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Environment and Climate Change Canada

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Dear Ms. Mellow:

On behalf of the Canadian Wind Energy Association (CanWEA) and the Canadian Solar Industries Association (CanSIA), please find enclosed our recommendations regarding Environment and Climate Change Canada's establishment of regulatory requirements for natural gas-fired electricity generation, including coal boilers converted to run on natural gas.

Introduction and Context

Climate change science confirms that greenhouse gas emission reductions of 80%, or greater, will be required in countries like ours by 2050 if the climate change targets agreed upon at COP 21 in Paris are to be met. There is broad consensus that any credible climate

change plan seeking to meet the Paris commitments must have at its heart the continued decarbonization of electricity generation—replacing existing fossil fuel generation with zero-carbon power over time, and ultimately producing all electricity with non-emitting sources. Equally as important, Canada's broader energy system must also increase its reliance on electricity—switching away from fossil fuel sources to clean, renewable power in a variety of energy end uses.

It is only by taking these actions together that Canada will be put on a path to achieve the scale of emission reductions needed to meet both our national 2030 target and put our economy on the right trajectory to achieve the much deeper reductions envisioned in *Canada's Mid-Century Long-Term Low-Greenhouse Gas Development Strategy* —all while creating new and expanded economic and social benefits, supporting the federal government's efforts to deliver 90 percent of Canada's electricity from non-emitting sources by 2030, and contributing toward fulfilling Canada's commitment to the Paris Agreement.

In order to assist the government in achieving these goals, the Canadian Solar Industries Association (CanSIA) and Canadian Wind Energy Association (CanWEA) are pleased to submit the following recommendations.

Long-term Visibility Needed on GHG Constraints to Natural Gas-fired Generation

While natural gas is viewed as a transition fuel that can help phase-out coal and facilitate the integration of renewable energy sources into the electricity grid, it can only be a transition

fuel because it emits GHGs and does not represent a long-term or sustainable solution to our climate change challenge.

Although natural gas has a role to play in the transition of Canada's electricity sector, as discussed we must ultimately transition to a world where electricity is produced from non-emitting sources.

In 2015, natural gas-fired generation provided only 6.8% of Canada's electricity supply, but with coal-fired generation providing 10.8% and virtually all this capacity targeted for retirement,[1] significant investment in new natural gas-fired generation is anticipated such that natural gas' share of electricity supply is likely to increase. This new natural gas-fired generation investment should be both least-cost generation and not represent a barrier or undue impediment to Canada's GHG emission reduction targets.

The recommendations offered by CanWEA and CanSIA focus on promoting these two objectives. Recognizing that there is little ability to retrofit GHG emission controls on natural gas-fired generators and reduce their emissions without constraints on output, CanWEA and CanSIA recommend that Environment and Climate Change Canada (ECCC) specify declining GHG emission standards for new or modified natural gas-fired generators based on their in-service date. Under this framework, more stringent GHG emission standards would apply to natural gas-fired generating units that began commercial operation in 2030 than would apply in 2025, with steady declines in such emissions standards over time. CanWEA and CanSIA are not proposing to subject existing natural gas-fired generators to these same

[1] http://www.electricity.ca/media/Electricity101/Electricity101.pdf

standards because all natural gas-fired generation would be subject to carbon pricing, which would produce GHG emission reductions by substituting non and lower-emitting resources for higher emitting GHG resources. However, we note that Alberta's carbon pricing approach, which exempts "best" natural gas units from its carbon tax does not provide such an incentive and effectively shields such natural gas-fired units from the province's carbon tax. Nonetheless, greater certainty and clarity is required for investors making new investments in natural gas-fired generation. Finally, CanWEA and CanSIA believe that the greater value of high efficiency cogeneration applications be recognized. We recommend that any natural gas regulations be sensitive to differences in the thermal efficiencies of the underlying natural gas-fired generation technologies.

To determine the appropriate and most cost-effective mix of generating resources to replace coal-fired capacity, capacity from other non-coal generator retirements and to meet increases in electricity demand, planners and investors need to understand future operating constraints such as GHG emission limitations and costs of carbon. The risks and consequences of "bad decisions" given inadequate information are compounded by the significant capital costs and long useful lives of these investments, with these risks further compounded by the magnitude of required electricity sector investment to achieve Canada's GHG emission reduction goals.[2]

When determining the appropriate generating technology and configuration for natural gas generators (e.g., simple cycle versus combined cycle) it is critical that investors, both private

[2] The most efficient natural gas-fired generating technologies are typically hundreds of MWs and hundreds millions of dollars, with useful lives of 30 or more years.

and public, have an understanding regarding future operating constraints such as the extent of any future limits on the GHG emissions of the project. Without an understanding regarding such limits investors aren't able to make the best decisions regarding the appropriate technology to employ. If there's going to be a cap on total plant GHG emissions and a high cost of carbon, then investing in more efficient gas turbine technology may be more appropriate to support an increase in project output or reduction in carbon costs incurred by the project. Alternatively, with low carbon prices if the operating hours of the resource will be constrained by emissions limits, a less efficient, more responsive unit may be more appropriate.

