Coalition for Responsible Energy Development in New Brunswick

www.crednb.ca | info@crednb.ca | PO Box 4561 | Rothesay, New Brunswick | Canada | E2E 5X3

Updating New Brunswick's Climate Change Action Plan:

Submission to the NB Legislature's Standing Committee on Climate Change and Environmental Stewardship

from:
Coalition for Responsible Energy Development in New Brunswick (CRED-NB)
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Introduction

The Coalition for Responsible Energy Development in New Brunswick (CRED-NB) includes 10 New Brunswick environmental and public interest groups as core members, 10 New Brunswick Champion groups and businesses, and more than 90 individual Champions of responsible energy development living across New Brunswick. Our core members and Champions are listed on our website: https://crednb.ca/about/

CRED-NB welcomes this opportunity to contribute to your very important work of reviewing and updating New Brunswick's climate change action plan. No issue is more urgent than avoiding a climate catastrophe which the latest report from the Intergovernmental Panel on Climate Change (IPCC 2021) tells us will unfold if the world exceeds the 1.5°C global warming ceiling (over pre-industrial average surface temperature). We are already at 1.2°C. warming.

The IPCC also determined that dramatic reductions in greenhouse gas emissions must occur by 2030–a mere eight years–to meet that 1.5°C warming limit, in the range of 45-50 per cent over 2005 levels. Estimates of Canada's fair share of this global target are in the range of 60 per cent reduction. This accounts for Canada's historic contributions to the current levels of atmospheric concentrations of greenhouse gases, and the differentiated responsibility of developed nations to lead in reducing emissions.

Time, then, is of the essence. With a minimum reduction target of 50 per cent upwards to 60 per cent reductions within a decade, this equates to approximately 7.5 per cent reductions every year starting now (Rockstrom and Gaffney, 2021). This target is extremely challenging, but it is reachable with measures and technologies that already exist and will have residual economic and social benefits.

Our concern is that the New Brunswick government is not yet oriented in the direction that would get us to 50-60 per cent reductions by the end of this decade. With scarce public funds, every dollar must be directed where it will contribute the most to reaching the 2030 goal.

In this brief, we provide evidence that the current preoccupation of the government with new nuclear reactors–small modular nuclear reactors (SMRs)–is not a viable response to the climate crisis.

- Across the globe, both the public and private sectors are investing rapidly in renewable energy technologies–wind and solar–that will deliver reliable, affordable energy by 2030.

- Globally, investments in nuclear energy technologies are minimal because nuclear energy is not renewable, electricity generated by nuclear energy will cost much more than electricity generated by renewable energy, and new nuclear technologies cannot be developed by 2030.

- Canada is one of the few countries providing public funds for SMR development; to date, New Brunswick is the only province in Canada to provide public funds directly to private companies to develop their SMR designs.

- The SMRs supported by New Brunswick are two unproven technology concepts at an early stage of development: ARC-100 and the Moltex SSR and its associated WATSS unit.

- Each design will take an estimated $2B or more to develop to the prototype stage. Despite considerable promotion, the private sector has shown no investment interest in these designs.

- To date, the Government of New Brunswick has committed $30M in direct funding to the two companies, recently established in the province, to develop their SMR designs. The federal government has provided $50.5M to the Moltex project, and additional funds for NB Power to prepare the site for SMRs at Point Lepreau.

- NB Power and the Government are also supporting salaries and associated overhead expenses for staff working primarily on promoting and facilitating the development of SMRs; we note that no comparable staff levels are devoted to the development of renewable energy technologies.

- In total, more than $80M in direct public funds has been committed to two “wild card” (CICC 2021) technologies in the next few years, with no reductions in greenhouse gas emissions ensuing.

- The NB Government and NB Power have stated that building SMRS will help the province reduce the carbon footprint of the electricity sector, and create jobs and low-carbon export opportunities.

- While we appreciate the Government’s commitment to moving toward a zero-emissions electricity system while creating economic opportunities, we believe the chosen pathway–backing private companies to develop SMRs–is deeply flawed and will fail to meet these expectations, at great cost to New Brunswickers.

We address three questions, followed by recommendations:

1. Will the proposed SMRs help NB Power deliver electricity reliably, affordably and sustainably, as required under the *Electricity Act*?

2. Will the proposed SMRs help New Brunswick meet its climate action goals?

3. What are some additional considerations with the SMR designs?

4. Conclusions

5. Recommendations

6. Supporting documents

1 Will the proposed SMRs help NB Power deliver electricity reliably, affordably, and sustainably?

1.1 What can we learn from NB Power's experience with nuclear energy at Point Lepreau?

Under the *Electricity Act*, NB Power is required to deliver electricity reliably, affordably and sustainably. According to NB Power's testimony to the Energy and Utilities Board, Point Lepreau currently generates the most expensive electricity on the New Brunswick grid.

