COMMENTS ON THE

Environmental Impact Assessment Report New Nuclear Power Plant in Lithuania August 27th 2008

For GREENPEACE

Ir. Jan Haverkamp
Lauri Myllyvirta

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Greenpeace European Unit
Belliardstraat 199 Rue Belliard, 1040 Brussels, Belgium
Tel: +32 2 2741900 Fax: +32 2 2741910
www.greenpeace.eu

GREENPEACE International

Introduction

This comment gives detail remarks on the EIA report as presented in August 2008 by the developers of the EIA report, Pöyry Energy Oy in Finland and the Lithuanian Energy Institute.

Greenpeace did not have the capacity to go into much of the detail analysis. The remarks made here result from a first fast scan of the report and can in no way be interpreted as a full analysis.

Nevertheless, Greenpeace thinks it is important that its observations are taken into account in the Environmental Impact Assessment process.

The numbering in the comments refers to the page numbering of the full EIA report.

About the authors: Ir. Jan Haverkamp is the Greenpeace EU Policy Campaigner on dirty energy and has over 25 year experience in the nuclear energy field in Central Europe. Lauri Myllyvirta is Greenpeace energy campaigner based in Finland.
For questions and further consultation, the authors can be reached under:
Jan Haverkamp – jan.haverkamp@greenpeace.org, tel.: +32 477 790 416
Lauri Myllyvirta – lauri.myllyvirta@nordic.greenpeace.org

Main Conclusions

This fast assessment of the EIA report comes to the conclusion that the EIA report is:

- misleading in crucial points of the analysis, e.g. by excluding vital alternatives;
- insufficient because of lack of information about the possible reactor designs, mainly caused by the fact that no specific design has been chosen yet and too many designs are under consideration;
- insufficient analysis of the entire fuel chain;
- insufficient analysis of the reality of nuclear construction, e.g. costs and time tables;
- insufficient analysis of serious accidents;
- insufficient inclusion of the effects of climate change;
- public participation in the safety analysis is not guaranteed, because it takes place after the EIA procedure. This should be amended.

Greenpeace therefore concludes that the EIA report is insufficient and should not be adopted. Greenpeace demands a new EIA in case a design for the project is chosen, so that conclusions can be made on real data rather than the vague date used in this report. Such a procedure should include a full analysis of all economic possibly viable alternatives, including that of an energy policy based on stimulation of energy efficiency and the development of renewable energy solutions as described in the Greenpeace / EREC energy [r]evolution scenario[1].

1 EREC, Greenpeace, energy [r]evolution - a sustainable world energy outlook, Amsterdam (2007) Greenpeace International; http://www.energyblueprint.info

General Comments

a. No information on reactor model

The environmental impact assessment (EIA) provides an interesting account of the history of nuclear technology but gives no tangible information whatsoever on the reactor model intended to be built. This leads to lack of concreteness and detail throughout the report – e.g. production of high-level nuclear waste is reported as ranging from 47 to 370 tons per annum, a range of almost an order of magnitude for maybe the most serious environmental impact of the project! The same staggering lack of detail is evident in the assessment of nuclear safety. In effect, the company is asking for a *carte blanche* to build any installation they please, and in so doing devaluating the whole EIA process. There needs to be a design-by-design analysis of main environmental impacts and nuclear safety measures.

b. Risks of nuclear waste omitted

The long-term health and environmental hazards caused by long-lived high-level nuclear waste are among the most severe and profound environmental impacts of a nuclear power plant. These impacts and their mitigation are fully omitted from the EIA report which can not be acceptable under any circumstances. Production of high-level waste is an integral part of the project and it cannot be separated into a separate EIA process, because the potential impacts of the waste need to inform the decision on whether or not building this nuclear power plant is justifiable. Construction and operation of the NNPP will lead inevitably and irreversibly to creation of nuclear waste. An EIA in a later stage would be therefore counter Lithuanian, EU and international law, which stipulate that the EIA should take place before irreversible decisions have been taken. Furthermore, management and especially long-term deposition of nuclear waste can entail substantial costs that can affect the economic viability of the whole project. It would be irresponsible for the environmental authorities to grant an environmental permit to a facility that does not have a plan on, a commitment to, a credible estimate of the costs of or demonstrated financial means for management of its own waste. The omission of high-level waste management from the EIA report is another demonstration of utter disregard for the EIA process.

c. Construction timetable will cause hazards

The proposed construction timetable is unrealistic and dangerous. As is evident in the nuclear projects in Olkiluoto, Finland and Flamanville, France, a tight timetable will inevitably lead to use of incompetent suppliers, breaches of planning and testing procedures and violations of nuclear safety requirements. The construction timetable presented in the EIA report needs to be based on existing experiences, not pipe dreams.

d. Questionable regional benefits

The claim in the report that a major inflow of migrant workers would entail significant positive regional spillovers is not justified by experience. Tax inflow and demand for local goods and services is minimal, whereas burden on local public services, infrastructure and law enforcement can be substantial. This especially so in the case where the majority of inflow is only for the limited construction time and will leave a void afterwards.

e. Viable solutions ruled out

The reluctance by the reporters to deal with alternatives is unacceptable from legal, environmental and governance point of view. Ruling out renewable energy and energy efficiency measures is not justifiable and the assumption that in the absence

of new nuclear reactors, electricity would be produced almost solely with fossil fuels is not sensible. As is imminent from the EIA report itself, the potential impact of the project on the Lithuanian electricity market is so large, that limiting the analysis to measures that can be implemented by the company is not justifiable. The assumption of increased reliance on fossil fuels is arbitrary. Furthermore, emissions from electricity production in Lithuania are bound by the Emissions Trading System of the European Union and most likely also by a new commitment period of the Kyoto protocol under negotiation at the moment. Therefore the emission targets will need to be met regardless of whether new nuclear capacity is added, ruling out the option of increased use of fossil fuels.