Bad investment decisions based on inadequate information will increase costs to consumers. First of all, the lowest cost alternative is not likely to have been selected. This can result in stranded costs, which will be borne by investors, customers, or possibly government. Alberta's recent experience where coal-fired generators required compensation for the early retirement of their facilities given the adoption of more aggressive GHG policies is illustrative and a warning. Canada could be in a similar situation with natural gas-fired generators in ten or fifteen years, unless explicit direction regarding future GHG emission constraints is provided prior to when such investments are being made. With clear direction regarding future operating constraints and carbon costs, investors are unable to claim that they have been unknowingly economically harmed and require compensation. Conversely, if clear direction regarding future GHG emission limitations is not provided then the GHG emission target is not likely to be realized or additional action will be required to achieve the target, increasing overall compliance costs.

The risks of stranded investment for natural gas-fired generating assets are real. Already in Texas, the 20,000 MW of wind capacity and in California the 15,000 MW of solar and 6,000 MW of wind are adversely affecting the economics of many operating natural gas-fired generating units.[3] This example, however, illustrates that proper planning and guidance regarding environmental objectives and their implications on generating resources is critical to avoid similar impacts on natural gas generators in Canada.

Finally, incomplete information and uncertainty can be a barrier to investment such that the necessary changes to Canada's electricity generation mix do not occur or are delayed, increasing GHG emissions and overall costs to customers. Uncertainty also increases costs of capital and thereby electricity costs to customers.

In sum, investors in natural gas generation facilities need clear signals on the future evolution of GHG emission policies to inform their investment decisions. The provision of such signals will lessen the probability that investors will make poor investment choices that lead to "stranded assets" as increasingly stringent greenhouse gas emission reduction requirements make electricity generation from natural gas more risky (i.e. resulting in assets suffering unanticipated or premature write-downs, devaluations or conversion to liabilities due to changing circumstances such as unforeseen policy or regulatory changes).

[3] See for example, http://oilprice.com/Energy/Natural-Gas/Natural-Gas-Is-Already-Losing-To-Renewables.html

Review of Current Proposal: Regulatory Requirements for Natural Gas-Fired Electricity Generation

On December 17, 2016, ECCC published a notice of intent to develop greenhouse gas regulations for electricity generation in Canada.[4] In addition to changes to the *Reduction of Carbon Dioxide Emissions from Coal-Fired Generation of Electricity Regulations*, the ECCC "intends to set regulatory requirements for natural gas-fired electricity generation, including coal boilers converted to run on natural gas". The proposed greenhouse gas regulations would mandate an emissions rate of 420 kg CO2/MWh for new or modified large combustion engines (greater than 100 MW) and 500 kg CO2/MWh for new or modified small combustion engines (less than or equal to 100 MW).

CanWEA and CanSIA do not believe that the proposed regulations meet the objective of providing clear direction to investors regarding future constraints on greenhouse gas emissions from natural gas-fired generation. The 420 kg CO2/MWh emissions standard is on par with current modern baseload gas-fired units (see Figure 1) and provides little incentive to invest in new, higher efficiency gas-fired generation technology.

[4] Canada Gazette, Vol. 150, No. 51 — December 17, 2016 - http://www.gazette.gc.ca/rp-pr/p1/2016/2016-12-17/html/notice-avis-eng.php#nl1

