

**EXTENDED and ADAPTED
SUBMISSION IN THE**

SEA PROCEDURE
for the Polish Nuclear Energy Programme

under
**the law of 3 October 2008 for Providing Information on the Environment
and its Protection, Public Participation in Environmental Protection and
Environmental Impact Assessment**
(OJ No. 199, as amended poz.1227.),

EU Directive 2001/42/EC
on the Assessment of the Effects of Certain Plans and Programmes
on the Environment
and
the Aarhus Convention
on Access to Information, Public Participation in Decision-making
and Access to Justice
in Environmental matters

by
Ir. Jan Haverkamp



GREENPEACE

Jan Haverkamp – EU policy campaigner dirty energy
Greenpeace European Unit
Rue Belliard, 1040 Brussels, Belgium
Tel: +32 477 790 416 Fax: +32 2 2741910 E-mail: jan.haverkamp@greenpeace.org
www.greenpeace.eu

GREENPEACE

International

My name is Jan Haverkamp. I have an academic engineering degree (Ir. - equivalent with a Masters degree) in Environmental Hygiene from the Agricultural University in Wageningen as well as a candidate (equivalent with Bachelors) degree in Biochemistry from the State University in Leiden, both in the Netherlands. I have studied also nuclear physics and energy policy at the State University in Leiden.

I work as an independent expert in energy issues with specialisation in nuclear energy for the global environmental organisation Greenpeace and work since 1987 in Central Europe. Previously to this SEA, I have participated in the Environmental Impact Assessment processes for the first two blocks of the Temelín nuclear power plant (NPP) in the Czech Republic, the Belene NPP in Bulgaria, the Cernavoda NPP in Romania, the Visaginas NPP in Lithuania, the Mochovce 3,4 NPP in Slovakia and the blocks 3, 4 of the Temelín NPP in the Czech Republic.

I have been asked by Greenpeace in Poland to write a submission in the SEA procedure of the Polish Nuclear Energy Programme. I wrote these comments on personal title and my opinion – though based on my experience within Greenpeace and benefiting from input from other Greenpeace colleagues and experts – does not necessarily coincide with the opinion of Greenpeace as organisation.

Greenpeace as organisation does, however, endorse my recommendation **that the report should be dismissed as insufficient and inadequate and that the Ministry of Economy be required to re-do the Strategic Environmental Assessment on a sufficient level of quality, and changes the Polish Nuclear Energy Programme in content by taking the remarks from the public participation into due account** following Aarhus Convention art. 6(8).

In the short term initially available for comment (only the legally minimum time for public comment of 21 days – without taking into consideration that the introduction of complex technology like nuclear power needs more time than, for instance, the construction of one small local heating installation), I prepared a short analysis, which was submitted on 18 January 2011. Because the time for submissions was consequently extended according to our demands, I have been able to rework parts of this initial submission into more depth.

I was hindered by the fact that the documentation was during the public participation phase in Poland only available in Polish, which means that I had to have important parts translated – which given the large amount of documentation could only be done in a very limited way.

The initial insufficient reaction time and availability of material only in Polish has had a negative influence on how systematic I have been able to assess the report and therefore on the quality of this submission.

I have been able to make an assessment of important parts of the Polish Nuclear Power Programme itself and of the SEA report. I have not been able to look into the Appendix dealing with location choice.



Prague / Brussels, 28 March 2011

jan.haverkamp@greenpeace.org – tel.: +32 477 790 416

COMMENTS

1. The process of a Strategic Environmental Assessment falls under article 7 of the Aarhus Convention¹ as a form of public participation during the preparation of plans and programmes. The Aarhus Convention recognises that public participation in decision-making enhances the quality and the implementation of decisions, and gives the public the opportunity to express its concerns and viewpoints, and enables public authorities to take due account of such concerns. From this follows that a SEA process is not an exercise for the sake of itself, but a process in which the quality of the decisions concerning plans and projects is enhanced. This means that the SEA process is functioning as a tool in a justification process for the environmental impacts of these plans and programmes, and if these impacts cannot be justified, as a means for the public authority to take measures to prevent them. For that reason, a full overview of information has to be available to the public in the form of the Plan or Programme under discussion and the relevant SEA report, so that the public can fulfil its function in the public participation process.

The Polish Nuclear Energy Programme and its SEA report do not give all information necessary to enable the justification of the potential environmental impacts of the development of nuclear power in Poland.

By not providing all necessary information and coming to misleading conclusions, the Programme and SEA report are an insufficient basis for public participation as prescribed under the Aarhus Convention, the EU Directive on SEA and the SEA Protocol of the Espoo Convention.

Article 6(8) of the Aarhus Convention requires that the responsible authority takes the input from the public into due account during the final decision. Because the final decision is in the form of a Polish Nuclear Energy Programme, i.e. the Programme is the final product, it follows that the input from the public should result in adaptations of the original text of this Programme.

We demand that the input from the public consultation as well as the input from the planned transboundary SEA consultations will be reflected in the body of the final text of the Polish Nuclear Energy Programme. A pro-forma mentioning of these outcomes in an appendix without influence on the original text is unacceptable in respect to art. 6(8) of the Aarhus Convention.

Process

2. **The preparation of the SEA report** – It becomes clear from the quality of the SEA documentation, that it has been prepared in a hurry. Research into the matter by Greenpeace revealed that the entire assessment was carried out in exactly one month! The tender for the consultant was awarded on the 25th of November 2010 and published on the government website on the 29th of November, and the documentation was submitted for public participation on 30 December 2010.² The consultant received contractually only 30 days for the preparation of 785 pages of analysis plus 295 pages of Annex³. In case the Polish government seriously thinks about the introduction of nuclear energy in the country, it should allow itself time to get acquainted with the matter. **Likely because of the hurry, this SEA report**

1 Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters done at Aarhus, Denmark, on 25 June 1998; <http://www.unece.org/env/pp/documents/cep43e.pdf>

Polish version: <http://www.unece.org/env/pp/EU%20texts/conventioninpolish.pdf>

2 *Postępowanie na „Ocenę oddziaływania na środowisko programu polskiej energetyki jądrowej”, prowadzone w trybie przetargu nieograniczonego* (Proceedings of the "Environmental Impact Assessment of the Polish Nuclear Power Programme", conducted by open tender), 28 September 2010; <http://bip.mg.gov.pl/node/11633>

Warszawa: *Ocena oddziaływania na środowisko programu polskiej energetyki jądrowej - Numer ogłoszenia: 341177 - 2010; data zamieszczenia: 29.11.2010* (Warsaw: Environmental impact assessment of the Polish Energy Nuclear Programme - Notice number: 341177 - 2010, date enlisted: 11/29/2010 - CONTRACT NOTICE – Services); <http://eprzetargi.org/Article.ashx?id=829019&p=True>

3 Ministerstwo Gospodarki, *Specyfikacja Istotnych Warunków Zamówienia - Numer Sprawy: Bdg-II-281-51/10, Przedmiot Zamówienia: „Ocena oddziaływania na środowisko programu polskiej energetyki jądrowej” - Kod zamówienia: 90711400-8, Waszawa (2010);* <http://bip.mg.gov.pl/files/przetargi/11633/SIWZ%20BDG-II-281-51-10.pdf>

is of extremely low quality and can therefore not properly function as a basis for a justification

process of the creation of radioactive waste, the emissions of radioactive substances into the environment during the entire fuel chain, operation of nuclear power plants and their decommissioning, the risk on nuclear accidents, the liabilities to be carried by the Polish population and an increase of the risk of nuclear proliferation – issues that all cause direct or indirect impacts on the environment for current and future generations.

The low quality of the report expresses itself in:

- **improper priority setting of important issues for a policy paper** – Issues that have a large priority for policy-setting (policy alternatives, overall chain analyses including radioactive waste policies, overall risk assessments and liabilities, costs, overall socio-economic parameter comparisons, large scale infrastructural issues, climate policy considerations) receive far too little attention. Issues that have a low priority for policy-setting (detail geographical and ecological parameters of different potential locations) receive far too much attention and thus divert the attention of the real policy questions and justifications that need to be answered by a policy paper in this stage of the political debate.

- **information from biased sources** – In order to achieve the tight deadline, the consultant obviously was forced to use non-reviewed biased sources for his report. The consultant uncritically copy-pasted material from websites and industry reports (partly on the basis of intransparent sources), and did not search critical review of many data. Because of this, the report lacks the level of quality that is needed for public consultation, as well as for proper justification procedures and policy making.

- **the use of outdated information** – Obviously the time lacked to check information on its current validity. One example out of many: On page 525 of the Strategic Environmental Assessment, it is claimed that Westinghouse delivers nuclear fuel for the Temelín nuclear power station in the Czech Republic. Deliveries from Westinghouse were stopped several years ago, however, when deformations were found in the fuel rods in the second half of their life-time and Temelín now receives fuel from TVEL.

I advise therefore, that the Strategic Environmental Analysis be re-done and that proper time is taken and proper resources reserved for the exercise, enabling the responsible consultant to create a scientifically sound and balanced report addressing the different environmental policy questions that need to be answered in the justification process of the Nuclear Energy Programme.

It has to be noted, that this study has translated a lot of material from English into Polish and with that made it accessible to the Polish public. However, because of the pro-nuclear bias of choice of materials – for instance materials concerning effects of radiation, safety analysis of reactors, externalities of energy sources, descriptions of radioactive waste management procedures, costs and socio-economic effects – and lack of inclusion of more critical material, as well as lack of coverage of certain important critical areas – for instance alternative policy scenarios, uranium mining, effects of large beyond design accidents, liabilities for the Polish state and population, a host of security issues – , the report threatens to further unbalance the already distorted debate in Poland. It is therefore extremely important, that the Polish government sees to it that more critical material is taken up in this assessment.

