

Modernizing Canada's Electricity Systems: A pan-Canadian electrification strategy to cut carbon pollution

Submission to the Mitigation Measures Working Group of the Pan-Canadian Framework on Clean Growth and Climate Change

July 2016

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A PAN-CANADIAN ELECTRIFICATION STRATEGY

INTRODUCTION

Across Canada, efforts are underway to expand the use of clean electricity. There is much more to do, however, to take Canada across the finish line to a 100% renewable energy system. Canada's pathway to deep emissions reductions, consistent with those required by the Paris Agreement, requires the country to move away from fossil fuels and towards clean electrification of the economy. Done right, this electrification pathway offers huge job creation potential and will help build healthy and resilient communities across the country.

The federal Government has a role to play in facilitating the creation and implementation of a pan-Canadian electrification strategy. A pan-Canadian electrification strategy should build on successful provincial efforts to transform their electricity systems. This strategy would secure resilient electricity systems, fuelled by renewable energy, capable of dramatically reducing greenhouse gas emissions from transportation, buildings, and industrial processes – while also reducing risk to Canadians from polluting facilities and climate change impacts such as more extreme weather.

In order to unlock this vision, federal climate change policies and financial resources should be directed toward a national strategy that includes **roadmaps for the electrification of transportation, building energy use (including home heating), and industrial processes**. The success of such a strategy will depend on **enhancing the distribution of renewable generation** within and between provinces from centralized (e.g. large-scale hydro) and decentralized (e.g. community-based wind power) sources, as well as growing our exports of clean electricity. **National aspirational goals** for renewable energy, energy efficiency and modernizing industrial processes should guide provincial actions, while keeping an eye on reliability, energy security, and convenience. Core to this strategy should be **an identification of job creation and skills-development opportunities**.

Developing and implementing a pan-Canadian electrification strategy requires the federal government, in partnership with provinces, territories and municipalities, to fund, regulate and set policy that achieves a cohesive vision for the electricity sector. There is a risk, given the federal intention to use infrastructure programs to accelerate sub-national climate action, that one-off disconnected projects will be approved that do not add up to the system-wide transformation required for significant greenhouse gas emissions reduction. There is an opportunity, however, to instead deploy a combination of traditional and innovative financing approaches to achieve public and private sector investments that support decarbonization.

Across the pan-Canadian climate action plan, governments must work together to achieve greenhouse gas reductions in line with commitments in the Paris Agreement and engage Canadians as part of the strategy. As with all elements of the package that will make up an effective climate action plan for Canada, federal leverage in implementing an electrification strategy depends on federal willingness to be firm in negotiations with provinces surrounding funding allocation. Funding for electricity projects must be screened using strict criteria that ensure optimization of emissions reductions, renewables integration, overall system resilience, and strategic export market opportunities.

A PAN-CANADIAN ELECTRIFICATION STRATEGY

STEPS TOWARD A PAN-CANADIAN ELECTRIFICATION STRATEGY

Policy, regulatory and funding components of a pan-Canadian electrification strategy

In the development of its pan-Canadian climate plan, the federal government should pursue the following actions:

- 1) Assess federal legislation to identify barriers existing to clean electrification of buildings, transportation and industry. The federal government should propose amendments to remove identified barriers. This could be secured through a thematically focused set of policies with the working title of the Canadian Electrification Strategy.
 - 2) Establish a funding mechanism that uses public funds to leverage private capital for investment, and reduces cost of capital for deploying low carbon electricity infrastructure.
 - 3) Amend the existing Canadian Environmental Protection Act (CEPA) regulations for coal-fired power to advance coal phase out to a 40-year end-of-life requirement, with a no later than 2030 end date for unabated coal-fired power.
 - 4) As much as possible, avoid the risk of emissions growth in the electricity sector and natural gas lock-in for electricity generation and home heating.
 - a. For natural gas electricity generation, establish a natural gas greenhouse emissions performance standard under CEPA.
 - b. For home heating, provide a one-stop shop information source for consumers and contractors on alternative home heating technologies, including heat pumps.
 - 5) Incorporate the requirement to consider the “best possible option” for decarbonization under the Canadian Environmental Assessment Act (CEAA). Further, ensure the federal government evaluates the economic and climate viability of all proposed projects in a domestic and global policy context consistent with the Paris Agreement.
 - 6) Coordinate with provinces on economic and environment assessment for transmission grid modernization projects, including storage and smart grid infrastructure. Further, supply funding for grid improvements that support integration and optimal dispatch of renewable generation nationally and within North America.
 - 7) Coordinate the development of best practices and model guides for energy regulators, including in rate setting to encourage performance-based rate setting in support of increased energy efficiency investments, storage and frequency investments.
 - 8) Establish federal funding criteria that would include the following principles:
 - a. Integrate federal-provincial agreements that secure long-term low carbon electrification;
 - b. Maximize renewable energy supply;
 - c. Incorporate lifecycle environment and economic assessments of infrastructure investments;
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A PAN-CANADIAN ELECTRIFICATION STRATEGY

