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Evaluation of Energy Efficiency Regulations - Glazing for Large Buildings

Type of Device	Glazing for new and existing buildings not referenced by Part 9 of the BC Building Code, excluding security glazing at ground level, and interior glazing.
Proposed Energy Performance Standard	For operable glazing less than 40% of building area: • Thermal Transmittance (U-value) less than or equal to 3.80 Watts (W) of energy per square meter of glazing area per degree Kelvin temperature differential between the inside and outside of the glazing; and, • Solar heat gain coefficient (SHGC) less than or equal to 0.49. For fixed glazing less than 40% of building area: • U-value less than or equal to 3.24 $W/m^2/K$; and, • SHGC less than or equal to 0.49. For operable glazing equal to or greater than 40% of building area: • U-value less than or equal to 2.67 $W/m^2/K$; and, • SHGC less than or equal to 0.36. For fixed glazing equal to or greater than 40% of building area: • U-value less than or equal to 2.61 $W/m^2/K$; and, • SHGC less than or equal to 0.26. The determination of the energy performance is based on the average performance of the entire assembly of manufactured windows or the entire building envelope of a building with site-assembled glazing, including all framing and fastening materials. This is consistent with the standards in Table 5.5 – Zone 5 of the ASHRAE[1] 90.1 (2004) - *Energy Standard for Buildings Except Low-Rise Residential Buildings*.
Effective Date	April 1, 2008

[1] American Society of Heating, Refrigeration and Air Conditioning Engineers.

Test Standard	NFRC 100 - 2004-E0A4 (March 07) *Procedure for Determining Fenestration Product U-Factors* or NFRC 200 - 2004-E0A3 (March 07) *Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence* or CSA A440.2-04 *Energy Performance of Windows and Other Fenestration Systems*
Current BC Regulation	None
Need for the Regulation	Supports the strategy, *Energy Efficient Buildings: A Plan for BC* (revised 2007) and its associated energy efficiency targets. Supports the energy conservation target in the 2007 Energy Plan – *A Vision for Clean Energy*. Ensures a consistent playing field between manufactured windows for low-rise buildings (up to 600m^2 and 3.5 stories) regulated under the *Energy Efficiency Act* in the 2006 regulatory amendment (U-value less than or equal to 2.0 W/m^2/K), and those in larger buildings. The standard for the latter is less stringent because of the structural characteristics of glazing in high-rise and large buildings.
Results Based Regulatory Design	This regulation adopts an energy performance standard that will improve the energy efficiency of new and existing large buildings, following significant voluntary uptake of the standard as per the Market Transformation Strategy below.

Transparent Regulation Development (Acceptability)	• MEMPR hosted a workshop in June 2006 with a wide range of stakeholders to present regulatory priorities for 2007. • A workplan was completed in fall 2006 and shared with a wide range of stakeholders. • A market study was completed in January, 2007 that included surveys of key industry players. • An economic and regulatory assessment was completed in April, 2007 and distributed to glazing industry players. • A meeting was held on April 16, 2007 with the Glazing Contractors Association of BC. • A meeting was held on July 17, 2007 with a Window and Door Manufacturers' Association of BC representative. • The regulatory assessment was sent to a wide range of stakeholders on August 1, 2007 for a 60 day comment period.
Market Transformation Strategy	BC Hydro's High Performance Building program provides financial and technical support to reduce electricity demand. The program supports a building design approach that integrates building envelope and heating, ventilation, and air conditioning system design. A "capacity building coordinator" is employed by the Ministry of Energy, Mines and Petroleum Resources (MEMPR) to support the BC-based fenestration industry, including manufacturers and suppliers of glazing for large buildings. MEMPR is advocating for the development of an Energy Star standard for commercial glazing to complement the standards already in place for manufactured windows, doors and skylights. MEMPR and BC Hydro will co-host a free technical seminar on the regulation, if approved, at least one year prior to the effective date of the regulation. This seminar will be delivered in the Lower Mainland, Victoria, Kelowna and Prince George. Large and medium offices and high-rise multi-unit residential buildings (MURBs) are commonly the only building types for which glazing is equal to or greater than at least 40% of building area. New buildings with less than 40% glazing already meet the proposed standard, therefore transformation efforts will be focused on large and medium offices and MURBs.

Certification	Under the Energy Efficiency Act prescribed products must display a label that states their energy performance (U-value and SHGC), as certified by a laboratory recognized by the Standards Council of Canada. The following companies can certify products: Quality Auditing Institute Ltd. Port Moody, B.C. Kent Adamson Phone: 604 461-8378 Email: kadamson@qai.org Intertek Testing Services NA Ltd. Coquitlam, B.CHoward Grisack Phone: 604 520-3321 ext 128 Email: howard.grisack@intertek.com Enermodal Engineering Ltd. Kitchener, Ontario Morgan Hanam Phone: 519 743-8777 ext. 228 Email: mhanam@enermodal.com CAN-BEST Brampton, Ontario Jim Scott Phone: 905 840-2014 Email: jim@can-best.com Bodycote Materials Testing Canada Inc. Mississauga, Ontario David Bailey Phone: 905 822-4111 ext. 307 Email: bailey.d@bodycote.ca Air-Ins Inc. Varennes, Québec Gilbert Riopel Phone: 450 652-0838 ext. 229 Email: g.riopel@air-ins.com