3. **The initial period of 21 days for reaction in the public consultation** – The Polish law on access to environmental information and environmental impact assessments prescribes a *minimum* period for public reactions of 21 days. Minimum means that this is considered the minimal reasonable time frame for procedures of minimum size.⁴

The Aarhus Convention requires that reasonable time-frames are given for the different phases.⁵ The EU Directive on SEA prescribes “appropriate time frames to express their opinion on the draft plan or programme and the accompanying environmental report before the adoption of the plan or programme or its submission to the legislative procedure”.⁶

4 See footnote 1

5 Aarhus Convention, art. 6(3): “The public participation procedures shall include **reasonable time-frames** for the different phases, allowing sufficient time for informing the public in accordance with paragraph 2 above and **for the public to prepare and participate effectively during the environmental decision-making.**” [emphasis added, JH]

6 EU Directive 42 of 2001 on SEA, art. 6(2): “The authorities referred to in paragraph 3 and **the public** referred to in paragraph 4 **shall be given an early and effective opportunity within appropriate time frames to express their opinion** on the draft plan

The minimum time-frame of 21 days in Polish law is the minimum for simple cases. In the case of over 1200 pages of complex documentation⁷ for a plan with potential influence on all of Poland and far beyond its borders, using this minimum is not reasonable as defined under the Aarhus Convention nor appropriate as formulated under the EU Directive on SEA.

The Ministry of Economy announced the public participation period for the SEA procedure on 30 December, thus including several public holidays, as well as partly choosing a time that is generally seen by the public as holiday-time. During this period, it is more difficult for the public and NGOs to gather expert input in order to formulate a quality opinion on the documentation. The reduction of time to prepare input resulting from the choice for such a period is neither reasonable nor appropriate and violates also the notion of “at least” as used in the Polish law.

~~For these reasons, Greenpeace demands from the Ministry a prolongation of the response time to 3 months, i.e. to 31 March 2011.~~

Greenpeace welcomes the prolongation of the response time to 3 months, i.e. to 31 March 2011, but points out that the late moment of announcement of this prolongation (after the deadline of 19 January was passed) had a negative influence on my planning and possibilities to deliver a more in-depth assessment.

4. **Transboundary consultation** - Poland has signed the SEA Protocol under the Espoo Convention on 21 May 2003 in Kiev, but has not ratified it yet. However, the EU, which is also signatory to the Protocol, approved the protocol on 12 November 2008.

The SEA Protocol under the Espoo Convention prescribes a full transboundary SEA procedure for plans and programmes in the energy field.⁸ The SEA Protocol under the Espoo Convention prescribes in art. 8 transboundary public participation.

The SEA Protocol under the Espoo Convention furthermore demands reasonable time-frames for public participation.⁹

The EU SEA Directive prescribes a transboundary SEA procedure for plans or programmes likely to have significant effects on the environment in another Member State. The adoption of the use of nuclear power in Poland will have potentially significant effects on surrounding Member States and beyond.

The EU SEA Directive prescribes in article 6 transboundary public participation.

~~Greenpeace demands from the Ministry the start of a transboundary SEA procedure in which~~
Greenpeace welcomes the announcement of a transboundary SEA by the Ministry, and demands it informs all surrounding countries and the countries around the Baltic Sea of its intention to finalise a Polish Nuclear Energy Programme and offers the possibility for a transboundary consultation including public participation.

5. **Availability of documentation only in Polish** – The documentation is only made available in the Polish language.

or programme and the accompanying environmental report before the adoption of the plan or programme or its submission to the legislative procedure.” [emphasis added, JH]

- 7 The documentation consists of the **Polish Nuclear Energy Programme** from 16 November 2010, 125 pages, the **Strategic Environmental Assessment of the Polish Nuclear Energy Program** of 785 pages and an **Appendix - Options for localization**” of 295 pages.

- 8 SEA Protocol of the Espoo Convention, art. 4(1-2): “1. Each Party shall ensure that a strategic environmental assessment is carried out for plans and programmes referred to in paragraphs 2, 3 and 4 which are likely to have significant environmental, including health, effects. 2. A strategic environmental assessment shall be carried out for plans and programmes which are prepared for [...] energy, [...] and which set the framework for future development consent for projects listed in annex I and any other project listed in annex II that requires an environmental impact assessment under national legislation.”

- 9 SEA Protocol of the Espoo Convention, art. 8(4): “Each Party shall ensure that the public referred to in paragraph 3 has the opportunity to express its opinion on the draft plan or programme and the environmental report **within a reasonable time frame.**”

The public is with this programme confronted with a highly complex matter. It is therefore likely that the public, and especially non-governmental organisations, will have to gather expert opinions in order to be able to give a quality response to the plans. The amount of nuclear expertise in Poland is highly limited and Greenpeace needed to consult experts from outside the country.

The public outside of Poland and residents in Poland who are not fluent in the Polish language have a right on access to the public participation procedure under the same circumstances as Polish citizens (Aarhus Convention, art. 9).¹⁰ Other EU Member States and signatories to the Espoo Convention and its SEA Protocol and their citizens will need access to the documentation in another language than Polish.

In the case of the transboundary Environmental Impact Assessments under the Espoo Convention of Belene (Bulgaria), Cernavoda (Romania) and Visaginas (Lithuania), a full English translation of all documentation was made available to the interested public.

Because of the obligation of international consultation under the EU SEA Directive and the Espoo Convention SEA Protocol, the availability of an English version of all materials should be taken as a standard procedure.

When the public has to produce translation itself in order to get international feedback, it will not be able to do so within the initially given time-frame of 21 days, nor in the extended time-frame of three months.

Greenpeace regrets that the Ministry did not give access to the documentation also in the English language, which is commonly seen within the EU as *lingua franca*, or extended the period for public consultation with an extra month – i.e. to 30 April 2011 – to enable citizens and NGOs to produce translations themselves.

Content

6. The Polish Nuclear Energy Programme

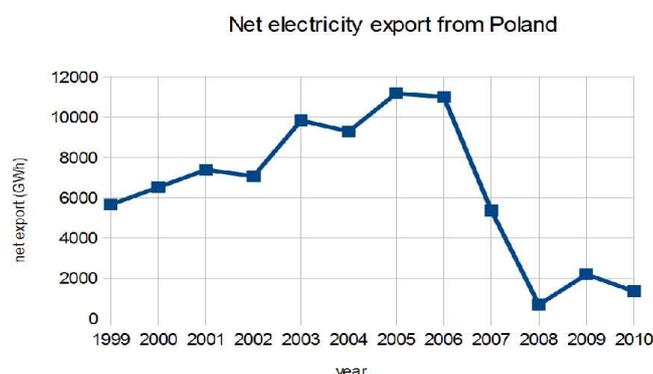
The Programme is a rough-brush plan. It misses a lot of essential information. The later developed SEA report gives the impression that it should function to overcome this lack of information. However, because of the low quality of the SEA report, it does not fulfil that function in the least.

Hereunder only a few of many examples of low quality information in the Polish Nuclear Energy Programme as an illustration.

The Programme states that Poland is a net importer of energy. Given Poland's dependence on external sources for oil and gas, this may be true for primary energy sources. It is not true for electricity.

The UCTE / entso-e statistics (see graph¹¹) show that Poland is traditionally a large exporter of electricity, although there are changes between different years, both in net amounts as well as in amounts to different countries.

The Programme concludes that “*Polska od 1980 r. jest importerem energii netto, a przy ograniczonym potencjale rodzimych zasobów energii pierwotnej*”



10 “Within the scope of the relevant provisions of this Convention, the public shall have access to information, have the possibility to participate in decision-making and have access to justice in environmental matters without discrimination as to citizenship, nationality or domicile and, in the case of a legal person, without discrimination as to where it has its registered seat or an effective centre of its activities.”

11 Source: ENTSO-E, <https://www.entsoe.eu/db-query/exchange/electricity-exchange-of-a-specific-range-of-time/>

tendencja ta będzie się utrzymywać.” (Poland since 1980 is a net importer of energy, and given the limited potential of native primary energy resources, this trend will continue.) It is astonishing to see that the authors do not see renewable energy sources (wind, sun, biomass, geothermal, small- and micro-hydro), as native energy sources, especially because, as can be seen in the alternative studies mentioned later in our comment, they are abundantly available in Poland.

The Programme furthermore seems to be stuck in a focus on centralised capacity. The potential for economically viable decentralised co-generation is heavily underestimated.

From further analysis it becomes clear that the Ministry seems to want to develop renewables and nuclear power in order to maintain Poland's export position – whereas it continues to rely on conventional fossil sources for covering the domestic demand.

The Programme is based on the 20/20/20 climate targets of the EU and does not take into account that the EU is likely to increase its emission reduction target to 30% in 2020, as soon as an agreement is reached with other high emitters within the UNFCCC. This is important, because possible construction work for nuclear power stations before 2020 will add to the greenhouse gas emissions in Poland and therefore reduce the chance of Poland to reach its 2020 goals.

The analysis of demand and capacity seems to be based on a cut-and-paste patchwork of different studies that do not fit together seamlessly. There is no systematic analysis of different possible policy scenarios. Neither for the Energy Strategy for Poland this Programme claims to be based upon, nor for this Programme.

Page 19 of the Programme shows completely unrealistic time-frames. A 4-year construction time for a nuclear reactor has not been achieved anywhere over the last decades, and certainly not in a newcomer country!

Furthermore, public participation periods in the form of this SEA and the following project-specific EIAs have not been included. This lack of awareness of need for environmental assessment is not only shocking in its own merit, but also will cause considerable delays in the time-line.

From the list of responsibilities on page 20 and further, it becomes clear that this is a state-driven project, not at all a market driven project. This goes against the liberalisation of the electricity market and gives nuclear power a non-market-conform advantageous position – especially in comparison with potentially competing generation forms like co-generation and renewable energy sources as well as energy efficiency measures. This is counter to EU policy concerning the liberalisation of the electricity market.

