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Monitored this issue:

The Boris Johnson nuclear programme

At the beginning of May, the government of Prime Minister Johnson announced a plan to invest heavily in new nuclear power plants. According to the British government, there should be one new nuclear reactor added to grid every year in the UK. The plan, presented as a response to be less dependent on Russian energy is completely infeasible. Emeritus professor of Energy Policy at the University of Greenwich, Steve Thomas writes an analysis.

Introduction.

The key policy in the Johnson government's Energy Security Strategy[1] was the major renewed commitment to a large nuclear programme, 24GW at eight new stations. This programme has resonated round the world but the key small-print questions that always arise with nuclear are seldom asked. These include: who will own them; where will they be sited; what technology will they use; when will they be completed; and what will the enigmatic Great Britain Nuclear, announced at the same time, actually do.

The parallels with the Tony Blair programme launched in 2006 – 'nuclear power back on the policy agenda with a vengeance' – are strong. This promised 16GW of new nuclear capacity (five stations, eleven reactors) by 2030. Provided nothing further goes wrong at Hinkley Point C (3GW), this is the only nuclear plant that will be online by then with three of the projects abandoned, and one, Sizewell C hanging on. Sizewell is expected to be the first of the eight new stations. A sixth station, Bradwell B, which would be owned by Chinese investors and would use Chinese technology appears to have little chance of proceeding for political reasons.

Who will own them?

In the past, this would not have been an issue. Most electric utilities would have been happy to fund the project from start to finish provided it was clear that consumers would pay whatever costs were incurred. This condition was no longer met in the USA from 1980 when regulators wearied of passing on massive cost overruns to consumers and in Europe from around 2000 onwards when electricity generation became a competitive business. With the exception of the French utility, EDF, utilities quickly lost their appetite for putting their future at risk by taking on a nuclear project. EDF's financial condition has been appalling for the past 4 years and this year, it expects to lose €26bn so even financing new reactors in France will be a challenge. The UK has been trying to launch a new ownership model, the Regulated Asset Base model, for the past 4 years. This would combine the worst features of the ill-starred US Vogtle and Summer projects with ownership by institutional investors. Like the Vogtle and Summer projects, consumers would pay all the finance charges in the construction phase as a surcharge on their bills long before – these are likely to be of the same order as the construction cost itself. This surcharge would be payable from the taking of a Final Investment Decision (FID) to plant commissioning. On government figures[2], this is expected to be 13-17 years. The Summer project was abandoned after four years of construction with project times and costs out of control after $9bn had been spent. Vogtle is running about 6 years late and way over budget and even with the advance consumer payments will produce very expensive power.

Whether institutional investors will want to be associated with nuclear projects remains to be seen and there is conspicuously no apparent queue of investors at the government's door. However, what is clear is that they will only be interested if little or none of the huge financial risk inherent in nuclear projects falls on them. That means it must fall on electricity consumers and perhaps taxpayers who will be writing an essentially blank cheque.

Before an FID can be taken, a significant amount of preparatory work has to be undertaken, for example, buying the site, getting regulatory approval for the reactor design, proving the suitability of the site and getting planning approval. These steps might cost in the region £1bn and unless these steps are just shams, the process will be at risk of failure, so institutional investors will only be interested when the project has been 'designated' by the government and an FID can be taken. So who will pay for this stage? For the Sizewell C project, this phase was funded by EDF (80%) and China General Nuclear, CGN, with the rest but these are not options for later projects.

Where will they be sited?

In 2011, the UK government identified eight sites[3] as suitable for the programme then being pursued, not surprisingly all sites of existing nuclear facilities. One of these has already been used (Hinkley Point) so all the remaining seven[4] will be needed plus one more. All are coastal or estuary sites and all are categorised as at risk from sea-level rise. While expanding existing sites will be met with a mix of opposition and some support from those wanting the employment they would bring, trying to find new sites looks a huge political challenge.

Wylfa, one of the sites abandoned from the Blair programme, is frequently seen as the prime site -less vulnerable to sea-level rise and with some local support for new nuclear capacity but this went through the planning process and the Planning Inspectorate's verdict was to recommend against its use.[5]

1. https://www.gov.uk/government/news/major-acceleration-of-homegrown-power-in-britains-plan-for-greater-energy-independence
2. https://publications.parliament.uk/pa/bills/cbill/58-02/0174/ImpactAssessment.pdf
3. Bradwell, Hartlepool, Heysham, Oldbury, Sellafield, Sizewell, Wylfa.
4. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47859/2009-nps-for-nuclear-volume1.pdf
5. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010007/EN010007-003948-Recommendation%20Report%20-%20English.pdf

What technology will they use?