f. Risks to population

According to the EIA report, tens of thousands of people live within a 5-20 km radius from the nuclear power plant. A few authoritative and well substantiated studies have recently found an alarming link between incidence of cancer, especially childhood leukemia, and proximity to nuclear power plants.[2] There is no established explanation for these findings, but they are nevertheless very relevant for the EIA and should not be omitted.

g. No sufficient assessment of serious accident

The evaluation of a nuclear accident in the EIA report is based on a 0,1 PBq emission of caesium-137 and a 1,0 PBq emission of iodine-131. Thus the total radioactivity of the evaluated emissions would only amount to less than 10PBq, which is less than 1/10000 of the radioactivity contained in a modern reactor[3]. 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 environment[4]. 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[5,6].

The total radioactive emission of the Chernobyl disaster was approximately 12 000 PBq, i. e. a thousand times that used in the EIA estimates[7], although compared to the Chernobyl facility, the planned Visaginas reactor would be many times larger and its fuel burn-up drastically higher. The estimates of the caesium release fraction, for example, in the Chernobyl accident vary from 20 to 80 percent[8]. The radioactivity of caesium in an EPR, for example, 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.

2 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

3 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*.

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

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

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

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

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

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 conceived 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.

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.

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 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.

Comments in detail

COMMENTS on the basis of the summary

1. (page 26) The facilities for nuclear waste and SNF storage as well as further management should be included. Argumentation: An EIA has to be done in an early stage before irreversible steps have been taken. In case the NNPP construction has started, the necessity for nuclear waste and SNF storage is inevitable and irreversible. Therefore they should be part of this EIA. If the EIA is left to a later stage, this would be in substance and spirit in breach with the Lithuanian, EU and international legislation on EIA's and public participation.

2. There are no alternatives worked out for the heat production for the NNPP Visaginas.

3. Influx of foreign workers during construction is stated as having a very significant positive socio-economic impact. This is not likely. As these people will be there only for a relatively short time, this will mean the set-up of a huge infrastructure to deliver services for these people, that after construction finished will be largely obsolete as the region does not offer possibilities for alternative employment for these relatively specialised workers. The influence of construction of later obsolete services and infrastructure is a negative one.

4. Impact on climate change. A full chain analysis of greenhouse gas emissions should have been included. Including (as example) the increased traffic during construction...

5. Fine-dust from increased largely diesel traffic is not taken up in the assessment.

6. Ground water and waters of Lake Druksiai – no analysis of the impacts of lowering of ground water on the construction site during the construction period and afterwards. Pressure on ground water due to water need for cooling has not been analysed.

7. (Page 27) “Waste suitable for energy production” - this depends on the availability of capacity to use this waste indeed for energy production. As the NNPP is supposed to deliver the heat for Visaginas, it is unlikely that this waste can be used for high efficiency energy production and for that reason needs to be seen as ordinary solid waste.

8. The influence of noise from construction is not only to be estimated for its impacts on people, but also on the environment, e.g animals.

9. Impacts of climate change on the hydrological situation of lake Druksiai have not been taken into account sufficiently. They have only been taken into account in the ice-calculations, but not in others.

10. There is no analysis of emergency sheds of heat on the lake ecosystem.

11. Climate and air quality: it is not justified to look only at the emissions from the power plant itself. For proper comparison one has to compare the greenhouse gas emissions of the total chain of activities. For nuclear power this includes mining, milling, processing, fuel production (front-end) as well as back-end

(decommissioning and waste management). This study has not looked at those factors, making any sensible comparison impossible.

12. (Page 28) Cooling. The report concludes that Lake Druksiai cannot tolerate the maximum power generation. This important conclusion is not featured clear enough. It has become clear in this case, that there are too little data on the table because no design has been chosen yet[9]. This means that no proper conclusions concerning cooling options and their impact on the environment can be made.

13. Impacts on biodiversity: "These impacts can be mitigated to an acceptable level" - The report does not argue what an acceptable level is, which puts this paragraph beyond judgement.

14. Landscape: The damage done by the INPP cannot be taken into the equation, as this power plant is supposed to be decommissioned and the area brought back to its natural state before the end of the decommissioning of the NNPP. The NNPP will cause further damage and it will cause damage to be prolonged beyond the time the landscape already will be damaged by the old NPP.

15. Socio-economic environment: there is no inclusion of possible alternative development plans for the region, which makes the statement that socio-economic impacts are positive empty.
A temporary boom in activity during construction leaves unused services and infrastructure, which has a strongly negative influence on the socio-economic environment.

16. Public health: Positive health effects because of improved economy and social security can only be evaluated if alternative regional development plans are taken up into the equation.

17. Radiological impact of the NNPP will depend strongly on the chosen design and its parameters. Current debates about effects of low-level radiation exposure show that there are possible effects on the incidents of childhood leukaemia. Certain NPP designs like the CANDU have highly elevated tritium emissions that according to some experts can have a hazardous influence for high risk groups as pregnant women and young children. As long as scientific discussions about exposure / dose relations are fluid, it is necessary to indicate the total exposure next to expected dose. An expected dose of 43,4 muSv is not low!
The town of Visaginas falls in both site choices within the 10 km zone. Calculations of spread of radioactive materials under different meteorological circumstances should therefore be made.

