Heat Pumps (Air Source, Split System)

REGULATORY PROPOSAL

PREPARED BY:

ENERGY EFFICIENCY BRANCH,

B.C. MINISTRY OF ENERGY AND MINES

HTTP://WWW2.GOV.BC.CA/GOV/CONTENT/INDUSTRY/ELECTRICITY-ALTERNATIVE-ENERGY/ENERGY-EFFICIENCY-CONSERVATION

SEPTEMBER 2016

COMMENTS MUST BE RECEIVED BY NOVEMBER 4, 2016

Contents:

SCOPE AND REQUIREMENTS – REGULATORY PROPOSAL

TYPE OF DEVICE	***Heat Pumps, Air-Source, Split-Systems (ASHP).*** The focus of this proposed standard is permanently installed air-source (air-sink) heat pumps with a capacity of less than 19 kilowatts (65 000 Btu/h or 0.067 GJ). Specific configurations of this product class are commonly referred to as split-system, multi-split-system or mini-split system. All of these systems use a reversible refrigeration cycle to transfer heat between the interior and exterior of a building and contain a compressor, indoor conditioning coil, and an outdoor coil. Small-duct and high velocity split-system heat pumps and single-package systems are not covered by this regulation.
TEST STANDARD	CSA C656-14 – Performance standard for split-system and single-package air conditioners and heat pumps.
PROPOSED ENERGY PERFORMANCE STANDARD	Heating Season Performance Factor (HSPF) ≥ 7.39 (Region 5); HSPF ≥ 8.50 (Region 4)
EFFECTIVE DATE	Products manufactured and sold after January 1, 2018
CERTIFICATION	Compliance with the proposed regulation will be based on testing and verification by Standards Council of Canada accredited Certification Organizations on adherence of manufactured products with the "Proposed Energy Performance Standard" using the proposed "Test Standard". No unique B.C. labeling will be required for products listed on the Natural Resources Canada (NRCan) Energy Efficiency Report database (per the Federal Energy Efficiency Regulations requirement for split-system heat pumps coming into effect on January 1, 2017).
NEED FOR REGULATION	The proposed standard will reduce the cost to consumers of using clean B.C. electricity for heating, improving the affordability of operating houses and buildings while reducing greenhouse gas (GHG) emissions. The standard supports: (1) the Province's Climate Leadership Plan Action: Regulations for More Efficient Buildings; and (2) B.C.'s energy objectives under the *Clean Energy Act* including the target to reduce GHG emissions by 33% in 2020 and 80% in 2050, and the target for BC Hydro to meet 66% of electricity demand growth through demand-side measures by 2020. The standard will update the B.C. Energy Efficiency Standards Regulation with the latest CSA Group testing standard for central air heat pumps (CSA C656-14), last updated in 2006.

HARMONIZATION	Amendment 13 of the Federal Government's Energy Efficiency Regulation includes a proposal to increase the minimum energy performance standard for air-source, split-system heat pumps to HSPF 7.1 (Region 5) for products manufactured on or after January 1, 2017. If the federal Amendment is passed, B.C.'s proposed standard for ASHPs will be moderately more stringent, but will harmonize with respect to the Federally prescribed testing procedure. As detailed below, the market for heat pumps in B.C. has largely shifted to the efficiency level of B.C.'s proposed standard. B.C.'s standard will not require unique labelling, instead relying upon NRCan's Energy Efficiency Report database to confirm compliance.
TRANSPARENT REGULATION DEVELOPMENT	Development of the regulation proceeded as follows: • Initial market analysis in B.C. • Economic assessment • Regulatory assessment A stakeholder consultation will be held during the 5-week public review period.
MARKET TRANSFORMATION ACTIVITY & INDICATORS	***Availability***: The majority of split-system ASHPs sold in B.C. already meet or exceed the proposed standard. In 2015, more than 5,000 ducted split-systems and 6,000 ductless mini-splits were shipped to B.C. Of these, Ministry staff estimate that 68% of the ducted systems and 96% of the ductless mini-split systems shipped meet or exceed the proposed standard. ***Awareness***: The proposed standard represents the minimum HSPF a split-system heat pump can achieve to qualify as an ENERGY STAR designated product. It is also the minimum energy performance level required by FortisBC's and BC Hydro's Home Renovation Rebate Program and the Province's Oil to Heat Pump Rebate. The ENERGY STAR brand and these programs will continue to help build public awareness of high performance electric heating options. ***Accessibility***: Residential ASHP equipment with HSPF ≥ 7.39 (Region 5) is widely stocked and installed throughout B.C. The installation cost of higher efficiency models is typically the same as that required for less efficient models. ***Affordability***: The installed cost of an ASHP that meets the proposed standard is about 8% higher than a heat pump that meets the current 6.7 HSPF (Region 5) federal standard. However, their lower energy costs means that these additional upfront costs will be fully recovered by most homeowners within 7 years. The exception is apartment-sized mini-split ductless systems where the unit's incremental cost may not be fully offset by future energy savings. However, since the HSPF of most new apartment-sized units sold are already well above the proposed standard, the practical impact on this segment is projected to be negligible. ***Acceptability***: ASHPs have a high level of acceptability in the B.C. market place. About 5% of B.C. homes currently use air source heat pumps as their main heating system. ***Demand Side Management (DSM) programs to increase market share:*** High efficiency ASHPs have been promoted in the province for nearly a decade through programs such as LiveSmart BC, FortisBC's and BC Hydro's Home Energy Rebate Program, FortisBC's Air Source Heat Pump Rebate and the provincially-funded Oil to Heat Pump Rebate. This proposed regulation can be promoted by energy utilities through their Demand-