As part of the Blair programme, a system of Generic Design Assessment (GDA) was introduced which would go through the design in exhaustive detail and if the design passed this process, it was approved for 10 years for construction at any site subject to specific local siting requirements. Four designs have completed this process; in 2012, the Framatome EPR under construction at Hinkley and proposed for Sizewell; in 2017, the Westinghouse AP1000 and the Hitachi-GE ABWR; and in 2022, the China General Nuclear Hualong One. What, if anything, is needed to renew design approval when the 10 years is up remains to be seen. There was speculation the Korean APR1400 would be submitted to the process but the absence of any prospect of UK orders meant this was not pursued. The track record of these designs is poor in terms of construction times and costs. There are ABWRs in operation but these use the 1987 version of the design, which has needed major upgrades to try to meet current requirements.

The government is putting money into two Small Modular Reactor designs, albeit both are actually far from small both being 450MW or more. One is a Westinghouse lead-cooled fast reactor and there must be serious doubts whether this is technically viable, much less economically viable. The other is a PWR offered by Rolls Royce. While there must be more confidence this design will be technologically viable, the economics are speculative. Will the economies from factory, production line manufacture compared to one-off fabrication be sufficient to pay for the lost scale economies of the large reactors? Being competitive with large reactors will not be enough. The competition is renewables and energy efficiency, and the price of renewables is falling steeply and is already far below that of nuclear – in the UK, offshore wind kWh prices are about 40% of nuclear prices. This is not a gamble Rolls Royce can afford to take and if it is to proceed filling out the design, getting it through the GDA and paying for the component production lines, it is requiring the government to pay a large proportion of these costs and guarantee orders for 16 reactors. Even on Rolls Royce's optimistic forecast of a construction cost of £2bn for a 470MW reactor, this would be an extraordinary risk of public money.

When will they be completed?

In 2020, EDF expected the Sizewell C project would receive a FID in mid-2022 with completion in 2034/35 but this target will not be met. The government has promised an FID on one project this Parliament (by mid-2024), so if its forecast of 13-17 years from FID to commissioning is met, it will not be till the late 2030s that Sizewell C is completed. The agreement to get Sizewell C to FID was signed in 2016 so it is likely to take eight years to complete this stage The Johnson government has promised two more FIDs in the following Parliament but given the sites and technologies have not been chosen yet much less the various regulatory permissions required, it is far from clear this timetable can be met.

What will happen?

The Johnson programme was met with incredulity by many energy policy analysts. The key policy in combating the triple-headed crisis of climate change, energy affordability and energy security of supply is one that might start to pay off in the late 2030s, if ever.

The Johnson programme has strong similarities with the Blair programme. It is built on the usual promises of cutting red-tape, streamlining planning procedures and a belief that the lessons of the past will be learned, and everything will go well this time. Successive reactor programmes in Britain and elsewhere have been built on this belief and nearly all have foundered and this new programme seems no better founded than previous ones. Arguably given the dismal record of the prospective technologies, the chances of success are even lower than those of its predecessors.

Nuclear energy, global warming and salt domes

By Herman Damveld,
independent Energy expert , Netherlands

Summary

The combustion of fossil fuels, coal, oil and natural gas, produces the greenhouse gas CO2, which contributes to climate change. Instead of these fuels, nuclear energy is therefore called upon to save the climate. But nuclear energy is also not free of CO2 emissions. Furthermore, the global uranium reserves are finite, same as the reserves of coal, oil and natural gas. Solar and wind are infinite, but not always available. That is why storage of energy generated by solar or wind is necessary. One possibility is storage of energy in salt domes in the North of the Netherlands. However, these have been on the list for the storage of nuclear waste for years. That is why it is time for a choice: either storage of hydrogen or compressed air, or storage of nuclear waste. You can't do both. This is in line with the vision of Rob Jetten, Minister for Climate and Energy. On June 2, 2022, at the presentation of the climate policy for the next ten years, he stated: "We will have to produce, consume, travel, live and generate energy in a fundamentally different way. Moreover, the choices that are necessary for this must be made now."

