

Regulating Carbon in Canada:

The impact of the federal government's proposed electricity coal performance standards

A Product of IISD's Climate Insights

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Overview

The federal government has moved to regulate coal-fired power plants in Canada. There is now a sound basis from which to conduct an impact assessment. This brief uses original modelling to provide our view of the likely impacts of the proposed regulations. Note that all modelling is uncertain.

Under the proposed federal regulations, new or modified coal-fired power plants must achieve a performance standard likely to be 375 grams carbon dioxide equivalent (CO₂e) per kilowatt-hour (kWh), which is roughly equivalent to the emissions rate of a natural gas combined cycle electricity generation plant.¹ New units in the proposed regulations are those that start producing electricity on or after July 1, 2015, while old units are those that have reached their end-of-useful-life date, which is defined as the later of 45 years from the units' commissioning dates or the end of their power purchase agreement. These proposed regulations apply to about 8 per cent of the total forecast electricity generation in 2020, and 54 per cent of fossil fuel generation.

Major impacts of the proposed regulations include:

- **Emissions are reduced 5 million tonnes (Mt) in 2020 and 20 Mt by 2030.** With nearly two thirds of existing coal electricity plants in Canada scheduled to surpass 45 years of operating life by 2025, the proposed regulations could reduce 5 Mt of direct emissions from plants by 2020 and 20 Mt by 2030. This is a drop of about 6 per cent of the forecast 91 Mt of emissions from electricity in 2020.

¹<http://www.gazette.gc.ca/rp-pr/p1/2011/2011-08-27/html/reg1-eng.html>

- **The average cost of reductions is \$26 per tonne (all figures Canadian dollars) or \$260 million annually.** The average cost of the proposed regulation could be about \$26 per tonne of greenhouse gasses (GHGs) reduced from 2015 to 2030. At this level, annual capital expenditures in the electricity sector could increase by an average of \$260 million per year over the same period.
- **Coal is displaced primarily by natural gas.** Total fuel demand (i.e., petajoules) in the electricity sector falls marginally under the regulation, with natural gas generation accounting for more than 60 per cent of the displaced coal.
- **A range of technologies are deployed to fill the gap.** Some baseline coal generation could be replaced with coal plants utilizing carbon capture and storage (18 per cent in 2020 and 15 per cent in 2030), but most would likely be replaced with natural gas turbines, (77 per cent in 2020 and 78 per cent in 2030). A smaller percentage is replaced by renewables, 6 per cent in both 2020 and 2030.

The remaining content of this brief provides more detail on the above points.

Approach to Estimating the Impact of the Proposed Regulations

The proposed regulation was modelled using the Canadian Integrated Modelling System (CIMS), an integrated set of economic and energy models designed to provide information on the likely response of firms and households to policies and changes in prices that influence their technology acquisition and use decisions. The CIMS model is based on energy flows through a country's economic system and tracks the flow of energy, beginning with production processes through to eventual end-use by individual technologies. The model has been used extensively by the federal and provincial governments of Canada to forecast GHG emissions.

An emission, energy and economic baseline was developed in CIMS that reflects the most recent government forecasts of GHG emissions, energy prices, industry growth, government policies and measures to reduce emissions that have been implemented. These measures include significant policies implemented federally and provincially in Canada, including:

- Renewable Fuels Content Regulation;
- Passenger Automobile and Light Duty Truck Emissions Regulation;
- British Columbia's Carbon Tax;
- Alberta's Specified Gas Emitters Regulation;
- Quebec's Carbon Levy;
- Nova Scotia's cap on electricity sector emissions; and
- Ontario's coal phase-out.

The baseline also reflects Natural Resources Canada (NRCAN) energy use and demand forecasts as well as Informetrica economic forecasts. The most recent energy price forecasts from the Energy Information Administration (EIA) also inform the baseline. We will be releasing this baseline to clients at a future date.

