Consultation on Clean Electricity Regulations

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November 1, 2023

Assessment and recommendations

- The government has committed to decarbonizing the electricity sector by 2035. SCAN! agrees with this objective.

- The Clean Electricity Regulations imposes a stringent limit (the 'prohibition') on the emissions of carbon dioxide from fossil fuel generating stations of 30 tonnes of carbon dioxide per gigawatt-hour of electricity generation. However, there are significant exceptions, concessions, and flawed assumptions that render the proposed legislation completely ineffective. For example:

  1. The End of Prescribed Life (EoPL) exemption allows gas fired GS to continue operating for 20 years from the date of commissioning. This would allow the Napanee generating station in Ontario (commissioned in 2020) to operate until 2040 subject only to the Output-Based Performance Standard (OBPS): an extremely weak regulatory instrument.

  2. For generating stations that are not exempted by the EoPL the imposition of the 'prohibition' on 1 January 2035 is too late to ensure a 'decarbonised electricity sector' by that year.

  3. The negative emission technologies that are proposed to offset the residual emissions from generating stations in 2035 have never been shown to work effectively at scale. For example:

  - Carbon capture and storage from fossil fuel-powered generating stations is not 100 percent effective. This is physically impossible. Moreover, the upstream fugitive emissions of methane are considerable and cannot be ignored as recent research has clearly shown.
  - Bioenergy with carbon capture and storage is not carbon neutral. This assertion has been debunked by numerous peer-reviewed studies.
  - The production of hydrogen at scale from biomass is not a feasible negative emission technology. The assumption that it is, is false.
  - Citing land use change and forestry as a negative emission option ignores the fact that Canadian boreal forests are now a net carbon source, not sink.
  - Direct air capture (which is not yet operational at scale) consumes very large quantities of electricity that will likely be produced from fossil gas combined with carbon capture and storage. This is not a feasible negative emission concept.

- The decarbonisation of the electricity sector can ONLY be achieved if the electricity sector is entirely carbon free. This means that in 2035, electrical power in Canada should be entirely generated by renewable sources of energy: solar energy, wind power, hydropower, and geothermal energy, with smaller amounts produced by innovative technologies such as wave energy.

- SCAN! recognizes that nuclear energy does not produce carbon emissions. However, small modular reactors (SMRs) are costly, unproven, technically complex, and produce toxic waste for which no solution has yet been found. While not part of this assessment, SCAN! urges the government to reconsider its commitment to the development of SMRs in light of the continuing decline in the cost of renewable energy technologies and electricity storage, and the proven reliability of these technologies at scale.

In order to achieve a decarbonized electricity sector by 2035, **it is therefore recommended that:**

1. The exemption from the performance standard during the period defined as the 'End of Prescribed Life' should be eliminated.

2. All fossil fuel generating stations must meet the performance standard of 30 tonnes CO2 / GWh from 1 January 2030 (not 2035).

3. The Clean Electricity Regulations performance standard (what the proposed legislation calls the 'prohibition'), which comes into force on January 1, 2035, should be set at zero tonnes of carbon dioxide per gigawatt hour. This is essentially a ban on the operation of fossil fuel generating stations from January 1, 2035.

Seniors for Climate Action Now!

Seniors for Climate Action Now! (SCAN!) is an environmental organisation based in Ontario with over 500 active members. SCAN! is dedicated to educating, motivating, and mobilizing seniors to engage in the social movement advocating for an urgent and just transition to a more sustainable, equitable, low-carbon economy and society - for both the producers and consumers of energy. We are a voice for one of the social groups most vulnerable to the impacts of global warming, figuring heavily among its casualties, and most concerned about our legacy for future generations. Our purpose in contributing to this consultation is to express that perspective based on our lifetimes of knowledge and experience.

Introduction

The federal government has declared that "the electricity system, which decarbonises by 2035 and achieves net-negative emissions thereafter, is the backbone of our net-zero scenario."[1] The proposed **Clean Electricity Regulations** have been formulated to achieve this objective.[2]

But the regulations have so many exemptions, concessions, and dubious assumptions that the argument that they will lead to a decarbonized electricity system by 2035 is an illusion. **The electricity system will never be decarbonized as long as fossil fuels are used to generate power.** There are no exceptions to this rule.

