Trade Impact of Life Cycle Analysis in Multi-Attribute Certification Programs for Flooring Materials and Plumbing Fixtures in Five Focus APEC Member Economies

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1. Background

This study provides an analysis of the trade impact of life cycle analysis in multiattribute certification programs for flooring materials and plumbing fixtures. The study was requested by the APEC Subcommittee on Standards and Conformance (APEC SCSC) for the United States host year, which focuses on promoting green growth and regulatory cooperation and convergence. None of the programs examined in this study presently certifies whole buildings, though the Green Tag/Green Rate program in Australia compares environmental impacts across the whole building supply chain, and SCS Certified, based in the United States, is developing such an approach.

Key objectives of this case study are to:

- Raise awareness of existing "green" standards, conformity assessment procedures, or codes being developed internationally, in advance of regulation
- Understand which APEC economies use voluntary or mandatory programs for "green" commercial construction and their similarities and differences
- Discuss how member economies may cooperate on the development of standards, conformity assessment and codes that underpin these policies, with a view to facilitating trade and avoiding technical barriers.

Analysis and recommendations from this case study were presented by DAI during the APEC Conference on Green Buildings and Green Growth: Approaches to Encouraging a Positive Green Building Climate, held September 12-13, 2011 on the margins of the International Green Buildings Conference in Singapore. The United States submitted the draft case study to the APEC Sub-Committee on Standards and Conformance (SCSC) plenary in San Francisco on September 20, 2011. It is expected the final publication will be submitted to the SCSC in February 2012 in Moscow, Russia.

The following questions were considered in the conduct of this case study:

- Based on the initial APEC Survey on Sustainability in Commercial Building Construction published in March 2011, further analysis was completed of voluntary programs, regulations and laws including whether life-cycle assessment (LCA) certifications are voluntary or mandatory—that is, required by governments or industry procurement programs
- Discussion of the similarities and differences in programs that serve the same purpose in each market
- Identification of similar programs that might be emerging in other markets
- Discussion of how these programs might facilitate trade or create barriers to trade
- Recommendations as to how APEC economies can work together to improve or streamline coordination for the region's programs.

With the most active economies in APEC being the United States, Canada, Japan, Singapore, and Australia the following questions were explored:

- Tools
  - — What other tools are being used for LCA certification?
  - — How does the BEES tool compare to the other LCA tools in use in the Asia Pacific?
- Certification programs in the 5 focus APEC economies and emerging programs being developed in other APEC economies, including China and Korea
  - — What standards are being used for LCA certifications?
  - — Who are the market users of the certifications?
  - — When crafting tools, standards and certification programs, are the developers thinking about whether these tools, standards and certifications will be accepted in other markets? How will other markets accept these services? Are there strategies for adoption of these services to any part of the Asia Pacific?
  - — Is there variability in the data, and if so how is that handled? How can the certainty of the data be improved?
- Access to markets and trade
  - — Do the tools, standards, and certification programs facilitate or hinder trade?
  - — Is access to this program open to any participant and is its structure transparent? Was the process to develop the standards in use open to participation by any interested party?
  - — Are the LCA certifications embedded in any other programs (such as rating systems)?

The first section of this report addresses tools used in APEC economies that are available to any interested party for conducting life-cycle analysis of products, processes, building assemblies, and whole buildings. The features, strengths and limitations of the models are evaluated for various types of users.

Section 2 of this report discusses the multiattribute LCA-based certification programs in the five key APEC economies. This section documents the origins, purposes, criteria development process and criteria, and conformance development processes and the conformance methods of the certification programs and how interested parties, including exporters, can gain access to the information about programs and their certification requirements.

Section 3 documents the market drivers for these certification programs through the eyes of the certification program managers, a limited literature review and (as indicated) by the link between multiattribute LCA-based certification programs and Green Building rating systems.

Sections 4 and 5 address emerging programs in other APEC economies. And the last section of the report documents the potential trade barriers of these certification programs and recommendations for how APEC economies can work together to improve alignment and coordination with regard to these programs.

2. Overview of LCA Tools in Focus APEC Economies

Tools useful for analyzing the life-cycle impact of green products are available in Australia, Canada, Japan and the United States, e.g. all but one of the focus economies (the exception is Singapore). Some tools are also in use in other APEC economies, including Chinese Taipei, Malaysia and New Zealand. The following provides a summary of these tools and their key characteristics.

Building for Environmental and Economic Sustainability (BEES), United States

The BEES[1] software was developed and updated by the National Institute for Standards and Technology (NIST) at the U.S. Department of Commerce. The software is used to evaluate the performance of building products and can be used to help evaluate the impact of complete buildings, as a summation of their parts. Its target audience is designers, builders, and product manufacturers. The goal of BEES is to generate environmental performance scores for building product alternatives sold in the United States. These are combined with economic performance scores to help the building community select cost-effective, environmentally-preferred building products.

Users can compare multiple building products using a functional unit of 0.09 m^2 (1 ft^2) of a product or service for 50 years, which allows comparable building products (such as toilets) to be substituted for each other, showing different impacts for each. Changes that can be made include weighting the relative importance of the 12 environmental impact categories, weighting environmental performance and economic performance based on various methods, changing the product distance transported, and changing discount rate. Table 1-4 summarizes impact categories analyzed by BEES.[2]

BEES is a user-friendly, fast and effective LCA tool. The online tool is free, works quickly, is accessible from anywhere and is easy to learn in half an hour. It does have, however, some limitations, including that data is not retained online, the tool does not evaluate product performance and does not analyze environmental impacts not scientifically proven, and evaluated products represent product line averages.