18 (Page 29) Nuclear fuel production and transportation: This does have an effect on the environment – and a considerable one for that in many cases – and therefore needs to be quantified so that it can be used in comparison with alternatives.
The remark that the uranium market would operate regardless the implementation of the NNPP is nonsense. The market only delivers the uranium for which there is a demand. Construction of new NPPs causes a continuation of demand, which will lead according to some studies already on the middle long term to the necessity of use of poorer uranium ore, with exponentially growing environmental impacts. The

9 *Nucleonics Week - Volume 49 / Number 40 / October 2, 2008* : "VAE management is considering using a cooling tower for the plant, as well as direct cooling from Lake Druksiai, which is now used to cool Ignalina-2. Grinevicius said the cooling tower would reduce the plant's environmental impact, but it would be more expensive. A decision on cooling mode will be made in conjunction with the plant supplier during the detailed design phase, he said."

use of alternative energy concepts can prevent this. These are, however, not included in the report.

19. Nuclear fuel would not only be transported to the NNPP by train or truck, but possibly part of the way flown. This needs to be included in the assessment.

20. Radioactive waste: The report states that there are different options available for the disposal of radioactive waste. This is not true. There are no disposal possibilities anywhere in the world for long-lived high radioactive waste. Lithuania's waste plans are in a very early stage and cannot even be properly assessed on their possible impacts.
The proposed further studies and EIAs according to local, EU and international law need to be conducted before construction of the NNPP Visaginas starts.

21. The statement that the operation of the NPP will cause no harmful radioactive releases or any radioactive contamination of the waste produced is wishful thinking and not scientific fact. During operation and waste handling, radioactive substances are bound to be emitted into the air, the soil and water. For some of the possible designs these might be of a substantial magnitude, but because there is no operational experience with any of the designs with the exception of the CANDU 6 and the AWBR, it is impossible to assess this precisely at this moment.
In case of incidents or accidents (design based and beyond design based!), large amounts of radioactivity could be released into the environment. Spreading in such a case is included for a small release of the core. This release is a very low estimate. Also exact impacts on environment and health are described in too little detail to be able to help with the qualitative decision about the desirability of the NNPP project.

22. Monitoring systems: These need not only to be designed to fulfil all the regulations and obligations mentioned, but also all the regulations and obligations coming forward from the Euratom Treaty, chapter 3, even where those regulations and obligations may differ from Lithuanian legislation.

23. (Page 30) Transboundary impacts: Possible transboundary impacts are largest after large design based incidents or beyond design based accidents. Although spreading of radioactive material from a minor release during a beyond design accident is included, the report does not really consider worst case scenarios (see general comments g. above), nor does it describe exact influences of such an accident on environment and health (see 21).

22. There are significant radiological transboundary impacts attached to the production of the fuel, as well as to the back-end of the fuel chain in case Lithuania chooses for reprocessing of SNF. In case Lithuania will not fulfil its obligation to find a solution for HRW and decides to go for a regional solution, this will add to transboundary impacts of the project. These impacts need to be quantified in this study in order to be able to give a proper over-all picture. Saying that the NNPP will have no transboundary radiological impacts during normal operation is misleading.

23. Workforce (page 30): The needed extra workforce during construction of this project is temporary and not from the directly surrounding countries. Alternative energy service provision options are likely to deliver a higher amount of jobs and therefore a higher need for infrastructure and services, as well as higher economic growth. These alternatives, however, have not been analysed in this study.

The influx from a large amount from foreign workers will have a strong influence on the social-economic environment, which will not only be beneficial, but could also easily lead to tensions as well will lead to a larger pressure on the natural environment.[10]

24. The study does not take into account the effects of climate change on the hydrology of Lake Druksiai, nor of the Prorva River and the Dysna River. As it is to be expected that such effects are considerable, they should be included into the analysis.

25. Nuclear safety and risk analysis: It is not clear on which basis the estimate of 100 Tbq of Cs-137 is made. The exposure to radioactivity from a beyond design based accident, as well as from a DBA is depending strongly on the technology used in the reactor. A CANDU core delivers other results than an EPR core, and that another than an ESBWR core or an AES-92 core. This needs to be specified in more detail and a more realistic (larger) range of uncertainty needs to be implemented.

26. In the detail analysis of possible accidents, acts of war have not been included. Seen the long life expectancy of the NNPP (60 years), acts of war cannot be excluded and should be included in the analysis.

27. The possible impacts of a severe accident as laid out in the study are shocking. What misses is a detailed estimate of damage to public health and economic damage in the cases of DBA, bDBA and SAs.

28. Decommissioning: As the lifetime of the reactor will span 2 human generations, *"giving time to the power plant operators to gather the resources needed for the implementation of this phase"* is per definition not sustainable. It is important that the information resources are there already before construction of the plant, and that financial resources are guaranteed within the period of the first human generation of the plant's operation. There is also a need for adequate provisions for decommissioning in case of early closure of the NNPP – these provisions need to be built up within the first generation of operation, as well as proper liability insurance in case of early closure needs to be guaranteed – full costs to be included in the project.

29. As the effects of decommissioning on the environment are integral effects of the NNPP, they need to be included in this EIA, not in a future one. Decommissioning is irreversibly necessary when an NNPP is started up, so an EIA after this date would be in breach with Lithuanian, EU and international legislation.

