WP2

Denmark

Short Country Report

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Final Version: 18 March 2019

HoNESt History of Nuclear Energy and Society

This project has received funding from the Euratom Research and Training Programme 2014-2018 under grant agreement No. 662268.

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DIALOGIK

EHU Europos humanitarinis universitetas

TU/e Technische Universiteit Eindhoven University of Technology Where innovation starts

Friedrich-Schiller-Universität Jena

Swedish Defence University

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KTH

LUT Lappeenranta University of Technology

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CONTENTS

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, spent fuel 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.[1] 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 Denmark. Even though Denmark was home to one of the pioneers of nuclear research, Niels Bohr, the country never introduced commercial nuclear power plants. Until the early 1970s, Denmark's development conformed to the general path among developed countries. The Danes participated in the Atoms for Peace Campaign and attempted to develop their own reactor type. However, when its utilities attempted to finally introduce commercial nuclear power as a

[1] This research is part of the HoNESt – History of Nuclear Energy and Society Project. This project has received funding from the Euratom Research and Training Programme 2014-2018 under grant agreement No. 662268. The author would like to acknowledge helpful comments from project partners, the anonymous reviewers, and to express gratitude to the interviewees for their time and willingness to share their memories and recollections.

response to the oil crisis, Denmark took a different route. The decision not to "go nuclear" was taken in three steps:

First, in 1974, the Danish government proved very open to civil society concerns, advanced notably by the newly founded Organisationen til Oplysning om Atomkraft (Organisation for Nuclear Information, OOA), which organised the emerging anti-nuclear movement. The OOA demanded that the decision on nuclear power was to be taken by parliament, not simply by the relevant minister. They also called for postponing the decision, in order to allow for a public debate on energy policy more generally, as the oil crisis challenged Denmark's traditional reliance on imported oil. The government accepted this and made public funds available for a "debate on energy" to civil society via the EnergiOplysningsUdvalget (Energy Information Committee).

Second, in the summer of 1976, the Social-democrat-led government further delayed the decision to licence nuclear power plants, for two reasons: internal divisions within the party, as a consequence of the intense public debates about nuclear power, and adverse public opinion due to the well-organised campaigns of the Danish anti-nuclear movement.

Third, in 1985, the Danish parliament decided to exclude nuclear power from future energy planning. Changing positions within the political parties, adverse public opinion, and concerns about how to dispose of nuclear waste within Denmark informed this decision. However, Danish anti-nuclear activists continued to engage with nuclear power outside of Denmark. The Swedish nuclear power plant Barsebäck – near Copenhagen – remained the target of annual marches. After Chernobyl, the OOA started a campaign against "radiating neighbours", protesting against Swedish, West German and even East German reactors (Kaijser and Meyer 2018c). Most recently, public engagement with nuclear issues concerned nuclear waste from the research reactors and potential uranium mining in Greenland.

Three main analytical conclusions can be drawn, with a view to civil society and public debate, economy and democracy and the perception of nuclear power, and politics:

1. Civil society and public debate

A well-organised and non-confrontational anti-nuclear movement highlighted the risks and potential problems of nuclear power in a small country, and managed to have a strong presence in an open, publicly supported “debate on energy”, which influenced public opinion.

2. Economy and Democracy: Perceptions of nuclear power

In the public debate of the 1970s, critics represented nuclear energy as contradicting the small-scale economic structures of Denmark. They further argued that the long-lasting impact of nuclear materials affecting future generations tested the limits of democratic decision-making.

3. Politics mattered

Party politics and the divisions within parties and within the fragmented Danish party system mattered greatly for the political decision to reject nuclear power.

1. Narrative of the Historical Context

1.1. Introduction

Denmark was home to one of the great pioneers of nuclear research, Niels Bohr, whose lab played a pivotal role in nuclear fission research in the 1920s and 1930s. Bohr joined the United States Manhattan project during the Second World War (Nielsen et al. 1999, 64) and played an important role in the establishment of nuclear research in postwar Denmark, as influential chairman of the Atomic Energy Commission. Still, the country never moved towards the commercial use of nuclear power. Today nuclear power does not even feature as an option any more, and there is great ignorance about it among younger people (Nielsen 2016). Indeed, it is indicative of Danish society's engagement with nuclear power that in a recent overview of Danish environmental history, the chapter on energy did not even mention nuclear power. Only the anti-nuclear sun – designed and spread world-wide by the Danish anti-nuclear movement – is presented in a section on environmental "action" (Fritzbøger 2014, 17-20, 32).

Until the early 1970s, Denmark's development, focusing mostly on nuclear research, conformed to the general path that many developed countries followed. This included the participation in the Atoms for Peace Campaign, and the establishment of a state-funded nuclear research centre to develop its own national reactor type. However, in terms of introducing commercial nuclear power, Denmark was a rather late mover. Its main utility only went ahead with its nuclear plans in early 1974 - as a response to the oil crisis. This sparked immediate protests and controversy over the costs and benefits of nuclear power, which eventually led Denmark to take a different route. This is surprising, considering Denmark's extremely high dependence on imported oil, accounting for some 88 per cent of Denmark's total energy supply in 1970 (Jamison et al. 1990, 90). Concerns about energy independence were indeed present in the public debate about energy in the 1970s. However, unlike domestic gas and wind power, nuclear energy's claim to making contribution to energy independence did not seem convincing to many critics, given that the technology and the enriched uranium fuel material had to be imported.

The decision *not* to "go nuclear" was effectively taken in three steps:

The first step was taken in 1974, when the Danish government responded to the critique by the emerging anti-nuclear movement led by the Organisationen til Oplysning om Atomkraft (Organisation for Nuclear Information, OOA), founded in early 1974, not only to put the decision on nuclear power in the hands of parliament, but also to delay the decision, in order to allow for a public debate on an issue, that – as OOA emphasized – would entail grave societal consequences (Jamison et al. 1990, 99).

The second step was taken in the summer of 1976, the government led by the largely pro-nuclear Social Democrats under Prime Minister Anker Jørgensen decided to delay the decision to licence nuclear power plants. Two reasons motivated this decision: Against the backdrop of intense public debates about the consequences of building nuclear power plants, the Social Democratic party became increasingly divided over the issue. Moreover, the government was facing an adverse public opinion (Villaume 2012) in part due to the active campaigns of the Danish anti-nuclear movement, led by the well-organised OOA (Mez and Ollrogge 1979/1981, Section 3.5). Concerns about the storage of nuclear waste also played a role.

Almost a decade later, on 29 March 1985, the Danish parliament – not the government – took the third step. Led by the Social Democrats, then in opposition, a left-leaning alternative majority decided to exclude nuclear power from future energy planning. In order to make the decision clearly irreversible, on 30 April 1985, the Danish parliament also withdrew the planning rights and claims to the sites foreseen for nuclear power plants (Sidenius 1986, 377).

However, mainly due to Denmark's geographical location, the history of societal engagement with nuclear power did not end with this domestic decision, but turned transnational. Located barely 20 km away from Copenhagen, the Swedish nuclear power plant Barsebäck remained the target of annual marches of the OOA together with Swedish protesters from 1976 onwards. Moreover, in April 1986 Denmark was affected by fallout from Chernobyl. In its "Radiating Neighbours" campaign the OOA lobbied the government to take international action on Barsebäck, but also on power plants in West and East Germany. An OOA delegation actually visited East Berlin in the October 1986 to protest against the East German reactors on the coast of the Baltic Sea (Meyer 2016, Kaijser and Meyer 2018c).

1.2. Emerging networks of nuclear research (1950s)

The early history of nuclear energy and society in Denmark conforms very much to the standard trajectory in Western Europe, and developed countries worldwide. From 1945 onwards, in the public sphere, all things nuclear were initially very much associated with the destructive forces of the "bomb" (Melosi 2013, 118ff.). However, from the mid-1950s – supported by the United-States-led Atoms for Peace campaign, also in Denmark, an emerging network of institutions and researchers supported by the state, and by the United States government, sought to put a different spin on the nuclear issue. They highlighted the practically and economically useful aspects of harnessing the forces of the atom. Prominent among these uses was the possibility of generating electricity (Melosi 2013, 166-171). Event 1, below, will examine this process of engaging with the public in greater detail.

The development of nuclear energy in Denmark in the 1950s and 1960s was characterised by the establishment of relevant institutions and networks; efforts to develop nuclear research in a national setting at the Risø (Risø 1968) research centre – whose founding director was Niels Bohr – , and subsequently in transnational cooperation with a Swedish reactor project. These efforts mostly focused on basic research. As in many other countries this research was part of a quest to develop a "national" reactor type of its own (e.g. Switzerland Wildi 2003, for Denmark Nielsen et al. 1999). In the Danish case, the goal of a national reactor was not only motivated by industrial policy and export aims, but by ideas of national self-sufficiency in uranium. The Danish reactor was to be fuelled with natural uranium from Danish Greenland (Knudsen and Nielsen 2016, Nielsen and Knudsen 2013). These technologically very ambitious projects failed, primarily due to a lack of resources for such a large-scale research and development task. Insufficient project management skills and experience among the Risø leadership played a role as well (Nielsen et al. 1999).

Engagement with the public did not feature very prominently in the 1950s and 1960s, except in the Atoms for Peace campaign. Civilian uses of nuclear power were linked to visions of a modern, positive, science-based future, and were not yet controversial.

1.3. Actors

Who were the actors, who were part of an emerging network of promoters of utilising nuclear power in Denmark?

The central institution for developing nuclear energy was the **Danish Nuclear Energy Commission (Atomenergikommissionen, AEK)**, modelled on the American Atomic Energy Commission, and established by law in 1955 (Petersen 1996, 40). This institution emerged from the scientific establishment, the Danish Academy of Technical Sciences, with seed funding from a private foundation. The expressed aim was to participate in the Atoms for Peace programme and to obtain fissible material from the US to start nuclear research in Denmark.

While scientists took the initiative on the establishment of nuclear (research) institutions, support from the state, and by political actors proved extremely important, not least due to the high cost of nuclear research. In the 1950s and 1960s, the Danish Social Democrats were very receptive to requests from scientists. Across Scandinavian and European countries, postwar Social Democrats were highly committed to science and education as a path to modernisation, prosperity and welfare. Particularly the social democratic finance minister Viggo Kampmann, under whose auspices AEK was established, provided massive financial support to this new body's activities. In 1960, the expenditures of the AEK-administered Risø research centre accounted for 40 per cent of overall Danish technological research spending across all technology research centre (Nielsen et al. 1999, 65f).