Page 37, Table 4.1 – investment costs for nuclear. The postulated investment costs of 3000 EUR '05/MW installed are approaching realistic figures, but are still around 50% under current reality. Given the de-learning curve trends traditionally visible in the nuclear sector, it would be wise to use at least 3500 – 4500 for a real comparison, with the reservation that prices might eventually appear to be even higher. Recent more realistic cost-studies are mentioned in the Annex of this submission.

The chapter on Environment is completely inadequate. It does not address the problems of fuel production, transportation risks, back-end, nor accidental emissions and their effects on the environment. It does not address the need for large amounts of cooling water and the effect on the local environment. This should not be out-sourced to the SEA report, but be an integral part of the Programme. This is also true for an analysis of potential accidents and their environmental consequences for Poland and Europe.

The Programme is not transparent in its sourcing of data and uses very little factual information. The source of all data used should be clearly referenced in foot- or end-notes, so that the public can check the basis, quality and credibility of these data and give its feedback on that. Claims have to be referenced with the same purpose.

The Programme completely lacks comparisons between different energy policy scenarios. This is an omission that can be traced back to the Energy Policy of Poland until the year 2025, as developed in

2005, and the consecutive policy until the year 2030. This energy policy is not based on a comparison of different policy scenarios, neither is it based on proper modelling of such scenarios. With that, all these policy papers are nothing more than wish-lists from certain interest groups and not justification documents for a certain policy.

The Strategic Environmental Assessment of the Polish Nuclear Energy Programme

7. Alternatives – The report is inadequate in its analysis of alternatives.

Under the Aarhus Convention, the Espoo Convention and the SEA Directive, the Programme needs to be compared with realistic alternatives. In the case of an energy programme (be it in general or the programme for one generation source of electricity), **the only sensible comparison is one between different policy scenarios, delivering different energy-mixes.** In order to create a comparable basis, these policy scenarios should be properly modelled for their impact until 2050. It is preferable that back-casting models are used with clear policy objectives, next to a fore-casting of business as usual.

As an example, the current German energy policy, based on an over-all shift towards renewable energy sources and efficient energy use and a gradual phase-out of nuclear energy, is based on extensive modelling and scenario work in the mid-1990s. On that basis, Germany developed – until recent industry-driven adaptations that leave, however, the general trend in tact – a forward looking energy policy that takes challenges of climate change, energy security and economic development as well as impacts on the environment into account in a holistic way. Poland lacks such a basic forward looking overview of options.

This analysis of alternatives should ideally have taken place in the formulation of the Energy Policy for Poland until 2025 or the one until 2030. In such a case, the Nuclear Energy Programme could have referred to (and taken over) this analysis in summarised form as justification of its general trends. Ideally, project EIAs could then have referred again to the Nuclear Energy Programme for the justification of the choice of this energy source. However, we do not face an ideal situation, because the Polish Government has failed in a proper analysis of its different alternative policy options during its formulation of the Energy Strategy for Poland. It also did not take up any comparison in the Polish Nuclear Energy Programme document. In such a case, the development of different (alternative) policy scenarios, leading to different energy mixes and their detail modelling should take place in the Strategic Environmental Analysis. Only in such a way, the SEA document can fulfil its task as justification document for the chosen energy source. Only in such a way, public participation in the SEA procedure can take into account all relevant alternatives (as prescribed in the Aarhus Convention, the SEA Directive and EIA law) and lead to an enhancement of the quality of decisions – the goal of public participation as formulated in the Aarhus Convention.

The report only describes one possible energy mix, based on a non-comparative analysis of the development of different electricity generation sources and energy efficiency. The report suggests that within that mix, nuclear energy is inevitable. This inevitability is, however, highly speculative, because no comparable data are made available for other possible energy mixes.

There is not only one possible development path, but there are many. Each of these paths, based on its own mix of policy measures, delivers in the long term different energy mixes.

There are several recent studies that have shown that for the EU-level scenarios leading to 100% renewable energy sources in 2050 are feasible¹², and these scenarios prove to be more beneficial on all

12 McKinsey & Company, KEMA, The Energy Futures Lab at Imperial College London, Oxford Economics and the ECF, *Roadmap 2050 - a practical guide to a prosperous, low-carbon Europe*, Berlin (2010) European Climate Foundation; <http://www.roadmap2050.eu/downloads>

Price-Waterhouse-Coopers, PIK, IIASA, ECF, *100% renewable electricity; A roadmap to 2050 for Europe and North Africa*, London (2010) Price-Waterhouse-Coopers; http://www.pwc.co.uk/eng/publications/100_percent_renewable_electricity.html

Sven Teske (ed.), *energy [r]evolution - towards a fully renewable energy supply in the EU 27*, Brussels (2010) Greenpeace / EREC; <http://www.greenpeace.org/eu-unit/press-centre/reports/EU-Energy-%28R%29-evolution-scenario>

socio-economic and environmental parameters than scenarios based on more conventional sources like coal and nuclear.

Therefore, among the alternative scenarios that should be developed for Poland, at least one, but preferably several, should be based on a target approaching a 100% renewable energy (RE) provision in 2050, based on development of energy efficiency and RE.

The report relies on outside studies, and as indicated above, the choice of these studies has been arbitrary, to say the least. The choice seems to be based on a bias towards nuclear power and therefore cannot form a proper basis for the justification process.

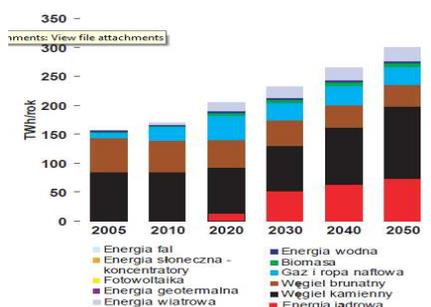
8. **Biased treatment of different energy sources in the proposed energy mix** – In the energy mix proposed in the SEA report, the overall demand growth numbers are unrealistically high. The energy efficiency and RE targets in the chosen mix are not brought forward as alternatives, but as insufficient means to fulfil this unrealistic demand growth (fig. 10.1.3). A 15% part of RE in 2020 is without any serious but realistic ambition – a lot lower ambition than the truly unrealistic one of this nuclear programme. With that, the authors introduced an unacceptable and unrealistic bias towards nuclear power.

We furthermore have to conclude that the criteria and uncertainties that are mentioned for the development of EE and RE are *not* used in the analysis for nuclear energy, which leads to further bias towards nuclear energy.

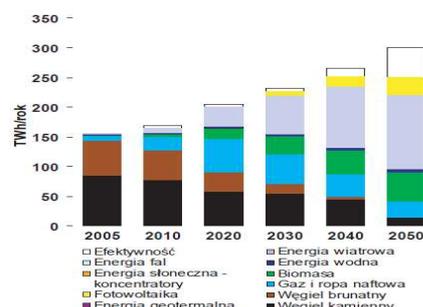
The Polish energy [r]evolution scenario from Greenpeace and EC BREC Instytut Energetyki Odnawialnej comes interestingly to a similar growth figure for demand of electricity in 2030 as the 54% presumed in the Nuclear Energy Programme – with demand after that time decreasing. The scenario, however, does not need any nuclear power to fulfil this demand¹³. This illustrates that there is a solid base for our demand that the Polish Government carries out a full scenario based comparison with different policy options.

9. **The costs of nuclear power** – Throughout the study, the authors use too low estimates for costs of new nuclear power stations. The current costs hover between 3500 € / MWe and 4500 € / MWe, with cost estimates in Canada and the US being even higher than that. The nuclear energy industry has, furthermore, traditionally a solid record of de-learning, with costs increasing over time. Also several studies on which this SEA report is based, e.g. the ExternE studies, use too low construction cost estimates for nuclear power stations. Correcting this is of crucial importance, because higher constructions costs make nuclear power uncompetitive with gas and with most RE sources as well as most of the available energy efficiency technologies. With that, the entire picture of the possible role of nuclear power shifts.
10. **Nuclear power and greenhouse gas emissions** – The authors claim on page 8-595: “**Elektrownie jądrowe nie będą miały negatywnego wpływu na klimat, a wprost przeciwnie – ich wprowadzenie pozwoli ograniczyć emisje CO₂ przez uniknięcie emisji z elektrowni opalanych paliwami kopalnymi.**” [Nuclear power plants do not have a negative impact on the climate, on the contrary – its input will help to reduce CO₂ emissions by avoiding emissions from power plants burning fossil fuels.]

13 Wiśniewski, Grzegorz (ed.), [R]ewolucja energetyczna dla Polski - Scenariusz zaopatrzenia Polski w czyste nośniki energii w perspektywie długookresowej, Warszawa (2008), Greenpeace, EC BREC Instytut Energetyki Odnawialnej;
<http://www.greenpeace.org/raw/content/poland/press-centre/dokumenty-i-raporty/rewolucja-energetyczna-polska.pdf>



Rys. B.1. Wytwarzanie energii elektrycznej według scenariusza referencyjnego.



Rys. B.2. Wytwarzanie energii elektrycznej według scenariusza alternatywnego.

This is not true.