- d. Consider the full carbon cost assessment of infrastructure investments;
 - e. Ensure governments are approving the best available technology solutions, to support Canada's decarbonization process.
- 9) Commit to federal procurement policies that support implementation of the electrification strategy and build on Procurement Canada's recent commitment to purchase 100% clean energy by 2025.
- 10) Work with First Nation, Métis and Inuit communities to develop and support Indigenous-led community electrification strategies.
- 11) Fully integrate up-skilling, training and education programs to ensure adequate supply of skilled tradespeople and professionals to implement the electrification strategy.

We explore two of these steps in more detail in the following sections.

1. MODERNIZING CANADA'S ELECTRICITY GRID

THE BIG PICTURE

Electricity grids across the country face unprecedented pressures with the rise of renewable energy and the concurrent shift from status quo large-scale, centralized electricity generation to smaller-scale, more distributed generation. These pressures are compounded by decades-long investment deficit that sees aging infrastructure in need of repair unable to adapt to the rapidly evolving electricity landscape.¹ Many of Canada's climate action strategies – including the decarbonization of transportation and the electrification of industrial activities – will depend on access to growing amounts of electricity generated from non-emitting, renewable sources. Meanwhile, given our export-dependent economy, meeting our climate commitments while protecting Canadians will necessitate systematic export substitution of high-carbon products for low-carbon commodities, and clean electricity is the most readily-available option. Thus, Canada requires a concentrated effort in the near-term to revitalize grid assets and strengthen provincial grid interconnections as well as Canada-US interties.

EMISSIONS REDUCTION

While electrical grid modernization does not itself offer a large amount of emissions reductions, it is a lynchpin of many of the strategies Canada will seek to deploy as we move toward our 2030 climate commitments. Investing in grid upgrades and interconnection in the near-term will build the infrastructural foundation that will ensure we achieve our long-term climate goals. Further, grid investments offer significant economic spin-off — the Conference Board of Canada estimates that every \$100 million invested in electricity generation, transmission, and distribution infrastructure boosts real GDP by \$85.6 million and creates 1,200 jobs.²

POLICY TOOLS

¹ Shedding Light on the Economic Impact of Investing in Electricity Infrastructure. 2012. Conference Board of Canada. http://www.electricity.ca/media/pdfs/Advocacy%20Reports/EconomicImpact_SheddingLight_E.pdf

² Ibid.

A PAN-CANADIAN ELECTRIFICATION STRATEGY

1. Federal loan guarantees for interprovincial (East-West) and Canada-U.S. (North-South) transmission tied to new renewable generation

Historically, large transmission projects have been triggered by new generation projects: the Labrador Island Link³ and Maritime Link⁴, which together will connect Newfoundland to the North American grid for the first time in order to transport electricity from the Muskrat Falls hydroelectric project, are examples of this trend. Federal loan guarantees have and should continue to support transmission projects that improve provincial and Canada-U.S. interconnection while facilitating the movement of clean electricity to market.

Meaningful consultation with indigenous and impacted communities is essential on all energy infrastructure projects, including those that aim to move or produce clean power.

2. Federal match and loan guarantees for provincial grid investments, interprovincial (East-West) and Canada-U.S. (North-South) transmission not tied to new generation

Incentives are required to help jurisdictions invest in transmission projects not tied to new generation, or to build transmission capacity, tied to new generation, that is larger than required by the generation project to accommodate additional electricity trading.⁵

Modernizing provincial and territorial grids through the implementation of smart grid and demand response technologies, integration of storage solutions, and upgrading of weather and asset modelling will be critical to the continued integration of more distributed, intermittent renewable generation.⁶ Grid modernization is also critical to the optimization of new transmission assets. For example, Ontario's Bruce to Milton transmission line was necessary to free up grid congestion blocking the integration of new wind and solar assets, but also temporarily worsens that province's struggle with excess power generation⁷ as it continues to upgrade the demand responsiveness of its grid.⁸

Federal match funding is recommended in addition to loan guarantees to facilitate these investments.