To better understand the regulations, we need to look first at the scenarios set out in **Canada's Energy Future 2023** (EF2023), a government report published earlier this year.[3]

The EF2023 sees electricity generation in Canada doubling by 2050 in response to the increased consumption of electricity as the economy electrifies: particularly across the transport and building sectors. However, the projection of a doubling of electricity generation through to 2050 is hugely exaggerated as several analysts and environmental organisations have convincingly argued. [4]

But based on this forecast, the key question for government energy planners therefore becomes: How is Canada going to generate this additional amount of electrical power? EF2023 proposes that in 2050, electricity generation will include not only renewable energy technologies such as wind power and solar energy, but also nuclear energy and fossil gas with carbon capture.[5]

At least two previous studies have modelled Canada's electricity generation through to 2050 and have shown that a more realistic increase in electricity demand can be met without either nuclear energy or fossil fuels.[6]

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[1] Published by Canada Energy Regulator *Canada's Energy Future 2023*. https://www.cer-rec.gc.ca/en/data-analysis/canada-energy-future/2023/

[2] The draft Clean Electricity Regulations were published in the Gazette: https://www.gazette.gc.ca/rp-pr/p1/2023/2023-08-19/html/reg1-eng.html

[3] Canada Energy Regulator *Canada's Energy Future 2023*. https://www.cer-rec.gc.ca/en/data-analysis/canada-energy-future/2023/

[4] For instance, see the articles by Ralph Torrie at Corporate Knights. Data based on Ontario municipalities show an average increase of less than 1% year-on-year, whereas the EF2023 projection for Canada forecasts an annual increase of 2.6%. Quebec, Canada's largest user of electricity, forecasts demand increasing by 1.15% from 2022 to 2032.

[5] EF 2023 page 10 Fig ES4

[6] See the report from the David Suzuki Foundation *Shifting Power: Zero-emission electricity across Canada by 2035* *https://davidsuzuki.org/science-learning-centre-article/Shifting-Power-Zero-Emissions-Electricity-Across-Canada-by-2035/* and the research by Mark Z Jacobson published here : https://web.stanford.edu/group/efmh/jacobson/Articles/I/145Country/21-WWS-Canada.pdf

But under pressure from the nuclear and fossil fuel industries, and no doubt mindful of the political implications at the provincial level of phasing out fossil fuels, the government has written both nuclear energy and fossil gas-powered electricity generation substantially into the script. Since gas plants even with carbon capture and storage (CCS) still produce emissions both upstream in the processing of the raw gas, and from the CCS technology itself (which is never 100% effective), the government is faced with a serious challenge when it proposes that the electricity system will be decarbonized by 2035.[7]

The Clean Electricity Regulations (CER) are the new tool in the toolbox that the government intends to use as it progresses down the path to a decarbonized electricity sector. There are already several regulatory measures in place that curb emissions from power generation, including the federal *Greenhouse Gas Pollution Pricing Act*, which came into force in June 2018. The GGPPA established a carbon pricing system that applies to fossil fuel-powered electricity generation, and includes an instrument called the Output-Based Pricing System (OBPS). The OBPS is designed to reduce GHG emissions, but it has a very light touch. Because of the fear of 'leakage', where an industry threatens to relocate to a jurisdiction where carbon pricing is much lower or inexistent, the OBPS only imposes a tax on emissions that exceed a benchmark that reflects industry 'best-practice'. This means that an industry may have an incentive to marginally reduce its emissions but not much more than that. All industries that are in compliance with the OBPS standard essentially pollute for free. For fossil gas-powered electricity generation, the OBPS standard is set at 370t CO2/GWh, which for a power station like the 900 MW Napanee gas-fired generating station in Ontario, allows for free emissions of around 2.8 million tonnes of CO2 a year, roughly equal to the pollution of 1.4 million combustion-engine cars.[8]

Perhaps unsurprisingly, given the exemptions allowed by the OBPS, the government has come to realise that these lax policies are not working. In the Regulatory Impact Assessment Statement (RIAS, an addendum to the CER), it states,

> *"The Department has conducted various modelling exercises and determined that a carbon price of $170/tonne applied to every tonne of electricity sector emissions does not move the sector far enough towards net zero by 2035."*[9]

The RIAS goes on to say: "In the absence of a regulated standard, it is likely for utilities to continue to use unabated natural gas …and pay an increased price on pollution, or to

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[7] EF2023 page 9

[8] Napanee GS is rated at 900 MW which at a capacity factor of 95% generates 7490 GWh/yr. If emissions are 370t CO2/GWh this converts to 2.77 million tonnes of CO2 per year. The average (2019) ICE car in N. America emits about 2 tonnes of CO2 per year. https://www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/greenhouse-gas-emissions-performance-2019.html#s2_2. Therefore, Napanee emits roughly the same as about 1.39 million passenger cars.