COMMENTS on the basis of the the detail report

10 Nucleonics Week - Volume 49 / Number 40 / October 2, 2008: *"More challenging than finding employees for VAE in its initial phase will be recruiting the estimated 500 employees who will run the plant, Grinevicius said. Operators transferring from the Ignalina-2 RBMK would have to be retrained to run the new reactors. Also, Grinevicius noted that the average age of Ignalina-2 employees is 50, and those workers are more likely to shift to decommissioning work than to operating new units. [...] Grinevicius said VAE will have to look outside Lithuania to recruit staff. He added that negotiations are already going on with several Finns, but declined to say from which companies or agencies. Given the international recruiting, he said, the operating language of the plant may well be English rather than Lithuanian."*

30. Nuclear safety (Page 73): Second generation designs. The report states*"These units have been found to be safe and reliable, but are being superseded by better designs."* However, the catastrophe at Chernobyl as well as a myriad of incidents and accidents over the last decades have shown that these units cannot be labelled safe and reliable. The very reason for newer designs is the necessary improvement of safety and reliability.

31. Generation IV reactors: According to recent literature these designs will possibly come on the market after the 2020s, not before then.

32. Comments 30 and 31 show a lack of alertness and critical stance towards nuclear power and the nuclear power industry from the authors.

33. Generation III and III+: ad standardised design: There are considerable design differences between the EPR currently under construction in Finland and the one in Flamanville. Also there are considerable differences in design between the AES-92 reactor from Atomstroyexport currently under construction in Kudankulam, India, and the one proposed for Belene in Bulgaria. On the basis of experience, the promise of standardised design has not been held.

34. Higher burn-up of fuel may reduce fuel use and the amount of radioactive waste, the radioactivity and longevity of the waste is both considerably higher, which puts new strains on the responsibility to keep spent fuel and waste out of the environment in the long term.

35. Concerning inherent safety features: You state that these reactors are *"not only intrinsically safer, but also have optimised features giving higher availability and better economics than their predecessors."* This is wishful thinking. CANDU 6 reactors show comparable economics and availability rates as other second generation designs, but are because of the positive void factor a higher safety risk. Concerning the other designs, there is no or too little operational experience with these reactors to date, so it cannot be known whether they indeed are safer. They are safer on paper, but the practice is still unknown. Similarly for availability and economy. An EIA should not be made on paper promises, but on the basis of analysis of possibilities. In this case the fact that none of the mentioned designs with the exception of the CANDU 6 and ABWR of General Electric / Hitachi has been operating in practice adds to the uncertainty levels concerning safety, availability and economics.

36. The report does not address one of the largest safety problems attached to the CANDU 6 reactor design – the positive void factor – which makes it unelegible in many countries in the world, including the USA.

37. (Page 74) The report states: *"**4 NON-IMPLEMENTATION** - According to a so called non-implementation, or zero option, no new nuclear power plant unit will be constructed in Lithuania. In this case the supply of energy from diverse, secure, sustainable energy sources which do not emit greenhouse gases and other pollutants will not be secured and the country's energy security will not be ensured."* – This is not necessarily true and depends on the Lithuania's and surrounding countries' energy policies. In case this project will not be implemented, other projects in the realm of energy efficiency and other generation capacity will be implemented. They indeed are already implemented today, to meet the upcoming generation gap caused by the closure of Ignalina 2. It is very likely that when the reactors of the Visaginas NNPP will come on-line, no shortage of capacity will exist.

On the other hand, if the Visaginas NNPP project will go ahead and construction will run into delays, like the current projects of Areva in Finland and France, the projects of Atomstroyexport in India and Bulgaria and the Westinghouse project in China, Lithuania and the surrounding countries will be confronted with a not-planned-for lack of capacity between the originally planned date of operation and the real one. This causes insecurity for the investors.

38. It is also not true that the supply from energy sources that do not emit greenhouse gasses will not be secured. In contrary: because Lithuania wants to fill the grid with inflexible nuclear capacity in the form of the Visaganas NNPP, development of renewable energy sources with consistently lower greenhouse gas emissions than the nuclear power station (including the full fuel chain) will be hampered. It is very well possible that the net result is that the Visaginas NNPP project will end up with net more greenhouse gas emissions than the development without the Visaginas NNPP!
This study does not deliver any data to make that comparison and is therefore insufficient.

39. "4. **Electricity demand forecast" -** The EIA report foresees long term growth rates between 4 and 6% for Lithuania. First of all, the NNPP is not only going to deliver electricity for the Lithuanian economy, so data should be given for the surrounding countries as well, as also for the entire market in which the NNPP is to operate. This, when Lithuania, Latvia and Estonia will be linked to the Nordic grid and UCTE, will comprise the entire UCTE and Nordic grid area. These data miss from the assessment and therefore it is impossible to assess the need for the project.

40. The given growth rates for Lithuania are very optimistic and out of line with the growth rate developments we see in other Central European countries, where a gradual slow-down of growth is estimated, moving towards the average EU growth rates which are currently around 2%.
The estimation furthermore links the economic growth rate with the increase in electricity consumption, so completely leaving out the steady increase in end-user efficiency of new equipment on the generation, transport and consumer side. Given the increase in need for efficiency because of energy security, climate change and price developments, it is likely that we will see a de-coupling of economic growth and electricity demand.
These developments are riddled with uncertainties. In order to meet the resulting demand, the region (and not only Lithuania) will need a flexible generation basis that can fast increase or decrease together with the development of demand. The inclusion of the NNPP in that picture influences the flexibility strongly in negative sense. The long construction times of the NNPP leave an investment gap for years until the electricity comes finally on-line and when it comes on-line there is little left in flexibility to reduce production, as any lowering of capacity factor will mean large economic losses.
It is therefore of paramount importance that the project of the NNPP will be compared with other developments of generation mixes under a wider scope of economic predictions and the resulting mixes compared with a scenario that includes the NNPP, also for impacts on the environment. This EIA does not do this, nor does it deliver any of the necessary data to do so and should therefore be dismissed as inadequate.