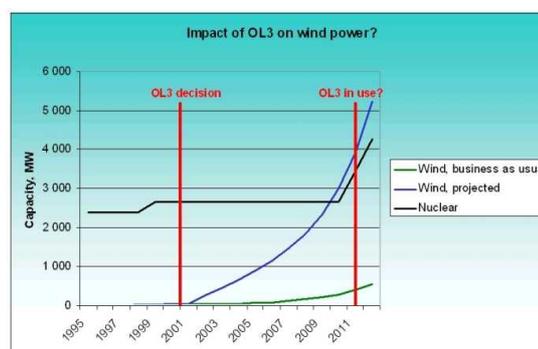
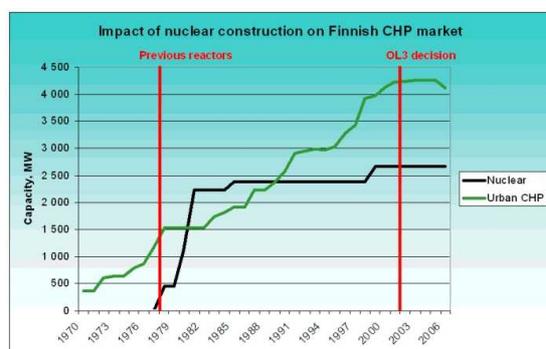
First of all, the construction of nuclear power stations in Poland would push Poland out of line with the European climate targets for 2020. For the construction of nuclear blocks, Poland will need to use an enormous amount of fossil fuels that will increase its CO₂ emissions before the operation date. It has to be pointed out here, that according to the International Panel on Climate Change, greenhouse gas emissions would need to peak around 2015 if we want to have a reasonable chance to maintain temperature rise this century under 2° C.

When Poland follows a similar trend as Finland, it will see because of the construction of nuclear power stations a slump in the development of energy efficiency and of renewable energy sources which would (per kWh delivered) emit less CO₂ than a nuclear power plant.¹⁴ Out of all options, a policy focusing on the development of a combination of energy efficiency and renewable energy sources is the most likely to be able to deliver the greenhouse gas emission peak in 2015.

The negative impact on the climate by a nuclear development is likely to sharpen in the years after the first nuclear block is predicted to come on-line and when renewable energy sources will deliver more than 40% of the electricity production. In Denmark, Northern Germany and Spain, we can already see the situation that the presence of inflexible capacity from coal and nuclear power inhibits the maximum use of – in terms of marginal costs – virtually free renewable energy sources, because the inflexible sources nuclear and coal cannot easily or sufficiently follow the grid-load. This leads to an under-use of renewable energy sources and a slow-down in investment in new renewable energy sources, pushing the final goal of a 100% clean electricity production further past the horizon.¹⁵

Nuclear power is an intermittent energy source: in cases of an emergency shut-down, all capacity is lost from the grid – it is basically on or off. This is contrary to sources like wind and sun, that deliver a highly predictable but variable input into the grid and therefore are called variable sources. As an intermittent source, nuclear power stations need large amounts of fast stand-by capacity in case of emergency shut-downs. In this way, nuclear power binds large centralised gas capacity or spinning stand-by coal or inefficient (non-co-gen) biomass capacity into the system. This means that as long as nuclear power stations operate, there will either be fossil fuels necessary, or inefficient use of biomass. Both go counter a sound climate policy. Contrary to centralised large inflexible capacity from nuclear power, highly predictable variable renewable sources can easily and efficiently be incorporated in a grid system with high flexibility and a large degree of decentralisation.¹⁶

14 Although Finland has a large potential for CHP and wind energy, investments in both have virtually halted because of the construction of new nuclear capacity in Finland. (Source: Greenpeace Finland)



15 Van De Putte, Jan, Rebecca Short, *Battle of the Grids – How Europe can go 100% renewable and phase out dirty energy*, 2011 (Brussels) Greenpeace; <http://www.greenpeace.org/eu-unit/press-centre/policy-papers-briefings/battle-of-the-grids>

Tröster, Eckehard, Rena Kuwahata, Thomas Ackermann, *European Grid Study 2030/2050*, Langen (2011) Energynautics GmbH; http://www.energynautics.com/downloads/europeangridstudy2030-2050/energynautics_EUROPEAN-GRID-STUDY-2030-2050.pdf

16 Ibidem

Depending on the development of the uranium market, the full-chain CO₂ emissions of nuclear power stations could reach after 2020 levels that could go as high as 112 gCO₂eq/kWh, which is a factor 2 to 5 more than most renewable energy sources.¹⁷

The construction of nuclear power stations therefore can in no way be seen as part of climate protection, but rather aggravates the situation. This apart from the other unsolved problems related to nuclear power, including nuclear waste, costs, technological and fuel dependency, ongoing radioactive emissions and rest-risk of a nuclear accident, including from terrorist threat.

The authors of the SEA report furthermore base their estimate of CO₂-emissions from nuclear power on intransparent industry data. Based on a comparison 103 life-cycle studies, Sovacool¹⁸ comes to a range between 1,4 gCO₂eq/kWh to 288 gCO₂eq/kWh with a mean value of 66 gCO₂eq/kWh.

11. **The grid-conflict between centralised nuclear and decentralised RE development** – The report does not pay any attention to the conflict that will arise in grid-development and -management between the input of variable, and flexible decentralised RE sources and inflexible centralised sources as coal and nuclear power. This grid-conflict – especially in the time-frame of the coming 15 years – results in large changes in the cost picture for nuclear power. Greenpeace has issued a first study on the issue in 2010¹⁹ and published a more detailed study in January 2011.²⁰

The upcoming conflict between RE and nuclear power can already be illustrated with the proposals from the authors of the SEA for new grid connections and grid improvements. This plan does not include the possibilities for connection to the German-Danish-Swedish sea-links that are currently under development for the attachment of off-shore wind in the Baltic Sea.²¹ That means that by developing the plans in this Programme, Poland is already missing the boat for one of its most promising and important potential RE sources and optimisation of the grid for that purpose.



The authors furthermore critiquelessly copy the claim from the nuclear industry that modern nuclear power stations would be able to load-follow. However, also modern nuclear power stations can only load-follow with reasonable flexibility within a limited margin of their total capacity. For most reactors this is around 30%. The reactors will, however, at all times need to deliver a base capacity of around 70%. When nuclear reactors are shut down in order to free space for, for instance, low-marginal-cost renewable capacity, they take up to 50 hours to be restarted, thus creating the need for more flexible excess capacity in the grid. From a technical safety point of view, nuclear load-following cannot be encouraged. Nuclear load-following involves regular high amounts of high-energy neutron fluxes that have a negative influence on the quality of

17 Benjamin K. Sovacool, Valuing the greenhouse gas emissions from nuclear power: A critical survey, Energy Policy 36 (2008) 21940 – 2953, Elsevier

18 Ibidem

19 Ackermann, Thomas, Eckehard Tröster, Rebecca Short, Sven Teske, [R]enewables 24/7 - Infrastructure Needed to Save the Climate, Brussels / Amsterdam (2009) EREC, Greenpeace; <http://www.greenpeace.org/raw/content/international/press/reports/renewables-24-7.pdf>

20 Van De Putte, Jan, Rebecca Short, Battle of the Grids – How Europe can go 100% renewable and phase out dirty energy, 2011 (Brussels) Greenpeace; <http://www.greenpeace.org/eu-unit/press-centre/policy-papers-briefings/battle-of-the-grids>

Tröster, Eckehard, Rena Kuwahata, Thomas Ackermann, European Grid Study 2030/2050, Langen (2011) Energynautics GmbH; http://www.energynautics.com/downloads/europeangridstudy2030-2050/energynautics_EUROPEAN-GRID-STUDY-2030-2050.pdf

21 See among others: Antje Orths, Ulf Moberg, Rüdiger Reinisch, First European Offshore Grid at the Baltic Sea? – Kriegers Flak: Techniques, Economics and Challenges, 2009 (Marseille) EWEC 2009: Workshop European Offshore Coordinator; http://ec.europa.eu/energy/infrastructure/tent_e/doc/off_shore_wind/2009_off_shore_grid_workshop_kriegers_flak.pdf

steel and welding seams. Also economically, load-following increases the final price of nuclear electricity even further, because the largest price-factor for nuclear electricity consists of the capital investment and not of the marginal costs. It will take 30% longer to earn back the initial investments when nuclear power stations have a load factor of 30% less because of the need to load-follow.

But it has to be pointed out here, that for the most modern reactor designs, like the EPR and the AP1000, load-following possibilities are speculative, to say the least. In 2010, ASN blocked load-following for the Flamanville EPR on the argument that this would introduce too large safety risks.

12. **Socio-economic impact of nuclear power** – Like all other factors, the socio-economic impact of nuclear power is not compared with possible alternative policy scenarios. Therefore the claims that nuclear power will lead to “changes in the value of land in the area, municipal revenue growth, improvement of infrastructure, a reduction of unemployment, economic recovery of the region, and improvement of the country's energy security” in chapter 9 are empty. It is unknown how the local economy would be able to benefit from the development of renewable and decentralised energy sources, it is certain that an energy efficiency and RE oriented development will create more jobs^{22 23}, especially in the region of Gdansk – Gdynia, with its established off-shore industry. An energy efficiency and RE oriented policy will certainly lead to larger energy security, because the electricity system will not be depending on imported nuclear fuel, to a far lesser extent on imported technical expertise, and will be less vulnerable to the instabilities in the grid caused by unexpected shut-downs of large 1000 MW or 1658 MW units.

Chapter 9 illustrates the problem of not comparing different policy scenarios. It states that jobs will be created, but does not calculate how many jobs will be lost because the energy efficiency industry and RE industry will not be developed instead.

13. **Completely insufficient analysis of impacts of the Polish liability regime in case of large accidents**

Poland has ratified the Vienna Convention from 1963 and signed the additional protocol from 1997, but has not ratified it so far. Under the additional protocol, the operator of a potential nuclear power station carries the liability risk of 150 Million SDR (170 Million EUR), whereas the state guarantees another 150 Million SDR. This regime is taken over in the proposed act for nuclear liability.²⁴ Currently, however, Poland knows a liability cap with a maximum of 150 Million SDR.²⁵

There is already for several decades a fundamental debate about the adequacy of the capped liabilities within the Vienna and Paris Conventions. However, consequences of larger accidents can be enormous. Estimates for total liabilities of the the Chernobyl catastrophe in 1986 go well past 100 Billion Euro, early estimates of the liabilities from the Fukushima disaster in 2011 run in the many tens of Billions of Euros and may well come in the same order of magnitude or go even far beyond of that of the Chernobyl accident given the fact that the Fukushima Daicchi reactors were situated in a far more densely populated and economic active area than Chernobyl.

