

**REGULATORY IMPACT STATEMENT FOR
RESIDENTIAL WATER HEATERS**

Prepared by:

Energy Efficiency Branch,
BC Ministry of Energy, Mines and Petroleum Resources

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Proposed Regulatory Area: Residential Water Heaters

Type of Device	Natural gas-fired storage-type water heaters with a rated storage capacity of 76 to 380 litres
	Electric storage-type water heaters with a rated storage capacity of 50 to 454 litres
Test Standard	<p>For natural gas-fired water heaters:</p> <p>CAN/CSA-P.3-04 entitled <i>Testing Method for Measuring Energy Consumption and Determining Efficiencies of Gas-Fired Storage Water Heaters</i> for efficiency rating.</p> <p>For electric water heaters:</p> <p>CAN/CSA-C191-04 entitled <i>Performance of Electric Storage Tank Water Heaters for Domestic Hot Water Service</i> for standby loss.</p>
Current BC Regulation	<p>For natural gas-fired water heaters: There are no performance requirements in the current Energy Efficiency Standards Regulation.</p> <p>For electric water heaters: Clause 5 of CSA-C745, effective Jan. 1, 1996.</p>
Proposed Energy Performance Standard	<p>For natural gas-fired water heaters:</p> <p>EF greater than or equal to:</p> $0.70 - (0.0005 * V)$ <p>where V is the rated storage capacity in litres</p> <p>For example, a 151L model must have an EF of 0.62 or greater, and a 189L model must have an EF of 0.61 or greater.</p>

	<p>For electric water heaters:</p> <p>All top inlet tank-type water heaters must have a built-in or installed heat trap on the inlet and outlet. All bottom inlet tank-type water heaters must have a heat trap on the outlet. Heat traps must not be disabled.</p> <p>Top inlet water heaters must have a standby loss (in watts) less than or equal to:</p> <p>$25 + (0.20 * V)$ (for storage volumes of 50 to 270 litres) $(0.472 * V) - 48.5$ (for storage volumes of >270 to 454 litres)</p> <p>where V is the rated storage capacity in litres.</p> <p>For example, a 182L model must have a standby loss no greater than 61, and a 272L model must have a standby loss no greater than 80.</p> <p>Bottom inlet water heaters must have a standby loss (in watts) less than or equal to:</p> <p>$40 + (0.20 * V)$ (for storage volumes of 50 to 270 litres) $(0.472 * V) - 33.5$ (for storage volumes of >270 to 454 litres)</p> <p>where V is the rated storage capacity in litres.</p> <p>This is the same as the current federal minimum efficiency requirement for bottom inlet electric water heaters.</p>
Effective Date	December 1, 2009
Certification	Standards Council of Canada designated certification organizations.
Need for the Regulation	<p>The proposed regulation supports the policies and targets of <i>The BC Energy Plan: A Vision for Clean Energy Leadership</i> and the <i>Energy Efficient Buildings Strategy: More Action, Less Energy</i>, and positions BC as the leading jurisdiction in North America on energy efficiency standards for water heaters.</p>

<p>Results Based Regulatory Design</p>	<p>Regulation is based on energy performance (efficiency factor or standby loss), with the exception of the heat trap requirement for electric water heaters. The heat trap requirement is necessarily prescriptive because the current standard (CSA-C191-04) does not measure energy savings from this device.</p> <p>The Ministry of Energy, Mines and Petroleum Resources (MEMPR) is chairing the CSA C191 committee to encourage inclusion of heat trap measures in the next version of the standard. MEMPR may re-evaluate the heat trap requirement after the committee has concluded.</p>
<p>Transparent Regulation Development (Acceptability)</p>	<p>Development of the regulation involved the following procedure:</p> <ul style="list-style-type: none"> • Obtained input from a wide variety of government and utility stakeholders through the Water Heating Sub-Committee of the national Forum for Leadership in Energy Efficiency Equipment Performance and Standards • Identified targeted equipment (i.e., electric water heaters) • Identified test procedures • Formed steering committee for market assessment, composed of Canadian utilities, provincial regulators, and Natural Resources Canada • National and provincial market assessment undertaken by Caneta Research Inc. • Caneta solicited industry input on regulations • Preliminary economic assessment by Caneta Research Inc. based on several regulatory options • MEMPR economic assessment of selected regulatory options • Consultation with BC utilities, NRCan, and provincial regulators • Industry consultation session scheduled for November 28, 2008 • Formal public consultation period, with written responses to regulatory impact statement, November to December 2008.