[9] RIAS Page 20

acquire and remit surplus or offset credits." [10] So, neither carbon pricing nor the OBPS are proving to be effective.

This explains why the government has been compelled to impose a regulatory standard. Without the Clean Electricity Regulations, the deal with the industry that allows fossil gas power generation to continue under the output-based pricing system will completely undermine government efforts to achieve a 'decarbonized' electricity system by 2035.

The Prohibition

The Clean Electricity Regulations will 'prohibit' a generating station from emitting more than 30 tonnes of CO2 emissions /GWh of electricity generation. Although, strictly speaking, this is not a prohibition (since it still allows for some emissions), it is nevertheless a stringent limit. For comparison, the EU limit is 100 t CO2e/GWh which, although counting other greenhouse gases besides carbon dioxide, is significantly higher than the limit proposed by the CER. [11]. The prohibition comes into force on January 1, 2035.

But there is a massive fly in the ointment; in fact, more than one. The Clean Electricity Regulations come with multiple exceptions and concessions that weaken them to the point where the probability of Canada achieving a 'decarbonized electricity system' by 2035 is almost zero.

The first is the delay before the 'prohibition' comes into force. Between now and January 1, 2035, existing fossil gas-powered generating stations continue to be subject to only the current regulations: the same ones the government acknowledges don't work. This exemption appears to have been granted specifically to allow the industry to recoup its investment in building and commissioning a generating station.[12]

End of Prescribed Life

The second is what's called the End of Prescribed Life. The EoPL exemption applies to all *existing* fossil gas-powered generating stations. In order for utilities to recover their investment in the construction of a fossil gas power plant, the CER performance standard of 30t CO2/GWh is not applied for a period of 20 years from the commissioning date of a generating station. This concession is to "address interested parties' concerns", by phasing in "the performance standard on existing units by applying the standard to any

[10] RIAS page 20
[11] See *7 key points about the EU taxonomy's 100g emission threshold*. https://ecostandard.org/wp-content/uploads/2021/12/EUTaxonomy_100g_7points.pdf
[12] RIAS page 14

given unit 20 years following its commission date, known as a unit's End of Prescribed Life." [13]

This means, for example, that the Napanee gas-fired station in Ontario, commissioned in 2020, would not be subject to the CER standard until 2040. The Napanee generating station will continue to pay a carbon price only on its emissions that exceed the OBPS benchmark of 370t CO2/GWh, and for the next 17 years Napanee will continue to pollute unabated.

A net full of holes

Because the generation of electricity in 2050 still relies on fossil fuels, the Canada Net-zero scenario outlined in EF2023 includes a portfolio of negative emission technologies (NETs) that, in principle, compensate for the greenhouse gas emissions produced by these fuels. The NETs include bioenergy with carbon capture and storage, (known as BECCS); Direct Air Capture; hydrogen produced from biomass; and land use change and forestry.

Bioenergy with Carbon Capture (BECCS) requires the processing of very large quantities of biomass; has convincingly been shown to be far from carbon neutral; and is generally reckoned to be an unrealistic option at any useful scale.[14] Direct Air Capture (DAC) is still largely a pipe dream and is energy-intensive and expensive [15]; and hydrogen produced from biomass has never been demonstrated at scale and is extremely unlikely to be carbon neutral [16]. Note also that BECCS, Direct Air Capture, and hydrogen produced from biomass, **all require the captured carbon dioxide to be permanently sequestered**; a technology that has had only limited success, and which the International Institute for Sustainable Development (based in Winnipeg, Manitoba) bluntly labelled **a decarbonisation pipedream.**[17]

Finally, the assumption that Canada's forests and wild lands will be a substantial carbon sink is absurd given the recent analyses that show that the boreal forests are now a carbon

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[13] RIAS page 14

[14] See: *BECCS deployment: a reality check*. Imperial College London. Briefing Paper No 28. 2019. https://www.imperial.ac.uk/grantham/publications/energy-and-low-carbon-futures/beccs-deployment-a-reality-check.php . And also : *Negative Emission Technologies: What role in meeting Paris Agreement targets?.* EASAC 2018. https://easac.eu/publications/details/easac_net

[15] World Resources Institute. *6 things to know about direct air capture*. Https://www.wri.org/insights/direct-air-capture-resource-consideration-and-costs-carbon-removal .