LCA Tools Used in the United States and Other Focus Economies

Records of LCA tools chosen by builders, planners and technical experts are often proprietary as the tools are privately owned, and data is often not collected when tools are available free online. A study by Verdantix, an independent analyst for sustainable business, collected data on LCA tools through interviews, though the data did not identify construction companies or groups who were required to use or were voluntarily using any LCA tools. The results of those interviews are shown below.

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1 BEES Online is the most recent of four iterations of the BEES model (http://ws680.nist.gov/Bees) The easy-to-use web platform includes a 15-page tutorial on the process.

2 Cost calculations are based on the American Society for Testing and Materials (ASTM) standard classification ASTM E 917, standard life-cycle cost method.

Tools to Evaluate Products

SimaPro: Australia, Japan, and the United States

SimaPro 7.3 is an LCA software tool developed by PRé Consultants, with 17 impact assessment methods and 8 inventory databases designed for construction professionals and facility managers. It is used to collect, analyze and monitor the direct and indirect environmental impacts of products and services in 11 attributes over their entire life cycle. Unlike the BEES and Athena software, SimaPro is designed to be used by dedicated professionals due to the financial and time investment required to operate it effectively. PRé Consultants has also developed ECO-it 1.4 to model product life cycles, including environmental impact and carbon footprint scores for commonly used materials such as metal, plastic, paper, board and glass as well as production, transport, energy and waste treatment processes. Scores from SimaPro can be fed into ECO-it analyses. SimaPro is used in two other APEC economies, Mexico and Malaysia, in addition to the focus APEC economies.

GaBi: Australia, Canada, Japan and the United States

GaBi is an environmental impact assessment tool for LCA, developed by PE Europe and University of Stuttgart's Fraunhofer Institute for Building Physics (IBP). The most recent iteration, GaBi 4, is ISO 14040 and 14044 compliant and allows evaluation of an organization, a facility, a process, or a product life cycle. GaBi includes the capacity to measure direct emissions from sites, areas, and activities, and indirect emissions from electricity, transport and production.

In order to develop a comprehensive life-cycle inventory and impact analysis, GaBi uses the NREL life-cycle inventory database and characterization factors of impact categories from the Chain Management by Life Cycle Assessment (CMLCA)[3] tool developed by the Centre of Environmental Science at Leiden University in the Netherlands and the EPA's Tool for the Reduction and Assessment of Chemical and other environmental Impacts (TRACI).[4] GaBi evaluates 16 environmental impact categories.

In addition to modeling products, GaBi combines the environmental product declarations (EPDs) from manufacturers of major building products in a structure that makes it possible to develop a building LCA across multiple impact categories. GaBi is also used in the APEC economies of Malaysia, New Zealand and Chinese Taipei.

[3] CMLCA supports the calculation of Life-Cycle Assessment (LCA) including social life cycle assessment (SCLA) and life cycle sustainability assessment (LCSA), input-output analysis (IOA) (including environmental input-output analysis, or EIOA), life cycle costing (LCC), eco-efficiency analysis (E/E), hybrid LCA, and combining LCA and EIOA. http://www.cmlca.eu

[4] In the TRACI methodology the impact categories were characterized at the midpoint level, including a higher level of societal agreement concerning the certainties of modeling at this point in the cause-effect chain. TRACI evaluates the environmental attributes of acidification, smog formation, eutrophication, human health cancer, human health noncancer, human health criteria pollutants (all developed specifically for U.S. conditions) as well as ozone depletion, global warming potential, ecotoxicity, fossil fuel use, land use and water use of products. The TRACI methodology reflects best practice for life-cycle impact assessment (LCIA) in the United States.

MiLCA LCA Software: Japan

Developed by the Japan Environmental Management Association for Industry (JEMAI), the Multiple Interface Life Cycle Assessment (MiLCA)[5] tool is general LCA software designed to support ISO 14040 Life Cycle Assessment. MiLCA has an inventory of 3,000 processes and related resource consumption and emissions, from the German Industrial Technology Research Institute Association. It uses the Japanese calculation-type damage assessment methodology LIME2 to evaluate 1,000 types of substances based on Japanese environmental conditions.[6]

Users add and modify impacts through a visual interface. While designed for the Japanese market, it can also project impact in other economies, using electricity data and models of 200 countries and regions. JEMAI has been producing LCA software since 2000; MiLCA is the most recent version. There is a free trial version that comes with limitations: a maximum of five sub-systems in any new process, import and export functions limited to case studies, and the software is not usable on corporate servers.

LISA: Australia

LISA is predominantly a materials and components LCA tool that also takes into account equipment used and other energy considerations. Developed by mining company BHP Billiton, it has a database of more than 65 materials. Categories covered include cradle-to-grave resource energy, greenhouse gas emissions, nitrous and sulfur oxides, suspended particulate matter made up of non-methane volatile organic compounds (NMVOC), and fresh water consumption.

Tools to Evaluate Whole Buildings or Industries

In addition to the LCA tools that evaluate individual products, tools to evaluate whole building life-cycle environmental impacts are available. The ATHENA EcoCalculator for Assemblies and Impact Estimator are two such tools used in Canada and the United States. EIO-LCA is used in the United States and Canada, as well as China.

Athena® EcoCalculator for Assemblies and Impact Estimator: Canada and the United States

The Athena Institute has developed two LCA tools that are useful to architects, engineers and other users. The first, the EcoCalculator tool, is used to evaluate building shell products and provides instant LCA results for commercial and residential building assemblies—that is, the building structure only—using separate versions of the model for commercial and residential buildings. “Building structure” includes the foundation, columns, walls, floors, windows and roofs. EcoCalculator is suitable for new construction projects, retrofits and major renovations, either for comparison of specific assemblies or to assess all assemblies in a structure.

