



**Asia-Pacific
Economic Cooperation**

**Energy-Saving Windows:
Survey of Policies and Programs to
Promote Advanced Window and Glazing
Technologies in APEC Economies**

APEC Energy Working Group

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Energy Saving Windows in APEC Economies

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Executive Summary

APEC economies are in a diverse condition regarding energy efficient window rating, testing, and policy. The conditions range from a fully mature window energy rating system required by local or national building energy codes and used by voluntary energy efficiency programs to no discernable activity for window energy rating or building energy code activity. This deliverable simply lists all information gathered to date. The next deliverable, a draft summary report, will include comparisons of performance testing and rating practices, policy and program assessments, and market assessment of energy efficient window technologies.

Several APEC economies have mature programs where standardized fenestration energy ratings are referenced or required by a local or national code:

- US: United States
- NZ: New Zealand
- CDA: Canada
- PNG: Papua New Guinea
- AUS: Australia

Several APEC economies require the energy rating for a window to be combined into the wall energy performance (sometimes call overall thermal transmittance value, OTTV) specified by a national energy code, but do not specify a precise method for window energy efficiency calculation:

- HKC: Hong Kong, China
- CT: Chinese Taipei
- INA: Indonesia
- THA: Thailand
- MAS: Malaysia
- VN: Viet Nam
- MEX: Mexico

Some APEC economies make reference to fenestration performance values based on WWR, climate zone, building type in a prescriptive manner, but the fenestration energy performance ratings are not standardized.

- CHL: Chile
- ROK: Korea
- PRC: China
- RUS: The Russian Federation

One APEC economy use voluntary ratings based on developing fenestration energy rating procedures, but does not have mandatory building energy efficiency code referencing fenestration energy performance.

- JPN: Japan

Four APEC economies have no or preliminary fenestration rating activity:

- BD: Brunei Darussalam
- PE: Peru
- INA: Indonesia
- RP: Philippines

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NFRC will begin to assess the relative differences among the fenestration rating systems and produce recommendations for future pursuit of energy efficient window rating programs in APEC economies that have not yet demonstrated a commitment to adopt fully functional energy efficient window programs.

Guide to SharePoint Web Site for Pertinent Documents

The window energy rating and testing and all building energy policy and program information gathered was too large to incorporate into this paper. NFRC has uploaded all pertinent documents to a password protected web site that it hosts. Please click this link to navigate to the site:

<http://files.nfrc.org/Research/Forms/AllItems.aspx?RootFolder=%2fResearch%2fAsia%20Pacific%20Economic%20Cooperation%2dCollected%20Data&FolderCTID=&View=%7bC347F7D3%2d6369%2d4D28%2dA451%2dF026375B38C8%7d> Once on this site, use your NFRC membership ID and PW to gain access. The information gathered is arranged identically to the summary table below for the reader's convenience. If you are not an NFRC member, contact Ray McGowan (240-821-9510, rmcgowan@nfrc.org) for information to enter this site.

Phases 1 and 2-Collect Information on Experience with Energy Efficient Windows-Summary Table

The table below summarizes the information collected on energy efficient window policies, programs, and testing standards. The summaries below correspond to the referenced online library created for the large amount of information collected. The structure of the online library matches the summary below listing three primary subjects as required by the contract:

- Testing and Rating
- Policies
- Programs

Use the table below for a brief description of the available documents. To view the actual documents, log in to this web site:

<http://files.nfrc.org/Research/Forms/AllItems.aspx?RootFolder=%2fResearch%2fAsia%20Pacific%20Economic%20Cooperation%2dCollected%20Data&FolderCTID=&View=%7bC347F7D3%2d6369%2d4D28%2dA451%2dF026375B38C8%7d> then use NFRC membership ID and PW.