41. (Page 76) Paragraph 4.4.2 states that *"In a case when future electricity generation is based mostly on fossil fuel, existing units at the Lithuanian TPP should*

produce more than 50 % of electricity necessary to meet the country's internal demand." In case we'd all live on chocolate and cream, we'd all be fat. A one-on-one replacement of the NNPP capacity by fossil fuels is completely irrealistic. There are many policy options thinkable that would lead to a stable development of the energy service sector without increase in greenhouse gas emissions, but that because of their more gradual implementation would be far more economically beneficial than the shock-introduction of 3400 MW into the system on a not to be foreseen date!

42. (Page 77) **OPTIONS EXCLUDED FROM THE INVESTIGATION** – Alternative locations in Lithuania. That there are no other realistic options for location is nonsense. When the NNPP is indeed as safe as the authors suggest, it could be build anywhere, even in the centre of Vilnius. Decisive in that case would only be the cost of different cooling options, as the availability of cooling water could become a bottleneck. The reason that no other option comes into question than one that is far away from main Lithuanian populations, in a corner of the country so that effects of a large accident only hit the own population for a small part, is that there is obviously a larger risk than suggested by the authors.

43. The authors should have worked out several options for siting and explain the advantages and disadvantages of each option honestly, so that the above mentioned risk also becomes clear to the public.

44. The fact that Lietuvos Energija AB is not intelligent enough to get involved in energy efficiency programmes is no excuse to exclude energy efficiency from the scenarios that could be seen as alternatives. The same reasoning is valid for the dismissal of alternative ways to produce energy.

45. Environmental Impact Assessments are supposed to compare the impacts on the environment of a certain project with alternatives, in order to minimise the finally occurring pressure on the environment. This EIA does not do that and therefore cannot be accepted.

46. The authors claim that *"The purpose and justification of the nuclear power plant project is described more in detail in Chapter 1."* There is no description of purpose and justification of the NNPP beyond that it has to produce electricity in chapter 1!

47. (Page 78) Technological Processes – The authors claim *"Nor does operation of a nuclear power plant produce carbon dioxide or other greenhouse gases causing global warming of the climate."* Even if we leave aside the complete nuclear fuel chain, also clean operation of the NNPP will cause the production of greenhouse gasses. There is transport of goods, emergency diesel generators (that even if never an emergency happens need to be tested regularly), transport of people, part of the heating of buildings and other activities that will require the use of fossil fuels. Stating that the operation of the NNPP does not produce CO2 or other greenhouse gases causing global warming of the climate is a misleading statement.

48. Furthermore, the NNPP will have to use nuclear fuel. That leaves a considerable track of CO2 and other greenhouse emissions, as well as needs to be decommissioned and the nuclear waste (including SNF) needs to be processed. Here also considerable amounts of CO2 and other greenhouse gasses enter the atmosphere. Sovacool[11] comes on the basis of an inventory of 103 lifecycle studies

11 Sovacool, Benjamin K., *Valuing the greenhouse gas emissions from nuclear power: A critical survey*, Energy Policy 36 (2008) 2940– 2953

of greenhouse gas-equivalent emissions for nuclear power plants to the conclusion that greenhouse gas emissions from nuclear power have an estimated value of 66 gCO2e/kWh. With this, nuclear power plants score worse than all renewable energy options with the exception of photovoltaic.

49. The authors state: *"Nothing is burned or exploded in a nuclear power plant".* It would have been less misleading to state that 'Under normal operation, nothing is burned or exploded in a nuclear power plant."

50. The authors state: *"Discharged fuel contains the waste products of fission many of which are radioactive and through a process of radioactive decay continue to generate heat for significant periods after shutdown and removal."* Less misleading would have been to add: 'and because of their high level of radioactivity have to be kept out of the environment for a period of more than a hundred thousand years." The authors furthermore do not mention here how they envision management of this SNF after wet storage, which is only the tiniest of fractions of their dangerous lifetime.

60. (Page 80) **5.1.2 Plant type options for Lithuania** - The authors state on page 83: *"Detailed specification of technical requirements for the new nuclear power plant will be developed under a separate work package as the project proceeds, hence cannot be stated in this EIAR."* The only conclusion can be that this EIA is made in a too early stage.

61. The EPR – On page 87, the authors state: *"The EPR is designed to achieve the highest unit power to date, mainly due to economies of scale. Other factors such as shortened construction times, [...] help achieve this."* The question arises whether this still holds true with the construction times of Olkiluoto 3 and Flamanville 3 being far beyond the originally indicated.

62. The CANDU 6 – The mentioned Enhanced CANDU 6 is not a generation III reactor, but a generation II reactor with some enhancements. One might call it a generation II+ reactor, but certainly not a III-! The units in Cernavoda are not of the enhanced design but of the basic CANDU 6 design.