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[5] http://www.milca-milca.net

[6] LIME2 was developed by Advanced Industrial Science and Technology (AIST) of Japan (www.jemai.or.jp/english/lca/pdf/JLCA-news-no6.pdf.) It is a spreadsheet software covering the environmental impact of 1,000 types of substances based on Japanese environmental conditions (lca-forum.org/English/pdf/No.10-11.pdf)

EcoCalculator uses Athena data and the U.S. Life Cycle Inventory Database from the NREL to evaluate the impacts on eight environmental attributes. The EcoCalculator has limitations, including not evaluating product performance or costs. Also, not all of the building's impacts during use (e.g. energy consumption) are included. It is not a cradle-to-grave LCA tool because impacts are estimated only through the construction stage of the life cycle. The EcoCalculator is downloaded to a user's computer and runs on Microsoft Excel, with a 2-page instruction sheet and five to ten inputs for each component of a building's construction. As a fairly user-friendly tool that allows users to see the impact of their changes quickly and simply, EcoCalculator is a good option for users who want more control over their life-cycle analysis than BEES can provide.

A second LCA tool from Athena is the Impact Estimator, which gives more flexibility and more results than the EcoCalculator. the Impact Estimator is designed to evaluate whole buildings over their operational life, including energy consumption and economic costs, making it a more comprehensive tool than the EcoCalculator. This cradle-to-grave analysis tool covers manufacturing construction, regional variations in energy use and transportation, building type and assumed lifespan, maintenance and replacement, demolition, and disposal Although the software is not a design tool, it is designed for people technically proficient in building design, as it is intended to express a design in sufficient detail for the purpose of estimating the environmental effects of a building. Practice is required to master the program, for which a trial version is available for free.

Economic Input-Output Life Cycle Assessment: Canada and the United States

The Economic Input-Output Life Cycle Assessment tool, operated by the Green Design Initiative of Carnegie Mellon, is free and easy to use. It covers the impact of industries as a whole (including construction but not individual buildings). The on-line tool is used broadly but is not applicable to individual building design. The tool is also used in China.

Envest: being adapted for Australia

Envest was developed in 1998 by the Building Research Establishment to meet UK construction needs. It covers both operational impacts and the materials-embodied impacts of a building as the design evolves, revealing building-life trade-offs. It makes explicit the environmental and financial trade-offs in the design process, allowing clients to optimize the final design according to their priorities. It uses a standard building as a template, which users modify for location, electricity, transport, and local conditions.

Comparison of BEES to LCA Tools in other APEC Economies

BEES can be compared to other LCA tools by examining its applicability in the APEC region. BEES is applicable only in the United States, whereas the Athena EcoCalculator and Impact Estimator are also usable in Canada. This is a key constraint to the use of BEES and its applicability to other APEC economies. Simapro and GaBi have wider geographic applicability. Simapro is usable in the APEC economies of Australia, Japan, Malaysia and Mexico in addition to the United States. GaBi can be used in Australia, Canada, Japan, Malaysia, New Zealand, Chinese Taipei, and the United States.

The five major tools can analyze products, buildings, assemblies (building shells), services, and/or processes, program complexity (how user friendly the software is), flexibility (in the capability to change inputs and calculations), detail coverage (the number and depth of description available for products), and product cost. BEES and the ATHENA EcoCalculator have low complexity, ATHENA ImpactEstimator has medium complexity, and Simapro and GaBi have high complexity. A low rating would be suitable for first-time users who can use the software within an hour, a medium ranking indicates users need 1-3 hours to become comfortable with the product, and a high rating suggests users need significant training or effort to use the program effectively. Flexibility relates to whether users can change the processes of the model. If they cannot change processes, the model is considered to have low flexibility; if they can change some processes, the model is considered to have medium flexibility, and if users can change a significant number of the inputs and calculations in the model, the model is considered to have high flexibility. BEES and ATHENA EcoCalculator have low flexibility, ATHENA ImpactEstimator and GaBi have medium flexibility, and SimaPro has high flexibility.

Detail coverage is a classification of the number and depth of the description available for products. BEES and ATHENA EcocCalculator have low detail, ATHENA ImpactEstimator has medium detail and SimaPro and GaBi have a high level of detail. Low detail indicates that only the outputs page is available for product details, medium that further information may be available, and high that it provides a comprehensive description of the impacts of products. Also indicated is the cost of the product—free, low (for products in the hundreds of dollars) or high (for products in the thousands of dollars). A summary of the features of the five major tools as well as the environmental attributes evaluated may be found in Appendix A.

3. Multiattribute LCA Certification Programs in Focus APEC Economies

Description of Certification Programs

General Description

The first portion of the case study examines how flooring materials fare in the use of multiattribute certification systems in the focus economies of Australia, Canada, Japan, Singapore and the United States. Flooring materials include carpeting, tile, resilient flooring and hardwood. The second portion of the case study examines how plumbing fixtures fare in the use of multiattribute certification systems in the focus economies. Plumbing fixtures include sinks, toilets, water closets, bathtubs, showers and showerheads, faucets, urinals, bidets, and other plumbing fixtures for kitchens and bathrooms.

There are many environmental labeling programs that operate throughout the APEC economies. The organizations below certify flooring products, plumbing fixtures or both. They also certify products that are used in the assembly process (e.g. adhesives), products made from recycled plastic or wood (including flooring) and all building products. Only those programs that certify these products (e.g. have criteria already developed) for these products and fixtures are included in this report. APEC economies that have no LCA-based, multiattribute programs that certify plumbing fixtures and flooring products (e.g. Mexico, Peru, Philippines) are not included in this report. However, Type III "Environmental Labeling" programs (see below) can certify any products that have a completed full LCA.