AUS: Australia	
Testing and Rating	American NFRC based certification system for residential and commercial window products dominate the marketplace. The US NFRC has a license agreement with the Australian Fenestration Rating Council (http://www.afrc.org.au/) to operate a rating program based on American NFRC procedures. The AFRC differs by requiring only simulation based on NFRC 100 (U-factor) and NFRC 200 (SHGC and VT).
Policies	Australian Building Codes Board (ABCB) is a government body in charge of the development and administration of building codes in Australia. The ABCB enforces the Building Codes of Australia (BCA-07) that reference NFRC 100 and 200 for energy ratings. The BCA uses whole building energy consumption calculations. Window values derived from NFRC ratings are integrated into the whole building energy calculation.
Programs	In 2006, the Australian Government introduced the Voluntary Building Industry Initiatives Program to persuade the building industry to adopt best practices to reduce greenhouse gas impact Projects developed include the: <ul style="list-style-type: none"> • Window Energy Rating Scheme (WERS) (uses NFRC ratings) <ul style="list-style-type: none"> • Green Building Council of Australia-Green Star Program <ul style="list-style-type: none"> ○ Green Star Calculation sheet
BD: Brunei Darussalam	
Testing and Rating	None identified
Policies	None identified
Programs	None identified

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CDA: Canada	
Testing and Rating	CSA-A440.2 Energy Performance of Windows and Other Fenestration Systems required ISO 15099 compliance software implying NFRC 100 and NFRC 200 (WINDOW 5.2 and THERM 5.2). British Columbia/Vancouver each references ASHRAE 90.1 which also reference NFRC 100 and 200.
Policies	<p>Building energy codes enforced by provincial authorities. Canada has two national codes: Model National Energy Code of Canada for Buildings (MNECB) and the Model National Energy Code for Houses (MNECH), both developed in 1997 and due for update in 2011 by National Resources-Canada. These codes use thermal transmittance for fenestration performance. For fenestration, the code provides regional maximum thermal transmittance values by heating source, with defined exceptions such as automatic sliding glass doors. MNECB varies the regional maximum thermal transmittance values by the ratio of fenestration to wall area for fixed and operable fenestration products. MNECH has similar requirements.</p> <p>British Columbia requires ASHRAE 90.1-04 and the city of Vancouver, BC requires ASHRAE 90.1.07. ASHRAE 90.1 references NFRC 100 and 200 exclusively.</p>
CHL: Chile	
Testing and Rating	Exact window measurement method not referenced by code.
Policy	Chilean Residential Building Code-2007. This code has two compliance paths. One list maximum Window to Wall Ratios (WWR) for a given thermal transmission value (U-factor) for either single or double glazed windows. In colder climates, higher U-factors are required and reduced WWRs. The second path allows an area weighted wall/window U-factor with maximum U-factors specified by climate zones.
Programs	None identified
PRC: China	
Testing and Rating	GB/T8484-2008- <i>Graduation and Test Method for Thermal Insulating Properties of Doors and Windows</i> . This is a thermal transmission test for U-factor.
Policy	GB 50189-2005-Design Standard for Energy Efficiency of Public Buildings is mandatory throughout China, but poorly enforced. Fenestration requirements are given in terms of maximum heat transfer coefficient and shading coefficient (SC) for different orientation. The window-to-wall ratio (WWR) shall not be greater than 0.7. The minimum visual light transmittance (VLT) of glazing for vertical fenestration shall not be less than 0.4 if WWR is less than 0.4. The standard includes fenestration requirements based on window-to-wall ratio and shape coefficient. Thermal transmission (U-factor) reduces as the shape coefficient and WWR rise. GB50189 divides China into three climate zones where U-factor values decrease as the location moves north.
Programs	Significant program efforts include the Green Olympic Building Assessment System (GOBAS) developed in 2004 for evaluating the environmental qualities of buildings for the 2008 Olympics, and the Standard for <i>Green Building Evaluation (GB/T50378-2006)</i> developed by the MOHURD in 2006, which represents a preliminary effort by the MOHURD to quantify and rate the environmental quality of both residential and public buildings.