Modelling of the proposed performance standard regulation was conducted in CIMS by restricting new build technologies in the electricity sector that exclusively use coal and have emissions that are lower than the proposed

performance standard (375 grams CO₂e/kWh). The maximum life of existing coal units was also reduced to 45 years to reflect the end of economic life of these units. These changes to the CIMS baseline scenario impact energy prices and affect what technologies the model selects to meet future electricity demand. Other industrial and economic sectors of the economy can also be impacted by changes in energy prices that may result both in changes in the fuels used and the technologies implemented.

Impact of the Proposed Regulations

The proposed electricity coal performance standard regulations will significantly change the emissions, fuel and technology profile of the electricity sector, resulting in reduced emissions, but also increased costs as the sector is forced to switch to different sources of electricity to meet demand. Changes in the emissions, fuel and technology profiles are summarized below.

Emissions Reductions

The modelling projects emissions reductions (below the reference case) will grow from 1.3 Mt in 2015 to 5.4 Mt in 2020 and 20 Mt by 2030. Emissions will likely occur almost exclusively in the electricity sector; however, because of interrelated effects of fuel pricing and fuel switching there are minor emissions reductions that also occur in the coal mining sector, mineral mining sector and petroleum crude sector. These emissions reductions are less than 3 per cent of the total emissions reductions projected from the performance standard regulation.

Emissions in the electricity sector are projected in the scenario to fall from 117 Mt in 2005 to 87 Mt in 2030 under the electricity coal performance standard regulation.

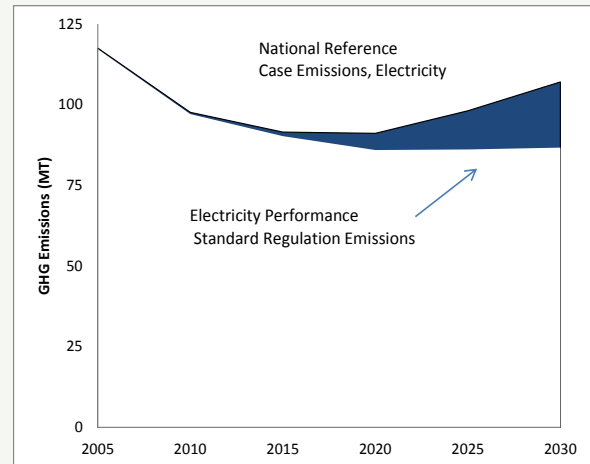


FIGURE 1: EMISSIONS REDUCTIONS SCENARIOS FOR COAL ELECTRICITY THROUGH 2030

Regulatory Costs

The regulation will impose increased societal costs related to an increased cost of electricity for residential, commercial and industrial consumers. While these societal costs must be weighed against a number of benefits, including the reduction of GHG emissions and other air pollutants, we express these costs simply as the dollars per tonne of GHG emissions reduced. That said, there is likely a net benefit to the policy (benefits minus costs) that we do not estimate.

Costs attributable to the proposed regulations were estimated based on the incremental increase in capital, operating and maintenance and energy costs between the baseline and the modelled scenario with the performance standard. The total cost of the regulation is estimated to be approximately \$26 per tonne (in 2011 dollars) of GHG emissions reductions over the period 2015 to 2030. Annual capital expenditures in the electricity generation sector are expected to increase by an average of \$260 million per year over the same period.

Fuel Profile

Total national demand for coal for electricity production falls 7 per cent from the baseline in 2020 and 39 per cent by 2030 under the regulation. While total demand for fuels in the electricity sector falls marginally under the regulation, most of the gap created by reduced coal electricity generation is met by switching to natural gas and renewable fuels. Natural gas generation increases by nearly 5 per cent in 2020 and 16 per cent in 2030 accounting for more than 60 per cent of the gap in electricity demand created by the regulation. The figure below provides estimates of the change in fuel demand in 2020 and 2030 between the baseline and implementation of the proposed regulation.