63. The ACR-1000 – The authors state that *"Construction is in modular form, with a time span of 42 months."* It is less misleading to state that the construction is currently estimated to take 42 months, but that no practical experience exists with this reactor to date.

64. (Page 99) Nuclear safety and liabilities – Lithuania is part of the Vienna convention, which limits liability for nuclear operators in case of large accidents. What is the limit of liability for the NNPP, and does the Lithuanian government generate sufficient income to be able to be able to guarantee coverage of the rest for the total life-time of 60 years as well as the following decommissioning time and nuclear waste storage time?

65. It is nice that you describe the IAEA safety principles, but what measures are put into place in order to guarantee that these principles? They should be mentioned in the report.

66. Competent staff and responsible operation: Given the fact that Lithuania has no available sufficiently educated and certified human resources to construct and

operate the NNPP[12], how is sufficient quality guaranteed, how is training guaranteed, how is sufficient communication guaranteed? Does this, for instance, mean that the Lithuanian regulatory authorities have sufficient language skills to assess the quality of foreign personnel sufficiently? Does the operator foresee to use personnel from different countries and how will communication be guaranteed? Will the operation language be Lithuanian?

67. Nuclear Safety (pages 100 and further) – These are a description of "how" and "why" in theory. They do not describe how in the concrete case of the Visaginas NNPP these principles and methods are actually implemented. This is impossible because no choice is on the table for the reactor design. We therefore demand a new EIA on the moment that the design is chosen.

68. (Page 107) 5.3.3 **Nuclear safety administration in Lithuania –** The technical support organisation ISAG is not independent from the nuclear power plant, as it is to give technical assistance to VATESI as well as the existing plant, which is owned by Lietuvas Energija. Is it also to provide technical assistance to the NNPP? If so, this is a conflict of interests that could lead to sub-optimal communication and transparency.

69. Questions: How many inspectors at VATESI are dedicated to the NNPP? Is there transparency about their background (i.e. are there any 'revolving door' relations – inspectors coming from the Ignalina 1 or 2 NPP or LEO or Lietuvos Energija?

70. Is there an appropriate whistleblower protection scheme in operation?

71. (Page 110) **5.3.4 Implementation of the safety requirements for a new NPP –** *"As well as being designed to withstand severe accidents caused by core melting, the plant must also be designed to withstand external threats and terrorism. Such effects include withstand of a collision with a large passenger airplane, and external threats caused by natural phenomena such as earthquakes or high winds."*
What are the guarantees that the authors have that the mentioned reactor designs meet all of these requirements?
The only design that advertises with being able to withstand a collision with a large passenger airplane is the EPR – still, according to expert analysis[13], this promise is not held.

72. Because the final analysis of design safety is only to be carried out after the EIA and before VATESI is to give the construction licence, no public participation is foreseen as prescribed in the Aarhus Convention. This public participation normally takes place during the EIA procedure.
We therefore demand that either a round of public participation is introduced during the safety analysis, in a form which is following the procedures during EIA procedures, i.e. including time for comment, hearings and inclusion of comments, questions and satisfactory answers on questions into the final safety analysis report. On top of that, access to justice on the final decision on the basis of such a safety analysis report is to be guaranteed. Because citizens of other countries

12 Platts Nucleonics Week Volume 49 / Number 40 / October 2, 2008, *Ignalina project company will pick single reactor design for entire plant*
13 Large and Associates, *Operational Risks and Hazards of the EPR when Subject to Aircraft Crash*, London (2006) Large and Associates / Greenpeace

possibly affected by environmental impacts from the project need to be consulted with the same rights as citizens form the project country according to the Espoo Convention, a similar level of public participation and access to justice needs to be secured for citizens outside of Lithuania.
Another option would be to postpone the final EIA report until a design is chosen and include another round of public participation.

73. **5.4 PROCUREMENT OF FUEL –** This chapter describes the process, but it does not describe and quantify the environmental impacts of mining, conversion, enrichment, fuel production, transport, and storage. In order to be able to assess the total environmental impacts of the NNPP, it is very important to get a full overview of the environmental impacts of these steps. As soon as the NNPP will reach finalisation of construction, it will inevitably lead to environmental impacts from the above mentioned processes.

74. As it is furthermore not secured that Lithuania will continue to refrain from reprocessing and the use of reprocessed fuel (including MOX), it is furthermore important that a full overview of environmental impacts is given of reprocessing. Reprocessing should be included as one of the alternatives for the NNPP, including all its hazardous influences.

75. **6 WASTE - 6.1 CONSTRUCTION OF THE NUCLEAR POWER PLANT –** *"[...] no radioactive waste will be generated during this stage."* This is not true. Radioactive isotopes are used during several stages of quality control and have to be disposed of safely. This needs to be included in the EIA.

76. *"The exact amounts, nature and volumes are linked to variables that can only be clarified*
as the project proceeds, such as reactor type and number, final layout of the site etc." Because these are important issues, a new EIA procedure should be run after a design has been chosen, or this EIA procedure should be prolonged until after design choice, and a new round of public participation should take place that can take into account the mentioned waste volumes. Or the EIA report should make an inventory of all involved detail waste streams for each of the possible designs.

77. *"When possible all staff shall minimize the amount of waste and water generated from their daily activities, opportunities for recycling or reuse shall be investigated and implemented if practical and cost effective."*
This is unacceptable. Not *"When possible"*, but all staff has to minimize the amount of waste and water generated from their daily activities and re-use and recycling should be implemented maximally. The sentence *"if practical and cost effective"* leaves too much space for not doing this.