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	MOHURD has shown increasing interest in the establishment of a building energy labeling system. In 2005, the Beijing city government adopted a standard for rating the energy efficiency of public buildings that requires detailed computer modeling of the building (DBJ/T01-100-205).
HKC: Honk Kong, China	
Testing and Rating	Use OTTV method described by Hong Kong OTTV-02 Calculation Method-window performance is combined into the OTTV
Policy	Performance based Building Energy Code-2007
Program	Hong Kong-Energy Efficiency Registration Scheme for Buildings-2007
INA: Indonesia	
Testing and Rating	Window testing and rating method not identified, code does not specify measurement technique
Policy	SNI 03-6389-2000-Building Envelope Energy Conservation in Buildings. This document uses the overall heat transfer coefficient value to limit the heat transmission of wall/window combinations.
Programs	None identified
JPN: Japan	
Testing and Rating	JIS A 4710-2004-Window and Doors Thermal Resistance Test-thermal transmission test method to determine U-factor
Policy	Commercial: Criteria for Clients of Certain Buildings on the Rationalization Concerning Residential Energy Use-2006 Residential: Design and Construction Guidelines on the Rationalization of Energy Use for Houses Japan-Energy Policy Act
Programs	Japanese Star Rating Program-New program ranking window energy performance using <i>one to four stars</i> on the product Measures to Encourage Housing-Business Owners to Improve Energy Efficiency in Housing
ROK: Korea	
Testing and Rating	Overall heat transfer coefficient of window/wall to limit heat loss used in building energy code. For the KEMCO window labeling program, KS F 2278 is used.
Policy	Homeland Ministry 2010-371-HO-Architecture of Energy-Saving Design Criteria
Programs	Ministry of Knowledge Economy (MKE) and Korean Energy Management Corporation (KEMCO) operate three standards and labeling programs: Energy Efficiency Standards & Labeling Program (windows included); e-Standby Program; High-efficiency Appliances Certification Program
MAS: Malaysia	
Testing and Rating	Window energy performance method not referenced by code, use OTTV-overall thermal transfer value where windows are integrated with other wall materials;

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Rating	shading coefficient also used for window calculation; Daylighting provisions in energy code also
Policy	Department of Standards-Malaysia: Code of Practice on Energy Efficiency and Use of Renewable Energy for Non Residential Buildings-2007
Programs	None identified
MEX: Mexico	
Testing and Rating	No testing or rating identified, window values are input into overall thermal transmission value for wall
Policy	Mexico Thermal Insulation Standard, NOM-018-ENER (2005); Building Design Code-CEV001-332 (voluntary, not adopted by government to date)
Programs	None identified
NZ: New Zealand	
Testing and Rating	None identified
Policy	NZS 4218-Thermal Insulation: Housing and Small Buildings Compliance Document for New Zealand Building Code Clause H1 Energy Efficiency – Third Edition-2006, references WERS rated windows
Programs	WERS (Window Efficiency Rating System) is the official New Zealand window & door rating system which is coordinated by Window Association of New Zealand (WANZ) and supported by the New Zealand Government agencies: Energy Efficiency Conservation Authority and the Foundation for Research, Science and Technology
PNG: Papua New Guinea	
Testing and Rating	See Australia
Policies	Adopted Australian BCA codes (see Australia)
Programs	None identified
PE: Peru	
Testing and Rating	None identified
Policies	None identified
Programs	None identified
RP: Philippines	
Testing and Rating	None identified
Policy	Green Building Act 2009-Philippines; Beginning in the late 1980's the Philippines passed an energy conservation law that encouraged consumers to save energy and informed them of best practices, as well as promoted energy efficient technologies and appliances and rewarded projects that conserved energy. In 1994, voluntary energy efficiency standards were