1 Introduction and overview

The fission of uranium in a nuclear power plant releases various dangerous radioactive substances, but there are no CO2 emissions. That is why nuclear energy is sometimes called CO2-free. Nuclear energy, however, also contributes to the greenhouse effect and is therefore not CO2-free. This greenhouse gas is released during the extraction and processing of uranium ore, during the construction of the nuclear power plant, the transport of nuclear fuel, the breakdown of the power plant, and so on. These are considered indirect CO2 emissions. The CO2 emissions of a nuclear power plant are comparable to those of a gas power plant with CO2 capture and ten times higher than with wind energy. [1] [2] [3]

We believe that the contribution of nuclear energy to mitigating the climate problem will be limited. According to the International Atomic Energy Agency (IAEA), nuclear energy accounts for 10.4% of global electricity use; electricity use is 18.8% of global energy use.[4] This makes nuclear energy 2% of global energy consumption. In the same way, we can calculate that, according to the IAEA, nuclear energy will supply between 1.5 and 3% of global energy consumption by the year 2050.

(In)finite stocks

In addition to climate change, the finite nature of energy supplies is also important. The energy company BP regularly publishes an overview of the stocks of coal, oil and natural gas.[5] The number of years that a stock lasts with constant production is 140 years for coal, 53 years for oil and 50 years for natural gas. The supply of uranium, the fuel for nuclear power plants, is also finite. In 1980, the International Atomic Energy Agency (IAEA) expected that 3,900 nuclear power plants of 1,000 megawatts each would be in operation worldwide by 2025.[6] If that scenario were to come true, the stock of 8 million tons of uranium would be exhausted by the year 2030. Due to an increase in energy consumption, stocks are decreasing at a rapid pace. Said 140-year coal supply will last for 42 years if use increases by 2% annually.[7] In the long run, the energy supply will therefore have to be based on infinite energy sources, such as solar and wind.

Choice of use of salt domes necessary

Because the sun does not always shine and the wind does not always blow, energy storage is necessary. One solution to this problem is the storage of hydrogen produced by wind energy or compressed air. Salt domes can do the trick. There already is one in the works called Zuidwending, but more are needed.[8] There are other salt domes located in the Northern Netherlands and they have been on the list for the storage of nuclear waste for years.[9] [10] [11] It is time for a choice in this regard. Either salt domes are suitable for the storage of hydrogen or compressed air, or for the storage of nuclear waste. You can't do both.

1. https://jaspervis.wordpress.com/2019/03/03/hoeveel-co2-kost-al-dat-staal-van-een-windmolen-eigenlijk-2019-update// , March 3, 2019.
2. https://web.stanford.edu/group/efmh/jacobson/Articles/I/NuclearVsWWS.pdf , June 15, 2019.
3. Jan Willem Storm van Leeuwen, Nuclear Monitor #886, June 8, 2020; CO2 emissions of nuclear power: the whole picture; http://nuclearfreenw.org/climate.htm .
4. https://www.iaea.org/publications/14786/energy-electricity-and-nuclear-power-estimates-for-the-period-up-to-2050 , 2020
5. https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html , July 2021.
6. https://www.iaea.org/newscenter/statements/keynote-speech-iaea-international-symposium-nuclear-fuel-cycle-and-reactor-strategies-adjusting-new-realities,June3,1997; IAEA, International Nuclear Fuel Cycle Evaluation, Working Group report 1, pages 30 and 123, average of the data.
7. https://books.google.nl/books?hl=nl&lr=&id=wdrCWG4aCCIC&oi=fnd&pg=PR13&dq=resource+lifetime+ecological+numeracy&ots=exbnKt8r5_&sig=2_yeJl7YMh3Vs2Necological%20&resource%necological_SOV=v3ConerQ_SOV
8. http://houdgroningenovereind.nl/ZW_Perslucht_2022.html , 3 May 2022.
9. https://www.covra.nl/nl/downloads/cora/ , CORA report (Commission on Storage of Radioactive Waste, 1995-2001).
10. http://www.kernenergieinnederland.nl/files/19760618-brief.pdf , June 18, 1976.
11. https://radioactiefafval.nl/kernafval-in-zout/, 7- Eighties: Land Retention Committee (OPLA), Research into the geological disposal of radioactive waste in the Netherlands. Final Report Additional Study of Phase 1 (1A), (1993).