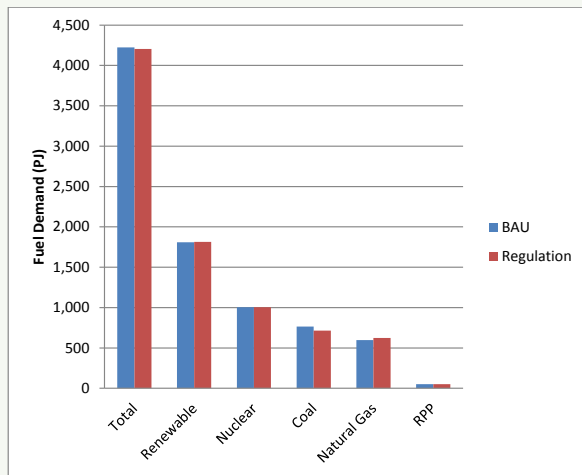


FIGURE 2: CHANGES IN FUEL DEMAND IN THE ELECTRICITY SECTOR 2020

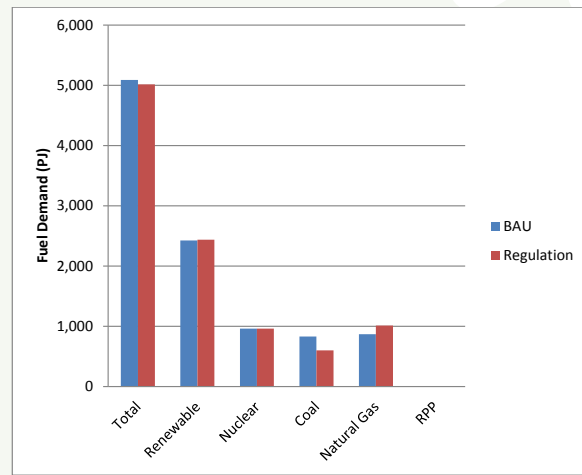


FIGURE 3: CHANGES IN FUEL DEMAND IN THE ELECTRICITY SECTOR 2030

Technology Profile

Electric coal generation that doesn't meet the regulation requirements is replaced in the baseline with a number of other electricity generation technology options. While some of this baseline coal generation is replaced with coal plants that utilize carbon capture and storage (CCS), 18 per cent in 2020 and 15 per cent in 2030, most of the coal generation is replaced with natural gas turbines, 77 per cent in 2020 and 78 per cent in 2030. A smaller percentage is replaced by renewables, 6 per cent in both 2020 and 2030. Figures 4 and 5 provide the estimated change in annual gigawatt/hour (GWh) production by technology type in 2020 and 2030.

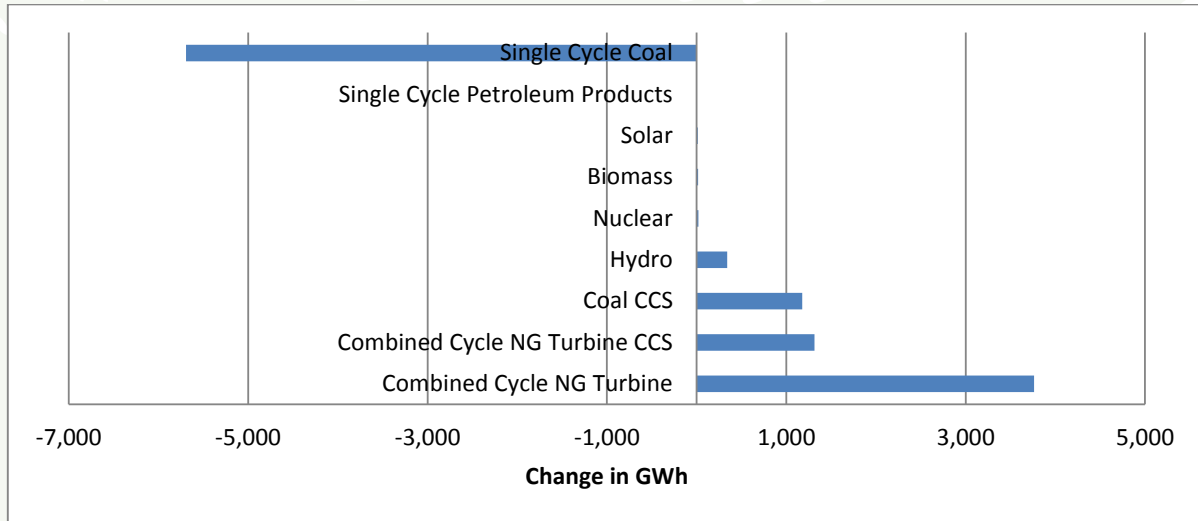


FIGURE 4: CHANGE IN ELECTRICITY PRODUCTION BY GENERATION TECHNOLOGY (2020)