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	incorporated into the National Building Code, which was last updated in 2005. These standards applied to commercial buildings and covered building envelope, lighting, HVAC, and water heating systems.
Programs	No national programs. Limited USGBC LEED building activity has resulted in some window with energy labels per the NFRC 100 and 200.
RUS: The Russian Federation	
Testing and Rating	Specific method not defined in code
Policy	Russia Thermal Performance of Buildings (SNiP 23-02-2003); Russia Multifamily Residential Buildings Code (SNiP 31-01-2003). These codes list the maximum thermal resistance for a window by specific building type and climate zone.
Programs	Energy Conservation and Thermal Performance for City of Moscow, MGSN 4.19-2005
SIN: Singapore	
Testing and Rating	Guidelines for Envelope Thermal Transmittance Values for Buildings-2004
Policy	Building and Construction Authority-CODE ON ENVELOPE THERMAL PERFORMANCE FOR BUILDINGS
Programs	BCA Greenmark for Nonresidential Buildings; Environmental Sustainability Code
CT: Chinese Taipei	
Testing and Rating	None identified
Policy	<ul style="list-style-type: none"> • Nonresidential Building Energy Standard (pending) • Residential Building Energy Standard (pending)
THA: Thailand	
Testing and Rating	No documents available. Use a simplified method to calculate the combined heat ventilation rate of building wall. The window heat rate is combined into this overall calculation. The code does not clearly indicate how the calculation must be made.
Policy	Ministerial Regulation: <i>Prescription of type or size of building and standard, criteria and procedure in designing building for energy conservation</i> ; B.E. 2552. This code prescribes the heat rate through the wall for buildings > 2,000 square meters. Several different building types have specific heat rate maximums.
US: United States	
Testing and Rating	NFRC certification system for residential and commercial window products dominates marketplace. NFRC is a nonprofit organization with 800 window manufacturing participants and 2.5 million rated products in an online database. NFRC 100 (U-factor) and 200 (SHGC and VT) are written and continuously updated by the NFRC membership. Applicable standards: <ul style="list-style-type: none"> • NFRC 100-U-factor simulation standard (click here)

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	<ul style="list-style-type: none"> • NFRC 200-SHGC and VT simulation standard (click here) <ul style="list-style-type: none"> ○ NFRC Approved Software: WINDOW and THERM (Lawrence Berkeley National Labs download site) ○ NFRC Approved Software: Component Modeling Approach Software Tool download site • NFRC 102-U-factor testing standard (click here) • NFRC 700-Product Certification Program-program procedure (click here)
Policies	<p>Each State, and some localities, references a common code, principally ASHRAE 90.1 for commercial buildings and the International Energy Conservation Code (IECC) for residential. State legislatures select a version of ASHRAE 90.1 and IECC and either mandate compliance or allow voluntary compliance. In both IECC and ASHRAE 90.1 NFRC window ratings per NFRC 100 and 200 are exclusively referenced and required for compliance.</p> <ul style="list-style-type: none"> • American Society of Heating Refrigerating and Air conditioning Engineers Standard 90.1-2007 • International Energy Conservation Code-2009
Programs	<p>Several voluntary programs exist in the US including ENERGY STAR for residential product, the US Green Building Council's Leadership in Energy Efficient Design (LEED). The US Government periodically offers tax credits for residential window product that exceed minimal codes. A list of programs that include NFRC rated window energy performance as part of the energy efficiency requirement is provided here:</p> <ul style="list-style-type: none"> • US Green Building Council-Leadership in Energy Efficient Design (LEED, New Construction V3 included) • International Green Conservation Code-Public Version 2-2010 • US EPA/DOE ENERGY STAR window, door, skylight program and homes program • US EPA/DOE ENERGY STAR Building and Plants <p>Numerous government and utility window installation incentives exist throughout the US and can be reviewed here: http://www.dsireusa.org/incentives/index.cfm?EE=1&RE=0&SPV=0&ST=0&technology=windows&sh=1</p>
Programs	<p>Canada's primary voluntary window program is the American ENERGY STAR window program that includes Canadian specifics on climate. USGBC LEED is present as well primarily for commercial projects. Other programs promoting energy efficient buildings include:</p> <ul style="list-style-type: none"> • ENERGY STAR-Canada (http://oee.nrcan.gc.ca/residential/personal/windows-doors/buying.cfm?attr=4) • LEED-Canada (http://leedcanada.ca/) • Sustainable Buildings-Canada (http://www.sbcanada.org/index.html) • Built Green Canada (http://www.builtgreencanada.ca/)
Programs	None identified
Programs	None identified

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VT: Viet Nam	
Testing and Rating	Testing and rating system not specified in Vietnam Building EE code. Code uses overall thermal transmittance value (OTTV) calculation for a wall where window U-factor and SHGC is embedded in this OTTV wall calculation. Maximum OTTVs are specified for compliance.
Policy	Vietnam Building Energy Efficiency Code-2005 (40/2005/QD-BXD)
Programs	None identified