2 Nuclear energy also contributes to climate change

The fission of uranium in a nuclear power plant releases various dangerous radioactive substances, but there are no CO2 emissions. This is misleading though. Nuclear energy involves a lot of indirect CO2 emissions during the extraction and processing of uranium ore, during the construction of the nuclear power plant, the transport of nuclear fuel, the breakdown of the power plant, and so on.

At the moment, uranium ores are mined with an average of about 0.1% uranium; in a thousand kilos of rock there will be one kilo of uranium. We have a number of formulas to calculate the indirect emissions of CO2 via this uranium ore and the further processing of the uranium.

A table accompanying the United Nations climate report published in 2014 lists CO2 emissions of almost 4 to 110 grams of CO2 per kilowatt hour (kWh), with an average of 12 grams of CO 2 per kWh.[12] This average has been mentioned often since then. For substantiation, reference was made to studies by Lenzen and by Warner and Heath.[13] Lenzen concluded that there is an average of 65 grams of CO 2 per kWh.[14] Warner and Heath mentioned 12-110 grams of CO 2 per kWh.[15] Warner and Heath have mentioned that they did not have access to enough reports or data to conduct their study.[16] This could indicate the CO2 emissions are actually higher.

It is not clearly explained what the often mentioned figure of 12 grams of CO2 per kWh is based on. The following two studies are more recent and, in my view, have more merit. In a report by energy analyst Jan Willem Storm van Leeuwen, published on 8 June 2020, he calculates 139-190 grams of CO 2 per kilowatt hour (kWh).[17] A report published on June 15, 2019 by Mark Z. Jacobson, Professor of Civil and Environmental Engineering and director of the Atmosphere/Energy Program at Stanford University, lists 78-178 grams of CO2 per kilowatt hour.[18]

See table 1 and figure 1. The studies on CO2 emissions all give almost the same number for fossil fuels. For nuclear energy there are big differences. Due to the great complexity of the nuclear energy cycle, it is difficult to accurately calculate the actual CO2 emissions.

There is only a limited amount of ore with a 0.1% uranium content. If more nuclear power stations are built - for example because of the greenhouse effect- it will be necessary to switch to ores with a lower uranium content in ten to fifteen years' time. Much more rock would then have to be excavated and processed for the same amount of uranium. As a result, indirect CO2 emissions would rise. At an ore content of 0.02%, the indirect CO2 emissions from a nuclear power plant are 300 grams of CO2 per kWh. With even poorer ores of 0.01%, a nuclear power plant is responsible for more CO2 emissions than if the same amount of electricity were obtained by burning natural gas directly.[19] [20] [21]

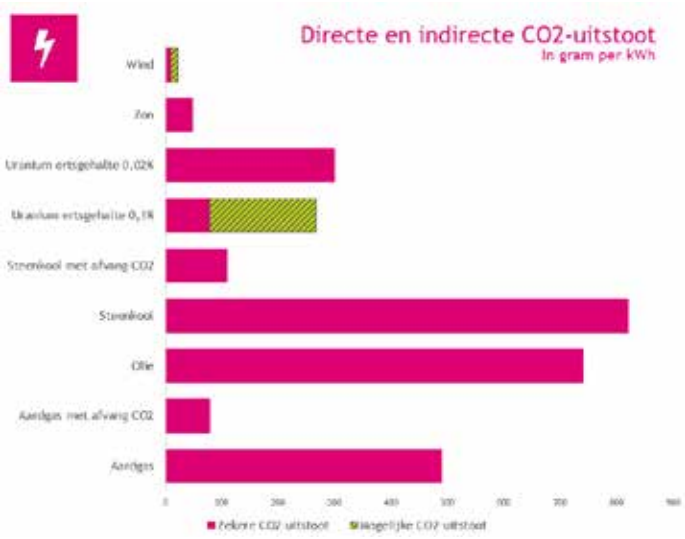
Table 1

Total (direct and indirect) CO 2 emissions in grams per kilowatt hour [22] [23] [24] [25] [26] [27] [28] [29] [30]

Fuel	Emissions
natural gas	490
Natural gas with CO2. capture	78
Oil	740
Coal	820
Coal with CO2. capture	110
Uranium ore content 0.1%	78-190
Uranium ore content 0.02%	300
Solar	15-55
Wind	10-12