Programs are implemented by a variety of organizations ranging from government agencies to private organizations supported by fees only. Other than an Australian program that received a grant from the Queensland Department of Economic Development and Innovation, the only Focus APEC economy certification program affiliated with its government is Japan. The EcoMark program, managed by the quasi-governmental organization Japan Environment Association (JEA), is subject to Japanese Government approvals. The EcoLeaf program, managed by the nonprofit Japan Environmental Management Association for Industry (JEMAI), was initiated by the Japanese Government, with seed funding provided. The remaining programs are voluntary, and are managed by private profit or nonprofit organizations in Australia, Canada, Singapore and the US, and rely on donations, grants and/or fees.

In the International Organization for Standardization (ISO) vernacular, there are two types of environmental labeling programs. The first type, Ecolabels, are based on the ISO standard 14024, "Environmental labels and declarations – Type I environmental labeling – Principles and procedures." These are voluntary, multiple criteria-based third-party programs that award a license for the use of labels on products indicating the overall environmental preferably in a particular category, based on life-cycle considerations. Therefore, a full LCA is not required. The second type, environmental declarations, are based on ISO standard 14025 for Type III environmental product declarations, "Environmental labels and declarations – Type III environmental declarations – Principles and procedures." These are voluntary

programs to provide LCA based information and additional information on the environmental aspects of products. The purpose of this standard is to provide information for assessing the environmental impacts of products over their life cycle and to assist purchasers and users in making informed comparisons between products.

Table 3-1. Organizational Affiliations in Focus APEC Economies

Private Organizations (profit or nonprofit)*	Private Nonprofits (Fees plus Donations and Grants)*	Nonprofits Started by Government	Nonprofits Supported by Government	Quasi-Governmental	Government Agencies
• Canada Terrachoice • United States UL Environment • United States SCS Certified • United States Cradle to Cradle Products Innovation Institute	• Australia Good Environmental Choice Australia Ltd • Singapore Environmental Council • United States Institute for Market Transformation to Sustainability	• Japan Environmental Management Association for Industry	• Australia Green Tag (one-time grant from QLED)	• Japan Environment Association	• None

** Those listed in the second column titled "Private nonprofits" are those that stated so on their web pages. Those included in the first column as private organizations are either profit or nonprofit organizations as their websites contained no explanatory information as to whether they are profit vs. nonprofit organizations .*

Type I Ecolabel programs have been established in all five focus APEC economies. The earliest Type I programs were established in Canada and Japan in the late 1980s. Canada based Ecologo, established in 1988, was recently acquired by the US-based Underwriter Laboratories, a UL Standards organization. EcoMark was established by the Japanese government a year later. The Green Label program was established by the nonprofit Singapore Environmental Council in 1995. Most Type III EPD programs were established much later—after 2000. The first was the United States based Sustainable Choice in 1994. Next was Japan's EcoLeaf program. Australia-based Green Tag/Green Rate program has an integrated Type I and Type III program, as will be explained later, as does the U.S. based Sustainable Choice. The U.S. based SMART program just began a Type III program in 2011; it is also integrated with the Type I program. Table 3-2 provides additional detail about the programs and organizations established in each economy, including the type of organization and ownership or support, as well as whether the program is a Type I or Type III, and the year the programs were established.

Table 3-2. Establishment of Type I and III Multiattribute LCA- Product Certification Programs in Focus APEC Economies

Economy	Program Name	Organization	Org Type	Support or Ownership	Type of Programs	Year Type I Program Began	Year Type III Program Began**
Australia	Green Tag	Ecospecifier Pty Ltd	Private company	Grant from Queensland Dept. of Economic Development and Innovation	Type I, Type III	2003	2003
Australia	Global Environmental Choice	Good Environmental Choice Australia Ltd	Nonprofit	N/A	Type I	2001	N/A
Canada	Ecologo	Terrachoice	Private company	Majority-owned by UL Standards	Type I	1988	N/A
Japan	EcoMark	Japan Environment Association	Quasi-governmental foundation	Established by the Prime Minister, Budget approved by Minister of Environment	Type I	1989	N/A
Japan	Ecoleaf	Japan Environmental Management Association for Industry	Public corporation	Developed with support of Ministry of Economy, Trade and Industry. Industry members	Type III	N/A	2002
Singapore	Green Label	Singapore Environmental Council	Nonprofit	Grants and Donations	Type I	1995	N/A
Singapore	Green Building Product Certification	Singapore Green Building Council; supports BCA Green Mark Green Rating system	Nonprofit	Members - Corporate, Government, Associations	Type I	2010	N/A

Economy	Program Name	Organization	Org Type	Support or Ownership	Type of Programs	Year Type I Program Began	Year Type III Program Began**
United States	Certification Program	UL Environment	Private company	Wholly-owned subsidiary of Underwriter Laboratories	Type I, Type III	2005	2010
United States	Cradle to Cradle	Cradle to Cradle Products Innovation Institute	Nonprofit	Grants, Training, Product certification fees	Type I	2005	N/A
United States	SMART	Institute for Market Transformation to Sustainability	Nonprofit	Membership	Type I, Type III	2002	2011
United States	Sustainable Choice, Sustainable Choice Carpet	SCS Certified	Private company	Product Certification Fees	Type I, III	2008	1994

*LCA is often called “cradle-to-grave” analysis. Cradle-to-cradle is a specific kind of cradle-to-grave assessment, where the end-of-life disposal step for the product is a recycling process. It is a method used to minimize the environmental impact of products by employing sustainable production, operation, and disposal practices and aims to incorporate social responsibility into product development

** Note that Australia has also begun developing carbon footprinting programs, a specific Type III program focused only on the climate change impacts over the product life cycle. One program, the Carbon Reduction Label program, is managed by Planet Ark in Australia in conjunction with the Carbon Trust. Other APEC economies may have organizations that have developed or are developing carbon footprinting certification programs as well. The programs appear to be focused on consumer or agricultural products at this time.

