Commercial Gas Boiler Regulatory Impact Statement

REGULATORY PROPOSAL

PREPARED BY:

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B.C. MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES

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COMMENTS MUST BE RECEIVED BY [OCTOBER 4], 2019

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SCOPE AND REQUIREMENTS

TYPE OF DEVICE	***Commercial Gas Hot Water Boiler*** means a boiler that uses propane or natural gas, is intended for application in a hot water, building space heating and/or potable service water application, and has an input rate of 88 kW (300,000 Btu/h) or greater, but not more than 2,930 kW (10,000,000 Btu/hr). A small commercial gas hot water boiler has an input rate of 88 kW (300,000 Btu/h) or greater, but not more than 730 kW (2,500,000 Btu/hr). A large commercial gas hot water boiler has an input rate of 730 kW (2,500,000 Btu/h) or greater, but not more than 2,930 kW (10,000,000 Btu/hr).
TEST STANDARD	ANSI/AHRI Standard 1500-2015 Standard for Performance Rating of Commercial Space Heating Boilers'
PROPOSED ENERGY PERFORMANCE STANDARD	Small commercial gas hot water boilers must have a thermal efficiency (E_T) equal to or greater than 90%. Large commercial gas hot water boilers must have a combustion efficiency (E_C) equal to or greater than 90%.
EFFECTIVE DATE	Products manufactured and sold after January 1, 2022.
CERTIFICATION	Compliance with the proposed regulation will be based on testing and verification of manufactured products to the proposed energy performance standard using the proposed test standard. Testing must be done by a Standards Council of Canada-accredited Certification Organization. Products must be labelled with an energy efficiency verification mark showing the trademark or logo of the certification body.
CURRENT STANDARD	The B.C. Energy Efficiency Standards Regulation requires commercial boilers to have a combustion efficiency equal to or greater than 80%. Products may be tested with the ANSI Z21.13-2004/CSA 4.9-2004 or the GAMA BTS-2000 test procedure. Compliant products must have an energy efficiency verification label from a Standards Council of Canada accredited Certification Organization.
HARMONIZATION	The proposed standard harmonizes with recent amendments to the federal Energy Efficiency Regulations requiring that commercial gas boilers manufactured on or after January 1, 2025 must be AFUE $\geq$ 90%. This standard applies to all boilers shipped into B.C., but not to boilers manufactured and then purchased within the province.
NEED FOR REGULATION	This standard will: • Create a harmonized and enforceable standard for boilers manufactured in B.C. and shipped into B.C.; • Reduce net heating costs for B.C. residents and commercial building owners; and • Achieve CleanBC commitments to reduce greenhouse gas (GHG) emissions through new energy efficiency standards for space heaters, water heaters and residential windows (2.2 Improving Where We Live and Work).

TRANSPARENT REGULATION DEVELOPMENT	Development of the proposed commercial gas boiler standard proceeded as follows: • Review of provincial climate and energy plans; • Market, economic and technical analysis; and • Development of a regulatory proposal. Public review and stakeholder consultation will be open for [45-days] after the publication of this document. Stakeholder consultation will be followed by regulatory drafting and submission of the regulatory proposal to Cabinet for approval.
ACCEPTANCE	The proposed performance level requires condensing technology and typically incorporates modulating technology and a mechanical draft. While this technology is widely available and well known to most installers, it is a change from single stage, non-condensing natural draft boilers. The two technologies have different venting requirements, physical footprints, control integration, maintenance requirements, materials of construction and operating schemes. Market acceptance is high as reflected by national shipping data that indicates 60% of commercial gas hot water boiler shipments from 2015-2017 were condensing.
MARKET TRANSFORMATION	Market transformation programs for commercial gas boilers have been operating in B.C. since 2016. FortisBC provides two tiers of incentives for commercial boilers: a lower incentive for non-condensing boilers and a higher incentive for condensing boilers that meet the proposed standard. The FortisBC program provided 240 incentives in 2016 (approximately 30% of provincial annual boiler shipments). The majority of retrofit and new construction incentives were for condensing boilers that are compliant to the proposed standard. The ENERGY STAR program (in Canada and the US) for commercial boilers was introduced in 2016. The ENERGY STAR program promotes boilers with thermal efficiency $\geq$ 94% and a turndown ratio $\geq$ 5:1 (a more stringent criterion than the proposed standard).
AVAILABILITY	Boiler shipments in Canada are used as a proxy for market availability in B.C. As noted above, from 2015 to 2017, 60% of commercial gas hot water boiler shipments in Canada met the proposed standard.

ASSESSMENT FROM AN INDUSTRY PERSPECTIVE

ACCESSIBILITY	Compliant small commercial gas hot water boilers are available from approximately 86% of manufacturers serving the Canadian market. There are 220 compliant models out of 454 models currently available in B.C. Compliant large commercial gas hot water boilers are available from 74% of manufacturers serving the Canadian market. There are 71 compliant models out of 174 models currently available in B.C.
MANUFACTURER PERSPECTIVE	There are four commercial gas boiler manufacturers with operations in B.C. All four companies sell products provincially and nationally. Three of the manufactures sell

	products compliant to the proposed standard. One manufacturer sells only products that are not compliant with the proposed regulation. Manufacturers can continue to produce non-compliant boilers for export, but will have to design and certify a new product line to continue selling in B.C.
IMPACT ON BUILDERS	Some engineering consultants, builders and installers may not be familiar with condensing boilers and will need to learn new practices for optimal installation and operation of condensing boilers. These groups may need additional engineering time or manufacturer support on their first condensing boiler installation.
OTHER ISSUES	The advanced technology and the higher initial cost of condensing boilers will result in higher expectations of contractor professionalism and service quality.