12. https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_annex-iii.pdf , Schlömer S., T. Bruckner, L. Fulton, E. Hertwich, A. McKinnon, D. Perczyk, J. Roy, R. Schaeffer, R. Sims, P. Smith, and R. Wiser, 2014: Annex III: Technology-specific cost and performance parameters. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.
13. https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_annex-ii.pdf .
14. http://energiasostenible.org/mm/file/GCT2008%20Doc_ML-LCE%26Emissions.pdf , Apr 8, 2008.
15. https://onlinelibrary.wiley.com/doi/full/10.1111/j.1530-9290.2012.00472.x , Apr 17, 2012.
16. https://wisenederland.nl/sites/default/files/images/Kernenergie%20en%20CO2%20November%202018.pdf , 9 November 2018: Mining methods are not investigated in more than half of the studies. More than half of the studies do not pay attention to the quality of the uranium ore. This can have a major impact on CO2 emissions. The decommissioning of nuclear power plants was not fully included. Mine repair, which can account for a large proportion of CO2 emissions, was not included in any of the studies. The methods were usually not described in enough detail.
17. Jan Willem Storm van Leeuwen, Nuclear Monitor #886, June 8, 2020 CO2 emissions of nuclear power: the whole picture; at: http://nuclearfreenw.org/climate.htm ;
18. https://web.stanford.edu/group/efmh/jacobson/Articles/I/NuclearVsWWS.pdf , June 15, 2019.
19. Jan Willem Storm van Leeuwen, Energy from Uranium, Oxford Research Group, July 2006, http://www.oxfordresearchgroup.org.uk/publications/briefing_papers/energy_security_and_uranium_reserves_secure_energy_factsheet_4 .
20. http://www.peopleplanetprofit.be/beelden/oko-institut.pdf , March 2007.
21. Jan Willem Storm van Leeuwen, Nuclear Monitor #886, June 8, 2020 CO2 emissions of nuclear power: the whole picture; at: http://nuclearfreenw.org/climate.htm ;
22. https://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_annex-iii.pdf .
23. http://www.nature.com/articles/s41560-017-0032-9 ; https://www.pv-magazine.de/2017/12/11/indirekte-photovoltaik-emissionen-kein-hindernis-fuer-dekarbonisierung/, 12 December 2017.
24. http://www.dont-nuke-the-climate.org/ Jan Willem Storm van Leeuwen, Climate change and nuclear power. An analysis of nuclear greenhouse gas emissions. Commissioned by the World Information Service on Energy (WISE) Amsterdam 24 October 2017.
25. http://energiasostenible.org/mm/file/GCT2008%20Doc_ML-LCE%26Emissions.pdf , Apr 8, 2008.
26. https://jaspervis.wordpress.com/2019/03/03/how much-co2 -cost-all-that-steel-of-a-windmill-eigenlijk-2019-update / , March 3, 2019.
27. https://web.stanford.edu/group/efmh/jacobson/Articles/I/NuclearVsWWS.pdf , June 15, 2019.
28. Jan Willem Storm van Leeuwen, Nuclear Monitor #886, June 8, 2020; CO2 emissions of nuclear power: the whole picture; http://nuclearfreenw.org/climate.htm .
29. https://www.sciencedirect.com/science/article/pii/S0301421521002330?via%3Dihub , Energy Policy, Volume 155, August 2021, 112363 Nuclear energy - The solution to climate change?
30. https://www.tno.nl/whitepaper-sustainability-solar energy , December 2021.

Figure 1



Source: https://www.zelfenergieproduceren.nl/nieuws/tweede-kamer-kernenergie-is-duurzaam/ , 21 June 2021.

When asked, Storm van Leeuwen states: “My reports are based on a physical (thermodynamic) analysis of all processes that are part of the nuclear energy system from cradle to grave, including the final storage of the radioactive material. As far as I know, virtually no other study has included all processes and all energy flows and CO2 emissions, direct and indirect. Most studies are in fact meta-studies in which the results of a small number of original studies are processed via all kinds of, often opaque, models, sometimes also in combination with economic models. As far as I have been able to judge, all meta-studies have statistically incorporated the results of many other studies as if all are done with the same method of measurement; this is not the case. Often, ‘outliers’ (always the high values) are omitted, without stating why they are high values according to the authors.”[31]

