choice made by</strong></td>
<td>Committee of the cooperating electricity companies (KEMA-committee Roodenburg)</td>
<td>PZEM</td>
</tr>
<tr>
<td><strong>Fuel</strong></td>
<td>Light enriched UO&lt;sub&gt;2&lt;/sub&gt;</td>
<td>Light enriched UO&lt;sub&gt;2&lt;/sub&gt;</td>
</tr>
<tr>
<td><strong>Fuel rods</strong></td>
<td>NUKEM (Germany)</td>
<td></td>
</tr>
<tr>
<td><strong>Fuel elements</strong></td>
<td>Philips (Netherlands), later from UK</td>
<td></td>
</tr>
<tr>
<td><strong>Fuel reprocessing</strong></td>
<td>Until 1974: Eurochemic (Belgium), from 1978: BFNL Sellafield (UK)</td>
<td>Cogema (France)</td>
</tr>
<tr>
<td><strong>Waste fuel storage</strong></td>
<td>COVRA (The Netherlands)</td>
<td>COVRA (The Netherlands)</td>
</tr>
</tbody>
</table>
4.5 Periodization of nuclear development

Figure 2 – A timeline of main nuclear facilities in The Netherlands

<table>
<thead>
<tr>
<th>Year</th>
<th>Positive</th>
<th>Negative</th>
<th>‘don’t know’/ status quo/ neutral (see note below)</th>
<th>negative according to the Eurobarometer(^{51})</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td>(50%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1979 (after Harrisburg)</td>
<td>(85%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1982</td>
<td></td>
<td></td>
<td></td>
<td>48%</td>
</tr>
<tr>
<td>1984</td>
<td></td>
<td></td>
<td></td>
<td>47%</td>
</tr>
<tr>
<td>1985</td>
<td>26%</td>
<td>58%</td>
<td>16%</td>
<td></td>
</tr>
<tr>
<td>1986 (after Chernobyl)</td>
<td>(85%)</td>
<td></td>
<td></td>
<td>57%</td>
</tr>
<tr>
<td>1987</td>
<td></td>
<td></td>
<td></td>
<td>54%</td>
</tr>
<tr>
<td>1989</td>
<td></td>
<td></td>
<td></td>
<td>58%</td>
</tr>
<tr>
<td>1991</td>
<td>21%</td>
<td>29%</td>
<td>45%</td>
<td>29%</td>
</tr>
<tr>
<td>1993</td>
<td></td>
<td></td>
<td></td>
<td>32%</td>
</tr>
<tr>
<td>1996</td>
<td></td>
<td></td>
<td></td>
<td>37%</td>
</tr>
<tr>
<td>2002</td>
<td>(80%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^{51}\) See: (Dekker, De Goede en Van der Pligt 2010, 31).
The Netherlands Short Country Report
July 2018

<table>
<thead>
<tr>
<th>Year</th>
<th>Pro (%)</th>
<th>Neutral (%)</th>
<th>Against (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>51%</td>
<td>44%</td>
<td>5%</td>
<td>43%</td>
</tr>
<tr>
<td>2006</td>
<td>31%</td>
<td>51%</td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>29%</td>
<td>46%</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>55%</td>
<td>41%</td>
<td>3%</td>
<td>42%</td>
</tr>
<tr>
<td>2010</td>
<td>38%</td>
<td>33%</td>
<td>29%</td>
<td></td>
</tr>
<tr>
<td>2011 (after Fukushima)</td>
<td>29%</td>
<td>51%</td>
<td>20%</td>
<td></td>
</tr>
</tbody>
</table>

Note: For the years 1985, 2007, 2010 and 2011 the question was: ‘Are you pro or against the building of new nuclear reactors in the Netherlands?’ (N = 1000 citizens of voting age). The data for the years 1975, 1979, 1986 and 2002 are from a paper-presentation (see below), with no further sources mentioned. Therefore they are placed between brackets.