[16] See: *Biomass-to-hydrogen: A review of main routes production, processes evaluation and techno-economical assessment*
https://www.sciencedirect.com/science/article/abs/pii/S0961953420304530

[17] See *Carbon capture: A decarbonisation pipe dream,* International Institute for Sustainable Development.. https://ieefa.org/articles/carbon-capture-decarbonisation-pipe-dream

source, not a sink, and have been a source for the last 20 years.[18] In short, the idea that negative emission technologies are going to lead the country to net zero emissions by 2050 is simply delusional.

The choice of technology

The federal government is keenly aware that it has a problem. The Regulatory Impact Assessment Statement, emphasizes that, "For Canada to meet its economy-wide net-zero emissions target by 2050, significant growth in clean electricity supply is needed." [19] The RIAS shows a helpful table of the "current and emerging electricity system technologies needed to meet net-zero GHG emission." The table sets out data for 21 technologies. The technologies most relevant to this discussion are shown below [20].

Technology	Description	Capital cost, $/kW	Fixed O&M, $kW	Variable O&M, $MWh	Fuel cost, $MWh	Estimated lifetime, years
NG CCS	Natural gas combined-cycle gas turbine with carbon capture & storage (CCS)	3,310	51	11	61	45
Biomass CCS	Thermal generation using biomass us fuel equipped with CCS	10,484	192	18	3	45
Nuclear	Steam turbine using nuclear fission as heat source	9,120	167	4	0	60
Onshore wind	Onshore wind turbines	2,117	51	0	0	30
Offshore wind	Offshore wind turbines	6,370	148	0	0	30
Solar energy	Photovoltaic solar array	1,825	18	0	0	30
Storage	Technologies capable of storing energy and releasing it later	1,409	11	1	0	15

All the cost estimates shown in this table were generated by the **government's own model**, E3MC.[21] We can immediately see that the least cost technologies are onshore wind, solar energy, and storage. But these are capital costs. It is more appropriate to

[18] See *Managed to death: How Canada turned its forests into a carbon bomb.* https://thebulletin.org/2023/08/managed-to-death-how-canada-turned-its-forests-into-a-carbon-bomb/ August 28, 2023
[19] RIAS page 8.
[20] RIAS page 8, Table 3
[21] See the footnote to Table 3 in the RIAS.

compare electricity technologies by calculating what is called the Levelized Cost of Energy or LCOE. This can be done quite easily using the data shown in the table, but we need the capacity factors for each technology; this is the ratio of the actual output compared to the output if the technology performed 24/7 at its rated power. This is most critical for solar energy where a utility-scale photovoltaic power system only produces about 18% of its rated power because of its diurnal response and its inherent variability. The table below shows the capacity factors used in the calculation and the LCOE calculated for each technology.[22]

Technology	Description	Capacity factor, %	LCOE, ¢/kWh
NG CCS	Natural gas combined cycle turbine with carbon capture & storage	80	11.83
Biomass CCS	Thermal generation using biomass us fuel equipped with CCS	80	17.20
Nuclear	Steam turbine using nuclear fission as heat source	82	12.98
Onshore wind	Onshore wind turbines	50.1	5.45
Offshore wind	Offshore wind turbines	58.7	13.88
Solar energy	Photovoltaic solar array	18	11.42
Storage	Technologies capable of storing energy and releasing it later	70	2.96

Once again, it is clear that renewable energy technology is less costly than both nuclear energy and 'natural' gas combined-cycle generation. Even offshore wind is not that much more costly than nuclear energy and wind farms can be built and commissioned in less than half the time: a huge advantage given the urgency of reducing emissions. Moreover, these comparisons don't take into account nuclear energy's still-unresolved problems with large quantities of toxic radioactive waste, or the substantial cost and the years required for decommissioning. For fossil gas generating stations, the upstream greenhouse gas emissions from raw gas processing remain uncounted; while for solar energy, wind power, and storage the trends run entirely in the opposite direction as the cost of electricity from these technologies continues to decline.

Will Small Modular Reactors (SMR) make a difference? The illusion of a future abundance of low-cost SMRs ranks right up there with the denial of climate change in terms of bald-faced lies and deception. Recent cost figures on the NuScale SMR design, one of the more advanced concepts, calculated the capital cost at $15,600CAD / kW, more than twice as costly as offshore wind to construct and commission [23]. Moreover,

[22] Capacity factors (CF) for renewables are based on Jacobson M.Z. *A solution to global warming, air pollution, and energy insecurity for Canada.* For nuclear energy, CF is calculated from Canada Energy Regulator https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-canada.html. The discount factor used to calculate LCOE is 8 percent p.a.