While generously funded by the state, in its structure, the AEK remained dominated by scientists. Among its 24 members, ten were scientists from academic institutions, seven represented industry, only three were from utilities – the future users of the technology – and three from the labour unions. Personal connections mattered: the only high-ranking official who provided a link to government, Hans Henrik Koch, permanent secretary in the Ministry of Social Affairs, also happened to be a personal friend of Niels Bohr's, the chairman of the AEK until his death in 1963 (Nielsen et al. 1999, 66).

The generous funding and corporatist setup of the AEK ensured that it remained the central hub of what may be characterised as the emerging nuclear network in Denmark. Furthermore, the

AEK was also in charge of the central research establishment for nuclear research in Denmark. The **Risø Research Centre** was established on a 250 hectar ground along Roskilde Fjord not far from Copenhagen. It officially opened on 6th June 1958 (Nielsen et al. 1999, 66), and subsequently acquired three research reactors.

Given the dominance of the AEK, utilities and industry played a more limited role as actors in the emerging nuclear sector. Despite the ongoing centralisation in the 1950s and 1960s, electricity provision in Denmark was relatively decentralised (Van der Vleuten and Raven 2006). There were only two larger players: **Kraftimport**, a body established in 1954 to import electricity from Sweden and to link between regional power grids and **Elsam**, which was founded in 1956 and integrated the grid for seven power stations in Jutland and Funen in the West of Denmark. These organisations subsequently became large enough to pursue nuclear plans by the early 1970s. As a federation of utilities, the association of **Danish Electricity Providers (*Danske Elvaerkers Forening, DEF*)**, was the central association and lobbying body of the utilities.

Due to the small-scale structure of Danish industry, very few companies were interested in actively pursuing nuclear power technology. Some industrial companies from the metal industry, like **Burmester and Wain** and **Helsingør skibsværft**, had know-how in outfitting power plants and providing boilers, and were thus interested to get their share of the cake of new power plant projects.

Despite the general interest in nuclear power, utilities' and industry's primary interest in reliable and cost-efficient power plants differed somewhat from that of the scientists at Risø. Hence, in order to have a say and to counterbalance Risø's monopoly on nuclear expertise, industry and utilities, led by the DEF, established **Danatom** to "help Danish industry and utilities with information on design and construction of nuclear reactors for generation of heat and power" (quoted in Nielsen et al. 1999, 69).

The development of nuclear research in Denmark did not lead to a nuclear power plant. The initial Danish reactor project of a Deuterium-moderated, Organic-cooled Reactor (DOR), to be run with uranium from Greenland was abandoned in 1963. The Danish utilities were not interested in buying such a reactor, for a lack of demonstrable "economy and reliability".

Subsequent cooperation projects with Swedish reactor development companies and attempts to develop a Nordic reactor equally failed. Thus when Elsam started to become interested in actually building nuclear power plants in 1971, they had to rely on imported nuclear technology. After a Canadian heavy water reactor to be run on natural uranium from Greenland could not provide the necessary safety documentation, the only option remaining were light water reactors relying on imported enriched uranium (Nielsen et al. 1999, 85). This put an end to any dreams of national self-sufficiency in uranium resources.

To the public, the Risø laboratory primarily presented itself in glossy brochures featuring images of their modern buildings and installations (Risø 1968). At a time when nuclear power remained mostly a vision, rather than a reality, and was hardly challenged, such a rather passive public relations strategy seemed appropriate. However, this changed in the 1970s, when nuclear power became more controversial. The new executive director Allan R. Mackintosh pursued a more active promotion of nuclear power. Risø researchers advocated nuclear power in the public sphere and refuted any criticism voiced by members of the public or the OOA (Nielsen et al. 1999, 86). This is discussed in greater detail in case 3 below.

With Risø's role as a provider of self-made nuclear reactors dwindling, in 1967 it starting taking over a new task. Apart from training nuclear engineers, gathering expertise in safety issues, in 1967 **Risø** was turned into the **regulatory body** for the implementation of nuclear power.

However, in the growing public debate about nuclear power, from 1973 onwards, Risø's problematic dual role of being an advocate of and a control body for nuclear power became increasingly apparent. Thus, in **September 1973, a new regulatory institution** was established, still under the auspices of the AEK, **the Nuclear Inspectorate (Tilsynet med nukleare anlæg**). The ten employees of the new Nuclear Inspection however had their offices at Risø. This induced critics to continue raising objections concerning their independence (Nielsen et al. 1999, 83-84, Henningsen 2017).

1.4. Not going nuclear (1970s-)

Nuclear power rapidly became a controversial issue in the public when Elsam presented actual plans for the introduction of nuclear power in December 1973. Elsam had started studying various possible reactor sites for their suitability since 1971. Given Denmark's reliance on imported oil, Elsam perceived building nuclear plants as the best available solution to combat rising fuel prices, and problems of providing fuel for its large number of oil-fired power plants, even more so after the start of the first oil crisis.

In the Danish parliament and in the public sphere, the existing Danish legislation concerning the licensing of nuclear installations was increasingly considered inadequate with a view to introducing much larger commercial nuclear power plants. Under legislation dating back to 1962 the Minister of Education could authorize power plants without any parliamentary involvement. It was in particular this rule that the anti-nuclear movement challenged (Petersen 1996, 169-171).

By 1973/74, Danish society had increasingly become more politicised – in the wake of 1968, the referendum of October 1972 on the controversial issue of joining the European Community, and the December 1973 "landslide" elections, which had fragmented and reshuffled the Danish party system (Petersen 1996, 169-171, Hein Rasmussen 1997). Economically, the oil crisis hit Denmark hard. It was in this context that the central organisation of the Danish anti-nuclear movement, the OOA emerged.

The origins of the **Organisationen til Oplysning om Atomkraft** (Organisation for nuclear information, OOA) are somewhat coincidental. The organisation grew out of the activities of young Christians who got together for a three-day meeting in mid-June 1973 at the Danish section of the International Fellowship of Reconciliation (IFOR) in Lyngby in the North of Copenhagen. Those attending the meeting explored internationally relevant issues that they would find worthwhile to devote their attention to. Their debate focused on what they considered urgent contemporary issues relating to peace or the fight against global inequality (Forsoningsforbundet and Christiansen 1973).

During the meeting – and clearly influenced by the group's internationalism, the contemporary debate on Limits to Growth (Meadows et al. 1972) and the growing environmental concern in the wake of the Stockholm UN Conference on the Global Environment (Ecologist and Earth 1972) – they singled out growing energy consumption and the plans for nuclear power as particularly problematic developments. The young Christians voiced their concerns about what they considered problematic aspects of nuclear power. They highlighted radiation and other consequences of using nuclear fission – for the environment, but also for global peace and global inequality, and for subsequent generations – in terms of waste and the exploitation of natural resources. Against the backdrop of this discussion, they decided to campaign against nuclear power, which they considered the most "concrete" expression of their concerns about the pursuit of unlimited growth, that ignored its consequences for the environment and humanity (Forsoningsforbundet and Christiansen 1973, Christiansen 2017).

Since then, this group of mostly young people started organising and involving other groups critical of nuclear power. The Danish environmental organisation NOAH (Jamison et al. 1990) had also founded a group on nuclear power during the summer of 1973. This group included among others the science student Jørgen Steen Nielsen (Nielsen 2016), who later organized many the activities against the Swedish nuclear power plant Barsebäck (Kaijser and Meyer 2018c). After being invited to a common meeting in August 1973, this group within NOAH joined forces with the young Christians. Subsequently also members of the Danish section of the Women's International League for Peace and Freedom (WILPF) and the Danish War Resisters International (WRI) joined the OOA.[2]

OOA's founders started their activities by avidly collecting information – also from international sources – on nuclear issues, and met regularly until early 1974. When they eventually decided to set up an organisation, they chose a name which was deliberately neutral, to ensure a broad appeal and enhance credibility: Organisation for Nuclear Information – or more literally – for "enlightenment" about nuclear power (OOA 1974-1995).

[2] Additional information on the groups involved in founding the OOA, which complements the sources consulted at the Rigsarkivet, was kindly provided by Siegfried Christiansen (by e-mail, 5 February 2019).

On 31 January 1974, the newly founded OOA held its first press conference in Copenhagen, in response to Elsam's application for the licensing of new nuclear power plants. The organisation not only challenged the nuclear option, but it called for an assessment of alternative energy sources. OOA's press release warned against what they considered an undemocratic and hastily taken decision. They criticised the licensing of the power plants by the minister as a "panikbeslutning" (panic-induced decision). Instead, the OOA called for a period of reflection, of three years, "1. to examine the problems related to using nuclear power, 2. to do further research and assess again alternative energy sources, and 3. to develop a long-term energy policy, which takes ecological and social precautions" (OOA 1974) (My translation from the Danish original, JHM).

The OOA called for a broad discussion of energy policy in the public sphere, rather than behind closed doors among experts. To them, energy policy was an issue of democratic, rather than technocratic decision-making. For reasons of democracy, they demanded that the licencing should be done by Parliament and not – as the old law of 1962 foresaw – by the minister of education. They also called for the provision of public funds for an information campaign on energy – in which both the promoters and critics of nuclear power would have a say (OOA 1974).

Indeed, the Danish Parliament took decision-making about nuclear away from the minister and back in its own hands. It postponed the law about the authorisation of nuclear power plants in May 1974. On 12 June 1974, Minister of Commerce (Handelsminister) Nyboe Andersen responded to the call for an open societal debate. He established the Energi oplysnings udvalget (Energy information committee), together with the Danish People's Information Council, a highly respected educational group active throughout the entire country. This body offered resources to those who intended to organise public discussions or meetings to inform people and to debate nuclear power. (Petersen 1996, 169-171). A more detailed discussion of these activities based on original sources can be found in case study 2.