<p>Market Transformation Strategy</p>	<p>MEMPR will work with installers, retailers and distributors to help them identify compliant models. This will be done with the assistance of public utilities such as Terasen Gas and BC Hydro.</p> <p>The US Department of Energy and Natural Resources Canada have published new Energy Star levelsⁱ for natural gas-fired water heaters (0.62 EF effective Jan 2009 and 0.67 in 2010), which are expected to improve the availability and cost of efficient water heaters.</p> <p>Testsⁱⁱ of electric water heaters show that a bottom inlet configuration reduces standby losses by 24-33 watts. These savings are not accounted for in the existing C191 standard. This regulation aims to create a level playing field between top- and bottom-inlet configured models (which are identical from the consumer perspective) by setting a minimum level for top-inlet models that is 15W more stringent than the bottom-inlet minimum level. This may reverse the current trend, where manufacturers have an incentive to discontinue bottom-inlet models in order to reduce inventory costs. According to our analysis, a shift to bottom-inlet water heaters is the most cost-effective way for consumers to increase water heater electricity savings in the short term.</p> <p>This regulation is planned to be the first in a series which will take effect over the next five years. MEMPR's long-term target is to achieve >0.80 EF in natural gas-fired water heaters, and >2.0 EF in electric water heaters.</p>
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Assessment from a Consumer Perspective

Criteria	Evaluation
<p>Capital / purchase costs</p>	<p>This regulation will increase the purchase cost of natural gas-fired water heaters by \$76-\$85, which is a 3% capital cost increase for new construction situations, and 9% increase for replacement situations.</p> <p>This regulation will not change the purchase cost of electric waters if a bottom inlet-configured model is available. In sizes where bottom inlet-configured water heaters are not available, consumers will see an increase of \$62-\$78, which is a 5-7% capital cost increase for new construction, and 8-12% for replacement situations.</p>

<p>Cost-Benefit Analysis</p> <p>Energy savings for each consumer</p> <p>(Affordability)</p>	<p>The proposed regulations for natural gas-fired water heaters have a positive impact on consumers. The net present value (NPV) of the regulations to the consumer is \$32-\$37, with future benefits discounted at 8%. Sensitivity analyses varying the energy savings, energy price, capital cost, product service life, and discount rate show that the NPV is positive in nearly all cases. It does become negative if the incremental cost is 40% higher than expected (for the large tank size only), or if the 9 year product service life is shortened to 5 years.</p> <p>The proposed regulations for electric water heaters have a positive impact on consumers in most cases. The net present value of the regulations to the consumer is \$123-\$136 when a bottom-inlet model is available. If none is available, consumers can select a top inlet model. The most likely NPV of a switch to top-inlet is uncertain because MEMPR was unable to obtain information on how many compliant top-inlet models already have in-built heat traps and how common the practice of disabling them is. However, of the six situations possible for top-inlet models, only one had a negative NPV (-\$24). Assuming current models do not possess heat traps, switching to a compliant top-inlet model with an added heat trap offers a positive value of \$11-46 to the consumer. Analyses varying the energy savings, energy price, capital cost, product service life, and discount rate show that the NPV is positive in the majority of cases. It does become negative if bottom inlet models are unavailable and, in the smaller tank size, the incremental cost is 20% higher than expected, the 14 year product service life is shortened to 10 years, or the energy savings are 14% less than expected.</p> <p>A full economic analysis can be found in the attached spreadsheets.</p>
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<p>Consumer choice / quality of service (Availability)</p>	<p>The majority of current models are at, or close to the minimum efficiency regulated by the federal government. This demonstrates a trend toward limited consumer choice. The market appears to be a “commodity” one where the majority of water heaters have similar efficiency levels and consumers generally accept whatever their installer recommends.</p> <p>This regulation will eliminate 66% of the current natural gas-fired models currently available. This leaves 134 models that will be compliant. Because water heaters sales resemble a commodity market, this regulation is expected to have little noticeable effect on consumer choice for efficiency, as suppliers shift their inventories toward the higher efficiency levels. The exception is where compliant models are unavailable in a given size. If new models are not introduced before the regulation goes into force, there will be two gaps: consumers who need very small tanks (113L or 114L) will have to upsize to a 151L tank; and the relatively uncommon 227L tank size may no longer be available, forcing consumers to the 189L size or 246L size.</p> <p>This regulation will eliminate 68% of electric models currently available, which leaves 139 models that will be compliant. This regulation is expected to have little noticeable effect on consumer choice. The exception is where compliant models are unavailable in certain sizes. If new models are not introduced before the regulation goes into force, there will be two notable gaps: consumers who prefer tanks 136-160L will have to downsize to 114L or upsize to 164L; and consumers preferring 303L tanks will have to downsize to 284L or upsize to 364L.</p> <p>Manufacturers may be able to close these gaps by introducing new models.</p> <p>Heat traps are readily available and inexpensive.</p>
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Assessment from an Industry Perspective