Use in Certifying Plumbing and Flooring Products

Before describing how the above programs address plumbing fixtures and flooring product certification, it is important to provide some background on the various types of programs and how their criteria are developed.

The Type I programs vary in their approach to developing criteria. Most Type I certifications in the focus APEC economies—eight out of eleven—are “traditional” in that they develop criteria based on life-cycle thinking rather than a full LCA. Nine of the 13 Type I certifications are based on what is termed ”life-cycle thinking” rather than a full LCA; for purposes of this report they are termed “partial LCA”. [7] This

[7] The Australia GreenTag and GreenRate are two different certifications within one program. Therefore there are only 12 programs, but 13 Type I certifications. Each calculates criteria differently: GreenTag bases criteria on a full LCA and GreenRate bases criteria on a partial LCA. The Green Tag and Sustainable Choice full LCA-based programs both follow the BRE model of calculating the weighted results of the LCA over the potential life of the

means that an understanding of the life-cycle impacts was used to develop criteria, but a full LCA was not completed. Four of the five Type I programs, those established after 2000, are based on a full LCA rather than a partial LCA. These programs are further divided in terms of how this life cycle information is used in certifying the products. The first group conducts a full LCA and ranks the products against the general criteria (U.S. based Cradle to Cradle) or develops product-specific criteria based on the LCA (U.S. based SMART).

The second group conducts the full LCA and uses the LCA and other analysis to determine environmental preferability. The Ecospecifier Greentag certification calculates a score for the certified product by conducting an LCA. This approach is similar to that of the BRE program in the United Kingdom, where the LCA results for the certified product are compared to a business-as-usual (BAU), or average, typical product sold in the marketplace to obtain an LCA-based score.[8] A classification of the different Type I programs in terms of their approach to developing criteria may be found in Table 3-3.

Table 3-3. Type I Environmental Labeling: Methods to Develop Criteria in Focus APEC Economies

Type 1 Ecolabels Based on LCA Thinking "Partial LCA"	Type 1 Ecolabels Based on Full LCA Criteria	Type 1 Ecolabels based on Full LCA Compared to BAU
Australia based GreenRate • Australia based Global Environmental Choice • Canada based Ecologo • Japan-based EcoMark • Singapore-based Green Label • Singapore based Green Building Certification • United States based UL Environment Certification • United States based Sustainable Choice Carpet	• United States based SMART • United States based Cradle to Cradle	• Australia based GreenTag • United States based Sustainable Choice

Note: BAU represents the average or typical product sold in the marketplace

eco-preferred building material, compared to a BAU, or typical, product used in the market (typically over a period of 60 years). It is a number between "0" and "1," with the lowest ecological and health impacts being a "0" score. Sustainable Choice has 27 indicators grouped into 5 categories.

[8] A UK Ecopoint score is a measure of the overall environmental impact of a particular product or process covering 13 environmental impacts. UK Ecopoints are derived by adding together the score for each issue, calculated by multiplying the normalised impact with its percentage weighting. Australia's Green Tag/Green Rate program uses a tool called LCADesign/LCA Detail to conduct their LCA. LCADetail, a subset of LCADesign, is used to evaluate environmental impacts of 70 indicators for products. It produces the LCA-based score mentioned above. Licensed to Ecquate, but designed by the Cooperative Research Centre for Construction Innovation (CRCCI), LCADesign supports computer-aided design (CAD) and gives outputs by life-cycle category, using Building Information Modeling, providing an eco-profile comparing environmental impacts across the whole building supply chain to compare the impact of all products.

Many of the Type I programs have 4-6 levels with graduated criteria. The levels represent the products' positions in the marketplace. This can be based on what percentage of the market the product represents based on a score, such as with the Australia based GreenTag certification (e.g. top 20%), the number of points earned when compared to the standard criteria (e.g. 75 out of 100 points), or other methods. Some of the programs have common names for the various levels and others are partially or totally different. For instance, the names for the basic level of certification are all different (e.g. Bronze, Certified, Conformant, Basic and Sustainable), several use the same terms for the top three levels (e.g., Silver, Gold and Platinum or Sustainable Silver, Sustainable Gold and Sustainable Platinum) and one uses the terms Good, Excellent and Leader. Additional information about the requirements of the various levels may be found in the description of criteria in Appendix B.

There are two types of Type III EPD programs, the "full" EPD program and carbon foot-printing, which calculates only global warming potential over the life cycle of a product. Of the four "full" EPD programs, only one is a stand-alone Type III program, Japan's Ecoleaf. The other three integrate the implementation of the EPD program with the implementation of their Type I certification programs. Japan is the only focus economy with a carbon foot-printing EPD program. This program will be discussed later in the report.

There are ten Type 1 Ecolabeling organizations in the five APEC economies that certify the environmental impacts of flooring products and plumbing fixtures for commercial buildings. All of the programs for which there are product-specific criteria certify some type of flooring and/or flooring components or criteria for products made with recycled materials. Cradle to Cradle does not certify against product-specific criteria. Two of the programs, Canada based Ecologo and Japan based EcoMark, certify some plumbing products, for the most part water-conserving products. For a detailed chart showing the types of plumbing and flooring products certified by each program, see Appendix C.

Type III EPDs are based on a full LCA. The purpose is not, as with Type I labels, to determine the environmental preferability of products, but to compare the environmental impacts of products with the same functionality. The LCA (and the contents of the EPD) per ISO standards are to be governed by product category rules (PCRs). PCRs function as the "criteria" for the full LCA. Japan's Ecoleaf lists PCRs on its website, though the one flooring product and three plumbing fixtures listed have no associated PCR document available. Ecoleaf uses dedicated software to conduct the LCA; to date it has been used primarily for electronics LCAs, although its scope includes buildings. None of the other Type III programs —Australia based Green Tag/Green Rate, U.S. based UL Certification, U.S. based SMART, and U.S. based Sustainable Choice—have PCRs for flooring or plumbing listed on their websites and none were available upon request. Carbon foot-printing is one form of a Type III EPD that focuses only on global warming potential of the product life-cycle. Though no PCRs, or related EPDs, for flooring or plumbing products are available for these programs, there are publicly available PCRs and associated EPDs available or in development. These are described later in the document.