Opposition to the introduction of nuclear energy was clearly growing. OOA not only maintained a very effective central office, but also liaised with numerous grass-roots branches all across the country. Decisions were taken by consensus in regularly held national meetings (landsmøder) for which members of the different groups came together. OOA's campaigns evolved from an initial emphasis on encouraging discussion and information on nuclear power and energy policy more generally, to a more explicitly oppositional stance. In 1975, they introduced the anti-nuclear sun stickers, politely but clearly declaring: "Nuclear power. No, thanks.", which subsequently spread worldwide (Christiansen 2017). In particular, near the construction sites of planned nuclear power plants, discussions were highly controversial. Opposition and protest were growing. OOA groups used different instruments such as the collection of signatures. Near Søra on Vendsyssel on the northern tip of Jutland, and Gyllingnæs near Aarhus in Central Jutland 90 per cent and 87 per cent of the local populations (respectively) signed up against the power plant (Petersen 1996, 171-173). OOA however always remained non-partisan with a view to political parties and did not engage in violent protest (Nielsen 2016, Christiansen 2017).

National newspapers like *Politiken* and *Aktuelt* – that previously supported nuclear research – started to question nuclear power. The debate extended beyond the issue of nuclear power, In the wake of the oil crisis, concerns raised by the influential Club of Rome about the "Limits to Growth" (Meadows et al. 1972) and the rise of environmentalism (Jamison et al. 1990), the societal debate considered the entire direction of energy policy in Denmark, including its growth-orientation and growing centralisation (on the issue of centralisation see: Van der Vleuten and Raven 2006). As a response to these debates, and the activities of the OOA (discussed in case study 3, below), the Danish Atomic Energy Commission (AEK) was dissolved in 1976. The Danish government also decided to postpone the decision to licence nuclear power plants, until a solution to the problem of nuclear waste had been found (Nielsen et al. 1999, 85-87).

Protest and mobilisation continued, most notably against those nuclear power plants that "concerned" and "affected" Danes – as the contemporary parlance went (Milder 2010). These reactors were not located in Denmark, but nevertheless in the vicinity of Copenhagen, just across the Sound. The Swedish power plant at Barsebäck, which went critical in 1975, was the target of numerous marches organised by OOA from the 1970s until the 1990s. Not only

protesters crossed borders: one reason for Barsebäck's location near Copenhagen was that this location facilitated supplying both the nearby Swedish cities, exporting electricity to Denmark. Indeed, OOA marched together with Swedish partners in transnational cooperation (Storm 2014, 53-55, 60, Kaijser and Meyer 2018c). Case study 4 examines this phenomenon in greater detail.

In the face of growing and continued opposition and internal divisions within the Danish political parties , and responding to the fact that no suitable and convincing solution had been found to the issue of storing nuclear wastes, on 29 March1985 in the Danish parliament amajority led by the Social Democrats (including other left-leaning and centre-left parties) decided to exclude nuclear power from the future Danish energy mix, and on 30 April 1985 to remove the reservations from planned construction sites (Sidenius 1986, 377).

The Danish nuclear energy debate of the 1970s was special, as it involved a massive societal engagement with on energy policy more generally. This had an important effect on the long-term debate on nuclear as it spread knowledge on technical and economic issues on energy policy and nuclear power in particular, linking them to wider debates about the future of society, such as concerning centralisation vs. the benefits of small-scale, renewable and regional energy provision (Petersen 1996, 176). In the course of one decade, the continued debate led to the political decision to exclude nuclear energy from Danish domestic energy production. The import of nuclear energy notably from Sweden as part of European networks continued, though. At the same time, the energy debate led to a pioneering role in the development of wind turbine technology, in which Denmark became a world leader (Heymann 1998). This also proved societally more acceptable, because, as the contemporaries highlighted, it conformed to Danish traditions and structures of small-scale, regional energy provision (Van der Vleuten and Raven 2006).

In recent years, nuclear issues have re-emerged in Danish society, regarding two issues. First, the problem of dealing with the nuclear waste from the Risø research reactors emerged after the reactors were closed. Currently, the government is engaging in "Coordination and

Communication with Stakeholders" on this issue (Denmark 2017). Secondly, Denmark is involved in nuclear debates on uranium mining through its colonial heritage: even though Greenland has been granted home rule and it is not part of the European Union, the island is still a country of the Kingdom of Denmark. Thus the issue of uranium extraction – which is highly divisive within Greenland between those highlighting economic opportunities and those expecting of environmental harm notably with regard to fisheries, which currently make up for 90 per cent of Greenland's exports – affects political debates in Denmark, too. It is particularly controversial, as it seems to challenge the anti-nuclear consensus that emerged since the decision not to build commercial nuclear power plants in the 1980s. The title of a Danish newspaper article published in June 2016 in the context of debates and decisions in the Danish Parliament aptly summarises what critics of nuclear power view as an apparent contradiction: "Once we said ‚no thanks' to nuclear power, now Denmark will sell uranium." (Arnfred 2016 (quote, my translation, JHM), Walsh 2017, Nielsen and Knudsen 2013, Mavhunga and Trischler 2014, Knudsen and Nielsen 2016).

2. Events

As indicated above, with a view to commercial nuclear energy in Denmark itself the history of nuclear energy and society is much shorter than in most European countries, as Denmark never "went nuclear". However, the nuclear power plants built by neighbouring countries were an issue of public debate and protest in Denmark.. Thus societal engagement with nuclear power had a strong transnational dimension. These two insights inform the choice of events, along with the ambition to broadly cover different periods, and the availability of secondary literature and primary sources.

First, like in many Western publics, the campaigns of the Atoms for Peace initiative sought to promote the peaceful uses of nuclear technology in the 1950s.

The second event – the activities of the Energy Information Committee 1974-76 – provides an exceptional example of public engagement. The Ministry of Commerce (Handelsministeriet) financed an information campaign on energy policy (including nuclear power) that was not top-down, but bottom-up, and included financial support for grass-roots initiatives, rather than providing an official view which benefitted either side.

The third event is the struggle of experts in the media and public events in Denmark in the 1970s. This includes both opinion pieces and letters in major newspapers, written by advocates such as researchers from the nuclear research centre at Risø, and counter-experts, often from abroad, facilitated by the anti-nuclear movement.

The fourth event relates to the long-drawn struggle of the Danish anti-nuclear movement against the Swedish nuclear power plant at Barsebäck, only 20 km away from Copenhagen (Kaijser and Meyer 2018c).

The fifth and final event is the response of the Danish anti-nuclear movement to nuclear power projects in neighbouring countries, even on the other side of the iron curtain in the wake of Chernobyl in the late 1980s.

2.1. Event 1: Public information on energy and nuclear power in the 1950s: Great expectations

In the 1950s, the emerging nuclear energy sector, supported by many European governments and in particular the United States' government, tried to engage the public across Western countries (Melosi 2013, 166-171). At the time, in the minds of many citizens, all things nuclear were largely associated with its destructive forces epitomised by the nuclear bombs on Hiroshima and Nagasaki, and the subsequent nuclear weapons tests in far-flung places (Weart 1988). The international 'Atoms for Peace' campaign (Krige 2006, 2010), kicked off by United States President Eisenhower in 1953 sought to change this image, and highlight the peaceful uses of nuclear power, such as in providing electricity at a competitive rate. In the United States, this campaign was conducted utilising the best available methods of public relations, including Disney's movie "Our Friend the Atom" and the accompanying book of 1956 (Haber 1956).

The first 'event' to be discussed actually consists of two similar events serving the same purpose. Two exhibitions in 1955 and 1957, respectively, were both intended to promote nuclear power and celebrate the modern consumer society arriving in Denmark in the 1950s.

In Denmark, the United States-led Atoms for Peace campaign hit home with an exhibition 'The Atom in Everyday Life' ('Atomet i hverdagen') in the summer of 1955. Devised by the US Information Service (USIS) and also involving Danish nuclear scientists, the exhibition was shown in Denmark's largest cities, Copenhagen, Aarhus and Odense. The exhibition attracted some 140,000 people and 190,000 pamphlets were distributed. Opinion polls conducted after the exhibition demonstrated that 84 per cent of the respondents had "heard or read of any peaceful, non-military purposes of atomic energy" and a large majority of respondents held a positive view of atomic energy (Christensen 2002, 95).

The United States targeted Denmark, and the country's energy policy, also for Cold War security reasons. Ideas of neutralism were traditionally popular in the country, even though it was part of NATO. Neutrality would have potentially endangered the US presence in Greenland (Petersen 2013). Moreover, in terms of energy provision, Denmark was highly reliant on coal

from the Eastern bloc, particularly Poland, thus making it responsive to political and economic pressures from the East (Nielsen and Knudsen 2010, 96).

While the first exhibition was part of the international Atoms for Peace campaing and thus a transnational intervention in Denmark, the second event, two years later, was more home-grown: “Live your life the electric way!” The poster for the ‘International Electric and Nuclear (literally ‘Atom’) Exhibition’ in Copenhagen in October 1957 promoted all the advantages of the modern life and the convenience of the new electrical appliances that became available during the postwar boom. Nuclear energy was shown to provide the ‘cheap’ and readily available electricity needed for a more convenient way of life. The exhibition fit well into what is usually considered the spirit of the time, a preoccupation with modernity and with the promotion of technological advances in the 1950s. Indeed, at the time, Danish consumer society was on the rise. Growth rates of electrical energy consumption in Denmark, which had been one of the lowest in Europe back in the early 1950s, were among the highest by 1957 (Petersen 1996, 112-115). This made energy planners think of alternative sources to imported coal. From the late 1950s until 1973, however, cheap imported oil from the Middle East provided an ample and inexpensive fuel for the postwar boom (Pfister 2010). Similar to the situation in various other Western countries at the time, this substantially reduced the appetite for nuclear power until the oil crisis.

The 1957 exhibition, which was open for 10 days only, attracted 134,515 visitors (Petersen 1996, 112). A poster advertising the event nicely illustrates the spirit and imagery of celebrating science and modernity (printed off in: Petersen 1996, 113).

The exhibitions did not directly lead to any decision on nuclear power. Nevertheless they were part of the public relations campaigns that accompanied the introduction of nuclear research to Denmark and the founding of the Risø Research Center, with its three research reactors (discussed above).

The event’s importance was not widely recognised at the time. Indeed I selected the event in retrospect, in line with the conventions of a nuclear historiography that tends to stress the importance of the ‘Atoms for Peace’ campaign. At the same time, the actors involved, such as

the cultural attaché of the American embassy, of course highlighted the importance of their own actions and their impact on the course of history: "It [the exhibition] came here at a most opportune time, as we all know, Denmark just recently embarked upon a program of all-out support for developing the potentials of nuclear energy. To what extent President Eisenhower's Atoms for Peace proposal has something to do with these Danish developments I can, of course, not say. But I wouldn't be surprised if there were some loose, hard-to-defined causal relations between the two – something in the nature of a mild chain-reaction…" (quoted after: (Nielsen and Knudsen 2010, 96)).