3 The CO2 journey of the uranium for Borssele

The uranium for the nuclear power plant in Borssele, the only one in the Netherlands, is mined in Kazakhstan. The usable part of uranium is extracted from the ore in a chemical factory on site. It then goes by truck to a port and by ship to England to be taken by truck to a factory, where it is made gaseous. With a truck, a ship and then another truck it goes to the enrichment factory of Urenco in Almelo. The enriched uranium is transported by truck to a nuclear fuel rod factory in Germany or France. The fuel rods then reach Borssele by truck or train. When the fuel rods have been exhausted, they are transported by train or truck to a reprocessing plant in France. The nuclear waste, high, medium and low radioactive, is stored above ground in bunkers at COVRA, a temporary storage facility close to Borssele. Ultimately, all the waste will also have to be transported to a final storage facility in salt or clay.[32] All these activities and transport require machines that use petrol or diesel and thus cause CO2 emissions.

We assume that all of this combined with the construction and operation, will make Borssele have total CO2 emissions of 78 to 190 grams per kWh. That is lower than the emissions from a gas-fired power station, but in the same order of magnitude or more than what remains at a gas-fired power station with CO2 capture and storage, since CO2 cannot be captured 100%.

4 The transport of solar panels

Solar panels also have to be transported, sometimes over great distances, and that transport also costs energy. According to a report from TNO published in December 2021, CO2 emissions from solar energy strongly depend on where the solar panels are made. If they come from China (with many coal-fired power stations), this is 55 grams of CO2 per kWh, for Europe 29 grams of CO2 per kWh. TNO calculates that this number will eventually go down to 15 grams of CO2 per kWh. A considerably lower number than that of uranium.

5 (In)finite energy reserves and storage in salt domes

The sun is the main source of all energy. The sun sends its rays in all directions. A very small amount of it ends up on the earth. Yet that little bit is very important. The sun gives off heat. If it shines through the windows, it will get warmer in the house. Solar energy is converted into electricity with solar panels. The sun makes the air warmer. Heated air moves and rises. The air moves: the wind blows because of the sun.

In the Netherlands, we receive an average of 35 times as much energy from the sun per year as we need for heating, industry, cars and electricity generation.[33] We do not have an energy problem so much as an energy conversion problem and a space problem for the installation of solar panels and wind turbines.

Furthermore, the sun does not always shine and there is not always enough wind. In order to have enough energy, in addition to storage in batteries, large-scale energy storage is required. This is possible by storing hydrogen made from solar and wind or by storing compressed air.

This is how we use infinite instead of mainly finite energy sources. Take the Netherlands as an example. About 90% of the Dutch energy supply is now based on fossil fuels such as coal, oil and natural gas. Biomass 5%, solar and wind 4% and nuclear energy 1% comprise the rest of

31. E-mail Jan Willem Storm van Leeuwen to Herman Damveld, 15-2-2019 14:17.
32. https://www.wisenederland.nl/sites/default/files/images/WISE_climate-energy-report_A4%20definitive_0.pdf , 9 November 2018.
33. http://www.techniekweekblad.nl/rubrieken/energieserie/kansen-we-over Schakel-op-duurzame-energie.130162.lynkx , 24 May 2011; http://www.knmi.nl/klimatologie/grondinformatie/Zonnestraal_in_Nederland.pdf ; http://www.allesoverzonnemetaal.nl/voorwaarden/zonne regard/

the energy supply.[34] However, supplies of coal, oil, natural gas and uranium are finite. The energy company BP published an overview of global energy supplies in July 2021.[35] To indicate how long the stocks last, BP divides the stock (the reserves) by the use or production of, for example, the year 2020. This gives the so-called R/P number (reserve divided by production), the number of years that a stock lasts. with constant production.

The R/P number for coal is 140 years.

The R/P number for oil is 53 years.

The R/P number for natural gas is 50 years.

Due to an increase in energy consumption, stocks are declining at a rapid pace. We can illustrate this by means of a calculation example. The coal supply is 140 years, based on current use. If energy consumption did not increase, we would have coal for 140 years. This stock will last for 42 years if usage would increase by 2% annually.[36] Whether coal use will increase remains an open question however. A coal-fired power station releases twice as much CO2 per kilowatt hour as a gas-fired power station.[37] These high emissions make it more likely that we will keep our global coal stocks in the ground.