	Side Management (DSM) programs, leading to increased market share of compliant products prior to the effective date. As per Section 4 (Subsection 1.4) of the Demand-Side Measures Regulation under the *Utilities Commission Act*, part of the energy savings from the proposed regulation can be attributed back to these DSM programs: http://www.bclaws.ca/Recon/document/ID/freeside/10_326_2008

ASSESSMENT FROM AN INDUSTRY PERSPECTIVE

RANGE OF PRODUCTS AFFECTED	The proposed regulation affects the manufacture and sale of air-source, split-system heat pumps in British Columbia. The regulation will only apply to products manufactured **after** the proposed effective date. Retailers that are selling inventory that is manufactured before the proposed effective date can continue to do so.
COST IMPACT	As 68% of the ducted systems and 96% of the ductless mini-split systems shipped to B.C. in 2015 meet or exceeded the proposed standard, there is not expected to be a cost-impact to industry.
COMPETITIVE ANALYSIS	There is a wide range of ducted and non-ducted split-system ASHPs that meet or exceed the proposed standard. NRCan's Energy Efficiency Report database includes more than 70 brands and 160,000 unique combinations of ducted ASHPs, and 40 brands and 450 unique combinations of ductless mini-split systems, registered in Canada that meet or exceed the proposed standard.

ASSESSMENT FROM A CONSUMER PERSPECTIVE

DATA AND ASSUMPTIONS	• 6.7 HSPF (Region 5) used as the baseline; this aligns with NRCan's current minimum energy performance standard for split system heat pumps
	• Economic analysis included BC Hydro Residential Inclining Block (RIB) rates, with 100% of customers using heat pumps on Tier 2 during the heating season and 100% using Tier 1 during the cooling season
	  o Tier 2 electricity rate in 2018: $0.1352/kWh
	  o Tier 1 electricity rate in 2018: $0.0902/kWh
	• Consumer discount rate is 6%
	• Gross output thermal requirements for average B.C. home: 65.65 GJ/yr for a detached single-family dwelling, 37.61 GJ/yr for a semi- attached single-family home or townhome, 19.86 GJ/yr for an apartment
	• The more compact size of semi-detached homes and townhomes means a smaller central ducted system is used that provides 25% fewer GJs/hr than one installed for a single-family dwelling
	• Gross output cooling requirements for average B.C. home: 3.52 GJ/yr for a detached single family dwelling, 2.69 GJ/yr for a semi-attached home or townhome, 1.75 GJ/yr for an apartment
	• A typical 6.7 HSPF ducted heat pump has a 14.3 SEER and a typical 7.39 HSPF ducted heat pump has a 15.9 SEER
	• A typical 6.7 HSPF ductless mini-split has a 13.5 SEER and a typical 7.39 HSPF

ductless mini-split has a 15.6 SEER

COST-BENEFIT ANALYSIS

ENERGY SAVINGS FOR EACH CONSUMER

An economic model using the above data and assumptions yielded the following results for consumers who purchase an ASHP in the first year that the new standard comes into effect:

	Ducted Single Family Dwelling	Ducted Semi-Detached & Townhome	Ductless Semi-Detached & Townhome	Ductless Apt
Energy Savings (kWh/yr)	895	518	518	281
Bill Savings – First Year	$113	$87	$65	$35
GHG Savings (kg CO2e/yr)	9.03	5.22	5.22	2.84
Incremental Installed Cost	$630	$417	$454	$454
Simple Payback Period (yrs)	6.1	6.9	7.5	13.9
NPV (15 yrs, 6% discount rate)	$553	$260	$218	-$115

A sensitivity analysis was performed to test the impact that different levels of incremental capital costs would have on the net present value of ASHP models that meet the proposed standard (Figure 1). The 15-year NPV remains positive in all cases except for apartment-sized mini-split ductless systems. Since the HSPF of most new apartment-sized units sold are already well above the proposed standard, the practical impact on this segment is expected to be negligible.