A detailed analysis of these two events is provided in the following table:

Event 1	**Public information on energy and nuclear power in the 1950s: Great expectations** **a) exhibition 'The Atom in Everyday Life' ('Atomet i hverdagen')** Exhibition demonstrating the potential uses of nuclear applications **b) The International Electric and Nuclear (literally 'Atom') Exhibition' in October 1957** Presenting electrical appliances, their practical use in the household. Nuclear power, which is presented in models and drawings is shown to produce the electricity.
Actors: Who was involved (refer to table of potential actors, above)? **Q1:** Who are the main actors for and against nuclear energy involved in the event and what are their political connections?	**Q1:** a) & b) the promoters had the full support of the governments (US, DK) involved Promoters: - National government institution from foreign country: United States information service (USIS) (i.e. transnational dimension) - Scientific body: researchers from the emerging state-funded Risø Nuclear Research Center (set up to develop and promote nuclear power) Promoters: - Companies: Danish electricity providers, Danatom (a private company, for the commercial exploitation of nuclear energy, founded in 1956) - Scientific body: the state-funded Risø Nuclear Research Center (set up to develop and promote nuclear power) - Association (of different players), the Danish Nuclear Energy Commission (AEK); Danish industry associations

Q2: How did the involvement of these actors change over time?	**Q2:** No change at this point, as this was a short-term event.
Q3: Did networks and alliances of actors play a role for this event: If yes: What alliances were formed? Which actors treated which other actors (explicitly or implicitly) as opponents? What transnational cooperations/alliances/flows of information took place?	**Q3:** At the time, a close-knit network emerged among those involved in the new technology in Denmark, and towards the United States, the technological leader, providing state of the art technological, scientific and PR know-how, as well as organisational models, such as the institution of the Atomic Energy Commission (AEK). For details on the actors, see Section 2 Narrative, above).
Q4: Which actors were the "regulators" for this event? What was the level of "trust" they enjoyed?	**Q4:** A distinction between regulators and promoters cannot be made at this early stage.
Q5: Did changing involvement (state/private) change public opinion/trust?	**Q5:** The issue of change in trust due to state and private involvement cannot fully be answered with the information available: The poll data quoted above (Christensen 2002, 95) only suggest growing familiarity with the issue of nuclear power, and a majority positive view, which the organisers of the event of course attributed to their own actions.
When and where did it take place?	Summer 1955, Copenhagen, Aarhus, Odense (Denmark's largest cities / metropolitan areas in the different parts of the country); 18-27 October 1957, Copenhagen
Public Engagement: What type of process was it (communication, consultation or participation)? How did this change over time?	
Q1: What type of public engagement was employed, if any?	**Q1:** Both events involved a Public Communication process, with information being provided and conveyed to a public, in a **top-down communication** process, relying on commercial advertising techniques, and the exhibition of nuclear and electrical energy and appliances.
Q2: How did PR/public engagement by the nuclear establishment change over time?	**Q2:** For these two events, it is not possible to observe change. Beyond the event itself, in any case, the US actors do not continue to be present subsequently. The Danish actors continue to promote nuclear power until the 1980s.
Q3: Who is the initiator of the event? (Promoters, Opponents, State or authorities, mixed origin)? What kind of events did they initiate?	**Q3**: Event is initiated by promoters, involving exhibitions and the distribution of information materials.

Q4: Is there evidence of some type of process of *interaction* between the "promoters" and the potentially "affected" people/stakeholders? What kind of interaction? How did this change over time?	**Q4:** The type of interaction renders the public a passive recipient that was to be taught a lesson they were expected to accept.
Q5: Were the events "evaluated"? If so, how? What claims have been made for their success/failure?	**Q5**: As mentioned in the text above, the events were accompanied by opinion polls, which demonstrate an increase in knowledge about and support for nuclear power.
Arguments and Behaviour: What rationale was given by the party that implemented the engagement (if any)?	
Q1: What kind of nuclear-civil society interactions can we distinguish in the broadest sense? Is there any explicit social conflict? What kind? Among which actors? Why? Was there violence or use of force? What sort of protest behaviour took place?	**Q1:** There is no explicit conflict. At the time, nuclear energy was uncontroversial (unlike nuclear weapons were at the time). However, texts and speakers implicitly anticipate arguments about nuclear fission's destructive potential in military technology that citizens are familiar with.
Q2: Who was against nuclear energy? How did they operate, and did they learn from experience? Is there evidence of (reluctant) tolerance / acceptance? What are the main issues/conflicts for those against nuclear energy (e.g. weapons, safety)? What is the promoter narrative? How does this narrative resonate with other actors, e.g. the media? How did it change over time?	**Q2:** There is only information on the behaviour and the discourse of the promoters, not of the affected populations, who probably broadly accepted and tolerated what they were shown. The events provided a forum for a promoter narrative of: Progress, prosperity, convenient and modern life, and the contribution to this made by nuclear energy – soon to be introduced in Denmark: Veteran Danish nuclear scientist Niels Bohr emphasized the following issues in the introduction to the exhibition's catalogue (Petersen 1996, 112-115): the new perspectives that the availability of the enormous amounts of energy available from nuclear power meant, the great challenges the new technology posed to industry and science, and the need to inform a broader population of these challenges and their contribution to society.
Q3: How has government (etc.) responded to resistance? How did government behave towards promoters and supporters of nuclear energy? Which were the main arguments (supporting points of view, justifying behaviour)? How were these arguments framed (relating to larger societal conflicts, the economy, visions of the vision etc.)?	**Q3:** not applicable, as there is no reported incidence of resistance.

2.2. Event 2 / Showcase: The Energi oplysnings udvalget (Energy Information Committee: a public information initiative) 1974-1976.

As a response to the oil crisis, in 1973 the Danish utility Elsam submitted plans to build nuclear power plants. In dealing with the issue of licencing, the Danish Parliament took an important decision. Instead of giving full support to these plans, not least under the pressure of growing protest of the newly founded, but very active *Organisation til Oplysning om Atomkraft* (Organisation for Nuclear Information, literally, 'Organisation for the Enlightenment about Nuclear Power', OOA)(OOA 1974), it decided to postpone the decision in the summer of 1974, and take time for public engagement and debate about the future of Denmark's energy provision.

Thus, Members of Parliament accepted the OOA's claim that more public information and debate on the advantages and disadvantages of nuclear power were necessary. The Ministry of Commerce (*Handelsministeriet*) set up the *Energi oplysnings udvalget* (Committee on Energy Information). This body was to organise debates via educational institutions, in part to depoliticise the issue and turn it into an issue of knowledge and education. It offered grants to groups and organisations applying for money to fund information meetings, discussion groups, or invite foreign experts on nuclear power (Geertsen 1974-1976). Minister of Commerce Minister Nyboe Andersen set up the *Energi oplysnings udvalget*, after consultation with the Danish Council for People's Information (*Dansk Folkeoplysningssamråde*t), the country's highly respected institutions of further education. It was administered by Uffe Geertsen, whose background was in engineering, which he taught at a people's "high school" (højskole – further education institution). Thus the *Energi oplysnings udvalget* became linked with those educational organisations, which were part of the "high school (højskole) movement". Founded in an age of educational reform in the 19th century, these people's high schools were well-established in public education in Denmark. They are a Danish particularity, offering elements of post-secondary education to everyone, and enjoyed enormous respect for their work in informing and engaging with citizens (Mejlgaard 2009, 487f). Rather than relying on state-of-the art public relations, as in the case of the Atoms for Peace campaign, the *Energi oplysnings*

udvalget's work was to be conducted in a grass-roots manner (Petersen 1996, 170-171). Citizens and groups could apply for funding to organise "meetings, study circles, exhibitions or other information activities". The Energi oplysnings udvalget offered "recommendations of possible topics for study circles, evening lectures or debates", they sent out "lists of relevant literature and films, slides and exhibition materials", and for "presenters and study circle teachers". Finally, they prepared a project "the energy-right town (energi-rigtig by)", and provided funds for citizens to explore energy consumption and potential energy savings and improvements in energy provision/consumption in their own town (Energioplysningsudvalget 1975b).

Groups from the "high school (højskole) movement" involved in these activities not only advanced the debate about energy across Denmark, but also started searching for alternative sources of energy. These groups contributed subsequently to the very successful development of reliable and efficient wind turbines in Denmark in the latter half of the 1970s (Rüdiger 2014, Heymann 1998).

The *Energi oplysnings udvalget* not only funded events and public meetings, it also published a six volume book series on energy policy, in which the pros and cons of the different existing and potential future energy resources were comprehensively discussed. The editors aimed at a well-balanced presentation of all the arguments at hand and at an account that was comprehensible for non-experts (Henriksen 1975, Geertsen 1975b). The second book of the series was entirely devoted to nuclear power, presenting the views of different actors, including labour unions, utilities, industry and consumers. The nuclear issue was also mentioned throughout the other volumes (Geertsen, Henriksen, et al. 1975, Energioplysningsudvalget 1975a, Degnbol et al. 1975, Geertsen, Algreen-Ussing, et al. 1975, Bondesen et al. 1975, Geertsen 1975a).

This "event" did not directly lead to any decision. However, the two years process of debate on energy, the controversy about and growing opposition to nuclear power (also reflected in poll data (Villaume 2012)) clearly informed the Danish government's decision not to go ahead with nuclear energy in 1976 (see discussion above). I chose the event as an exceptional example of grassroots, but state-sponsored engagement, with very few strings attached. The event itself was not recognized so much by the contemporaries as "historical", nevertheless as an important

national exercise at a turning point in energy policy (Geertsen 1975b), after the end of cheap imported oil. The event is not very much recognised in subsequent debates. Some of the historical overviews on the issue of nuclear energy policy do not mention it (Villaume 2012).