3. Data gathering and analysis on the benefits of enhanced regionalization of grid assets and the impact of enhanced North-South interconnection

Budget 2016 set aside \$2.5 million over two years "to facilitate regional dialogues and studies that identify the most promising electricity infrastructure projects with the potential to achieve

³ <https://muskratfalls.nalcorenergy.com/project-overview/labrador-island-link-and-transmission-assets/>

⁴ <http://www.emeranl.com/en/home/themaritimelink/overview.aspx>

⁵ For example, talks are underway between Nova Scotia and New Brunswick to increase transmission capacity between the two provinces so that surplus electricity from Muskrat Falls might be moved through the region to sell to markets in New England. Building that new transmission larger than it needs to be in order to accommodate hydroelectricity sales would go a long way in alleviating grid congestion as the Maritime provinces incorporate more renewable energy.

⁶ Distributed Generation: Cleaner, Cheaper, Stronger. 2015. Pew Charitable Trust.

<http://www.pewtrusts.org/~media/assets/2015/10/cleanercheaperstrongerfinalweb.pdf>

⁷ http://www.thestar.com/business/2012/06/19/ontario_energy_gets_boost_with_new_bruce_to_milton_power_line.html

⁸ <http://www.ieso.ca/Pages/Ontario's-Power-System/Reliability-Through-Markets/Demand-Response.aspx>

A PAN-CANADIAN ELECTRIFICATION STRATEGY

significant greenhouse gas reductions”.⁹ Little detail has been provided on how these dialogues will be carried out. Federally organized processes to gather data and analyze potential benefits of increasing transmission capacity and power pooling between provinces and territories can do the work of facilitating cooperation between entrenched governments and utilities while giving them the information they need to move forward. This is evidenced by the Atlantic Energy Gateway Initiative¹⁰, which produced quality information that encouraged the joint dispatch pilot project currently underway between New Brunswick and Nova Scotia.¹¹ This model is worth adapting to other jurisdictions: there is ripe potential for Manitoba, Saskatchewan, and Alberta to come together under a similar process, for instance.

Electricity trade between Canada and the US does not benefit from significant centralized statistics gathering and analysis. This presents a barrier to strategically increasing such trade.¹²

4. Reducing red tape for cross-border transmission, particularly in the U.S.

As discussed by the Canadian Electricity Association, several proposed cross-border transmission projects “[...] have suffered serious setbacks in their project timelines. Many of these are attributable to ill-defined and out-of-date parameters around project reviews and scoping periods — particularly under the U.S. framework. These impediments ultimately reduce certainty for proponents and lead to unnecessary and burdensome escalations of administrative costs.”¹³ There is work to be done reducing these outdated administrative barriers on both sides of the border, and it will be critical for Canada to open a dialogue with the United States on this issue immediately. These efforts should build on the recent trilateral statement on a North American climate, clean energy, and environment partnership.¹⁴

5. National aspirational goals that guide federal investments in electricity infrastructure

National goals that prioritize energy efficiency and distributed renewable energy development will be vital to ensuring federal investments are strategically coordinated to build electrical grids of the future. Investments in low carbon electricity infrastructure require significant upfront capital – most technology is front-loaded in capital costs, but also has lower operating costs and leads to longer-term savings. These upfront costs amplify the impact of the cost of capital on the economics of a project, and raise the cost for technologies that face a higher cost of capital due to asymmetrical information gap or other market failures.

The overall cost of infrastructure investment needed to decarbonize the economy is significant – much beyond the levels of funding government alone can provide. To that end, we recommend the federal government establish a funding mechanism that deploys public funds to leverage private capital for investment in grid modernization and other climate projects. A funding

⁹ <http://www.budget.gc.ca/2016/docs/plan/ch4-en.html>

¹⁰ <http://www.acoa-apeca.gc.ca/eng/Agency/mediaroom/NewsReleases/Pages/3746.aspx>

¹¹ <http://www.nspower.ca/en/home/newsroom/news-releases/nb-power-and-ns-power-working-together-to-lower-co.aspx>

¹² The Integrated Electric Grid: Maximizing Benefits in an Evolving Energy Landscape. 2013. Canadian Electricity Association. http://www.electricity.ca/media/pdfs/CanadaUS/CEA_US%20Policy%20Paper_EN.pdf

¹³ [Ibid.](#)

¹⁴ <http://pm.gc.ca/eng/news/2016/06/29/leaders-statement-north-american-climate-clean-energy-and-environment-partnership>

A PAN-CANADIAN ELECTRIFICATION STRATEGY

mechanism of this nature could reduce the cost of capital for deploying low carbon electricity infrastructure.