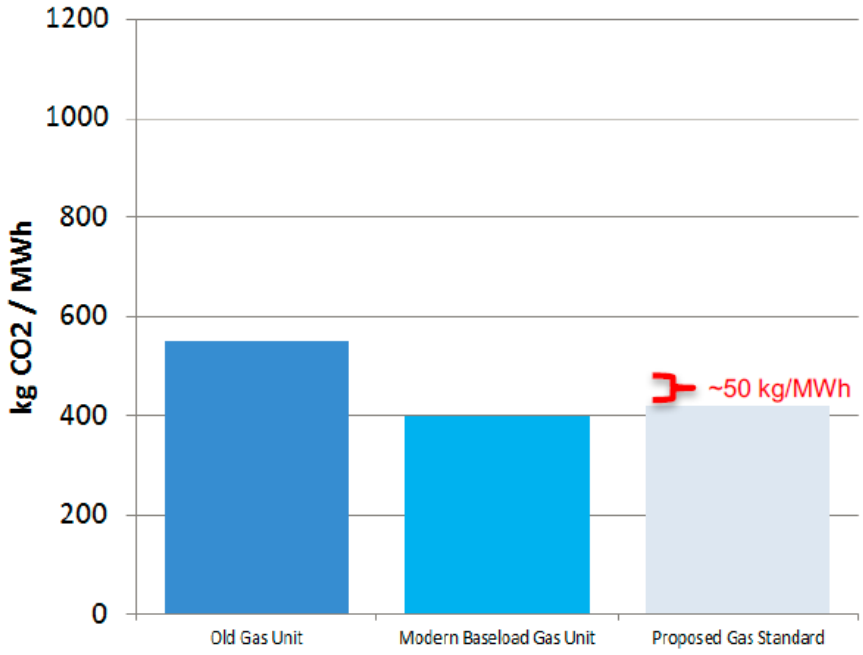

Figure 1: Proposed Gas-fired Regulations versus Existing Gas-fired Generation Technology

The proposed regulation for natural gas-fired generation does not contribute to the commitments that Canada made as part of the Paris Agreement (COP 21). By not specifying a decrease in the emissions rate over time, the proposed regulation provides no visibility to natural gas-fired generation owners and investors to allow them to align with Canada's long-term objectives for major greenhouse gas emission reductions. Furthermore, without reductions in such GHG emissions natural gas cannot be viewed as a transition fuel. With no signaling to investors of the magnitude of required reductions in GHG emissions, there is an increased risk that natural gas-fired generator assets will become stranded as new regulations are implemented to achieve Canada's GHG emission reduction commitments. As discussed, this would lead to increased costs for electricity customers. In

addition, a decrease in allowable emissions over time will drive innovation to increase the efficiency of gas-fired generation technologies, reducing the risk of stranded assets, or to simply invest in non-emitting resources like energy storage or hydro to provide the same necessary types of balancing services without the associated GHG emissions.

Accompanying the greenhouse gas regulation for natural gas-fired generation, the Government of Canada has proposed pan-Canadian pricing of greenhouse gas emissions (i.e., price on carbon) starting in 2018.[5] The announced carbon price would begin at $10/tonne in 2018 and increase by $10 each year until reaching $50/tonne in 2022. A $10/tonne carbon price would increase the cost of electricity from a natural gas-fired generator by about $4.2/MWh. The announcement indicated that "the overall approach will be reviewed in 2022 to ensure that it is effective and to confirm future price increases." CanWEA and CanSIA agree that a regular review of carbon pricing policy is critical. However, here as well the current policy announcement provides no guidance on long-term carbon pricing. The long-term guidance on carbon pricing is another critical input into investment decision making. Without guidance on carbon pricing beyond 2022, all electricity sector generation investment decisions, including those for long-lived natural gas-fired generation investment face increased uncertainty which is a barrier to investment, particularly those investments that are likely to assist Canada in achieving its GHG emission reduction goals. Without such guidance, customers risk higher costs if the wrong investment decision is made.

[5] Government of Canada Announces Pan-Canadian Pricing on Carbon Pollution - http://news.gc.ca/web/article-en.do?nid=1132149

With international and domestic analysis concluding that deep decarbonization in Canada will require an almost complete adoption of non-emitting electricity by 2050[6], further direction on carbon pricing beyond 2022 is essential.

CanWEA and CanSIA believe that the commitment beyond 2022 should include an increasing carbon price that aligns with meeting Canada's COP 21 commitments. The review of the overall approach to carbon pricing in 2022 can be the opportunity to adjust the carbon prices, but clear direction for investors on long-term carbon pricing must be provided so that Canada's GHG emission reduction goals can be achieved cost-effectively. While this review is scheduled to occur in 2022 and apply to prices after 2022, the timing of such a review provides inadequate lead time for investors. CanWEA and CanSIA recommend that this review be undertaken well before 2022 so that additional clarity can be provided regarding future carbon pricing.