The cost to build Point Lepreau, which opened in 1984, was $1.4 billion, more than three times the original estimate. At $2.4 billion, the refurbishment of the reactor, necessary because of premature aging of the nuclear components, was $1 billion over budget (Auditor General).

In 2001, to keep it off of NB Power's rate base, the provincial government took $450 million of Point Lepreau debt off of NB Power's books and added it to the provincial debt.

Throughout its lifespan, and even after the early retrofit, which the Energy and Utilities Board recommended against, the reliability of Point Lepreau has been "an ongoing frustration for NB Power."

The Auditor General found that the money borrowed to build and refurbish Point Lepreau ($3.6 billion) is the primary reason that NB Power is currently carrying a $4.9 billion debt.

The $3.6 billion nuclear debt is currently a nuclear debt load of more than $4,500 for every adult and child resident in New Brunswick.

1.2 Will the cost of building the two proposed SMRs be affordable?

Globally, sodium cooled reactors like the proposed ARC-100 have been more expensive to build than heavy water reactors like Point Lepreau on a capacity basis.

The ARC and Moltex proponents have not publicly released their proposed costs. The CEO of Moltex stated in 2016 in the UK that building his model would cost between $1.8 billion and $2.6 billion CDN (£1 billion to £1.5 billion GBP).

In the US, where other SMR experiments are underway, the projected cost of the most advanced project (NuScale) had risen by 2020 from $3 billion to $6.1 billion USD, including lifecycle costs.

This represents around $8,500 US per kilowatt, much more than its renewable competitors such as wind ($1,250 US per kilowatt) and utility scale solar ($900 US per kilowatt).

The design costs for the most advanced US SMR (NuScale) have exceeded $1 billion USD, and the reactor has not yet been built.

Since Japan's Fukushima nuclear reactor meltdowns in 2011, technical, safety, and security requirements for new nuclear builds globally are increasingly complex, resulting in construction cost hikes and uncertainty about completion dates.

In addition, both the ARC and Moltex proposals are so-called "advanced" SMRs. They are cooled not by water but other complex liquids. If built, the costs of the radioactive wastes generated by these proposed nuclear reactors are unknown but projected to be much more difficult–and costly–to manage safely.

1.3 Are the proposed SMR prototypes based on previous reliable and cost-effective technology?

Both the ARC and Moltex designs are unproven concepts. Their development costs, therefore, are highly unpredictable. Historically, prototype reactors in Canada have ended up as duds. Four small nuclear reactor prototypes were built and scrapped without ever becoming commercial: Gentilly-1, Maple 1, Maple 2, and Slowpoke 3.

The Moltex design is a molten salt reactor. Only two molten salt reactors have operated, both more than 50 years ago. Neither generated electricity, and neither operated for long (less than one year, and less than four years, respectively).

During testimony to, and exchanges with, the Standing Committee, it was stated several times that the ARC design is "proven." This statement itself is unproven, as we explain below.

The ARC reactor is cooled not with water–not even heavy water–but with liquid sodium metal, a material that bursts into flames or even explodes on contact with air or water.

Statements suggesting that the ARC-100 design is "proven" are exaggerated claims based on the performance of the second Experimental Breeder Reactor (EBR-2) built in Idaho 60 years ago. EBR-2 was not a commercial facility, and it was only one-fifth the power of the ARC reactor. It operated as a research project under laboratory conditions for almost 30 years.

The EBR-2 relied upon a highly enriched type of fuel that would never be allowed for use in a commercial plant. The level of fuel enrichment for the non-commercial EBR-2 reactor would now only be allowed in military facilities because of the risk of nuclear weapons proliferation.

The ARC design is a sodium-cooled fast reactor. Sodium-cooled reactors have suffered severe accidents, including a partial nuclear meltdown at the EBR-1. The first commercial sodium-cooled reactor in the US (the Fermi-1 plant, just outside Detroit) suffered a partial meltdown and was quickly scrapped. The book “We Almost Lost Detroit” describes in detail what went wrong.

In other countries, sodium fires and erratic performances led to the abandonment of sodium-cooled reactors in France (the Superphénix), in Japan (the Monju breeder), in Germany (the Kalkar plant), and in Scotland (the Dounreay reactor). Sodium-cooled reactors have never been commercialized successfully. All of these shut-down sodium-cooled reactors have proven to be far more expensive to decommission than they were to build. The costs of radioactive decontamination are extraordinarily high in every single case.