Because both the Nuclear Energy Programme and the SEA lack a proper analysis of large possible accidents, there is in the public consultation even no basis for estimating real liabilities.

Neither the Polish Nuclear Energy Programme nor the SEA document investigate whether the proposed liability coverage would be justifiable in comparison with liabilities that alternative solutions face or whether this would cause a discriminatory advantage for nuclear power. Neither one investigates what the impacts

22 Short, Rebecca (ed.), *Working for the Climate - Renewable Energy & the Green Job [R]evolution*, Amsterdam (2009) Greenpeace, European Renewable Energy Council (EREC);
<http://www.greenpeace.org/raw/content/eu-unit/press-centre/policy-papers-briefings/working-for-the-climate-15-09-09.pdf>

23 Gaj, Henryk, Elżbieta Wójcik-Gront, Maria Szwejkowska-Muradin, *Pracując dla Klimatu - zielone miejsca pracy w Polsce*, Warszawa (2011) Greenpeace, Primum+;
<http://www.greenpeace.org/poland/press-centre/dokumenty-i-raporty/pracujac-dla-klimatu-raport>

24 http://bip.mg.gov.pl/files/upload/11397/odpowiedzialnosc_cywilna_za_szkode_jadrowa.pdf

25 Gomez-Acebo & Pombo, Abogados SCP, *Final Report - TREN/CC/01-2005 - Legal Study for The Accession of Euratom to the Paris Convention On Third Party Liability in the Field of Nuclear Energy*, Brussels (2007) European Commission;
http://ec.europa.eu/energy/nuclear/studies/doc/2009_12_accession_euratom.pdf

are on the Polish economy in case of a large accident with a larger damage than 300 Million SDR. The Polish Nuclear Energy Programme does not get any further than mentioning the efforts to bring the existing liability legislation in line with the additional protocol to the Vienna Convention (on page 42, 46, 49, 54), nor does the SEA report (on pages 66, 339, 346, 664). It does not even mention the fact of current and planned caps. Given that these caps are completely inadequate, not mentioning them in a report for public consultation constitutes misleading of the public.

It has to be noted here, that the capping of liabilities and lack of compulsory insurance for the operator for all liabilities of nuclear power plants is *de facto* state aid to nuclear power of a magnitude that could well surpass, for instance, the total of support schemes given to the development of renewable energy sources in a country like Germany.

The Polish Nuclear Energy Programme should describe in detail the existing and planned liability regimes, give a detail description about possible liabilities from large beyond-design nuclear accidents for the Polish economy and compare these with liabilities in realistic alternative energy scenarios. Ideally, the Polish Nuclear Energy Programme should describe steps how Poland will move away from the minimalistic legal liability currently chosen towards a truly “polluter-pays-principle” based liability regime. Only in this way, a decision about the justification of the huge liability risk that nuclear power will constitute for Poland can be made.

14. **The use of external studies is one-sided** – The authors use a wide spectrum of outside studies to support their argumentation. It has to be noted, however, that they consequently leave out more critical studies and some of the studies they use are contested (e.g. the ExternE studies from the European Commission – contested on its assumption of construction costs, its methodology for comparing incidents and accidents, and others).

In Annex I of this submission, I include a list of studies that should be integrated in the analysis leading to the Nuclear Energy Programme and its SEA report. These studies relate to:

- nuclear energy and sustainability;
- comparison with alternatives;
- social consequences of energy policy;
- impact of nuclear power on grid development;
- comparison of external effects of energy sources;
- costs of nuclear power.

This list is far from comprehensive, but gives at least a first orientation. For the justification process of which a SEA is supposed to be a part, the Polish government cannot rely only on material from the nuclear industry, pro-nuclear lobby groups and research institutes that are fully bound to the nuclear industry. The data base for the justification decisions needs to be broad, objective, science based, balanced and transparent.

15. **Insufficient inclusion of full fuel chain analysis** – Although the report claims to pay attention to full fuel chain influences, among others by using the McKinsey study on greenhouse gas emissions per delivered kWh and the ExternE studies on inclusion of externalities, full fuel chain analysis is not consequently used in the report. There is insufficient description of the environmental impacts of uranium mining, fuel production, risks of transport, risks of spent nuclear fuel management, environmental impacts of reprocessing and once-through use of fuel and radioactive waste management. For a more detail analysis of what is missing, more time needs to be available.
16. **Insufficient basis for the conclusion that the Programme would reduce social costs associated with energy production** – Because there are no scenario comparisons, no total integration of full-chain analysis, an insufficient analysis of impacts of accidents, the conclusion that the Programme would reduce social costs associated with energy production is at least preliminary and unscientific if not outright misleading.

17. **Inconsequential use of basic principles** – The Programme quotes the central principles of the Treaty of the Functioning of the European Union art. 191 as basis - including the precautionary principle, the principle of prevention, the principle of repairing the damage at the source and the polluter pays principle. However, these principles seem to play no role in the assessment of risks of large accidents and their environmental impacts, the environmental impacts of fuel production and radioactive waste production and radioactive waste management.
18. **Insufficient analysis of large accidents** – The report pays insufficient attention to the possible environmental impacts of large – especially beyond design – accidents. Certainly after the nuclear catastrophe in the nuclear power station in Fukushima in Japan, this issue should be seriously reconsidered.

Malevolent attack – In comparison with other ways to meet the demand for energy services, especially in comparison with energy efficiency and renewable energy sources, nuclear power stations add a unique risk in the form of malevolent attacks. The possible emissions and possible enormous consequences from such an event should be taken into account in the justification process of environmental impacts of the project. If 9/11 has shown anything, it is that no effort of security services, flight security and protection of airspace can fully exclude the possibility of malevolent attack on strategic or symbolic objects. During the investigations around 9/11 it also became clear that nuclear power stations were possible targets. The risk of malevolent attack is not only confined to attacks with aircraft, but also includes internal sabotage, including the introduction of malware in computer systems, armed take-over of the operation room, attacks with charged heads and others.

The necessary measures by the state to completely prevent these kind of events would need to turn Poland into a police state – the so called “Atomstaat”, for which the philosopher Robert Jungk already warned in 1977.²⁶ The Polish Nuclear Energy Programme does not pay sufficient attention to this risk.

Insufficient assessment of a serious accident

The evaluation of a nuclear accident in the SEA report does not sufficiently assess the possible impacts of large accidents. It gets stuck in industry provided (and not independently reviewed) PSA calculations, and does not sufficiently acknowledge the possibility that part of the core can come into the environment under certain circumstances, as illustrated by the recent nuclear accident in Fukushima in Japan.

The data for this assessment in paragraph 7.3 of the Environmental Assessment (page 7-432 and further) have been lifted without further analysis from the documentation for the generic design assessment for the UK nuclear regulator. This is documentation produced by the provider of the design, adapted to the UK circumstances, and not yet approved by the UK regulatory bodies.²⁷ The consultant even copy-pasted crucial localised data from those studies, although these have been made for locations on the English coast. An example: on page 7-438, the consultant takes daily fish intake estimates of Cumbrian citizens as a basis for daily fish intake from Polish citizens. This undermines the credibility of claims made in these chapters.

First of all, this documentation is not based on peer-reviewed analyses, but on data from the potential constructors of nuclear power stations in the UK. This means that there could be “advertisement bias”. Secondly, these materials have not been approved yet by the UK nuclear regulator, which means that important issues might not have been taken into account. Thirdly, a future Polish regulator might use other criteria than the UK regulator, leading to considerable changes in the data. Fourthly, the data are for a large part location specific and cannot be transferred one-to-one to the Polish environment.

The study completely lacks an analysis of the spread of emissions in the case of a large beyond-design accident. It furthermore does not even attempt to independently estimate possible source terms for such

26 Robert Jungk, *Der Atomstaat – Vom Fortschritt in die Unmenschlichkeit*, München (1977) Kindler, ISBN 3-463-00704-5

27 For the EPR design, the data were translated from material produced by AREVA and EdF for the UK regulator, <http://www.epr-reactor.co.uk>

For the AP1000 design, the data were translated from material produced by Westinghouse for the UK regulator, <https://www.ukap1000application.com>

accidents.

This follows the trend to underestimate such events in Environmental Impact Assessments for new nuclear power stations, like for instance the EIA of the proposed Temelín blocks 3 and 4 in the Czech Republic. There, calculations were based on a 0,03 PBq emission of caesium-137, a 1,0 PBq emission of iodine-131 and 770 PBq of Xe-133. Thus the total radioactivity of the evaluated emissions would amount to less than 100 PBq, which is less than 1/1000 of the radioactivity contained in a modern reactor²⁸. This presupposes that only 0.015 percent of the caesium, for instance, and 0.03 percent of the iodine contained in a European Pressurized Reactor would be released into the environment²⁹. This does not correspond to a serious nuclear accident. Analyses made on the international level typically suppose that between 10 and 50 percent of caesium and at least one percent of iodine is emitted in a nuclear accident^{30,31}.

The total radioactive emission of the Chernobyl disaster was approximately 12 000 PBq, i. e. a thousand times that used in the Temelín EIA estimates³², although compared to the Chernobyl facility, the planned Temelín reactors would be larger and their fuel burn-up drastically higher. For example, the estimates of the caesium release fraction in the Chernobyl accident vary from 20 to 80 percent³³. The radioactivity of caesium in an EPR is approximately 700 PBq, that is 2,5 times that in the Chernobyl reactor. The high fuel burn-up and the possible use of MOX fuel further dramatically increase the potential emission of radioactive substances.