<p>Range of products affected</p>	<p>Natural gas-fired storage-type water heaters with a rated storage capacity of 76 to 380 litres; Electric water heaters with a rated storage volume of 50 to 454 litres.</p>
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<p>Cost impacts</p>	<p>Higher efficiency models are more costly to produce. Some designs are more costly to ship because of the product dimensions. However, because all products sold in the province will need to meet the new efficiency requirements, manufacturers and distributors should be able to pass this cost on to the consumer, who will recover those costs through lower energy bills. Such cost increases are already reflected in the cost of higher-efficiency models.</p>
<p>Competitive Analysis</p>	<p>A number of studiesⁱⁱⁱ have indicated that feasible design options are available to improve the efficiency of tank-type water heaters. Given the current climate of increasing energy prices and public concern about greenhouse gas emissions, and the recent introduction of similar Energy Star levels, it is expected that manufacturers will bring to market new models in a fairly short timeframe.</p> <p>There are no water heater manufacturers in British Columbia. For natural gas, three of the five manufacturers in the market do not currently produce compliant products. For electric, two of the five manufacturers do not currently produce compliant products.</p> <p>This regulation may negatively impact any BC distributors, retailers or installers that specialize in models from non-compliant manufacturers if they don't introduce new products. However all manufacturers produce compliant products for at least one of electric or natural gas water heater markets.</p> <p>Although regulations for natural gas-fired and electric water heaters are being implemented concurrently, the new standards may cause some consumers to switch from natural gas to electric water heating, which would affect utilities in BC. Both electric and natural gas-fired water heater regulations have a positive financial impact on consumers, but the impact is greater for the electric regulations. In addition, the upfront capital cost increase for natural gas-fired water heaters is greater.</p>
<p>Market Share</p>	<p>Approximately a third of current water heater sales are of products that meet the proposed EF or standby loss requirements. It is unknown how many electric water heaters currently have heat traps that are in use.</p>
<p>Waste Management</p>	<p>In general this regulation is not expected to affect disposal options. However, one type of insulation that is more common in high-efficiency water heaters, cyclopentane, is highly flammable and may require special handling at the end of its useful life. This regulation may increase the number of water heaters with this type of insulation. MEMPR is scheduled to meet with the Ministry of Environment to discuss disposal options.</p>

Assessment from a Provincial Government Perspective

<p>Economic assessment from a provincial perspective</p> <p>(Aggregate energy, emission and net cost savings)</p>	<p>The proposed regulations for natural gas-fired water heaters will result in a yearly emission reduction of 22,400 tonnes of greenhouse gases and 451,500 GJ in 2020. The net present value (time-discount financial value) to the province totals \$11.2 million.</p> <p>The proposed regulations for electric water heaters will result in a yearly emission reduction of 4,900 tonnes of greenhouse gases in 2016 (the last year before electricity becomes carbon neutral in BC). It will generate 132 GWh per year in electricity savings in 2020. The net present value (time-discounted financial value) to the province totals \$107.7 million.</p>
<p>Regulatory Requirements Avoid or Eliminate Duplication with Other Jurisdictions</p>	<p>British Columbia will be the first in North America to introduce more stringent regulations for water heaters. MEMPR has worked closely with Natural Resources Canada, provincial regulators and utilities to select the proposed efficiency levels and test methods. Federal and provincial regulators have expressed interest in adopting the proposed BC regulations in future.</p> <p>The US Department of Energy is expected to release minimum efficiency recommendations in the same range, in the spring of 2010.</p>
<p>Administrative Feasibility for Compliance and Enforcement</p>	<p>Water heaters do not currently have efficiency labels. Prior to the regulation effective date, MEMPR will establish and distribute a list of compliant products. Natural Resources Canada also maintains a publicly accessible online database of water heater models which lists water heater efficiency ratings. An enforcement plan is currently being developed for all products regulated under the <i>Energy Efficiency Act</i>.</p> <p>Heat traps are commonly disabled by installers at the time of installation. Enforcement of the heat trap requirement is expected to be difficult, but MEMPR will work with industry associations to promote compliance with the new regulation among installers.</p>
<p>Regulatory Assessment Completed by</p>	<p>Katherine Muncaster Senior Policy Advisor Ministry of Energy, Mines & Petroleum Resources (250) 952-0154</p>
<p>Date</p>	<p>November 25, 2008</p>

ⁱ See http://www.energystar.gov/index.cfm?c=new_specs_water_heaters

ⁱⁱ Hayden, A.C.S, Thomas, M., and MacKenzie, M. (2004). *An Evaluation of Storage Water Heater Performance and Implications for Canadian Standards*. Integrated Energy Systems Laboratory, CANMET Energy Technology Centre: Ottawa. Prepared for the Office of Energy Efficiency, Natural Resources Canada.

ⁱⁱⁱ Kinetrics study for NRCan (2002); Integrated Energy Systems Laboratory (2003); DOE Rule (2001); Valley Energy Efficiency Corporation (May 2008). *Super Efficient Gas Water Heating Appliance Initiative: Pier Final Project Report*. Prepared for the California Energy Commission Public Interest Research Group.

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