Other jurisdictions have successfully leveraged private capital through the creation of Green Bank. Such institutions, capitalized with public funds, reduce the cost of infrastructure investments while creating the scale of capital required. Institutions can provide funding on a project-by-project basis, ensuring they are flexible to meet the needs of the unique geographies while also ensuring the funds are spent towards realizing the overall goal.

Jurisdictions across Canada have varying regulatory regimes governing the type and source of investment (e.g. private vs. public) allowed in the electricity sector. Regional contexts will have to be considered and respected as funding models are developed.

2. ACCELERATED COAL PHASE-OUT OF COAL-FIRED POWER

THE BIG PICTURE

Canada's electricity sector represents just over 85 Mt, approximately 12 per cent of Canada's overall emissions in 2014 (732 Mt).¹⁵ Coal represents over 70 per cent of these electricity emissions, at around 61 Mt, while only providing around 10 per cent of our electricity.¹⁶ Coal plants are highly concentrated in a small number of locations across the country: half of Canada's top-10 GHG emitters are coal plants and Canada's 14 coal plants emit around one-quarter of GHG emissions from Canada's approximately 560 reporting facilities.¹⁷

In order for Canada to secure significant emissions reduction benefits from the eventual electrification of the economy – including in buildings, transportation, and industry – it must first eliminate unabated coal-fired electricity on the grid. The Deep Decarbonization Pathway Project, an initiative of the United Nations Sustainable Development Solutions Network, identifies the decarbonization of electricity as one of six key components of an overall emissions reduction package consistent with limiting atmospheric warming to 2 degrees C. They note that, in 2050, “low-emitting electricity captures a much larger share of total energy use across the entire economy and provides a low-cost fuel-switching path for currently fossil fuel-based end uses.”¹⁸

EMISSIONS REDUCTIONS

To that end, we recommend that the federal government require zero-emitting electricity supply by 2050, with a schedule for decreasing proportion of emitting sources of electricity between

¹⁵ NIR 2016, Part 3, Table A13-1

¹⁶ Ibid.

¹⁷ Environment Canada, Reported Facility Greenhouse Gas Data: Downloadable Emissions Data, <http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=8044859A-1>

¹⁸ http://deepdecarbonization.org/wp-content/uploads/2015/09/DDPP_CAN.pdf, 4.

A PAN-CANADIAN ELECTRIFICATION STRATEGY

now and 2050. Further, the federal government should join provincial trends and commit to an accelerated phase-out schedule for Canada's coal-fired electricity. More specifically, the government should incrementally claw-back the end-of-life of coal plants in a measured fashion down to 40 years, with no later than a 2030 end-date for unabated coal power. The schedule must account for regional electricity supply.

Table 1 shows a possible schedule in line with fair treatment for different ages of plants given the economic and policy realities at the time of their investment, modeled closely on the schedule that can be instituted in Alberta without compensation for privately owned facilities.

Table 1. Proposed timeline for phasing out Canada's unabated coal-fired electricity units