[23] Ramana M.V. *SMRs riddled with high costs, among other 'unresolved problems'* https://nbmediacoop.org/2022/07/31/smnrs-riddled-with-high-costs-among-other-unresolved-problems/

solar parks and wind farms can be built in a fraction of the time it takes to get a nuclear power installation, even a small one, up and running.

Why not shut gas down?

Recall that the only reason that Canada needs Clean Electricity Regulations in the first place is because the Global Net-zero scenario of EF2023 has fossil gas still generating electricity in 2050. The 'Global net zero scenario' sees fossil gas with CCS adding about 70 TWh of new capacity, roughly 10 percent of what's required if electricity demand doubles over the next 30 years, which is the EF2023's very dubious base-line scenario..[24]

It is interesting to note that the modelling described in the Regulatory Impact Analysis Statement actually evaluated this scenario and reported the results. The model was run with the performance standard set at zero, "equivalent to a *de facto* ban on fossil fuel-fired generation at their End of Prescribed Life".[25]

But strangely, according to the model, the zero-performance standard, while reducing emissions as expected, actually *increased* overall costs by 18 percent. This seems counterintuitive since both the capital cost of solar energy and onshore wind and their LCOE are less than the corresponding values for combined cycle gas generation and for nuclear. The RIAS offers no explanation for this odd result, and since we don't have access to the model and the constraints written into the code it is impossible to explain this divergence. But all computer simulations reflect the biases of their modellers and I suspect that the NextGrid model penalises renewables for their 'variability' even though it has been convincingly demonstrated that the variability of renewable energy is no impediment to the reliability of the grid.[26]

A second sensitivity analysis is also interesting. What happens if we drop the exemption that allows fossil fuel-powered generating stations to avoid the performance standard until the end of their 'prescribed life'?

The effect on the cost of the proposed regulations and on emissions was assessed with an EoPL of 0 years, and then at five year increments. The results are striking. If electricity demand doubles by 2050 (the EF2023 scenario), the increase in cost was found to be negligible, while the reduction in emissions increased—only slightly but a reduction none the less.[27] So why is this option not favoured?

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[24] EF2023 Figure ES.4 page 10.
[25] RIAS page 48.
[26] See: *Three Myths About Renewable Energy and the Grid, Debunked*
https://e360.yale.edu/features/three-myths-about-renewable-energy-and-the-grid-debunked
[27] RIAS page 51. The scenario is referred to as the '2.5X load scenario' where electricity rises to 2.5 times the 2020 level.

The Impact Assessment argues that "given the increased logistical difficulty that could be reasonably expected with an accelerated buildout of new capacity needed to ensure system reliability and the relatively small gain in emission reductions, decreasing the number of years that existing units can operate after commissioning does not seem to be advantageous."

With this opinion, the bias of the analysis presented in the Regulatory Impact Assessment Statement is on full display. According to the RIAS, if the industry is not allowed to avoid the imposition of the CER performance standard during its prescribed life, the 'reliability' of the system can only be ensured by an "accelerated buildout of new capacity", which the Department assesses as being 'logistically difficult'. This is complete nonsense. If new capacity is needed, substantial solar energy and wind power capacity could easily be constructed and commissioned *before 2030*, never mind 2035. The idea that this is logistically difficult is ridiculous and simply exposes the bias of the analysts formulating the proposed regulations.

In conclusion, Canada's electricity system **will never be decarbonized** as long as fossil 'natural' gas is used to generate electricity. It is physically impossible to capture and sequester all the carbon contained in fossil fuels, and the idea that the residual emissions can be compensated by negative emission technologies is a dangerous illusion. Only a carbon-free power system based on renewable energy technology can decarbonize Canada's electricity system.

The government's insistence that nuclear power based on Small Modular Reactors is essential is a costly mistake that is certain to ramp up the cost of electricity both for industry and consumers. Canada's energy future should be based on hydropower, solar energy, and wind power: low-cost energy resources that the country has in abundance.

Recommendations

The federal government has asked for comments on the proposed Clean Electricity Regulations to be submitted by November 1; three recommendations are proposed:

1. The Clean Electricity Regulations performance standard (what the proposed legislation calls the 'prohibition'), which comes into force on January 1, 2035, should be set at **zero tonnes of carbon dioxide per gigawatt hour**. This is essentially a ban on the operation of fossil fuel generating stations from January 1, 2035.

2. A**ll fossil fuel generating stations** must meet the performance standard of 30t CO2 / GWh **from 1 January 2030 (**not 2035**).**

3. The exemption from the performance standard during the period defined as the 'End of Prescribed Life' **should be eliminated.**

Seniors for Climate Action Now!
October 16, 2023.