An Alternative Proposal Regulating Natural Gas-Fired Generation GHG Emissions

CanWEA and CanSIA previously recommended an approach modeled on the framework negotiated between Footprint Power, the developer of a natural gas-fired combined cycle gas turbine project located at the site of a coal-fired power plant that was being retired, and an environmental group. To ensure that this new natural gas-fired power plant conformed to the *Massachusetts Global Warming Solutions Act,* which requires an 80% reduction in statewide GHG emissions relative to 1990 levels by 2050, the environmental group negotiated a

[6] Canada's Mid-Century Long-Term Low-Greenhouse Gas Development Strategy, Section 3.2 - http://unfccc.int/files/focus/long-term_strategies/application/pdf/canadas_mid-century_long-term_strategy.pdf

declining GHG emissions cap on the project. The emissions cap was constant for the first ten years and then declined to zero by 2050.

Flexibility was provided in complying with the emissions caps. In particular, the project could bank its GHG emissions if it achieved annual emissions lower than the cap; purchase GHG emission allowances through the Regional Greenhouse Gas Initiative (RGGI) trading framework; or purchase of Renewable Energy Certificates.

Following the Footprint Power decision, the Massachusetts environmental regulatory agency issued draft regulations for a program to reduce GHG emissions for all electricity generating units in the state. The Footprint Power decision only applied to the specific generating facility, whereas these proposed regulations apply to all fossil generating units (existing and new) in the state. With all coal-fired generating resources retired or scheduled to retire these regulations effectively apply to natural gas and oil-fired generating units.

The proposal establishes:

- An annually declining limit on GHG emissions from power plants in Massachusetts, ensuring reductions associated with current electricity sector policies will occur in Massachusetts;
- A process for apportioning the aggregate limit on total GHG emissions among existing and new power plants in Massachusetts; and
- A mechanism for power plants to earn and use over-compliance credits (OCCs), providing compliance flexibility.

Massachusetts is proposing that the aggregate limit decline by 2.5% each year. In order to ensure compliance with the annually declining aggregate limit, the regulation would establish separate limits for new and existing generating units, the sum of which equal the aggregate limit. In determining the size of this limit, Massachusetts considered likely emissions of proposed new facilities and the fact that the operation of these facilities is desirable because of their efficiencies and quick start capabilities. However, Massachusetts does not consider it necessary to set the new facility limit equal to the full amount of anticipated GHG emissions because new facilities can obtain OCCs if they emit more than their assigned limits. Individual facility limits are apportioned based on the average annual electricity output over the three most recent years.

To provide operating flexibility, while ensuring enforceability of the aggregate limit transferable OCCs will be used. OCCs can be created when a facility's emissions are less than its limit for a particular year or when the facility retires. OCCs can be traded or banked for future use.

The Massachusetts regulation represents a potential model that could be employed by Canada. While CanWEA and CanSIA are not advocating for the imposition of greenhouse gas emission reduction requirements on existing natural gas-fired electricity generation in Canada, we believe that several key principles underlying the Massachusetts approach should inform the regulations of greenhouse gas emission standards for new or modified natural gas generation in Canada. Specifically:

- Individual new or modified natural gas-fired generation facilities should be required to meet a schedule of greenhouse gas emission targets that become increasingly stringent over time
- The starting point for any new or modified natural gas-fired facilities should also become increasingly stringent over time such that a natural gas-fired generation facility built in 2025 should face a more aggressive starting point than one built in 2020
- Natural gas-fired generation should be provided with sufficient flexibility (e.g., banking, trading or purchasing of carbon credits) to reduce the cost of compliance

This approach would ensure that natural gas-fired generation is in fact a transition fuel. Longer term, CanWEA and CanSIA expect continuing declines in the cost of wind, solar and energy storage technologies will allow this natural gas-fired generation to be cost-effectively displaced by these technologies. For example, a recent study estimated that the levelized cost of energy from wind is projected to decline by 35% by 2050.[7] GTM Research and Solar Energy Industries Association report 21% year over year decline in utility scale solar pricing in the quarter ending Q3 2016. Analysis performed by Power Advisory on behalf of CanWEA on the cost a highly efficient natural gas-fired generation facility entering commercial operation in 2025 with a 3.3% annual decline in project output and a carbon price of $50/tonne escalating at 2% real, would have a price that is about twice that of a new wind project in Canada. Given recent declines in the cost of solar and the potential for continued significant declines in the cost of solar it is difficult to estimate solar costs in 2025.

[7] Nature Energy, Expert Elicitation Survey on Future Wind Energy Costs, September 2016

However, the evidence suggests that utility scale solar will be competitive with natural gas-fired generation by 2025.