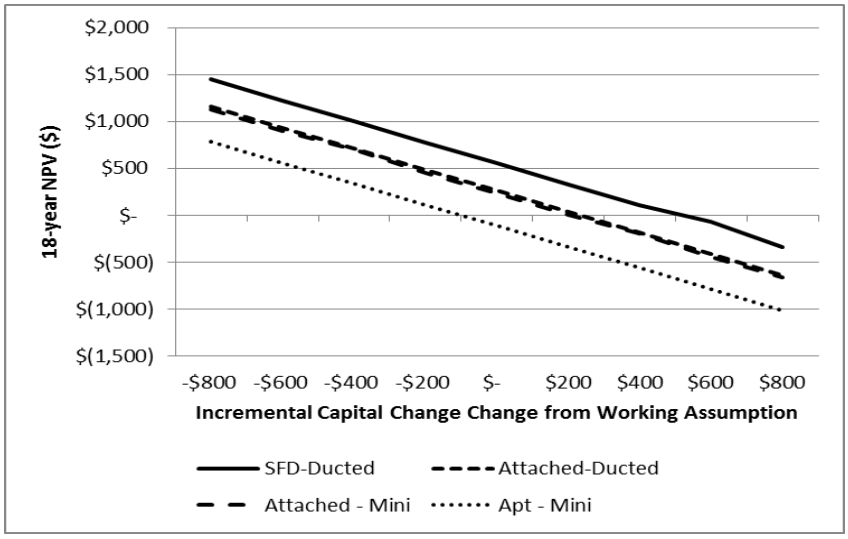

Figure 1: **Varying Incremental Capital Cost for Each Major Housing Type**

IMPACT ON BUILDERS	The proposed standard will have no impact on builders as it will not result in a technological departure from heat pumps that meet the current Federal Energy Efficiency Standards Regulations 6.7 HSPF requirement.

ASSESSMENT FROM A PROVINCIAL GOVERNMENT PERSPECTIVE

ECONOMIC ASSESSMENT FROM A PROVINCIAL PERSPECTIVE

(Aggregate energy, emission and net cost savings)

A province-wide impact assessment considers the following additional assumptions and trends:

- long run marginal cost (LRMC) of electricity: $0.1034/kWh
- provincial and consumer discount rates are 6%
- 5,450 ducted split-systems and 6,380 ductless mini-slits will be sold in B.C. in 2018
- 87% of the split-system, ducted heat pumps sold in B.C. are for detached single-family homes, 13% are installed in semi-detached homes or townhomes
- 68% of ducted split-systems sold in B.C. meet or exceeds the proposed 7.39 HSPF standard
- 97% of ductless mini splits sold in B.C. already meet or exceed the proposed 7.39 HSPF minimum standard
- By 2018, there will be almost no ductless mini-split heat pump systems sold that are lower than 7.39HSPF (Region 5)
- The market share of high efficiency heat pumps grows at a rate of 1% per year
- The total number of heat pumps sold in B.C. grows at a rate of 1.2% per year

The following three metrics illustrate the benefit of the regulation from an energy, cost, and provincial NPV perspective:

Cumulative Energy Savings in 2025	10.5 GWh/yr
Cumulative Cost Savings in 2025	$1.4M
Provincial NPV ($) over the lifetime of products installed between 2018-2025, with energy benefits	$6.3M

In summary, British Columbians as a whole will see 10.5 GWh/yr of savings in 2025, resulting in $1.4 million in annual energy bill savings. The province will benefit from a $6.3 million NPV over the lifetime of products installed between 2018 and 2025.

ADMINISTRATIVE FEASIBILITY FOR COMPLIANCE AND ENFORCEMENT

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

No unique labelling of B.C. products will be required. Enforcement will rely upon product listings on NRCan's Energy Efficiency Report database.

NOTES

REGULATORY ASSESSMENT COMPLETED BY	Tom Berkhout Senior Policy Advisor, Energy Efficiency Branch Tel: (250) 953-3153 E-mail: tom.berkhout@gov.bc.ca
DATE	September, 2016