Assessment from a Consumer Perspective

Criteria	Evaluation
Cost-Benefit Analysis Energy savings for each consumer	Because there is no financial impact for buildings with less that 40% glazing, only large and medium offices and MURBs were analysed. Over a 30-year period, the net present value of savings is estimated at $12 per square meter of window area, or $20/$m^2$ for MURBs, including incremental capital costs and energy savings. This is based on the following assumptions: • Discount rate of 8% • An electricity price of $0.0501/kWh for the entire building stock (a weighted average of residential and large commercial electricity rates), and $0.0627/kWh for residential buildings, assuming an annual 2.5% real price escalation. • A natural gas price of $11.565 per Gigajoule (GJ) for the entire building stock (again a weighted average of residential and large commercial rates)and $12.099 / GJ for residential buildings, assuming an annual 2% real price escalation. Electricity savings are estimated at 13.952 kilowatt-hours (kWh) per square meter per year for the entire building stock, or 28.702 $kWh/m^2/yr$ for MURBs. This assumes that 70% of heating in MURBs is from electricity. Natural gas savings are estimated at 0.137 Gigajoules per square meter per year for the entire building stock, or 0.077 $kWh/m^2/yr$ for MURBs. This assumes that 30% of heating load in MURBs is from natural gas. The energy savings result in a simple payback of 7 years for the entire building stock or 6 years for MURBs.
Consumer choice / quality of service	For buildings with more than 40% glazing in their building envelope, this regulation will require a low-emissivity coating on double glazed windows, or equivalent energy performance. Over 50% of the market was already providing this level of energy performance in 2006. There is sufficient supply of glazing that meets this standard, and sufficient British Columbia capacity to install such products. The regulation will exclude security (shatter resistant) glazing typical for storefront windows, along with all glazing that is used in the interior space of a building.

Capital / purchase costs	The incremental capital cost of meeting the standard over double glazed windows is $18 per square meter of glazing for buildings with more than 40% glazing in their building envelope and $0 for buildings with less than 40% glazing. This translates to a $70,000 incremental cost for a typical large office building, $56,000 for a typical MURB, and $33,000 for a typical medium office building, all with more than 40% glazing.

Assessment from an Industry Perspective

Range of products affected	The regulation will apply to all manufactured windows, swinging glass doors and glazing that is installed in new buildings of the designated size, and major retrofits of building envelopes. This includes aluminium frame windows, structural windows made of other materials and site-assembled glazing. It applies to both operable and fixed glazing.
Cost impacts	The additional cost of manufacturing or procuring such products is expected to be fully recovered through the price paid by builders or tradespersons installing the product.
Competitive Analysis	The major manufacturers of windows are based in southern British Columbia. It is estimated that approximately 50% of products sold are manufactured in British Columbia. The manufacturing of site-assembled glazing is dominated by relatively few suppliers in northwest United States. It is estimated that the majority of products sold are manufactured in British Columbia. Given the widespread regulation of glazing in other jurisdictions that matches the proposed standards (e.g., City of Vancouver Building Bylaw, State of Washington Energy Code, City of Seattle Energy Code and Province of Ontario Building Code), it is expected that industry impacts will be minimal.

Assessment from a Provincial Government Perspective

Economic assessment from a provincial perspective (Aggregate energy, emission and net cost savings)	Over a 30-year period, the net present value of savings is estimated at $35 million, including incremental capital costs and energy savings at the marginal cost of supply and greenhouse gas emissions. This is based on the following assumptions: • Discount rate of 8% • 155,520 m^2 of installed glazing per year • A marginal electricity price of $0.085/kWh, along with an annual 2.5% real price escalation. • A marginal natural gas price of $11.565 per Gigajoule (GJ) (weighted average) for the entire building stock and $12.099 / GJ for residential buildings, assuming an annual 2% real price escalation. • $15/tonne for greenhouse gas emission reductions, assuming 360 tonnes per Gigawatt-hour of electricity supply until 2016 and 49.68 tonnes per Terajoule of natural gas savings. Discounted electricity savings are estimated at 248.92 GWh, ranging from non-discounted savings of 2.17 GWh in the first year of the regulation to 65.10 GWh in year 30 (e.g., 2038). Discounted natural gas savings are estimated at 2,443.14 Terajoules, ranging from non-discounted savings of 21.30 TJ in the first year of the regulation to 638.93 TJ in year 30. Non-discounted greenhouse gas emissions reductions of 31,755 tonnes will be achieved in year 30, while total reductions over 30 years will be 143,339 tonnes.
Regulatory Requirements Avoid or Eliminate Duplication with Other Jurisdictions	The regulation will not duplicate other regulations in British Columbia or Canada, with the exception of the City of Vancouver Building Bylaw that only applies to new construction buildings within the city.
Administrative Feasibility for Compliance and Enforcement	Compliance will be monitored by the professional engineering community who are required under the BC Building Code to provide oversight on health, safety, structural integrity and accessibility provisions for new buildings. MEMPR and BC Hydro will host a seminar to all players in the industry to raise awareness on the standard. It is impractical to monitor compliance for retrofit activities that do not trigger the BC Building Code.

Regulatory Assessment Completed by:	Andrew Pape-Salmon, P.Eng., MRM Electricity & Alternative Energy Division BC Ministry of Energy, Mines & Petroleum Resources (250) 952-0819 Andrew.PapeSalmon@gov.bc.ca
Date	April 12, 2007, Revised August 20, 2007.

Attachment – Market Assessment:
Innes Hood and John Sampson. **Commercial Window Market Assessment Report**. The Sheltair Group with Sampson Research. Prepared for the BC Ministry of Energy, Mines and Petroleum Resources, January 2007.