Although the EBR-2 reactor was shut down permanently in 1994, scientists are still–27 years later–trying to extract the sodium metal from the highly radioactive used metallic fuel so that that high-level radioactive waste material can be safely disposed of without causing underground explosions due to sodium-water or sodium-air reactions, as happened in the case of the Dounreay reactor.

The US government considers the ARC design to be at the “concept development” stage. In 2020, the US Department of Energy funded the development of the ARC nuclear reactor design under a program to assist the progression of advanced reactor designs in their earliest phases and to support projects low on the Technology Readiness Level scale.

The ARC-100 design development is research to prove feasibility, far from commercial viability.

1.4 Will the proposed SMRs keep electricity rates low?

A recent study by the Energy Futures Group in the Atlantic region found that electricity generated by SMRs is likely to be more expensive relative to the rapidly falling cost of renewable energy (including the cost of providing firm capacity through storage).

The higher cost of SMRs will result in higher electricity costs to New Brunswickers. Further, building SMRs will multiply the long-term cost liabilities of dismantling radioactive plant structures and managing radioactive wastes. (Alternatively, renewable energy and efficiency investments promise to cap and eventually lower power rates.)

2 Will the proposed SMRs help New Brunswick meet its climate action goals?

2.1 Will the proposed SMRs be ready in time to meet greenhouse gas reduction targets?

According to the Intergovernmental Panel on Climate Change (2018, 2021), the world must reduce climate changing emissions by nearly 50% by 2030 to limit global warming to 1.5 degrees C.

Accordingly, Canada's current 2030 targets of 40-45% reductions over 2005 levels will most certainly be increased as early as November 2022 (at COP 27). At 35% reductions from 2005, New Brunswick is short by at least 15%.

Under federal law, the Belledune coal-fired power plant must be phased out by 2030. The ARC and Moltex designs are not yet licensed to operate in Canada and the Canadian Nuclear Safety Commission has not yet evaluated these designs in any detail.

Given the nuclear industry's poor track record for approvals and on-time and on-budget new builds, it is virtually impossible for either of these prototype reactors to replace carbon-emitting power plants by 2030. Yet, we will need zero-emissions replacement power, and there are affordable sources available now.

2.2 Is nuclear an effective climate change mitigation strategy?

When solving an urgent challenge like climate change, that requires money to be spent in a limited time window, we need to look at both cost and speed to choose effective solutions.

Cost will drive the demand for low-carbon electricity sources. New (and existing) nuclear is not competitive with today's low cost of wind, solar and hydro. Unlike nuclear, the renewable technologies are demonstrated, affordable, and can be deployed at scale quickly.

New Brunswick's most reliable, available and affordable climate change mitigation path is a rapid expansion of renewable energy infrastructure, investing aggressively in energy efficiency, and upgrading interconnections to access existing hydro from the Atlantic Loop and Quebec.

Recent analysis found that power systems organized around expensive nuclear have difficulty integrating renewable energy technologies. To a great extent, they are mutually exclusive.

3 What are some additional considerations with the proposed SMRs?

3.1 Will the proposed SMRs produce clean energy?

SMRs–like all nuclear reactors–will produce low-level radioactive waste as well as intermediate and high-level waste (spent nuclear fuel) that will require secure containment for hundreds of thousands of years to keep the dangerous radioactive materials away from living beings.

The Moltex design includes opening the solid bundles of high-level used fuel waste currently stored at Point Lepreau and dissolving them in molten salt to make new fuel for its proposed reactor. This process is highly theoretical, risky, unproven, and very expensive. It has never been done anywhere.

Claims that the Moltex unit will reduce the high-level nuclear waste problem at Point Lepreau are, quite simply, false. It is also false to call this process "recycling" because less than 1% of the existing high-level waste could possibly be re-used as new fuel. If built, the proposed SMRs would create new, dangerous radioactive waste streams that will be very expensive to manage.

The liquid sodium coolant from the proposed ARC design will become a new category of liquid radioactive waste, posing special problems that promise to be very expensive.

Should these SMRs be built and actually operate, the additional costs for managing even greater volumes of nuclear waste and keeping it out of the environment will be borne by the province's ratepayers and/or taxpayers, not the private companies that will benefit in the short term.

3.2 Will the proposed SMRs introduce new security and legal issues?

The nuclear fuel recycling proposed by the Moltex design requires the extraction of plutonium from the high-level radioactive waste at Point Lepreau. Since plutonium is usable in nuclear explosives, this will require heightened security and increased inspection levels by international regulators at Point Lepreau.