The following illustrates one example of a sequence of events that might lead to a serious nuclear accident in a modern pressurised water reactor. This scenario was developed by John Large, a leading advisor in nuclear safety, who has worked for decades in research projects at the British Atomic Energy Authority. Among other tasks, Mr. Large was in charge of charting the state of the sunken nuclear submarine Kursk and raising it back to the surface.

TIME seconds	SEQUENCE EVENT
0	The assumption is that the reactor is operating at full power when the operators take inappropriate action following what seems to have been a straightforward reactor trip triggered by, say, the loss of steamside feedwater to the steam generators.
30	Unknowingly, the operators then follow established plant procedures to restart the reactor being unaware that the plant is in fact suffering from an unanalysed (not prescribed) event such as, say a small loss of coolant incident via the RPV circuit pressuriser system. As the incident develops with the operator intervention having no effect, at about 30 seconds into the incident, the reactor alarms transmit to the control room at a rate of over 100 per minute.
480	Too many of the alarm messages are of a diversionary nature and delay the operators present moving to a correct analysis of the situation and inability be able to isolate the fault conditions then developing apace.
555	In the highly stressed environment, the operators trigger the high pressure injection pumps not knowing that this would result in a loss of the pressuriser bubble and injection of unboranated

28 This estimate is based on the isotope distribution in a 1000 MW pressurised water reactor with a fuel burnup of 35 GWd/t. Data: Large & Associates 2007: *Assessments of the radiological consequences of releases from proposed EPR/PWR nuclear power plants in France, Annex 2*.

29 Bouteille, François & al. 2006: *The EPR overall approach for severe accident mitigation*. Nuclear Engineering and Design 236 (2006), p. 1464 – 1470.

30 Large & Associates 2007: *Assessments of the radiological consequences of releases from proposed EPR/PWR nuclear power plants in France*.

31 US Nuclear Regulatory Commission 1975: *Reactor Safety Study, an Assessment of Accident Risks in US Commercial Nuclear Power Plants, WASH-1400*.

32 Nuclear Energy Agency 1995: *Chernobyl, Ten Years On*, p. 29.

33 Sich, A. R. 1994: *The Chernobyl Accident Revisited: Source Term Analysis and Reconstruction*. MIT.

	water into the core. When, at about 75 seconds. The condenser hotwell high level alarm sounds with an impending loss of condenser vacuum, the operators become preoccupied in considering the option of initiating a steam dump to atmosphere.
2055	With the operators still believing that events are on course for the reactor restart, at about 25 minutes into the incident increased neutron flux signals, caused by steam voids now forming in the MOX fuel core, prompt concern about recriticality so much so that the operators scram the reactor, turning off the primary pumps in one of the two steam generator loops to provoke flow reversal induced by continued pumping in the other loop.
2415	However, again unbeknown to the operators, the isolated loop has boiled dry, so flow reversal and cooling is unavailable because steam has siphon blocked the 'U' section of the primary circuit to this loop. The remaining loop pumps a two-phase mixture, flow decreases due to increasing voidage causing the pumps to trip followed by boiling in the RPV after about 6 minutes with the water level lowering to uncovered the fuel core.
3315+ say 1 hour	Within 15 minutes, the dry space above the core fills with superheated steam leading a zirconium-steam reaction with, within seconds, a hydrogen explosion sufficient to rupture the RPV and eject much of the molten fuel mass, itself leading to a series of molten fuel-water explosions sufficient to breach the reactor building containment.
14,115 say 4 hours	Incident ends, radioactive release commences through damaged secondary containment, continuing steadily for about three hours as water remaining in the containment continues to boil off incurring a series of smaller hydrogen burns and explosions.

On these grounds we demand that the examination of a nuclear accident be based on the quantity of radioactive materials contained in a modern nuclear reactor with a high fuel burn-up and the supposition that a significant fraction of these materials is released into the atmosphere. The estimation of these fractions must be based on acknowledged international research and experience. All data used in evaluating these emissions must be published – currently, for example, the quantity of radioactive materials contained in a functioning EPR cannot be found in any public documents.

Also the Austrian Federal Ministry for Agriculture, Forestry, Environment and Water Management points out in its Expert Statement to the EIA report of the NPP Lithuania that the source-terms used there, based on the same data as used by the authors of this SEA, are insufficient.³⁴ This also happened in the EIA for the Temelín NPP in the Czech Republic.³⁵

Proper source terms should be used in meteorological spreading models to estimate the impacts of such large accidents on a larger scale. It is incomprehensible that such analyses have not been taken up in Chapter 7. Given proper source-terms, such maps can illustrate better than anything else what the consequences of large accidents can be for the population.

It is in a fast analysis of Chapter 7 not clear where the data and methodology used in this chapter come from. We know they have been copy-pasted from the providers of nuclear technology (Areva, Westinghouse, GE), but they were not clearly referenced. The reference to a “Good Practice Guide for Atmospheric Dispersion Modelling” without any other reference of source is not really impressive. It is not clear whether the used calculation methods are a hodge-podge of different methodologies or a systematically built up own methodology.

17. **Nuclear safety** - The authors have a blue-eyed view on the reality of nuclear safety. They write on page 3-178, for instance, “*Elektrownie proponowane dla Polski będą spełniały najostrzejsze wymagania bezpieczeństwa i ochrony radiologicznej.*” [The proposed Polish power plants will meet the strictest requirements for safety and radiological protection.] What a Nuclear Energy Programme can prescribe is that these highest levels of safety and radiological protection should be met. Whether they are met in reality

34 Wenisch, Antonia, Helmuth Hirsch, Gabriele Mraz, Petra Seibert and Klemens Leutgöb, *NPP Lithuania – Expert Statement to the EIA report*, Vienna (2008) Bundesumweltamt, page 23; <http://www.umweltbundesamt.at/fileadmin/site/publikationen/REP0186.pdf>

35 Wenisch, Antonia, Wolfgang Konrad, Helmuth Hirsch, Stephan Renner, Martin Baumann, KKW Temelín 3 & 4 – Fachstellungnahme zur Umweltverträglichkeitserklärung, Vienna (2010) Bundesumweltamt, page 66 and further; <http://www.umweltbundesamt.at/fileadmin/site/publikationen/REP0296.pdf>

is a question of design, implementation and high quality oversight – all of which still have to be established. The construction of new nuclear capacity in Finland (Olkiluoto 3), France (Flamanville 3) and Slovakia (Mochovce 3,4) shows that during the actual implementation of nuclear power projects, many problems are encountered that do not automatically guarantee the highest level of safety. Whether this is in the form of design (Mochovce 3 and 4 are not meeting BAT) or implementation (Olkiluoto 3 already has registered over 3000 safety violations during construction, Flamanville 3 is following closely). Also, the French and Finnish example illustrate the importance of a highly experienced and independent nuclear regulator – something that still needs to be developed in Poland.

The last paragraph on page 3-178 illustrates that the authors only rely on positive information and are not sufficiently aware of critical information.

18. Nuclear power and health

In general, the study is severely one-sided in the choice of its sources on the issue of nuclear power and health.

Tritium – Chapter 7 pays too little attention to the emissions of Tritium and possible consequences. These have recently been highlighted by studies of IRSN (France) as needing more attention.³⁶

Recent research possibly linking certain cancers to nuclear power – In paragraph 7.7.8, the authors leave out recent large scale studies in Germany³⁷ and the USA³⁸ that indicated an increase of several forms of cancers related to the distance towards nuclear power plants. Also in the overall table in 9.1.1, page 9-654, these findings have been excluded.

19. Spent nuclear fuel and nuclear waste

Reprocessing - The information about reprocessing in chapter 8 has been taken from PR materials from EdF and Areva and does not give an adequate picture of the immense pollution caused by the technology³⁹ nor of the fact that only a small fraction (less than 10%) of the initial material is actually re-used.

High-level radioactive waste (HRW) – The issue of HRW is not dealt with adequately at all. It sketches deep geological disposal as final management, without addressing any of the controversies that currently exist around this form of waste management in Finland, Sweden or France (the only countries currently investigating the option).⁴⁰ It does not mention alternative options. It does not come to the hard conclusion that currently there is no existing management method anywhere in the world and investigated methods are so far only speculative.

The report avoids difficult issues – On page 8-546, the authors state: “*W niniejszym opracowaniu starano się nie unikać problematyki powstawania, transportu i składowania odpadów promieniotwórczych.*”

36 ASN, *Livre Blanc du Tritium*, Paris (2010); <http://livre-blanc-tritium.asn.fr/plus/telechargements.html>

IRSN, *L'IRSN publie six rapports sur le tritium*, Paris (2010); http://www.irsn.fr/FR/Actualites_presse/Actualites/Pages/20100709_rapports_IRSN_etat_connaissances_tritium.aspx

37 Kaatsch P, Spix C, Schulze-Rath R, Schmiedel S, Blettner M (2008) *Leukaemia in young children living in the vicinity of German nuclear power plants*. *Int J Cancer*. 2008 Feb 15; 122(4) pp 721-6

Fairlie, Ian, (2009) *Commentary: childhood cancer near nuclear power stations*. *Environmental Health Journal*. 2009, 8:43 <http://www.ehjournal.net/content/pdf/1476-069X-8-43.pdf>

38 Mangano, Joseph, Janette D. Sherman (2008) *Childhood Leukaemia near Nuclear Installations*. *European Journal of Cancer Care*, 2008, 17, 416-418; http://www.radiation.org/reading/pubs/ecc_948.pdf

39 Schneider, M., X. Coeytaux, Y.B. Faïd, Y. Maignac, E. Rouy, *Possible Toxic Effects from the Nuclear Reprocessing Plants at Sellafield (UK) and Cap de La Hague (France) - A first contribution to the scientific debate*, Brussels (2001) STOA Unit; <http://www.wise-paris.org/english/reports/STOAFinalStudyEN.pdf>

40 Helen Wallace, *Rock Solid? A scientific Review of Geological Disposal of High-Level Radioactive Waste*, Buxton (2010) GeneWatch UK; <http://www.greenpeace.org/eu-unit/press-centre/reports/rock-solid-a-scientific-review>

[In this study, an attempt was made to not avoid the problems of formation, transport and storage of radioactive waste.] This is factually not true, because the fact that there is no solution for radioactive waste has not been explicitly mentioned.