Event 2	**The Energi oplysnings udvalget 1974-76 (a public information initiative, which sponsored grassroots initiatives' information and engagement activities on energy policy including nuclear power)**
Actors: Who was involved (refer to table of potential actors, above)? **Q1:** Who are the main actors for and against nuclear energy involved in the event and what are their political connections?	*Energi oplysnings udvalget*, a state-sponsored office funding events and consultation on nuclear energy, organised by grassroots and public education groups, including the OOA. It also published books on energy issues. **Q1:** Promoters: (present at events, views included in books) - Companies: Utility Elsam, which planned to build four nuclear power plants, e.g. its director E.L. Jacobsen (Jacobsen 1975) - Scientific body: researchers from the state-funded Risø Nuclear Research Center (set up to develop and promote nuclear power), such as C.U. Linderstrøm-Lang co-authored overview of the nuclear issue within Energi oplysnings udvalget's book on nuclear power(Linderstrøm-Lang and Meyer 1975); - Scientific body: Researchers from the: Niels Bohr Institute (Elbæk 1975) - Association (of different players), the Danish Nuclear Energy Commission (AEK); Atomenergikommission: Henning Sørensen, Physicist, advocating the use and the ready availability of uranium from Danish Greenland (Sørensen 1975) - Companies: Industry (Foss 1975): supportive, but not uncritically supportive - Interest organizations: including labour unions (Møller 1975) - Interest organizations: Newly founded (in 1976) – with support from Risø and the Niels Bohr institute (Elbæk 1975) – pro-nuclear association in Real Energy Information (Reel Energi Oplysning, REO)(Villaume 2012). - Political parties: Individual party members, like Social Democratic MP Morten Lange, who in 1976 considered opponents to nuclear power as driven by

"religious zeal" and "emotions"(Villaume 2012)
- Media: Local and more conservative newspapers (including Berlingske Tidinge) supported nuclear power (Villaume 2012)

Receptors / Affected people (mostly opposing)
- Scientific body: Individual actors other co-author of the overview of the nuclear issue within Energi oplysnings udvalget's book on nuclear power: Professor Niels I. Meyer from Denmark's Tekniske Hogskole (Danish Institute of Technology). Meyer took a more critical position,(Linderstrøm-Lang and Meyer 1975).
- Interest groups: Organisation for Nuclear Information (Organisation om Oplysning til Atomkraft, OOA) and its representatives. They contributed to the books (Christiansen 1975). Their local groups also organised events and very actively drew on Energi oplysnings udvalget's money (Geertsen 1974-1976).
- Educational groups from the Danish people's educational council (Dansk Folkeoplysnings Samrådet) and from the "high school movement" organised events, drawing on the funding from the Energi oplysnings udvalget (Geertsen 1974-1976)

As concerns the political connections, while the pro-nuclear actors enjoyed substantial state/government support initially, this support was waning, as notably the social democrats were increasingly facing opposition and polls indicating the diminishing support for nuclear. Individual social democrats, like above-mentioned Morten Lange publicly defended nuclear power as the energy of the future.

Interestingly enough, within scientific bodies, but also across different associations and groups, there is substantial pluralism, no uniform commitment to nuclear power, but a rather open search for the most suitable and least expensive (in the long run) solution to Denmark's energy dilemma.

Q2: How did the involvement of these actors change over time?

Q2: The involvement of the OOA definitely was able to expand, between its foundation in 1974 and 1976, due to the supportive political opportunity structures (Kolb 2007, Kriesi 2007) and in particular the resources (Edwards and McCarthy 2007, Jenkins 1983) made available for "nuclear information" via the *Energi*

	oplysnings udvalget. Hence, it does not come as a surprise that in parliament, notably among the pro-nuclear Conservative people's party, the activities sponsored by the *Energi oplysnings udvalget* were increasingly perceived as state-funded support for anti-nuclear activism. While the social democrats defended the *Energi oplysnings udvalget* in the debate, they did not continue its funding for another year (Petersen 1996, 171). Hence this did not develop into a longer-term exercise of public engagement. However, the activities had reached and involved some 150,000 Danes.
Q3: Did networks and alliances of actors play a role for this event: If yes: What alliances were formed? Which actors treated which other actors (explicitly or implicitly) as opponents? What transnational cooperations/alliances/flows of information took place?	**Q3:** It is hard to trace networks at this stage, as the nuclear cleavage was only emerging at the time. Clearly, the book projects, and the various events, offered plenty of potential for network building. International involvement and transnational exchange, such as the invitation of foreign (counter-)experts (see next event) was greatly facilitated by the sponsorship available through the *Energi oplysnings udvalget.* There were also alliances involving political parties, scientific bodies, and utilities, on the other side: The REO was build up through a network involving the venstre partiet's energy commission, actors from Risø (Per Brøns, O. Walmød-Larsen), from Elsam (Søren Mehlsen) and from the Niels Bohr institute (Prof. Bent Elbek, (Elbæk 1975)). The organisation only had a membership of 1100 people and associations (by 1978), which ensured substantial funding (340,000 DKK in 1977). (Petersen 1996, 176-177)
Q4: Which actors were the "regulators" for this event? What was the level of "trust" they enjoyed?	**Q4.** There were no regulators for these events per se, except for the parliament (providing the funding) and the Handelsministeriet (the Ministry of Commerce), under whose auspices the money was disbursed. However, at this time, the role of the Atomic Energy Commission and Risø as the future regulators of nuclear power plants was controversially discussed and the relevant laws were changed to improve independent regulation of nuclear facilities.
Q5: Did changing involvement (state/private) change public opinion/trust?	**Q5.** The involvement of various actors in the debate did most likely contribute to a more comprehensive

	understanding of nuclear power, and a loss of simple trust in its potential benefits (Christiansen 2017).
When and where did it take place?	1974-1976, with events taking place across Denmark, sponsored by the *Energi oplysnings udvalget*
Public Engagement: What type of process was it (communication, consultation or participation)? How did this change over time?	
Q1: What type of public engagement was employed, if any?	**Q1.** The events and publications of the *Energi oplysnings udvalget* allowed for participation, as they were initiated by groups of affected citizens (opponents). Often the events financed involved talks by experts and counter-experts, but also discussion among participants on energy policy, e.g. during a weekend seminar, organised by a civic education group, which frequently involved a lot of discussion.
Q2: How did PR/public engagement by the nuclear establishment change over time?	**Q2.** Change over time is impossible to trace during these short-lived events.
Q3: Who is the initiator of the event? (Promoters, Opponents, State or authorities, mixed origin)? What kind of events did they initiate?	**Q3:** While there was state-funding, the individual events sponsored by the *Energi oplysnings udvalget* were organised by grassroots groups – including local OOA groups. The kinds of events included discussion groups, weekend seminars, or talks of invited experts.
Q4: Is there evidence of some type of process of *interaction* between the "promoters" and the potentially "affected" people/stakeholders? What kind of interaction? How did this change over time?	**Q4**. The interaction between proponents and opponents in the book projects demonstrates considerable respect for the position of the other one, and involved cooperation. For the events, it is hard to trace exactly how the proponents and opponents interacted, and how seriously they took citizens' concerns, as there are no records of these meetings available to me. Such records would be necessary to analyse the engagement process in greater detail.
Q5: Were the events "evaluated"? If so, how? What claims have been made for their success/failure?	**Q5:** The event was not formally evaluated. When deploring its discontinuation, the organisers mentioned that they reached 150,000 people.
Arguments and Behaviour: What rationale was given by the party that implemented the	The decisions of the Danish Parliament and of the Ministry of Commerce allowed for a wide, open, and

engagement (if any)?	multi-faceted debate, by funding events organised by a variety of educational bodies. Funding was also available to anti-nuclear groups, which helped them, given their lack of institutional funding that the established nuclear sector had, e.g. through the research centre at Risø.
Q1: What kind of nuclear-civil society interactions can we distinguish in the broadest sense? Is there any explicit social conflict? What kind? Among which actors? Why? Was there violence or use of force? What sort of protest behaviour took place?	**Q1:** There was substantial conflict about the issue of introducing nuclear power to Denmark, however, no use of force. At this stage, the information campaign involved discussion and public information, within schools, weekend retreats, educational centres, rather than protest and taking the streets.
Q2: Who was against nuclear energy? How did they operate, and did they learn from experience? Is there evidence of (reluctant) tolerance / acceptance? What are the main issues/conflicts for those against nuclear energy (e.g. weapons, safety)? What is the promoter narrative? How does this narrative resonate with other actors, e.g. the media? How did it change over time?	**Q2:/Q3:** Parts of the government, as well as the utility Elsam, supported the introduction of nuclear power in Denmark, as did the Risø research centre. They argued for nuclear as an alternative energy source after the end of cheap oil. Initially, there was a great deal of acceptance and tolerance. Many critics argued that this wasdue to a lack of knowledge. Indeed, there is little evidence of book and publications on nuclear energy before 1974. Even the first book of the promoters only appeared in 1974, highlighting that indeed this was the first such publication, responding to the beginning of the debate in 1973/74 (Korsbech and Ølgaard 1974, 7-9). Basically, the main issues of the debate were the following (Linderstrøm-Lang and Meyer 1975, 12-18): Pro: - To ensure cheap and reliable energy provision in the face of rising oil prices and problems of availability. - There is no alternative (TINA-argument): with growing consumption, and no more cheap oil, nuclear is the only option available. - Trust in technology arguments: - Accidents are unlikely, and with growing technological knowledge, can be prevented more effectively. - There will be technical solutions to the nuclear waste problem. Against: - The issue of nuclear waste and the need to protect it for a very long time. - The risk of accidents and the large-scale damages that such accidents may involve. - The societal consequences of nuclear power, with a
Q3: How has government (etc.) responded to resistance? How did government behave towards promoters and supporters of nuclear energy? Which were the main arguments (supporting points of view, justifying behaviour)? How were these arguments framed (relating to larger societal conflicts, the economy, visions of the vision etc.)?	

view to societal structures and democracy. The argument suggests that use of nuclear power leads as a consequence to the necessity to impose protection for nuclear installations, and to centralize decision making and economic power – the "nuclear dictatorship" or nuclear superstate ("Atomstaat") argument. Rather than centralising, and committing to ever larger structures, society should opt for local small-scale energy provision.

- The "Limits to Growth" (Meadows et al. 1972)-argument: since endless growth is not possible, the way forward should be energy saving and renewables.
- "It's the society, stupid" – argument: The long-term societal implications of nuclear power were so grave, that these issues are for society, not for technicians, to decide (Nielsen 2016).