78. **6.2 OPERATION OF THE NUCLEAR POWER PLANT – 6.2.1 Non-radioactive waste –** Because there is no reactor design chosen, there is too much unclarity about the exact amounts for the different designs. Table 6.2 furthermore does not indicate the time-frames involved in the production of the mentioned amounts of waste – it is unlikely that this is the total amount of waste for a 40 to 60 year operation time.

79. **6.2.2 Radioactive waste –** The EIA report states that it needs to be ensured that radioactive waste can be retrieved in the end of the storage period. It does not describe a process in which it is possible to ensure this for SNF and HRW for a period of longer than 100000 years.

80. *"There are a lot of well established and worldwide used technologies for treatment of solid radioactive waste."* This is not true for solid HRW and SNF. There are currently no technologies for final treatment of this type of waste.

81. (Page 127) *"Like any nuclear power plant, the new NPP will discharge certain amounts of liquids which contain radionuclides into the environment. Radioactive effluents, i.e. technical water, household waste water (which had no contact with radioactive materials) and surface water (i.e. storm water) may be released into the environment if the activity of the radionuclides does not exceed the limit activity, determined in the permission issued by the Lithuanian Ministry of Environment."* This is an interesting description of what has to be by law, but it fails to describe what will actually happen. What is needed is a description of the to be expected reality, not a wish list. So: needed is an estimation of the amount of released radionuclides into the environment on the basis of past experiences and proper transparent estimates.

82. (Page 128) *"Main strategies for SNF management are as follows"* – An EIA should not describe general principles, but outline the concretely to be expected impacts of the activity on the environment. This does not happen in this chapter.

83. There is no detail description of the management of SNF from this project – which is probably logical because there is up to date no proven technology that could function as a final solution. Nevertheless, if this is true it should be stated and taken as reason to abandon the project.

84. What is even more striking is that there is not even a detail description of a pathway leading to a possible final solution, including time table, even though Lithuania is suppose to have that under Euratom legislation.

85. This means that it is impossible to judge whether Lithuania and the project promotor are capable of dealing with SNF.

86. **6.3 Decommissioning** – As in previous chapters, we find here only a theoretical description of decommissioning strategies, procedures and methods, but no description of what is going to happen in the case of this project. No choices are made, no details given. This means that no proper analysis can be made of the effects of the project on the environment.

87. Also here, the fact that there is no choice of design makes a deeper analysis impossible.
A new EIA should therefore be carried out once a design has been chosen.

88. Because details per design are not known, it is also impossible to make a proper estimate of back-end costs.

89. The paragraph about decommissioning and design is an interesting wish list, but it does not describe which design has taken which measures with which results on decommissioning.
Once more: an EIA is not a tool for creating wish lists – it is to describe the actual concrete impacts of a project on the environment. Father Christmas is not available to fulfil nuclear wish lists and dreams – it needs concrete measures and estimates.

90. TOO LITTLE LITERATURE (page 133) – Reliance on one study (Devgun J.S., 2008) is too little and not an acceptable practice. There is more literature available on the issue that can assist in proper analysis and estimates.

91. **7 PRESENT STATE OF THE ENVIRONMENT, ASSESSMENT OF POTENTIAL IMPACTS OF THE PROPOSED ECONOMIC ACTIVITY AND MITIGATION MEASURES - 7.1 THE STATE OF WATERS** – The EIA report fails to address the possible impacts of climate change. Because the project is to run over a 60 year life time, a significant increase in average surface temperature is to be expected with likewise significant influences on the hydrological situation.
If the authors would argue that this includes too many uncertainties, the logical conclusion would be not to build a project with such large possible impacts and a project lifetime of 60 years.

92. The EIA report describes stunning effects of the former Ignalina NPPs on the aquatic ecosystem. The NNPP project would bring back these negative dynamics, but even on a larger scale. In spite of all indicators remaining within norms now, it is unclear from the EIA report whether this will continue to be so with the increased capacity of the NNPP and what are the factors of uncertainty in this.

93. The EIA report describes the “is” and “was” situation of radioactive substances in the water environment, but fails to give a predictive estimate of the situation when the NNPP will be constructed, in full operation and decommissioned.

94. In the case of a CANDU reactor, a monitoring system of only 6 surface water samples for tritium is completely inadequate, as are 17 samples for groundwater. It is clear that the monitoring system will have to be upgraded in that case.

95. It is good that the current situation is well described for later comparison, but the “to be expected” situation is completely missing in the report.

96. Water temperature monitoring: Again only a description of the “the rules are” situation and not of the to be expected reality, including uncertainties involved.

97. (Page 185) Anti-fouling measures: there is no description of the impacts of anti-fouling measures in the cooling water on the environment. Even with post-treatment of cooling water, it cannot be avoided that anti-fouling chemicals will get into the environment. These have significant impacts on biotopes.

PART TWO of the EIA report

98. Interesting to see that climate change was taken aboard in the ice-sheet modelling but not in water temperature modelling...

99. It is interesting to see that the study highlights problems with eutrophication... clear that something needs to be done to that!
But citing eutrophication as a reason for using the lake for cooling water is absurd.

100. (Page 217) *“From this point of view, moderate warming of the lake can be even environmentally advantageous”* – This is nothing less than ridiculous! You see that eutrophication is a problem. Advantageous is doing something about the eutrophication – not heating up the lake as end-of-pipe solution! An author writing this disqualifies him/herself as serious ecologist.