Standards Used

For Type 1 certification programs, the standards outline the requirements that the products must meet to qualify for the certification and to use the associated program label indicating an environmentally

preferable product. The standards developed for the multiattribute life-cycle based environmental labeling programs among focus APEC economies vary in terms of the types of attributes evaluated and the level of the requirement. The criteria have been evaluated separately for programs that use a partial LCA and those that use a full LCA to develop the criteria. Though many programs have similar criteria, significant differences are apparent. For example, the only criterion that all programs include is health (human health and toxicity). Also, while water use seems to be consistently addressed by all of the programs that certify plumbing fixtures, not all of the flooring certification programs address water; carpeting manufacturing in particular uses large amounts of water. Some of the programs do not address global emissions (global warming potential) or air emissions, including acidification, considered a key element of LCA, or energy, a key contributor to global warming potential. The fewest programs (four) address biodiversity. This is interesting since some of the program criteria relate to flooring made from natural wood harvested from biologically important forests. Summaries of the criteria evaluated for all Type 1 certification programs based on a partial LCA can be found in Appendix D.

Like the criteria for Type I partial LCA programs, the criteria for full LCA programs address human health and toxicity. They also all address global and local emissions, i.e., global warming potential, greenhouse gases, and air and water pollution. This is one of the main differences between criteria that are developed for a partial LCA and a full LCA. Global environmental impacts are a strong feature of full LCAs. Also, biodiversity is addressed by three out of four programs, though reducing material use, extraction specifically, is addressed by only two programs. However, Cradle to Cradle emphasizes closed-loop systems where materials are reutilized to the maximum extent possible. Australia's Green Tag program has unique criteria compared to the other programs. The program includes evaluation of an integrated design strategy (IDS) that represents the process by which buildings and their systems beneficially interact with occupants or associated buildings processes, providing enhanced outcomes, so that the integrated systems achieve a degree of synergy, thus reducing the resource intensity of the overall project. Summaries of the criteria evaluated for all Type I full LCA certification programs may be found in Appendix E.

Conformity Assessment Process

Conformity assessment entails verifying that the product meets the requirements of a given standard, including the criteria. Type 1 Ecolabel programs all begin with submission of documents and review by the certifying organization. However, the program features beyond that vary. Several of the programs engage a third-party auditor in line with requirements of ISO 17020. One company hired independent auditors through their own organization, i.e., a second-party verifier. It appears that SGBC and Ecologo perform the audits directly and several programs conduct audits only "when required" (or not at all). However, the criteria for judging whether an audit is required are not available.

Product testing requirements vary and is a subject worth further study. Product testing is required by five of the programs; two conduct testing only when required or deemed necessary by the certification program. Some of the programs include testing requirements in the product criteria or standards, whereas the criteria used to determine when testing is required is unknown for other programs. For two of the programs, testing requirements were unclear based on the information available. Lastly, five of the programs (approximately 50 percent) conduct post-certification surveillance and sometimes de-certify

products. Four of the programs, less than 50 percent, require that the auditors and/or testing facilities be accredited by or registered with an accrediting body. Interestingly, all four of the programs are in Australia and Singapore. The other programs do not appear to have this requirement. None of the programs mentioned accepting certifications completed in other economies. However, Singapore Green Label will accept test results from a Global Ecolabeling Network (GEN) member. A detailed summary of the conformity assessment procedures and requirements, including documentation, auditing, testing and post-license surveillance and accreditation requirements for auditing and testing facilities of the certification programs can be found in Appendix F.

Certifiers and verifiers play different roles in evaluating Type III Environmental Labeling programs. An LCA practitioner (the manufacturer or their consultant) is responsible for conducting the initial LCA and drafting the EPD. Rather than verify that the product meets the pre-defined criteria as with Type I programs, verification includes determining whether the EPD was prepared and the LCA was conducted according to the PCR rules chosen. Organizations involved in developing or certifying EPD programs play various roles. In many cases, the same organization acts as LCA practitioner, verifier of the LCA, and verifier of the EPD. Notably there does appear to be a practice of ensuring that the individuals verifying the LCA or EPD were not involved in conducting the original LCA or developing the original EPD. A detailed summary of the role organizations play in the certification programs, and the roles as defined in ISO standards, can be found in Appendix G.

The primary responsibility of a Type III conformity assessment is to verify the LCA that forms the backbone of the EPD. As with Type I Ecolabels, verifiers may perform audits. While U.S. based UL Environment acts only as a verifier of the manufacturer's EPD, United States based SMART, Japan's EcoLeaf, Australia based Ecospecifier Green Tag, and U.S. based SCS Certified's (SCS) Sustainable Choice programs hire either contractors or third-party EPD and LCA verifiers. SCS also conducts LCAs and develops EPDs. A detailed summary of the conformity assessment procedures for all Type III programs can be found in Appendix H.

Data Variability and Uncertainty

For Type I full LCA programs both the LCA and the reporting format vary by the PCR used. It is not clear what PCRs are used in developing the LCAs upon which these Type 1 full LCA programs are based. The apparent lack of common PCRs does impact the comparability of both the LCA "score" for those programs that calculate one, the criteria developed for those that do not use scoring and the LCA impact calculations, as well as the EPD format. Due to a lack of access to flooring product or plumbing fixture LCA profiles for the focus APEC economies that develop Type 1 labels based on a full LCA, a comparison was completed between a BRE (UK certification organization) environmental profile for Tufted Tiles and an EPD for tile carpeting published on the website of the Institut Bauen und Umwelt e.V (IBU). Out of 13 environmental attributes evaluated by IBU, only seven were evaluated by BRE. A comparison of the attributes evaluated by both programs may be found in Appendix I.