It is near impossible to assess how these arguments resonated with the wider public, as no detailed information and analyses from contemporary surveys exists.

The debate of the 1970s can best be illustrated by the "stickers' war" between three different Danish associations, active in the discussion on Denmark's future energy provision:

- the Organisation for Nuclear Information, OOA (rejecting nuclear power ("no, thanks")), [http://www.ooa.dk/ ;they discontinued their work in 2000]
- the Organisation for Renewable Energy (Organisationen for Vedvarende Energi (OVE)) OVE (advocating "sustainable (=vedvarende)" energy (which had emerged in the context of OOA in 1975, and is today called Vedvarende Energi; https://www.ve.dk/ and
- the association Real Energy Information REO (advocating nuclear power ("Hvad ellers?="what else?"). Founded in 1976, since 2012 they are called Ren Energi Oplysning (=Clean Energy Information), advocating nuclear energy as CO2-free. Accordingly their present-day sticker says: "Atomkraft – CO2-fri energi", encircling a green heart-shaped nuclear symbol): http://www.reo.dk/).

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2.3. Event 3: The struggle of experts (conducted in Danish newspapers among pro-experts from Risø vs. anti-nuclear activists and counter-experts from abroad (1970s))

Controversies about environmental issues tend to rely heavily on scientific and technical expertise (Sörlin 2013). This also holds for nuclear debates – as examples from various countries demonstrate (Topçu 2008, Weish 2013). In the discussion about the introduction of nuclear power in Denmark from 1974 onwards, both sides heavily drew on experts. The advocates of nuclear energy relied on their own technical and scientific expertise, available notably at the nuclear research centre at Risø. By contrast, the OOA invited various counter-experts from abroad, to gave talks and to participate in public discussions, challenging public authorities to engage with the issue. The list of anti-nuclear experts invited – presented below – looks like the "who's who" of international nuclear critics, and demonstrates the excellent transnational connections the OOA established from its very beginnings. In the conflict, OOA sought to benefit from the key resources (Edwards and McCarthy 2007) these scientists provided, notably scientific credibility and legitimacy. For instance, on a poster advertising an "evening debate" on 22 April 1976 on "Nuclear energy – putting the future at stake", Hannes Alfvén was presented as "Swedish physicist, professor and Nobel price winner" next to the more political description as "the pioneer of global nuclear critique" (OOA 1976). Furthermore, foreign experts were often invited, since they were not part of the domestic conflict, and thus enjoyed greater credibility (Weish 2013).

At the same time, advocates of nuclear energy, engaged in campaigns in newspapers, writing book reviews, opinion pieces and letters to the editor, challenging the scientific credibility of the experts the OOA presented. Among them, Risø engineer Heinz Hansen (OOA 1974-1989), who was also a founding member of the pro-nuclear REO (Reel Energi Oplysning) (Oplysning 2016), was one of the most active pro-nuclear experts.

This “event” is again actually a series of events or a continuous event. It can only be loosely linked to the decision of the government to postpone the decision of introducing nuclear power, as the debate involving experts extended beyond that 1976 decision well into the late 1970s. Thereafter the invitation of counter-experts became less frequent.

These events were covered by the media – or actually took place within the media’s comment pages or letters to the editor. Hence a certain contemporary relevance in the public sphere can be assumed. None of these events were considered historical, or became a point of reference, neither then, nor in retrospect.

The following list of events with foreign experts the OOA organised between 1973 and 1991 draws on the files of the OOA (OOA 1973-1980):

Date	Invited Expert	Location
21.11.1973	Björn Gillberg	Copenhagen
14.12.1973	Dean Abrahamson	Lyngby - DTH
16.04.1974	Thorkild Bjørnvig Prof. Ove Nathan, Niels Bohr Institut Arne Schiøtz	Copenhagen
21.05.1974	Björn Gillberg Arthur Tamplin	Copenhagen
26.10.1974	Myron Cherry	Copenhagen
28.11.1974	Dean Abrahamson	Copenhagen
2.03.1975	Henry Kendall	Copenhagen
28.04.1975	Amory Lovins	Copenhagen
22.04.1976	Hannes Alfvén	Copenhagen
22.04.1977	Dean Abrahamson	Copenhagen
25.-27.04.1977	Amory Lovins	Lyngby
10.05.1975	Heldagsmøde Alternative Energikilder = One-day meeting on alternative energy resources	Copenhagen
13.06.1977	Robert Pollard	Copenhagen

27.01.1978	Frank von Hippel	Copenhagen
20.02.1978	Amory Lovins	Copenhagen
29.03.1979	Klaus Traube	Copenhagen
08.04.1979	Robert Jungk	Copenhagen
03.05.1979	Amory Lovins	Copenhagen
21.08.1979	Alice Stewart	Copenhagen
30.10.1979	Karl Morgan, George Kneale, Alice Stewart, Rosaly Bertell	Event “Kraeftrisiko ved lave strålingsdosis” = Risk of cancer due to low-level radiation
26.11.1979	Kitty Tucker	Copenhagen
03.03.1980	Donald Geesaman	Copenhagen
8.03.1980	Robert Pollard, Daniel Ford and Steven Nadis, Union of Concerned Scientists	Copenhagen
19.03.1980	Carl Johnson	Copenhagen
09.05.1984	„Alternativ Energiplan 1983“ (Frede Hvelplund, Klaus Illum, Johannes Jensen, Niels I Meyer, Joergen S. Nørgaard, Bent Sørensen)	Copenhagen
26.02.1991	Chernobyl-Photographer Alexander Salmygin	Copenhagen

Event 3	**Mobilisation of counter-expertise through events with foreign experts and the mobilisation of pro-nuclear expertise by Risø employees/REO to challenge and at times**
Actors: Who was involved (refer to table of potential actors, above)? **Q1:** Who are the main actors for and against nuclear energy involved in the event and what are their political connections?	**Q1:** Promoters: *Scientific bodies*: Risø research centre employees, e.g. Heinz Hansen, who wrote opinion pieces etc. In the 1970s, the Risø research centre was the well-connected hub of nuclear expertise and advocacy in Denmark. *Interest groups*: pro-nuclear Reel Energi Oplysning (Real Energy Information), founded in 1976, with Heinz Hansen being one of the founding members(Oplysning 2016) There were network ties and overlapping memberships between Risø, the Niels Bohr Institute/Institute for Theoretical Physics (via Bent Elbek, another founding member of REO) and REO (Oplysning 2016). Receptors / Affected People *Interest groups*: OOA (Organisation for Nuclear Information), who mobilised Scientists as experts OOA maintained manifold transnational connections with anti-nuclear groups in Europe (Meyer 2014)
Q2: How did the involvement of these actors change over time?	**Q2.** Change over time is hard to establish. It seems that the conflict tended to harden.
Q3: Did networks and alliances of actors play a role for this event: If yes: What alliances were formed? Which actors treated which other actors (explicitly or implicitly) as opponents? What transnational cooperations/alliances/flows of information took place?	**Q3.** For networks, see answer to question 1.
Q4: Which actors were the “regulators” for this event? What was the level of “trust”	**Q4.** While Risø was initially expected to become the regulator, this role was withdrawn from it (see

they enjoyed? **Q5**: Did changing involvement (state/private) change public opinion/trust?	above), also due to a lack of trust in their independence. **Q5.** On the basis of the evidence available, changes in trust in public and private actors were not relevant. Generally, many contemporary anti-nuclear activists were sceptical towards the intermingling of public and private interests, and more generally in the profit-interest of private companies.
When and where did it take place?	1973 until 1991, events mostly in Copenhagen, at times also elsewhere, in national media
Public Engagement: What type of process was it (communication, consultation or participation)? How did this change over time?	
Q1: What type of public engagement was employed, if any?	**Q1:** The type of public engagement employed by the promoters, who also initiated this communication, in this case was public communication, mostly in the media. The critics of nuclear energy, who initiated these events, inviting counter-experts for evening or weekend discussions, routinely also started out with public communication, with a talk by the expert. However, often the debates actually had an interactive format, conforming rather to the model of public participation.
Q2: How did PR/public engagement by the nuclear establishment change over time?	**Q2.** Change cannot be established on the basis of the documents available.
Q3: Who is the initiator of the event? (Promoters, Opponents, State or authorities, mixed origin)? What kind of events did they initiate? **Q4:** Is there evidence of some type of process of *interaction* between the "promoters" and the potentially "affected" people/stakeholders? What kind of	**Q3**: Both promoters and opponents could initiate an event. Often opponents (i.e. OOA) organised events with foreign experts. Debates in the letters to the editor sections could be started by either side, provoking a response from the other side. **Q4.** In the case of the newspaper articles by researchers from Risø, this involves a discussion – and usually dismissal – of the information, knowledge and views of nuclear critics.

interaction? How did this change over time?	When opponents initiated events, they often sought to invite public authorities, and criticised public authorities for not being willing to engage.
Q5: Were the events "evaluated"? If so, how? What claims have been made for their success/failure?	**Q5:** There is no information available on this, but we can assume that they were at least informally evaluated.
Arguments and Behaviour: What rationale was given by the party that implemented the engagement (if any)?	
Q1: What kind of nuclear-civil society interactions can we distinguish in the broadest sense? Is there any explicit social conflict? What kind? Among which actors? Why? Was there violence or use of force? What sort of protest behaviour took place?	**Q1.** Conflict played out in a war of words, not in violence or use of force. The foreign counter-experts mobilised by OOA clearly highlighted the perceived risks and problematic implications of nuclear power. Conversely, supporters of nuclear power, like Heinz Hansen (OOA 1974-1989), often dismissed the credibility of these counter-experts.
Q2: Who was against nuclear energy? How did they operate, and did they learn from experience? Is there evidence of (reluctant) tolerance / acceptance? What are the main issues/conflicts for those against nuclear energy (e.g. weapons, safety)? What is the promoter narrative? How does this narrative resonate with other actors, e.g. the media? How did it change over time?	**Q2:** Clearly, in this debate in which highly motivated actors engaged on both sides, who believed in their cause with substantial zeal, there is no evidence of acceptance or tolerance. While the prominence of different arguments (see Q3) changed over time, the confrontational style did not give way to acceptance or tolerance.
Q3: How has government (etc.) responded to resistance? How did government behave towards promoters and supporters of nuclear energy? Which were the main arguments (supporting points of view, justifying behaviour)? How were these arguments framed (relating to larger societal conflicts, the economy, visions of the vision etc.)?	**Q3:** Arguments of the promoters of nuclear power were often politically framed. Three features were most prominent: Critique of the scientific credibility of those counter-experts, attacking the quality of their science (what more recently has been characterised as the "junk science" argument in the US context (Oreskes and Conway 2010) - critique of their political position, e.g. by denigrating them as unreliable left-wingers, who only criticised western corporate nuclear power, and forgot about the dangerous plants in socialist

countries (OOA 1974-1989).
- Claims that concerns about safety were exaggerated.