In 1991 the question to the respondents was (according to the Dutch Minister of Economic Affairs who presented the outcomes to Parliament (see sources below)) whether the respondents found nuclear energy acceptable, non-acceptable or were in favour of a ‘status quo’.

For 2005 and 2008 the question was ‘Are you entirely pro, a bit pro [here interpreted as ‘positive’, auth], a bit against or entirely against [here interpreted as ‘negative’, auth.] producing nuclear energy?’ In 2006 it was also possible to vote ‘neutral’.

For the other years the exact question is unknown.

Sources:
5. References

5.1 General remarks

Much is written about the history of nuclear energy and society in the Netherlands. Many books and articles provide an overview of a certain period or from a certain angle or cover subthemes. Below a selection of the literature is presented. For the overall topic of this short country report the PhD-thesis of Verhees (2012) and the publications of Lagaaij and Verbong (1998) and Verbong (2000) were especially useful, as they provide long term scientific analyses. For the contextual historical narrative I frequently made use of these three.

Next to these, useful publications about specific topics are: Van Lente (2008) and Roodenburg (2016) about the public image of nuclear technology in the post-war years, including the exhibition “The Atom” in 1957. For Dutch nuclear policy from before WW 2 until the late 1950s - including the Dutch-Norwegian JEEP-project - see especially Van Splunter (1994). Detailed and inside information about the history of the enrichment-project and about Urenco Netherlands provide Kistemaker (1991) and Andriesse (2000). While Boskma and co-workers (1975), De Beer (1988) and Van den Bosch (2006) are very useful in understanding the opposition against Urenco and the fast-breeder project in Kalkar. Hagendijk and Terpstra (2004) is a good starter for studying the Broad Societal Discussion on energy policy.

The LAKA-foundation – Documentation and Research Centre on Nuclear Energy – has a large collection of documents about the history of nuclear energy in the Netherlands, which is partly digitized and online available (see http://www.laka.org/ and http://www.kernenergieinnederland.nl/) Although very useful the information provided is somewhat anti-nuclear biased.

Other important sources of information for this Country Report were the Proceedings of Dutch Parliament that are digitally available at http://www.statengeneraaldigitaal.nl/ and the online historical newspaper-archive from the Royal Library http://www.delpher.nl/nl/kranten. The latter is especially useful to determine – or at least get a feeling about - the impact of certain events.
5.2 Sources and literature about Nuclear Energy and Civil Society in the Netherlands

Archives:
There are several public archives that contain interesting material on the history of nuclear energy and society in the Netherlands. The list below is far from complete. Note that some archives/documents have restrictions for consulting.

- The National Archives in The Hague:
  - Archive of the Department of Economic Affairs, directorate Nuclear Energy, mainly 1956-1971
  - Archive of the Health Counsel [Gezondheidsraad], (1953) 1957-1990. Amongst others no. 3.3.81 about the Nuclear Energy Commission.

- Gelders Archive in Arnhem, Archive no. 1154: Archive of GKN Nuclear Reactor Dodewaard 1.


- Regional Archive Rivierenland in Tiel, Archive no. 1488: Municipality of Dodewaard, no. 222888 on nuclear energy and the Dodewaard Reactor. [including files about civil protests].
• Zeeuws Archive in Middelburg, Archive no. 676: Archive of the Zeeuwse Milieufederatie (ZMF) and frontrunners, 1966-2002
• Drents Archive in Assen, Archive no. 0671: A collection of files/documentation of/about the Anti-Nuclear Movement (AKB) in the Netherlands, 1973-1983

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G. Verbong et.al., Een kwestie van lange adem. De geschiedenis van duurzame energie in Nederland (Boxtel: Aeneas 2001).


G. Verbong and A. van Selm, ‘De opkomst van de antikernenergiebeweging’, in G. Verbong et.al., Een kwestie van lange adem. De geschiedenis van duurzame energie in Nederland (Boxtel: Aeneas 2001)

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