101. (Page 219) *"For comparison the actual annual average releases during years 2004–2006 from two existing nuclear power plants in Finland are presented in Table 7.1-31 (STUK 2005, STUK 2006, STUK 2007). In the Finnish plants the annual discharges of tritium have been approximately 10 % and the annual discharge of other activation products about 0.002-0.003 % of the site specific discharge limit values."*
This actually implies that the tritium levels from a CANDU 6 reactor would get near the maximum level! Given inherent uncertainties in these estimates, it means that a CANDU 6 reactor could indeed deliver too high tritium emissions already within the current (controversially too low) norms.

102. (Page 220) *"The new NPP will be constructed and operated using the best available techniques and practises to ensure low radioactive releases. Consequently the liquid radioactive releases of the new NPP will not have any negative impacts on environment or natural resources."*
This remark is not acceptable. First of all, there is no operational experience with any of the designs with the exception of the CANDU 6 and the AWBR, and the CANDU 6 has considerably higher emissions of tritium. So at least the CANDU 6 could pose a larger danger, secondly it could well be that operational practice with the other designs shows larger emissions.

103. (Page 221) *"The environmentally and technically best cooling technology will be selected later in the design phase of the new plant."*
This concretely means that we do not know what the effect of the project on the lake will be. This supports our claim that a new EIA needs to be made after design choice, or the current EIA put on hold and new public participation rounds organised after design choice.

104. (Page 229) Interesting to see that CO2 emissions did not go sharply up after closure of Ignalina 1. This underscores the experience that closure or start of new nuclear capacity does not automatically lead to large changes in CO2 emissions.

105. (page 231) *"Unit 2 of Ignalina NPP will be shut down at the end of 2009 and therefore before start up of the new NPP replacement capacity will be needed. The production of unit 2 is about 20 TWh annually. This amount of electricity will be replaced by production of thermal power plants in Lithuania and by imported electricity."*
Why automatically with thermal power plants? No energy efficiency measures planned? No renewables? No co-generation? That seems to be a completely wrong answer on the closure of INNP 2 over the last 16 years in which it was known it had to close down.... Lack of and wrong policy may not be abused in the argumentation for a new project.

106. (Page 232) *"If fossil fuels are used for electricity production greenhouse gases will be produced, whereas nuclear power plants, hydropower plants and thermal power plants using biofuels do not produce greenhouse gases."*
This is complete nonsense – Also all these power plants produce GHG emissions, nuclear the highest amount of estimated 66 g/kWh (Sovacool, 2008)[14]

107. **7.2.2 Assessment of impacts on air quality –** 7.2.2.2 – The analysis does not include efficiency increase, for instance by the use of heat-power co-generation

14 Sovacool, Benjamin K., *Valuing the greenhouse gas emissions from nuclear power: A critical survey*, Energy Policy 36 (2008) 2940– 2953

with natural gas and biomass. The avoided emissions from heat production should be included into the calculation.
The analysis also does not look into the development of renewable energy sources like wind, solar (at least for heat provision) and other possible options. The indicated CO2 emissions therefore are strongly over-estimated.

108. It is not logical to calculate the CO2 production of biomass as zero. Biomass production needs fossil fuel input as does the construction of biomass installations. Biomass plants, according to Sovacool (2008)[15], emit 11 to 35 gCO2e/kWh (depending on the technology), whereas nuclear power stations emit 66 gCO2e/kWh.

109. The study does not calculate any CO2 emissions from nuclear power, although it already does indicate CO2 emissions during the construction phase. Climate change and CO2 emissions are not included systematically and consequently.

110. (Page 353) 7.7.3 Mitigation measures – In spite of what is stated here, it has to be concluded that the plant in any set-up is plainly ugly and an eyesore in the landscape.

111. (Page 419) **7.11.2.3 Landscape –** *"The landscape in the Lake Druksiai watershed has degraded because of the building and operation of INPP, Visaginas town and related infrastructure. Construction of the new NPP near the INPP will produce no greater effect of landscape degradation and will not disrupt the ratio between the natural and anthropogenic territories. The impacts on the landscape of Lake Druksiai and its surroundings will therefore not be significant."*
This is an unacceptable conclusion. The INPP was not envisioned as a permanent degradation of the landscape and normally would be decommissioned after which the area would have to be brought back into its natural state. The NNPP will extend this degradation for a period of another century or more. That is a significant impact on the landscape of Lake Druksiai!

112. (Page 408) Because of current discussions on the exposure / dose impact of tritium, it is doubtable that the currently mentioned special zone of 3 km is sufficient. From precautionary sight it would be advisable to have a 10 km special zone, which would bring Visaginas unfortunately inside the zone.

113. (Page 478) *"The dose constraint of annual population exposure during normal operation of NPP and taking into account AOO shall not exceed 0.2 mSv/year."*
This is not an impact assessment. This is a statement of wishes, be it legally formulated. What is missing in the assessment is which actual exposure the population can expect during normal operation of an NPP. Given the current debates about impacts of low exposures to radioactivity, a stronger precautionary approach should have been used.

114. *"The frequency of SA is less than one in 1 000 000 years of reactor operation (IAEA Safety Reports Series No. 23)."* This is not true. The frequency of SA is **expected** to be less than one in 1E+6 years of operation. As there is no operational experience with the mentioned reactor designs with the exception of the ABWR and CANDU 6, it is impossible to use such definite statements as in the report.

15 ibidem

115. In case the choice is made for a CANDU 6 reactor, the environmental impacts of heavy water production should be included in the EIA