The arguments of the critics varied with their respective approaches to the problem,

- "There is no such thing as safe enough": Abrahamson/Tamplin: dangers of low-level radiation
- The "nuclear state"-argument, i.e. the safety requirements of nuclear power will lead to dictatorship (Robert Jungk's notion of "Atomstaat") (Jungk 1977)
- Critique of the centralised structure of energy provision - Armory Lovins

The arguments in debate clearly link nuclear issues to societal problems, ideological cleavages and visions of society.

2.4. Event 4: Anti-nuclear protest organised by the OOA (Organisation til Oplysning om Atomkraft) (1970s/1980s), notably against the Barsebäck power plant in Sweden (just opposite of Copenhagen)

In 1975 and 1977, at the time of the most vibrant debate about nuclear energy and energy policy in Denmark, two nuclear reactors went on line in the vicinity of the Danish capital. The two reactors of the power plant at Barsebäck, Sweden, were located only 20 km from central Copenhagen, as the opponents routinely highlighted. Its two towering blocks were visible from the beaches and port sides in North-Eastern Sealand, making the perceived threat to Danish citizens symbolically visible. The power plant was originally intended to have up to six reactors. It was operated by the Swedish company Sydkraft, and delivered nuclear-generated electricity also to consumers in Denmark, through a thick cable on the ground of the narrow Sound (Öresund) that separates the Danish archipelago from the Scandinavian peninsula.

As the Danish decision on moving towards developing nuclear power within Denmark had been put on hold in 1976, the Danish anti-nuclear organisation OOA made Barsebäck the main target of its campaigns. In 1976 environmental groups from Norway, Sweden and Denmark marched against Barsebäck. Since then OOA as well as local anti-nuclear groups organised marches from all parts of Denmark to Barsebäck, for demonstrations together with the Swedish anti-nuclear movement (OOA 1980, 1978, 1979, Nielsen 1976). The OOA specifically highlighted the risk of nuclear accidents, so close to Copenhagen (Storm 2014, 55,59, Petersen 1996, 174-176), while the REO produced a leaflet in 1982, which dismissed these concerns (Korsbech 1982)

The Danish battle against the power plant in neighbouring Sweden continued for more than twenty years (Löfstedt 1996), also involving diplomatic pressure from the Danish government, a Danish-Swedish joint parliamentary commission of enquiry in 1983-84 (Barsebäckvaerket 1985), a motion of the Danish Parliament in 1986 (Folketinget 1986) and direct communication of the OOA with Swedish Social Democrats, until the power plants were finally closed down in 1999 and 2005, after the privatisation of Sydkraft, which was taken over by the German utility Eon (Storm 2014, 67, Kaijser and Meyer 2018c).

Eventually, the decision to close down Barsebäck can be linked to the engagement of the Danish (and Swedish) population with nuclear power, and their ongoing protest. Indeed, these annual demonstrations can be considered one long-term event in the transnational history of Scandinavian nuclear power and society. Hence, more than the other events, the protest against Barsebäck was recognised by the contemporaries as important and covered by the media, and became a point of reference in subsequent debates. The slogan "Hvad ska' væk – Barsebäck. Hvad ska' ind – sol og vind" (What needs to go – Barsebäck, what do we need instead – sun and wind"), which linked Barsebäck to the need for a transition to small-scale and renewable energy sources, demonstrates the symbolic importance of Barsebäck in the Danish and Scandinavian conflicts about nuclear energy.[3]

[3] A more comprehensive account of the Danish-Swedish conflicts and cooperation around Barsebäck can be found in an article jointly written with the author of the Short Country Report on Sweden (Kaijser 2018), Arne Kaijser (Kaijser and Meyer 2018c). On the issue of nuclear installations at the border in other European border areas see the contributions to the special issue, which was edited by the two authors: (Kaijser and Meyer 2018b, a, Rubio-Varas, Carvalho, and Torre 2018, Kirchhof 2018, Renard 2018)

Event 4	
Actors: Who was involved (refer to table of potential actors, above)? Q1: Who are the main actors for and against nuclear energy involved in the event and what are their political connections?	Promoters: Companies: The Swedish Utility Sydkraft / Eon Energy, which was the object of the protest, as it was operating Barsebäck Political Parties: Swedish socialists, as addressees of Danish complaints about Barsebäck Affected people: Civil society: OOA as organiser of the protest marches, mobilising thousands of citizens and lobbying the Danish and Swedish governments Regulators: Swedish authorities: closing down Barsebäck Danish authorities: issuing emergency information (Miljøstyrelsen 1986) etc.
Q2: How did the involvement of these actors change over time?	**Q2:** There is no information on this.
Q3: Did networks and alliances of actors play a role for this event: If yes: What alliances were formed? Which actors treated which other actors (explicitly or implicitly) as opponents? What transnational cooperations/alliances/flows of information took place?	**Q3:** The OOA built up alliances with Swedish anti-nuclear activists.
Q4: Which actors were the "regulators" for this event? What was the level of "trust" they enjoyed?	**Q4:** The Swedish authorities were the regulators for the Barsebäck plant. Repeated Danish reports on the oversights of Swedish regulators pointed to a lack of trust.
Q5: Did changing involvement (state/private) change public opinion/trust?	**Q5:** There is no information on this.
When and where did it take place?	Throughout Denmark and Sweden, with marches leading from different places in Denmark and Sweden to Barsebäck, annually, from 1976.

Public Engagement: What type of process was it (communication, consultation or participation)? How did this change over time?	
Q1: What type of public engagement was employed, if any?	**Q1:** The public engagement was initiated by the opponents, the Danish (OOA) and the Swedish anti-nuclear movements and involved protest marches, which amount to public participation. Protest also addressed the Danish government, for instance, when in the wake of the Three Mile Island accident, the OOA collected some 320,000 signatures calling upon Danish premier Anker Jørgensen to demand the closure of Barsebäck from the Swedish government (Kaijser and Meyer 2018c). The promoter, the Swedish utility Sydkraft invited e.g. a Danish girl's orchestra to play at the "topping out" party of the second reactor in Barsebäck. This event should be characterised as a public communication event. The public communication to the citizens locally about the plant, including assurances about its safety, was targeted at the Swedish communities around the plant (Storm 2014, 53-55).
Q2: How did PR/public engagement by the nuclear establishment change over time?	**Q2:** As concerns change over time in the utilities' PR/public engagement with a view to the protest marches, this would require further research for additional evidence, from Swedish company or state archives.
Q3: Who is the initiator of the event? (Promoters, Opponents, State or authorities, mixed origin)? What kind of events did they initiate?	**Q3.** The events were initiated by OOA and its partners, i.e. the opponents, and involved marches and demonstrations. OOA also engaged in different lobbying activities.
Q4: Is there evidence of some type of process of *interaction* between the "promoters" and the potentially "affected" people/stakeholders? What kind of interaction? How did this change over time?	**Q4.** There is very little information available on the process of interaction between the promoters and the "affected people", and the change over time. This would require further detailed study and search for additional primary sources.
Q5: Were the events "evaluated"? If so, how? What claims have been made for	**Q5:** The OOA evaluated their own marches, assessing problems, e.g. in the cooperation with

their success/failure?	the Swedish side, in order to improve its campaigns (OOA 1978).
Arguments and Behaviour: What rationale was given by the party that implemented the engagement (if any)?	
Q1: What kind of nuclear-civil society interactions can we distinguish in the broadest sense? Is there any explicit social conflict? What kind? Among which actors? Why? Was there violence or use of force? What sort of protest behaviour took place?	**Q1.** There was clearly social conflict, with protest marches. Protest – of Danish citizens – mobilised and organised by OOA, and Swedish citizens - however remained largely non-violent. People marched and sang protest songs and stood their ground in front of the power plant to demonstrate their disapproval.
Q2: Who was against nuclear energy? How did they operate, and did they learn from experience? Is there evidence of (reluctant) tolerance / acceptance? What are the main issues/conflicts for those against nuclear energy (e.g. weapons, safety)? What is the promoter narrative? How does this narrative resonate with other actors, e.g. the media? How did it change over time?	**Q2.** There was very little evidence of acceptance. The goal of the OOA was to close down Barsebäck, as it was considered to endanger the Danish capital region, with the risk of a nuclear accident. This was even more clearly highlighted after Three Mile Island and Chernobyl, and illustrated with images demonstrating that Copenhagen was going to be in the most heavily devastated zone after an accident. Barsebäck was routinely described as the world's worst location for a power plant, due to its proximity to the large Copenhagen conurbation. The promoter narrative was about cheap and reliable energy provision (also for Denmark), and the irrelevance of safety concerns, which were routinely dismissed as far-fetched.
Q3: How has government (etc.) responded to resistance? How did government behave towards promoters and supporters of nuclear energy? Which were the main arguments (supporting points of view, justifying behaviour)? How were these arguments framed (relating to larger societal conflicts, the economy, visions of the vision etc.)?	**Q3.** The Danish government did not actively side with the Swedish utility across the Sound. However, after Chernobyl, it issued safety information to Danish households, indicating what to do in case of emergency (OOA 1974-2000). To what extent this actually reinforced the protest, as it emphasized the dangers, remains unclear.