In order to limit global warming, the use of all fossil fuels must be reduced in the short term, according to the report of the UN climate panel IPCC published on 4 April 2022. To keep global warming below 1.5 degrees, global CO 2 emissions must peak before 2025 and reach zero by 2050.[38] [39]

Another example of the finite nature of the stock of fossil fuels is the natural gas in the Groningen field. Using data from Central Bureau of Statistics Netherlands (CBS), TNO, NAM and the government, we can calculate that some 560 billion m^3 of natural gas remains in the ground and that since the earthquake in August 2012 near Huizinge 230 billion m^3 of gas has been extracted from the Groningen field.[40] [41] [42] [43] In 2012, therefore, there was still 800 billion m^3 of gas in the Groningen field. According to the production plans until 2011, NAM was allowed to extract 42.5 billion m^3 of gas from the Groningen field every year.[44] That means that if there would not have been any earthquakes, the total supply of 800 billion m^3 would have been depleted in 19 years, ending in 2030.

Or take nuclear power. In 1980 IAEA based in Vienna published reports on the International Fuel Cycle Evaluation (INFCE) of, among other things, uranium stocks. At the time, the IAEA expected that 3,900 nuclear power plants of 1,000 megawatts each would be in operation worldwide by the year 2025.[45] If the INFCE's scenario had come true, the stock of 8 million tons of uranium would be depleted by the year 2030.

6 Conclusion

In conclusion, in the long run our energy supply will have to be based on infinite energy sources, such as solar and wind. Because the sun does not always shine and the wind does not always blow, energy storage is necessary. This is possible in batteries, which also use finite raw materials. An alternative is the storage of compressed air or hydrogen, and salt domes are suitable for this. The one in the works at Zuidwending is not enough, we need more.[46] There are salt domes in the Northern Netherlands that are suitable for this, but they have been marked as potential sites for the storage of radioactive waste since 1973. We can not do both, so what's left is a question of conscience. Do we either choose to use our salt domes to continue to extract energy from a polluting finite resource like uranium, or do we choose to store energy so we can enable a greater use of infinite energy sources like solar and wind?

34. https://www.cbs.nl/nl-nl/nieuws/2021/22/11-percent-energieeconomie-in-2020-afkomstig-uit-hernieuwbare-brons , 31 May 2021.
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Still lack of public participation on environment at Netherlands nuclear plant Borssele

WISE, LAKA and Greenpeace react in Aarhus case

By Jan Haverkamp, senior expert nuclear energy Greenpeace Netherlands and WISE Netherlands

The Dutch government last month reacted on a complaint from WISE, LAKA and Greenpeace under the Aarhus Convention, that there had been no public participation on the environment before the last two license changes of the Borssele nuclear power plant in the Netherlands in 2015 and 2018. On 13 June, these organisations responded. Later this year or somewhere next, there will be an open hearing by the Aarhus Convention Compliance Committee (ACCC), in which the issue will be investigated further.

According to the environmental organisations, there is a lack of fundamental information about the possible impacts on the environment for the operation of the power station between 2013 (when Borssele had its 40th anniversary – the end of its initial technical lifetime) and 2033, the currently foreseen date of closure. The Netherlands deny this, but because such information never has been submitted to public participation, the Netherlands already received a slap on the wrist from the ACCC after the license change in 2013 that enabled operation until 2033. That license change therefore did not comply with the international norms under the Convention.

The license adaptation of Borssele in 2015 to include measures based on the 2013 10-year periodic safety review (10EVA13) and the post-Fukushima nuclear stress tests could once more not be assessed on its sufficiency in respect to potential environmental impacts. Again, no environmental impact assessment (EIA) or comparable information was presented.

In 2018, the license was adapted to fulfil new guidelines from the West European Nuclear Regulators Association (WENRA) and the new Radiation Safety Directive from the EU. And again no information on possible impacts of Borssele until 2033 was available, making it impossible to judge whether these changes would keep the risks from Borssele sufficiently under control.

A few fundamental points are playing out here. Under art. 6(10) of the Aarhus Convention, environmental impacts from activities like nuclear power plants always must be submitted to public participation in case of extensions and updates, and the Netherlands so far interpreted this restrictively by dropping this when there were no large physical changes to a nuclear power station.

Then, over the years, views on these kind of risks have changed. New nuclear power plants need to fulfil much more stringent norms than were used during the construction of Borssele. France, for instance, therefore strives to bring nuclear reactors that it wants to operate beyond 40 years as near as possible to the norms for new nuclear power stations – and therefore wants to see them consider new technologies like a core-catcher. In the Netherlands, norms have become more stringent over time, but they absolutely don't meet those for new nuclear power stations.