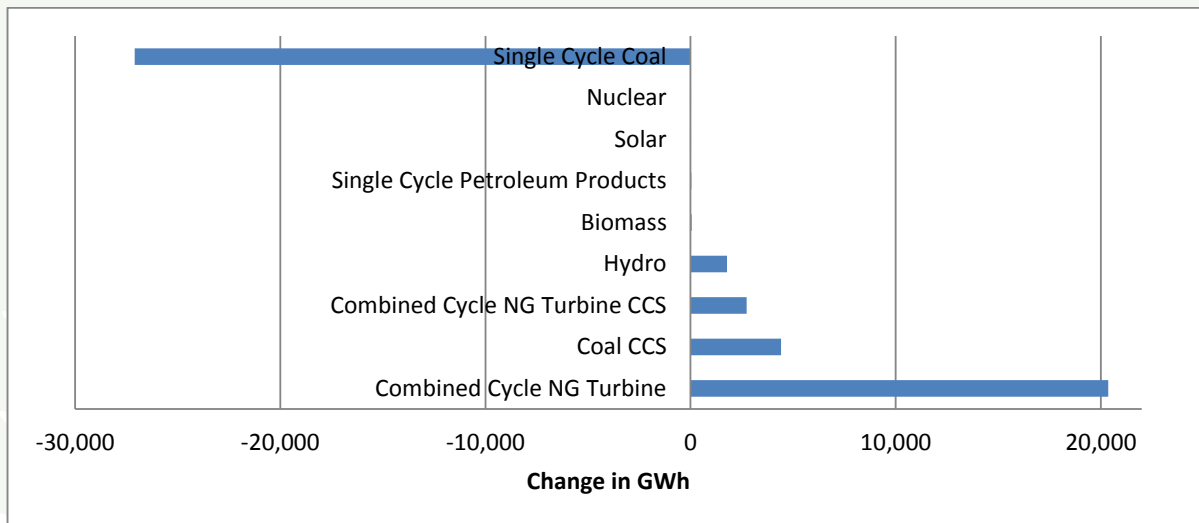


FIGURE 5: CHANGE IN ELECTRICITY PRODUCTION BY GENERATION TECHNOLOGY (2030)

Appendix A: Data Tables

REFERENCE CASE WITHOUT PROPOSED REGULATION: CANADA'S GREENHOUSE GAS EMISSIONS IN MEGATONNES

	2005	2010	2015	2020	2025	2030
Residential	45	44	42	40	38	35
Commercial	36	40	43	45	47	50
Transportation	186	179	193	196	194	200
TOTAL Chemical Products	12	10	13	14	15	16
Industrial Minerals	15	15	18	20	21	23
Iron and Steel	15	11	11	11	10	9
Metal Smelting	11	8	9	9	8	7
Mineral Mining	6	5	6	6	5	5
Coal Mining	2	2	2	2	3	3
TOTAL Mineral Mining	8	7	8	8	8	8
Paper Manufacturing	7	5	5	4	3	2
Other Manufacturing	19	15	16	15	16	17
Agriculture	73	71	69	74	79	83
Waste	22	23	24	24	25	26
Electricity	117	98	91	91	98	107
Petroleum Refining	21	20	21	21	20	21
Petroleum Crude Extraction	62	91	118	140	147	155
Natural Gas Extraction	66	55	57	51	49	47
TOTAL Oil and Gas	129	146	176	191	196	201
SUB -TOTAL	716	692	739	763	778	804
Other (Non-modelled Emissions)	24	15	15	15	16	16
TOTAL	740	708	754	778	794	820

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