| Unit Name | Prov. | Year of commission | Capacity (MW) | End of economic life | Allowed life (CEPA regs.) | Proposed end-of-life | Proposed life |
|----------------|-------|--------------------|---------------|----------------------|---------------------------|----------------------|---------------|
| Battle River 3 | AB | 1969 | 150 | 2019 | 50 | 2016 | 47 |
| Trenton 5 | NS | 1969 | 154 | 2019 | 50 | < 2019 | 50 |
| Boundary Dam 4 | SK | 1970 | 139 | 2019 | 49 | < 2019 | 49 |
| Sundance 1 | AB | 1970 | 280 | 2019 | 49 | 2017 | 47 |
| HR Milner 1 | AB | 1972 | 150 | 2019 | 47 | 2016 | 44 |
| Point Tupper 1 | NS | 1973 | 154 | 2019 | 46 | 2019 | 46 |
| Boundary Dam 5 | SK | 1973 | 139 | 2019 | 46 | 2019 | 46 |
| Sundance 2 | AB | 1973 | 280 | 2019 | 46 | 2017 | 44 |
| Battle River 4 | AB | 1975 | 150 | 2025 | 50 | 2016 | 41 |
| Sundance 3 | AB | 1976 | 407 | 2026 | 50 | 2020 | 44 |
| Sundance 4 | AB | 1977 | 392 | 2027 | 50 | 2020 | 43 |
| Sundance 5 | AB | 1978 | 392 | 2028 | 50 | 2020 | 42 |
| Boundary Dam 6 | SK | 1978 | 284 | 2028 | 50 | 2020 | 42 |
| Lingan 1 | NS | 1979 | 155 | 2029 | 50 | 2020 | 41 |
| Sundance 6 | AB | 1980 | 392 | 2029 | 49 | 2020 | 40 |
| Lingan 2 | NS | 1980 | 155 | 2029 | 49 | 2020 | 40 |
| Poplar River 2 | SK | 1980 | 291 | 2029 | 49 | 2020 | 40 |
| Battle River 5 | AB | 1981 | 370 | 2029 | 48 | 2021 | 40 |

A PAN-CANADIAN ELECTRIFICATION STRATEGY

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|----------------|----|------|-----|------|----|------|----|
| Keephills 1 | AB | 1983 | 406 | 2029 | 46 | 2023 | 40 |
| Keephills 2 | AB | 1983 | 406 | 2029 | 46 | 2023 | 40 |
| Lingan 3 | NS | 1983 | 155 | 2029 | 46 | 2023 | 40 |
| Poplar River 1 | SK | 1983 | 291 | 2029 | 46 | 2023 | 40 |
| Lingan 4 | NS | 1984 | 155 | 2029 | 45 | 2024 | 40 |
| Sheerness 1 | AB | 1986 | 380 | 2036 | 50 | 2026 | 40 |
| Genesee 1 | AB | 1989 | 410 | 2039 | 50 | 2029 | 40 |
| Sheerness 2 | AB | 1990 | 380 | 2040 | 50 | 2026 | 36 |
| Trenton 6 | NS | 1991 | 154 | 2041 | 50 | 2030 | 39 |
| Shand 1 | SK | 1992 | 276 | 2042 | 50 | 2030 | 38 |
| Belledune 1 | NB | 1993 | 458 | 2043 | 50 | 2030 | 37 |
| Genesee 2 | AB | 1994 | 410 | 2044 | 50 | 2029 | 35 |
| Point Aconi 1 | NS | 1994 | 171 | 2044 | 50 | 2030 | 36 |
| Genesee 3 | AB | 2005 | 495 | 2055 | 50 | 2030 | 25 |
| Keephills 3 | AB | 2011 | 495 | 2061 | 50 | 2030 | 19 |

With the significant advancement of renewable energy and energy storage technologies, the adoption of an increasing carbon price over time, and the deployment of grid integration investments, Canada can secure non-emitting generation as the predominant replacement for coal production. At Alberta’s rate of replacement (two-thirds replacement with renewables¹⁹), a national phase-out would reduce emissions by approximately 40 Mt relative to current emissions.

POLICY TOOLS

In November 2015 we were pleased to learn that Minister McKenna was evaluating options for an accelerated national coal phase-out.²⁰ To implement this accelerated phase-out, the environment minister needs only to strengthen the existing Reduction of Carbon Dioxide Emissions from Coal-fired Generation of Electricity Regulations issued under the *Canadian Environmental Protection Act* (CEPA) — a federal authority that is already being exercised for this purpose. The accelerated phase-out is simply a strengthening of these regulations, which

¹⁹ Alberta Government, Climate Leadership: Ending coal pollution, <http://www.alberta.ca/climate-coal-electricity.cfm>

²⁰ Government of Canada, “Minister McKenna pleased to see Alberta taking leadership on climate,” news release, November 22, 2015. <http://news.gc.ca/web/article-en.do?nid=1021789>

A PAN-CANADIAN ELECTRIFICATION STRATEGY

were originally drafted with a 45-year phase-out before being weakened to allow up to 50 years of unabated coal emissions. Improving the existing regulatory regime has two advantages:

1. It already allows for coal to continue if coal plants physically meet an emissions performance standard based on “good-as-gas”. This standard needs to improve, because the emissions intensity of gas (375 tonnes per GWh or less) is now lower than the 420 tonnes per GWh permitted in the existing regulations, but this does permit coal to continue with CCS deployment, should CCS become economic within the timeframe. However, the hope that CCS for coal power will become economic — a hope that has been clearly dashed over the last decade — cannot allow unabated coal to continue beyond the above schedule.
2. The CEPA regime allows for equivalency agreements with provinces that can meet the same GHG reductions through other policy approaches. This can allow for greater flexibility in jurisdictions that have unique circumstances; such as Nova Scotia with its relatively small system, heavy extant reliance on coal power and absence of existing natural gas infrastructure.

CO-BENEFITS OF AN ACCELERATED COAL PHASE OUT

In addition to climate change, air pollution is another federal government priority that can be addressed with a coal phase-out. Environment and Climate Change Minister Catherine McKenna’s mandate letter includes the directive to “work with provinces and territories to set stronger air quality standards, monitor emissions, and provide incentives for investments that lead to cleaner air and healthier communities.” Regionally, coal plants are dominant polluters: they are the three largest GHG emitters and mercury emitters in Saskatchewan and top the lists of worst emitters in Nova Scotia, New Brunswick, and Alberta for a number of pollutants and GHGs. In fact, over the first 20 years of even the relatively weak existing federal regulations on coal-fired GHGs, Canada will avoid 900 premature deaths, 800 emergency room visits, 120,000 asthma episodes and 2,700,000 smog days.²¹ Accelerating the end-of-life dates for coal units will commensurately improve these outcomes much further. Our extrapolation using the schedule in Table 1 indicates that Alberta, for example, could more than double the benefits in avoided health impacts. Nationally, this is likely around another 1,000 deaths avoided.²²

With GHGs and air pollution combined, the externalities of coal combustion are absolutely unmatched — they can be an order of magnitude higher than other common energy sources. Fortunately, because we have readily available, competitively priced, alternative technologies for producing electricity, the best means for reducing both types of emissions are perfectly aligned: shut down coal combustion or require stringent GHG and air pollution performance standards (if the necessary controls can prove economic).²³ The economics of coal are also

²¹ Environment Canada, *Reduction of Carbon Dioxide Emissions from Coal-fired Generation of Electricity Regulations: Regulatory Impact Analysis Statement* (2012).

²² The RIAS, referenced in footnote 23, provides an assessment of the health impacts avoided by the advanced closure of coal units under the federal regulations. The extrapolation calculated a “health impact factor” based on the number of avoided health impacts per reduction of coal-fired electricity (in GWh), then applied this factor to the larger amount of reductions in coal-fired GWh that is generated by the above schedule.

²³ In fact, under federal BLIERS, the federal government already has the authority and impetus to impose pollution control reductions on Canada’s coal plants. Consideration has already been given to applying BLIERS reduction controls at plant mid-life.

A PAN-CANADIAN ELECTRIFICATION STRATEGY

clear: when accounting for full costs, including those borne by society, coal is not competitive. Thus, the pace of coal plant closures increasingly defines leadership on this critical climate issue. Scheduled closures also supply clearer investment signals for replacement generation.

Clear deadlines for phasing out conventional coal will prove very persuasive for international recognition of Canada's climate action. The international community increasingly recognizes the imperative to stop burning our highest-emitting fossil fuel to avoid wasting unnecessary emissions under a constrained global carbon budget — particularly in developed countries.²⁴ Countries are lining up to join a global move away from coal. The U.K. announced a phase-out of unabated coal-fired electricity by 2025, leaders in Germany and Italy have expressed similar interest, and coal is falling state-by-state south of our border. We have already seen that this action is spurred by international common cause and a mutual race-to-the-top, inspired by leading jurisdictions, including Ontario and now Alberta. These two provinces are already demonstrating leadership and paving the way for national action.

Under an accelerated phase-out schedule, it would be possible to exempt units from the mid-life BLIERS, where they are scheduled to close within 10 years after their mid-life trigger date, thus saving the units from the cost of these necessary controls.

²⁴ Kiri Hanks and Julie-Anne Richards, *Let Them Eat Coal* (Oxfam, 2015); E3G, "G7 climate agreement means coal phase out actions required" (2015). <http://www.e3g.org/news/media-room/g7-climate-agreement-means-coal-phase-out-actions-required>