2.5. Event 5: Responses to Chernobyl and transnational activities in the context of the "Radiating Neighbours" Campaign of 1986

In the wake of the debate on nuclear power since the 1970s, Chernobyl in April 1986 was viewed by many contemporaries as clear evidence that nuclear power involved actual and considerable risks. As a response to this, the OOA reinforced its routine requests to public authorities about safety procedures (OOA 1974-2000) on risks nearer to home, notably the Barsebäck plant. Public authorities, such as the Danish Environmental Admininistration (Miljøstyrelsen), subsequently distributed information brochures to the public(Miljøstyrelsen 1986). The OOA also embarked on its own attempts at NGO diplomacy. It kicked off the "Radiating Neighbours" campaign targeting all nuclear power plants within 150 km of the Danish borders; in Sweden, West and East Germany. Over the summer of 1986, the OOA collected some 160,000 signatures, which they handed over to the West and East German, and Swedish embassies in September 1986, in a large demonstration to the embassies (Meyer 2016, Kaijser and Meyer 2018c). In the wake of this, the OOA received an invitation to visit the German Democratic Republic in October 1986, to voice their concerns about East German power plant projects, on the Southern coast of the Baltic Sea, in the vicinity of Southern Denmark (Christiansen 1986a). Danes were particularly worried as the East Germans relied on problematic Soviet nuclear technology (OOA 1983-ca.1990). At the same time, the OOA self-assuredly offered to advise the GDR on renewables policy(Christiansen 1986b). They also visited East German anti-nuclear activists at the East Berlin Umweltbibliothek (Heitmann 1986).

While Chernobyl as an event clearly had an impact on nuclear policy East and West, the activities covered under this event only made a small difference. The events were not recognised as important, even though they were transnationally covered in the media (in East Germany, West Germany and Denmark, as for the visit to East Berlin). The events themselves – unlike Chernobyl – did not subsequently become a point of reference.

Event 5	Responses by the OOA to Chernobyl: The "Radiating Neighbours" campaign of 1986 (OOA 1983-ca.1990)
Actors: Who was involved (refer to table of potential actors, above)?	
Q1: Who are the main actors for and against nuclear energy involved in the event and what are their political connections?	**Q1:** Promoters: - Government: East German government representatives (including junior ministers), talking to the OOA visitors Receptors/Affected people: Interest Group: OOA visiting East Berlin, lobbying governments of Sweden, East and West Germany Regulators: National and Local authorities: Distributing information to citizens about what to do after a nuclear accident (Miljøstyrelsen 1986).
Q2: How did the involvement of these actors change over time?	**Q2:** The campaign "Strålende naboer" – "Radiating neighbours" is much more sophisticated than previous ones, combining the collection of signatures, with a protest march and the submission of these signatures to the embassies of the GDR, the FRG and Sweden, and lobbying, direct contacts. With its signature collection, OOA repeated a similar campaign after Three Mile Island, which however was directed to the national government, rather than directly at the foreign governments (Kaijser and Meyer 2018c).
Q3: Did networks and alliances of actors play a role for this event: If yes: What alliances were formed? Which actors treated which other actors (explicitly or implicitly) as opponents? What transnational cooperations/alliances/flows of information took place?	**Q3:** Transnational networks and alliances with West German activists played an important part in finding civil society activists in GDR to visit, next to the official visit of the GDR state authorities.
Q4: Which actors were the "regulators" for this event? What was the level of "trust" they enjoyed?	**Q4:** Upon their visit to East Berlin, the Danish OOA activists sought to talk to the East German regulators, potentially also in order to enquire about their trustworthiness.

Q5: Did changing involvement (state/private) change public opinion/trust?	**Q5:** This is unknown.
When and where did it take place?	1986, Copenhagen region / East Berlin
Public Engagement: What type of process was it (communication, consultation or participation)? How did this change over time?	
Q1: What type of public engagement was employed, if any?	**Q1.** Public engagement in the context of the OOA's "Radiating Neighbours" campaign in Denmark included public communication, i.e. the distribution of information to citizens, the collection of some 160,000 signatures, protest in front of the embassies, and an invitation to talk with high-level embassy staff. In East Berlin, it involved participation along the lines of diplomacy, in which the OOA was given polite, but often not very far reaching concessions, e.g. that an article on renewable energy sources was distributed in an East German newspaper.
Q2: How did PR/public engagement by the nuclear establishment change over time?	**Q2.** Change over time is impossible to trace here.
Q3: Who is the initiator of the event? (Promoters, Opponents, State or authorities, mixed origin)? What kind of events did they initiate?	**Q3.** The events were initiated by the opponents, by their protest (including a night guard protest in front of the Soviet embassy in Copenhagen one year after Chernobyl). An OOA delegation indeed visited East Berlin to talk to authorities and civil society groups (closely surveyed by the GDR secret service)
Q4: Is there evidence of some type of process of *interaction* between the "promoters" and the potentially "affected" people/stakeholders? What kind of interaction? How did this change over time?	**Q4.** The interaction, as indicated, was characterised by lobbying/diplomacy/asking critical questions on behalf of the OOA, and by public information by the authorities.
Q5: Were the events "evaluated"? If so, how? What claims have been made for their success/failure?	**Q5:** Surely informally, as this was common practice among the OOA, but there is no evidence.

Arguments and Behaviour: What rationale was given by the party that implemented the engagement (if any)?	
Q1: What kind of nuclear-civil society interactions can we distinguish in the broadest sense? Is there any explicit social conflict? What kind? Among which actors? Why? Was there violence or use of force? What sort of protest behaviour took place?	**Q1.** In the aftermath of Chernobyl, there was conflict and protest, however, not of the violent kind. Protest was peaceful and symbolic.
Q2: Who was against nuclear energy? How did they operate, and did they learn from experience? Is there evidence of (reluctant) tolerance / acceptance? What are the main issues/conflicts for those against nuclear energy (e.g. weapons, safety)? What is the promoter narrative? How does this narrative resonate with other actors, e.g. the media? How did it change over time?	**Q2.** There is no evidence of peaceful acceptance among those active in protest. The main critique relates to the safety issue, the example of Chernobyl plays an important role. Fear of an accident is the overwhelmingly important argument. Government is encouraged by OOA to update their safety information and plans, so as to be well-prepared.
Q3: How has government (etc.) responded to resistance? How did government behave towards promoters and supporters of nuclear energy? Which were the main arguments (supporting points of view, justifying behaviour)? How were these arguments framed (relating to larger societal conflicts, the economy, visions of the vision etc.)?	**Q3.** Government response in Denmark is to engage in diplomatic exchange with neighbours who maintain power plants, and encourage them to improve safety or close down. Government in GDR seeks to win a diplomatic victory by demonstrating their openness to Danish protest, and willing to talk about the issue. However, they insist that they will have to produce energy and that nuclear energy is the best way to do this. Nevertheless, after Chernobyl they accept that they will have to improve their safety, and thus delay construction. In GDR, the vision of high energy-consumption and industrial progress is still officially the guiding concept, with any opposition to it strictly monitored and at times openly suppressed.

3. Facts & Figures (assembled by Aisulu Harjula, Lappeenranta University of Technology)

The purpose of this section is to give an overview of nuclear power in Denmark. It contains such data as number of reactors, reactors' locations, technical and chronological details of reactors' construction as well as statistics on electricity production, periodization and social connections to nuclear constructions. This data can be used as a supplementary material to the other sections of this country report, to help understand the country's overall situation. Key dates and abbreviations used in this report are presented in the beginning of this section.

3.1. Key facts

- Danish researchers contributed importantly to nuclear research, notably Nobel Prize laureate nuclear physicist Niels Bohr (1885-1962).
- The backbone of Danish nuclear research in the post-war period were three research reactors at the **Risø Research Centre** on Roskilde fjord which are now decomissioned.
- Denmark has no nuclear power plants. Imported nuclear power is supplied to its grid, mostly from Sweden, and to lesser extent from Germany, as well as water power from Norway.
- Low level nuclear waste from three research reactors remained in Denmark after the closure of the research reactors of the **Risø Research Centre**. Spent fuel has been sent back to the US. The government has been searching for a place for a repository within the country, and started engaging with stakeholders (Denmark 2017).
- Greenland is a prospective place to mine uranium. Recently the Danish government issued legislation that created a legal framework to export Greenland's uranium. Uranium will be supplied under bilateral nuclear cooperation under Euratom and IAEA (Arnfred 2016, Walsh 2017).
- Denmark offers incentives to encourage the use of renewable energy. Danish researchers and entrepreneurs have been among of the pioneers of wind power since the 1970s.

3.2. Key dates and abbreviations

Key dates:

1921	The Institute for Theoretical Physics was founded by Niels Bohr in Copenhagen.
1922	Niels Bohr received the Nobel prize in physics "for his services in the investigation of the structure of atoms and of the radiation emanating from them."
1939	Nuclear fission was proved for the first time experimentally.
1957-1960	The Danish Atomic Energy Commission commissioned three research reactors.
1965	The Institute for Theoretical Physics was renamed to Niels Bohr Institute.
1975	The second research reactor DR-2 was shut down because of the decision to substitute it with a bigger research reactor DR-3.
1985	The Danish parliament decided that nuclear power plants will not be built in the country.
1988	Use of HEU was abandoned and instead of it LEU was used in the research.
1999	The Danish parliament decided to reform energy policy with a view to electricity provision that enables competition and promotes renewable sources.
1999	The third research reactor DR-3 had a leak in drain pipe. Decision was made not to put it back to operations. Used fuel was shipped to USA.
2000	The third research reactor was shut down.
2001	The second research reactor was shut down.
2001	Production of uranium fuel for research reactors was stopped.
2007	Government established a plan to provide 30% of energy consumption coming from renewables by 2020 and 50% of electricity consumption from wind energy.
2007 - 2016	Preparations and legislation about uranium mining in Greenland
2016	A legal framework to export uranium from Greenland was created. Greenland is independent to mine uranium but its export requires Danish authorization.

Abbreviations:

HEU	High enriched uranium
IAEA	International Atomic Energy Agency
LEU	Low enriched uranium
WMP	Waste management plant
MW	MegaWatt

3.3. List of reactors and technical and chronological details

The tables below show the list of research reactors, operators as well as the dates of their operation.

Table 1 - Research nuclear reactors in Denmark

Name	Use	Operator	Type & MWt	Operations start	Shutdown	Decom-missioning
DR-1	research, education	Risø National Laboratory	low power 0,002 MW	1957	2001	2006
DR-2	physics research production of radioactive isotopes	Risø National Laboratory	5 MW	1959	1975	2005-2008
DR-3	neutron physics research, materials tests, production of radioactive isotopes for medicine and industry	Risø National Laboratory	heavy water 10 MW	1960	2000	by 2020

Table 2 – Decomissioned nuclear facilities in Denmark

Facility	Operations start	Shutdown	Decommissioning
Fuel fabrication facility		2001	2015
WMP	1964	1989	2008-2012

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