ASSESSMENT FROM A CONSUMER PERSPECTIVE

COST-BENEFIT ASSUMPTIONS	A cost-benefit analysis was completed for representative commercial buildings (a school, office building, and hospital) in the lower mainland. The cost-benefit analysis weighs the incremental purchase and maintenance costs against the energy cost savings discounted over the equipment lifetime. Net Present Value (NPV) is used to represent the economic impact of the proposed standard on each consumer. Colder climates in B.C. will have better results due to higher energy consumption and savings. Cost-benefit assumptions include: • A natural gas cost for small and large commercial buildings in the lower mainland that includes delivery charges, commodity charges, carbon tax, sales tax and the clean energy levy. • A consumer discount rate of 6%. • Incremental installation costs derived for 400,000 Btu/hr, 800,000 Btu/hr and 3,000,000 Btu/hr boiler sizes from the US Department of Energy (DOE) 2016 Final Rule[1] and converted for inflation and currency. • A product lifetime of 26.9 years (derived from the US DOE 2016 Final Rule). • Building energy loads modelled for space heating demand intensities from historical commercial building energy studies,[2] climate conditions in the Lower Mainland and typical boiler sizing criteria. • Energy savings were modelled using the rated thermal or combustion efficiency, adjusted to account for differences in modulating vs single stage performance as well as average return water temperature profiles for B.C. climatic conditions. Data and methodology from the US DOE Final Rule 2016 were used for the adjustment factors.

[1] EERE-2013-BT-STD-0030 Energy Conservation Program: Energy Conservation Standards for Commercial Packaged Boilers; Final Rule

COST-BENEFIT ANALYSIS

ENERGY SAVINGS FOR EACH CONSUMER

The following tables show the cost-benefit analysis for the purchase of a boiler compliant to the proposed standard versus the lowest efficiency benchmark (thermal efficiency of 82%). The lowest efficient benchmark is the average thermal efficiency of products with performance near the Provincial minimum energy performance standard (combustion efficiency $\geq$ 80%).

Cost-Benefit Analysis for a 400,000 Btu/hr boiler	
Incremental installed cost	$10,000
Annual gas savings	110 GJ
Annual GHG Reductions	5 tonnes CO2e
Simple payback per unit	10 years
NPV	$3,000

Cost-Benefit Analysis for an 800,000 Btu/hr boiler	
Incremental installed cost	$14,000
Annual gas savings	220 GJ
Annual GHG Reductions	11 tonnes CO2e
Simple payback per unit	7 years
NPV	$14,000

Cost-Benefit Analysis for a 3,000,000 Btu/hr boiler	
Incremental installed cost	$73,000
Annual gas savings	850 GJ
Annual GHG Reductions	42 tonnes CO2e
Simple payback per unit	9 years
NPV	$36,000

[2] The thermal energy demand intensity was estimated for archetype buildings using data from BC Hydro Commercial Building Energy Modelling Studies completed between 1999 and 2014.

NON-ENERGY IMPACTS	The proposed standard will reduce GHG emissions associated with commercial space heating, helping consumers reduce their environmental footprint. Condensing boilers also reduce air pollution associated with the combustion of fossil fuels and minimize the risk of indoor combustion spillage. Condensing boilers that use modulating technology improve comfort by creating more consistent indoor temperatures.

ASSESSMENT FROM A PROVINCIAL PERSPECTIVE

ECONOMIC ASSESSMENT FROM A PROVINCIAL PERSPECTIVE

(Aggregate energy, emission, and net cost savings)

A cost-benefit analysis was completed to assess the impact of the proposed standard on the Province. The cost-benefit analysis is represented by the net present value of boiler installations that are affected by the proposed standard between 2022 and 2030. The Provincial cost-benefit assumptions include:

- All assumptions made in the consumer cost-benefit analysis.
- Energy savings were modelled using the rated thermal or combustion efficiency, adjusted to account for differences in modulating vs single stage performance as well as average return water temperature profiles for B.C. climatic conditions. Data and methodology from the US DOE Final Rule 2016 were used for the adjustment factors.

The Province-wide cost-benefits results are shown below.

Provincial Cost-Benefit Analysis[3]	
Aggregated Annual Gas Savings	730 TJ in 2030
Aggregated Annual GHG Reductions	36,500 tonnes CO2e in 2030
Provincial NPV	$20 Million by 2030

ADMINISTRATIVE FEASIBILITY FOR COMPLIANCE AND ENFORCEMENT

Compliance and enforcement approach under the *Energy Efficiency Act* is based on random inspections and response to compliance complaints.

Enforcement will be based on provincially and federally regulated labelling and the certified product directories of designated testers.

[3] The aggregated annual values accounts for the savings / reductions that occur in 2030 from all units installed since the implementation of the standard up to the year specified.

NOTES

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