Salami-slicing of the Programme to avoid difficult issues – On page 8-546 it is stated: “*Należy jednak podkreślić, że ta część cyklu paliwowego nie jest objęta przedmiotowym zakresem prognozy oddziaływania na środowisko Programu Polskiej Energetyki Jądrowej.*” [It should be noted, however, that this part of the fuel cycle does not fall within the scope of environmental impact assessment of the Polish Programme for Nuclear Energy]. If a SEA does not look to the waste products produced by the plan or programme, what is the use of a SEA? This is really incredible! The quoted reference to art. 5.2 of the SEA Directive is a *chotspe*. The crucial criterion in art. 5.2 is reasonability.⁴¹ With a pig-stable one would not be allowed to leave out the waste produced. Let alone with a nuclear energy programme. It is more than reasonable to expect the waste phase of the proposed strategy to be included in the SEA. There is also no problem of duplication, as Poland so far has not made a SEA on radioactive waste management from nuclear power production yet.

What has to be acknowledged here is that – very controversially – the waste issue also is not addressed in recent EIAs of nuclear power stations. The production of radioactive waste is, however, a crucial and inherent element of the environmental impacts of nuclear energy and likewise is its analysis essential for any justification decision for the adoption of nuclear power in the energy mix. Even stronger – it should be the basis for any decision procedure for new nuclear projects: **if there is no solution for the waste and there are feasible alternatives for the programme, there should be no new production of nuclear waste (precautionary principle).**

Under the Aarhus Convention and the EIA Directive, salami-slicing (slicing projects or programmes in smaller portions in order to prevent important issues of surfacing) has long been recognised as a non-acceptable practice.

20. **Impact of emissions** – The description of possible influences in chapter 9 (page 9-652 and further) does not address the impacts of emissions after a heavy accident. This chapter also does not include impacts of emissions during the front-end of the fuel chain (mining, fuel production, transport) and decommissioning and the back-end of the fuel chain (spent nuclear fuel processing, radioactive waste management). As these are crucial potential emissions that need to be justified in comparison with other options that can fulfil the goals of the Polish energy policy, this omission is unacceptable.

21. **Conclusions and recommendations (Chapter 11, page 11-734 and further)** – This chapter is possibly the weakest of the entire report.

It is postulated that “*wdrożenie Programu ma wysoki potencjał obniżenia kosztów społecznych związanych z produkcją energii jak również redukcji emisji gazów cieplarnianych*” [the implementation of the Programme has a high potential for reduction of social costs associated with energy production as well as reducing greenhouse gas emissions.]

Because the analysis is based on unrealistically low construction cost estimates for new nuclear power stations, on an insufficient analysis of back-end costs (decommissioning and radioactive waste management) and an insufficient analysis of the development of the uranium market in the coming 60 years, this statement cannot be upheld.

Furthermore, the analysis completely lacks a comparison of different realistic policy scenarios, including scenarios without nuclear power development and based on further development of energy efficiency and renewable energy, as for instance carried out by McKinsey, PriceWaterhouseCoopers, Greenpeace and EREC, EC BREC Instytut Energetyki Odnawialnej and the Instytut na rzecz Ekorozwoju.⁴² Because of that,

41 Directive 2001/42/EC of the European Parliament and of the Council on the assessment of the effects of certain plans and programmes on the environment, art. 5(2): “*The environmental report prepared pursuant to paragraph 1 shall include the information that may **reasonably be required** taking into account current knowledge and methods of assessment, the contents and level of detail in the plan or programme, its stage in the decision-making process and the extent to which certain matters are more appropriately assessed at different levels in that process in order to avoid duplication of the assessment.*” [emphasis added, JH]

42 McKinsey & Company, KEMA, The Energy Futures Lab at Imperial College London, Oxford Economics and the ECF, *Roadmap 2050 - a practical guide to a prosperous, low-carbon Europe*, Berlin (2010) European Climate Foundation; <http://www.roadmap2050.eu/downloads>

it is impossible to claim on the basis of this SEA report that the development of nuclear power in Poland will indeed reduce social costs and greenhouse gas emissions with such a level that it can justify the potential environmental impacts and indeed negative social and economic impacts.

The arguments used in Chapter 11 for the urgency of implementation of this Programme are exactly the same as for the implementation of possible alternatives. From that perspective the lack of comparison with realistic alternative policy scenarios is incomprehensible.

The conclusions fail to address the issue of management of radioactive waste as a top-priority. There is world-wide no satisfactory solution for dealing with radioactive waste, be it long-lived waste or high-level waste. On the basis of the precautionary principle, this issue should be resolved before Poland would want to start the development of nuclear power.

22. **Propaganda** - The SEA report rightfully states concerning the proposed educational campaign: “*Program ten nie może mieć charakteru propagandy na rzecz energetyki jądrowej.*” [This program may not have the nature of propaganda in favour of nuclear power.]

However, the Polish Nuclear Energy Programme itself states that the goal of the educational campaign is acceptance of nuclear energy. This is a propagandist goal with a pre-determined conclusion.

Also the public support targets mentioned in the Programme on page 18 (target 7) point to opinion massaging instead of an open public debate and proper public participation. The fact that the main responsibility for obtaining a favourable public opinion is put into the hands of a ministry is nothing less than shocking – instead of a public debate that could help inform the ministry about the necessity of this programme, the ministry takes, in spite of its public function and public funding, the role of propagandist.

The statement in the SEA means, that the current nuclear propaganda campaign carried out by the plenipotentiary for nuclear power should immediately be stopped and replaced by an open and widely informed public debate about nuclear power before any further steps are taken. It is advisable to start with a debate about management of nuclear waste.

This wide public debate should not only include education about technological aspects and advantages of nuclear power as is the case now, but also education about disadvantages and problems of nuclear power. Such education cannot be done by those who have a direct ideological or commercial interest in the development of nuclear power in Poland, but will have to be done by institutions that are traditionally critical about nuclear energy. The entire debate should be facilitated by a content-neutral institution – and certainly not by the current plenipotentiary for nuclear power who over the last years has constantly trumpeted her critiqueless and biased pro-nuclear ideology. Financing should be available for all sides in

Price-Waterhouse-Coopers, PIK, IASA, ECF, *100% renewable electricity; A roadmap to 2050 for Europe and North Africa*, London (2010) Price-Waterhouse-Coopers;

http://www.pwc.co.uk/eng/publications/100_percent_renewable_electricity.html

Sven Teske (ed.), *Energy [R]evolution - Towards a Fully Renewable Energy Supply in the EU 27*, Brussels (2010) Greenpeace / EREC; <http://www.greenpeace.org/eu-unit/press-centre/reports/EU-Energy-%28R%29-evolution-scenario>

Wiśniewski, Grzegorz (ed.), *[R]ewolucja energetyczna dla Polski - Scenariusz zaopatrzenia Polski w czyste nośniki energii w perspektywie długookresowej*, Warszawa (2008), Greenpeace, EC BREC Instytut Energetyki Odnawialnej;

<http://www.greenpeace.org/raw/content/poland/press-centre/dokumenty-i-raporty/rewolucja-energetyczna-polska.pdf>

Instytut na rzecz Ekorozwoju, *Alternatywna Polityka Energetyczna Polski do 2030 roku – Raport dla osób podejmujących decyzje*, Warszawa (2009), Eko-Herkules;

http://www.chronmyklimat.pl/theme/UploadFiles/alternatywna_polityka_decyzje.pdf

Instytut na rzecz Ekorozwoju, *Alternatywna Polityka Energetyczna Polski do 2030 roku – Raport techniczno-metodologiczny*, Warszawa (2009), Eko-Herkules;

http://www.chronmyklimat.pl/theme/UploadFiles/alternatywna_polityka_teknika.pdf

Instytut na rzecz Ekorozwoju, *Energia – konieczność ale i odpowiedzialność – Broszura dla społeczeństwa*, Warszawa (2009), Eko-Herkules;

http://www.chronmyklimat.pl/theme/UploadFiles/alternatywna_polityka_energia.pdf

the educational activities and the public debate.

The debate needs participation of a wide part of the Polish public, and needs to address among others issues like the true costs of nuclear energy, all radiation risks, the nuclear waste problem – LILW storage and 100+year consequences as well as HLW management and related dilemmas, proliferation risks (in the long and short term), nuclear security and the risks that the introduction of nuclear power in Poland poses to democracy, the consequences of the Chernobyl and Fukushima catastrophes and other nuclear incidents and accidents and resulting liabilities for the Polish taxpayer and state, all parts of the nuclear fuel chain and the choice of sites.

Indeed, consequently, the current public participation process in the SEA procedure should fulfil itself the condition of not functioning as a tool of propaganda, i.e. the public should be given wider information (e.g., different realistic policy scenarios for the development of the energy sector, better quality information on front-end and back-end of the fuel chain, better quality information about possible accidents and nuclear security, information on liabilities, about the risks of radiation, costs, etc.) and the public should get a reasonable possibility to react on that information. The chaotically organised SEA procedure, including the far too short month-long period for the preparation of the SEA report, the initially 21 days public participation period that was prolonged only on the final deadline, the not yet executed transboundary consultation all hinder an open and objective information stream and optimal public participation.