On May 25, 2021, nine US non-proliferation experts sent an open letter to Prime Minister Justin Trudeau expressing concern about the Moltex project. The experts stated that by "backing spent-fuel reprocessing and plutonium extraction, the Government of Canada will undermine the global nuclear weapons non-proliferation regime that Canada has done so much to strengthen."

The nine signatories to the letter include senior White House appointees and other US government advisers who worked under six US presidents: John F. Kennedy, Lyndon B. Johnson, Richard Nixon, George H.W. Bush, Bill Clinton, and Barack Obama; and who hold professorships at the Harvard Kennedy School, University of Maryland, Georgetown University, University of Texas at Austin, George Washington University, and Princeton University.

Importing used nuclear fuel or weapons-grade fissile material from dismantled nuclear warheads from the US, as suggested by the ARC proponent, will be contested both politically and legally.

3.3 What are the global trends for nuclear energy?

Nuclear power has been declining as a percentage of the world's electricity generation and is now barely 10 percent, down from a maximum of 17 per cent. If not for government subsidies which are keeping private nuclear companies afloat in the US, and high power rates to customers, this fraction would be even lower.

Because it is such a risky investment, private sector investment in SMRs is highly unlikely without hefty government guarantees, with the New Brunswick tax/rate payer carrying all the risk.

4 Conclusion

SMRs do not exist at all in Canada except on paper or as computerized plans. There is no guarantee these new untested reactors will ever succeed in producing electricity in Canada in a safe and affordable manner.

There is no evidence of any real markets for SMRs, export or domestic, at anywhere near the scale that would make these SMR developments profitable. Consequently, it is highly unlikely that there will be any substantial economic spin-offs for New Brunswick, other than what public money might generate in the short term.

Proposed SMRs would not help NB Power deliver electricity reliably, affordably and sustainably. On the contrary, local, national and international evidence suggests that building SMRs is financially risky and will drive up the cost of electricity to New Brunswick ratepayers, while proven and available renewable technologies would stabilize and eventually lower power rates.

The proposed SMRs would not help New Brunswick meet its 2030 greenhouse gas emission reduction targets. International research strongly suggests that nuclear is not an effective climate change mitigation strategy over the next few decades. The millions being spent now on SMRs will have no resulting greenhouse gas reductions by 2030.

The proposed SMRs introduce significant additional risks to New Brunswick: new forms of dangerous, long-lived radioactive wastes that will be expensive to manage and for which there is no permanent solution and increased nuclear weapons proliferation and security risks.

NB Power has a regrettable record of speculating on technologies: consider Orimulsion, and JOI Scientific's saltwater hydrogen, not to mention Point Lepreau itself, which is the highest cost electricity on the grid and is responsible for the lion's share of NB Power's staggering debt. Spending scarce tax dollars on unproven nuclear concepts is not responsible financial or environmental stewardship.

Spending public money on unproven nuclear reactor concepts is the path to escalating power rates, long-term billion-dollar liabilities, and a growing radioactive waste legacy that will burden future generations far beyond any useful lifespan of these plants.

5 Recommendations

5.1 Make reliable information about SMRs available to the public

The information available on the government and NB Power websites about the SMR projects and investments is presented as nuclear industry promotion. In our submission and supporting documents, we provide independent information from credible sources.

We urge the government to share credible information from independent sources on its websites. Without balanced credible information, the government can sow confusion, for example by promoting "recycling" as a solution to the used nuclear fuel problem.

5.2 Implement protections from financial risks

Request the Auditor General to prepare a report on the full costs of liability for nuclear wastes, existing and proposed, including importing toxic wastes from other countries, as well as the costs of decommissioning and abandonment of additional reactors.

Commission an independent economic feasibility study of the proposed SMRs based on credible market data.

Halt all public funding of these projects. If the business case is sound, private sector investors will not require coaxing.

5.3 Pivot the climate change action strategy to renewable energy and deep retrofits

In the next iteration of the Climate Action Plan, exclude new nuclear development and base the plan on deep energy efficiency retrofits, renewable energy and storage, and building the Atlantic Loop. This is a proven pathway to affordable energy security, low carbon footprints, regional economic development, and a clean, healthy environment.

Use the revenues from the carbon tax to invest in this transition.

6 Supporting documents and further information

This submission and supporting documentation will be available on the CRED-NB website at this link:

https://crednb.ca/submissions/

Thank you.

We appreciate this opportunity to share our knowledge and analysis.

The CRED-NB team
www.crednb.ca/about