The environmental organisations argue furthermore that risks of nuclear energy are also influenced by changes in the environment. When more important nature areas around a nuclear power station appeared or were developed, when more people live around it, when there is more economic activity than when the original license was issued, the risks of a severe accident increase. Risk is chance times impact – and in case of equal chance, but larger impact, the risks grow. To balance higher impacts, more technical measures are needed to reduce the chance on a severe accident. This happens to some extent in Borssele, but it is unclear whether this is sufficient.

Short, when taking decisions on license changes, it is extremely important to know what the environmental impacts of Borssele can be for its remaining years of operation.

The Netherlands currently adapt its legislation to the findings of the ACCC after the license change of 2013. What the environmental organisations notice is that it only wants to make these adaptations for nuclear power stations – so not in general for all activities for which sufficient environmental public participation should take place. And that it wants to use public participation procedures under a so called uniform public participatory procedure (Uniforme Openbare Voorbereidingsprocedure – UOV), which does not explicitly demand the provision of the environmental information as prescribed by the Aarhus Convention. Concluding, the Netherlands continue to cut edges. This is not good for nuclear safety, and in the end not good for the environment.

In the mean time, some Dutch authorities seem to understand that before the upcoming periodic safety review of Borssele in 2023, the so-called 10EVA23, public participation on the environment does need to take place. The Dutch nuclear regulator ANVS already contacted WISE with the question what should be on the table in such a procedure. The big open question remains, however, whether this will be sufficient to prepare Borssele for the next and hopefully last ten years of operation. Or that the costs for necessary measures will be deemed to high. In that case, WISE thinks the power station should be closed and investments could be used better to fill the hole in decommissioning and waste funds and for really clean energy sources.

Original complaint WISE, Greenpeace, LAKA, sept 2021 https://unece.org/sites/default/files/2021-09/Comm_GreenpeaceWise_NL_02.09.2021.pdf

Reaction Dutch Government https://unece.org/sites/default/files/2022-05/frPartyC187_13.05.2022_response.pdf

Full response, June 13 2022 https://unece.org/sites/default/files/2022-06/frCommsC187_13.06.2022.pdf

NUCLEAR NEWS

World Nuclear Power Status

Number of Reactors
(as of June 2022)

Source: https://www.worldnuclearreport.org/

Construction starts

China, In May the construction start of Xudabu-4 was announced by Rosatom. It is an example of growing cooperation between the Russian and Chinese nuclear industry.

New to grid

China, In May the Hongyanhe-6 reactor was connected to grid.

South Korea, In June Shin Hanul 1 came to grid. Construction of this APR-1400 started in 2012.

Closures

US, After being in operation for 50 years, the Palisades PWR in Michigan was shut down permanently. In recent years the NPP has faced quite some technical problems.

ANTI-NUCLEAR NEWS

Germany, Towards the Atomausstieg – the future is renewable!

From July 9th to July 31st, 2022 and from August 13th to September 4th, 2022, the German anti-nuclear group Ausgestrahlt celebrates the upcoming Atom-ausstieg (exit from nuclear) together with many local initiatives. With hundreds of people who have campaigned against nuclear power and for the energy transition in recent decades and are fighting against a fossil-nuclear rollback, there will be a cycling-tour towards the phase-out into a renewable future!

First in Northern Germany and then in Southern Germany, the group will cycle to nuclear power plants that are still running, reactors that have already been shut down, power plants that have been prevented, interim storage facilities for nuclear waste, landfills for “cleared” radioactive waste, potential locations for a deep geological repository, nuclear factories, headquarters of the nuclear industry and nuclear plants close to the borders in neighboring countries.

Protest movements are not particularly used to celebrating their own successes. Usually there is still enough criticism, even if a partial success has been achieved. It will be the same in 2022 when the last power reactors in Germany will go offline. That’s why the anti-nuclear bike tour connects scenes of great success with places where nuclear politics are still burning. But with all unsolved problems: A party should not be neglected! After all, the anti-nuclear movement once faced off against very powerful opponents. Anyone who is aware of this cannot help but be very happy about what has been achieved. And by celebrating, to recharge your batteries for current and future disputes.

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