After the conclusion that information and education should not be propaganda, the report concludes: *“Powinien natomiast dostarczać społeczeństwu rzetelnych informacji oraz wskazywać na atuty energii jądrowej i jej niezbywalne miejsce wśród innych korzystnych dla środowiska metod pozyskiwania energii.”* [Society should be provided with reliable information and indications of the advantages of nuclear energy and its inalienable place among other environmentally beneficial methods of energy generation.] It is incomprehensible to me that this sentence can follow the former one. Non-propagandist information supply and education implies that society has a right to receive reliable information on the advantages **and disadvantages** of nuclear energy, and that society then should get the chance to freely conclude whether nuclear energy deserves a place among environmental beneficial methods of energy generation, **or not**. Basically, the report demands open debate, but is in itself a blunt tool of propaganda with predetermined conclusions and one-sided information. With this, the call for open debate has become a fig-leave for state-sponsored manipulation.

Also the description of opposition against nuclear power on pages 71 and further falls under the label of propaganda. Instead of a proper description of movements that oppose nuclear developments in Poland and internationally, and a fair reflection of their arguments, the authors resort to defamatory language. The authors then give extra-proportional attention to a handful of people that present themselves with green credentials and that have a more favourable opinion towards nuclear energy (though it fails to mention that not all of them have a fully favourable one). The authors do not discuss the argumentation of those people, nor put them into a wider perspective, including their links with the nuclear industry and resulting conflicts of interest.

I advise that the entire text is scanned for propaganda and adapted in order to deliver a more balanced basis for the Strategic Environmental Assessment.

23. **Proposals incompatible with Aarhus, Espoo and EU EIA Directives** – The criteria proposed for the Environmental Impact Assessment in paragraph 11.3 do not fulfil those set in the Aarhus Convention, the Espoo Convention and the EU EIA Directives. I suppose they also do not fulfil Polish law, but because there is no English version of the Polish EIA law readily available on internet⁴³, I was not able to verify that. It is certainly not sufficient to look in the EIA only to the infrastructure and to discuss only two possible sites for the nuclear power station. The EIA needs to give a sufficiently detailed overview of the potential environmental impacts of the whole necessary fuel chain and related infrastructure, including issues like greenhouse gas emissions, emissions of other key pollutants, impacts on eco-systems, resource use, impacts on biodiversity, etc. The EIA also needs to reflect possible cumulative effects from the planning of multiple reactors within the project. It furthermore needs to include a description of the zero-option, i.e. the impact on the environment when the project is not developed. This needs to be compared with reasonable

43 http://www.mos.gov.pl/kategoria/1977_law/

alternatives. In case these alternatives are described already either in the Energy Strategy for Poland or in this Nuclear Energy Programme (which they are currently not), they will need to be reflected in sufficient detail in the EIA report. As the situation is now, the EIA would need to develop a full set of alternative scenarios. Only in this way, the EIA report does not only give a description without any practical value, but can be the key-instrument for justification of the impacts of the entire project on the environment – the tool over which public participation concerning the environment can meaningfully enhance the quality of the concluding decision to grant a construction permit for the project – or not.

ANNEX I

Studies to be included in the preparation of a Polish Nuclear Energy Programme and its SEA

nuclear energy and sustainability

- Kromp-Kolb, Helga and Andreas Molin (eds.), *Nuclear Power, Climate Policy and Sustainability – An Assessment by the Austrian Nuclear Advisory Board*, Vienna (2007) Federal Ministry of Agriculture and Forestry, Environment and Water Management; <http://www.umwelt.net.at/filemanager/download/20557/>

comparison with alternatives

- Teske, Sven (ed.), *Energy [R]evolution – a Sustainable World Energy Outlook, 3rd edition 2010 world energy scenario*, Amsterdam/Brussels (2010) European Renewable Energy Council (EREC), Greenpeace; http://www.energyblueprint.info/fileadmin/media/documents/2010/0910_gpi_E_R_full_report_10_lr.pdf
- Teske, Sven (ed.), *Energy [R]evolution – Towards a Fully Renewable Energy Supply in the EU 27, 2010 EU 27 energy scenario*, Brussels/Amsterdam (2010) Greenpeace, European Renewable Energy Council (EREC); http://www.energyblueprint.info/fileadmin/media/documents/national/2010/0910_gpi_E_R_eu_report_4_lr.pdf
- Wiśniewski, Grzegorz (ed.), *[R]ewolucja energetyczna dla Polski - Scenariusz zaopatrzenia Polski w czyste nośniki energii w perspektywie długookresowej*, Warszawa (2008), Greenpeace, EC BREC Instytut Energetyki Odnawialnej; <http://www.greenpeace.org/raw/content/poland/press-centre/dokumenty-i-raporty/rewolucja-energetyczna-polska.pdf>
- Instytut na rzecz Ekorozwoju, *Alternatywna Polityka Energetyczna Polski do 2030 roku – Raport dla osób podejmujących decyzje*, Warszawa (2009), Eko-Herkules; http://www.chronmyklimat.pl/theme/UploadFiles/alternatywna_polityka_decyzje.pdf
- Instytut na rzecz Ekorozwoju, *Alternatywna Polityka Energetyczna Polski do 2030 roku – Raport techniczno-metodologiczny*, Warszawa (2009), Eko-Herkules; http://www.chronmyklimat.pl/theme/UploadFiles/alternatywna_polityka_technika.pdf
- Instytut na rzecz Ekorozwoju, *Energia – konieczność ale i odpowiedzialność – Broszura dla społeczeństwa*, Warszawa (2009), Eko-Herkules; http://www.chronmyklimat.pl/theme/UploadFiles/alternatywna_polityka_energia.pdf
- McKinsey & Company, KEMA, The Energy Futures Lab at Imperial College London, Oxford Economics and the ECF, *Roadmap 2050 – a Practical Guide to a Prosperous Low-Carbon Europe*, Berlin (2010) European Climate Foundation; <http://www.roadmap2050.eu>
- PriceWaterhouseCoopers, PIK, IIASA, ECF, *100% Renewable Electricity – a Roadmap to 2050 for Europe and North Africa*, London (2010) PWC, Potsdam Institute for Climate Impact Research; http://www.supersmartgrid.net/wp-content/uploads/2010/03/100-renewable_electricity-roadmap.pdf
- WWF, *The Energy Report – 100% Renewable Energy by 2050*, 2011(Gland) WWF, Ecofys, OMA; <http://wwf.panda.org/?199249/Brave-new-world-fuelled-by-clean-economical-energy-possible-and-imperative-by-2050>
- Froggatt, Antony and Mycle Schneider, *Systems for Change: Nuclear Power vs. Energy Efficiency + Renewables?* Berlin (2010) Heinrich Böll Stiftung; http://www.boell.de/downloads/ecology/TXT_20100810_Froggatt_Schneider_V100.pdf

social consequences of energy policy

- Short, Rebecca (ed.), *Working for the Climate - Renewable Energy & the Green Job [R]evolution*, Amsterdam (2009) Greenpeace, European Renewable Energy Council (EREC); <http://www.greenpeace.org/raw/content/eu-unit/press-centre/policy-papers-briefings/working-for-the-climate-15-09-09.pdf>
- Gaj, Henryk, Elżbieta Wójcik-Gront, Maria Szweykowska-Muradin, *Pracując dla Klimatu - zielone miejsca pracy w Polsce*, Warszawa (2011) Greenpeace, Primum; <http://www.greenpeace.org/poland/press-centre/dokumenty-i-raporty/pracujac-dla-klimatu-raport>

impact of nuclear power on grid development

- Ackermann, Thomas, Eckehard Tröster, Rebecca Short, Sven Teske, *[R]enewables 24/7 - Infrastructure Needed to Save the Climate*, Brussels / Amsterdam (2009) EREC, Greenpeace; <http://www.greenpeace.org/raw/content/international/press/reports/renewables-24-7.pdf>
- Van De Putte, Jan, Rebecca Short, *Battle of the Grids – How Europe can go 100% renewable and phase out dirty energy*, 2011 (Brussels) Greenpeace; <http://www.greenpeace.org/eu-unit/press-centre/policy-papers-briefings/battle-of-the-grids>
- Tröster, Eckehard, Rena Kuwahata, Thomas Ackermann, *European Grid Study 2030/2050*, Langen (2011) Energynautics GmbH; http://www.energynautics.com/downloads/europeangridstudy2030-2050/energynautics_EUROPEAN-GRID-STUDY-2030-2050.pdf

external effects of energy sources

- Sovacool, Benjamin K., *The costs of failure: A preliminary assessment of major energy accidents, 1907–2007*, Energy Policy 36 (2008) 1802–1820, Elsevier; www.elsevier.com/locate/enpol
- Helen Wallace, *Rock Solid? A scientific Review of Geological Disposal of High-Level Radioactive Waste*, Buxton (2010) GeneWatch UK; <http://www.greenpeace.org/eu-unit/press-centre/reports/rock-solid-a-scientific-review>

costs of nuclear power

- Koplow, Doug, *Nuclear Power: Still Not Viable without Subsidies*, Cambridge, MA (2011) Union of Concerned Scientists; http://www.ucsusa.org/assets/documents/nuclear_power/nuclear_subsidies_report.pdf
- Sokoloski, Henry, *The High and Hidden Costs of Nuclear Power*, Policy Review, August & September 2010, No. 162, Hoover Institution, Stanford University; http://www.npec-web.org/article_file/20100805-The_High_And_Hiden_Costs_of_Nuclear_Power_290111_0356.pdf
- CitiGroup, *New Nuclear – The Economics Say No*, London (2009); <https://www.citigroupgeo.com/pdf/SEU27102.pdf>
- Steve Thomas, *The Economics of Nuclear Power: An Update*, Berlin (2010) Heinrich Böll Stiftung; http://www.boell.de/downloads/ecology/Thomas_economics.pdf
- Cooper, Mark, *The Economics of Nuclear Reactors: Renaissance or Relapse?* Vermont (2009) Institute For Energy And The Environment Vermont Law School; <http://www.vermontlaw.edu/Documents/Cooper%20Report%20on%20Nuclear%20Economics%20FINAL%5B1%5D.pdf>