Market Issues

Government procurement regulations favoring or requiring green products, as well as regulations allowing local jurisdictions to add requirements to their codes, are important driving forces of the market for green building products. In March 2011 a survey of APEC economies documented the current and planned codes, standards and regulations relating to Green Buildings and associated environmentally preferable materials and products. During the research for this project, interviews were held with certification program staff and independent experts to clarify information from the survey. In the March survey, the Australian government noted that government procurements require a Green Star rating. Additional research identified that the government plans to introduce LCA materials credits as well. While the March survey found that national building and plumbing codes may introduce additional green requirements, this is not expected to happen. However, the British Columbia province has recently passed legislation allowing local governments to pass more stringent building codes. Japan responded to the March survey that green building requirements were mandatory in some "obligatory areas". Additional research identified that some local governments do require a CASBEE rating for buildings of a certain size. It is not clear whether this is only for government buildings or which local governments have this requirement. Singapore established mandatory green building codes for existing and new buildings over a certain size, according to responses to the March survey. No new information was obtained. The U.S. federal government, through an executive order, has established green requirements in federal purchasing regulations. Research found that the General Services Administration and the U.S. Navy have now adopted LEED requirements in their purchasing programs. Products are scored by the Navy on how they benefit the environment in 11 life cycle categories from climate change to smog. Expansion of the U.S. Lacey Act to cover wood products could mean that companies will be prosecuted for purchasing illegally harvested wood; the companies will be more concerned about the source and will want to rely on trustworthy certification programs.

Other Market Drivers and Channels

In Australia, certification program operators believe there is a perception among manufacturers that "green" is a major driver of the market. Therefore, they seek LCA certification to differentiate themselves in the market. Also, they "see the writing on the wall" for carbon. As mentioned above, the British Columbia province in Canada proposed a building code revision that would allow local governments to make laws regarding conservation of energy and water, also to reduce greenhouse gases. According to a 2008 survey completed by the *Climate Change Business Journal*, the top market drivers in the United States include rising energy costs, government incentives, and improved cost and performance of sustainable materials and green building features and equipment.

They also believe there is demand from the government, architects and designers for buildings with low greenhouse gas emissions. In fact, market users usually approach Ecospecifier Green Tag program staff requesting a carbon footprint analysis; Ecospecifier educates them about the other environmental attributes that need to be assessed in a full LCA. Australia spends more than $10.1 billion per year in increasing environmental performance in the market and has passed over 100 pieces of legislation relevant to environmental performance of industry and community. Therefore, companies have initiated policies in their operations.

Consistent with the trends in several of the focus APEC economies to focus on Green Building rating systems, the Director of the United States SMART certification program, also the founder of LEED, noted that USGBC appears to be constantly searching for the "next green product" and environmental labels to provide a transparent description of why the product is "good". Green Building Rating Systems appear to be a strong market for these products. Most certification organizations, including Australia based Green Tag and Global Environmental Choice programs, United States based SMART, UL Certification, and Cradle to Cradle programs, and Japan based EcoMark program have applied for, and gained approval, for their certified products to earn "points" in Green Building rating systems. Products certified by both Singapore certification programs earn points in the Singapore Green Mark rating system and others, including the United States based Sustainable Choice Carpet program, are earning points under the Innovation category (though it is not clear whether any of the products were flooring or plumbing). The USGBC's next update to the LEED green building program, coined LEED 2012, includes updates to the Materials and Resources credit category. The update includes an increased focus on the application of LCA to encourage transparency of information about products. A new credit rewards the use of materials for which EPDs have been made to increase transparency and enable more informed decisions about product specification. The previous LCA pilot credits and innovation credits for LCA-certified products will be eliminated.

Retailers have a large influence in the market for certified products as well. Home Depot is the leader in single-attribute products and is considering the promotion of multiple-attribute certified products. A "halo effect" extends into the marketplace whereby selling environmentally preferable products in stores has a positive impact on the sales of other products.

Recent information suggests that consumers will pay more for a sustainable product if the environmental claim is simple and transparent; consumers, particularly businesses, may even pay more in certain markets. Though consumers want what is good for the environment, the economy and social equity are equally important and also drive the market.

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4. Emerging Multiattribute LCA Certification Programs in Other APEC Economies

Description of Certification Programs

General Description

Many environmental labeling programs have been established in other APEC economies. Flooring products and/or plumbing fixtures and equipment, as well as products used in the assembly process (e.g. adhesives), products made from recycled plastic or wood (including flooring) and all building products. All of the organizations that manage certification programs other than Hong Kong, China based Green Label are supported in some way by governments, meaning that they were initiated by their governments, are supported with funds or are provided government budgets, or are themselves government agencies. These governments took the lead in establishing the certification programs, with the two nonprofit organizations in Hong Kong, China and Russia following their lead. Only two of the seven programs are based on a full LCA. Most rely on a partial LCA, as explained further below. The programs in Korea, Chinese Taipei, New Zealand, China, and Thailand were established in the early 1990s, and the programs in Hong Kong, China and Russia were established in about 2000. The Korea Type III labeling program was established by law in 2009, but when the Chinese Taipei program was established is unclear. Table 4-1 notes the various types of implementing organizations in other APEC Economies and Table 4-2 provides details on organizational affiliations and dates the programs were established.

Table 4-1. Organizational Affiliations in Other APEC Economies

Private Organizations (Profit or Nonprofit)*	Private Nonprofits (Fees plus Donations and Grants)*	Nonprofits Started by Government (with funding)	Nonprofits Supported by Government	Quasi-Governmental (including subject to Government approvals)	Government Agencies
None	• Hong Kong, China's Green Label	• Chinese Taipei based Green Mark • New Zealand's Environmental Choice	• Russia based Vitality Leaf	• Thailand based Green Label	• China's Environmental Labeling Program • Korea's Ecolabel

Note: Those listed as private nonprofits stated nonprofit status on their web pages.

Table 4-2. Establishment of Programs in Other APEC Economies

Economy	Program Name	Organization	Org Type	Support or Ownership	Year Program Began
China	China Environmental Labeling	China Environmental United Certification Center	Government	Established by Chinese Government, reporting to the China Certification Committee for Environmental Labeling (CCEL), which in turn is overseen by the State Environmental Protection Administration (SEPA)	1993
Chinese Taipei	Green Mark	Environment and Development Foundation	Nonprofit	Start-up fund and technology transfer from the Industrial Technology Research Institute ("ITRI").	1992
Hong Kong, China	Green Label	Green Council	Nonprofit	Membership fees, donations, sponsorships, grants	2000
Korea	Ecolabel	Korea Environmental Industry and Technology Institute	Semi-governmental	Established under Development of and Support for Environmental Technology Act, subsidiary to Ministry of Environment	1992
New Zealand	Environmental Choice	New Zealand Ecolabel Trust	Public corporation	Initiated and endorsed by NZ Government, and Supported by NZ Government directly and indirectly.	1992
Russia	Vitality Leaf	St. Petersburg Ecological Union	Nonprofit	Non-commercial partnership of environmental organizations. Supported by municipal administration and several state certification bodies.	2001
Thailand	Green Label	Thailand Environment Institute	Nonprofit	In association with Ministry of Industry who appointed Board members in 1994. Minister also sits on the Board.	1994

Use in Certifying Plumbing and Flooring Products

As with the focus APEC economies, there are two types of environmental labeling programs: (1) Ecolabels, based on the ISO standard 14024 "Environmental labels and declarations – Type I environmental labeling – Principles and procedures," which do not require a full LCA; and (2)

environmental declarations, based on the ISO standard 14025 for Type III EPDs, "Environmental labels and declarations – Type III environmental declarations – Principles and procedures,." which provide information for assessing the environmental impacts of products over their life cycle and to assist purchasers and users in making informed comparisons between products.

Most Type I certifications in the other APEC economies (that certify flooring and plumbing products), are "traditional" in that they develop criteria based on life-cycle thinking rather than a full LCA. As mentioned above, two of the Type I programs are based on a full LCA rather than a partial LCA. Those that do conduct a full LCA base their standards on product-specific criteria. None of the programs in the other APEC economies have levels with graduated criteria.

As in the focus APEC economies, there are two types of Type III EPD programs, the "full" EPD program and carbon foot-printing. Though both Korea's Ecolabel and Chinese Taipei based Green Label parent organizations, the Korea Environmental Industry and Technology Institute and the Chinese Taipei Environment and Development Foundation, respectively, state that they have EPD programs, there are no PCRs or verified EPDs available on their websites. Therefore, it is not possible to determine whether they have certified any flooring or plumbing product Type III environmental labels. Table 4-3 shows the program categories in other APEC economies. A summary of what types of flooring products and plumbing fixtures are certified by each program may be found in Appendix J.

Table 4-3. Types of Programs in Other APEC Economies

Type 1 Ecolabels Based on LCA Thinking	Type 1 Ecolabels Based on Full LCA and Criteria	Type 1 Ecolabels Based on Full LCA compared to BAU	Type III Environmental Declarations*	Type III Environmental Declarations—Carbon Footprinting*
• Russia based Vitality Leaf • Thailand based Green Label • New Zealand's Environmental Choice • China's Environmental Labeling • Hong Kong, China based Green Label	• Korea's Ecolabel • Chinese Taipei based Green Mark	• None	• Korea and Chinese Taipei EPD programs	• Korea's carbon foot-printing program • Chinese Taipei based carbon foot-printing program • China's carbon foot-printing program • Thailand based carbon foot-printing program

**It appears these programs address only electronic products, not building products (including flooring products and plumbing fixtures. The Type III programs (EPDs and carbon foot-printing) in Korea, China and Chinese Taipei are being developed by the same organizations that manage the Type 1 Ecolabel programs and these are the organizations that are members of GedNet. The Thailand carbon foot-printing pilot program is managed by the Thailand Greenhouse Gas Management Organization.*

Standards Used

As in the focus APEC economies, all of the economies' programs address health and toxicity. Most of the programs in these economies address waste, three out of five have criteria in the category of Material and

Energy and only two for water and GHGs. Local laws and regulations are clearly included in the general criteria for two of the programs. Since ceramic tile and sanitary products and plumbing are covered by many of these programs, a greater emphasis on water and energy may be expected. It is also interesting to see so little emphasis on greenhouse gases.

Unique criteria for programs in these economies include sustainable wood and transport, and an emphasis on regional impacts. The inclusion of radiation is due to the certification of tile (Hong Kong, China). Many of the unique categories are very general "resources" or do not relate to environmental criteria directly, as in consumer information and truth in advertising. Product performance is key and reflects the emphasis in this region on product quality.

Both Korea's and Chinese Taipei based programs use a full LCA. While toxics and air emissions are addressed, global emissions are not addressed at all (a contrast with the focus APEC economy programs based on full LCA that mostly address global emissions). Details on criteria evaluated can be found in Appendix K.

Conformity Assessment Process

All of the programs in other APEC economies require audits, including two programs that require third party audits. All but two programs require testing. China and Hong Kong, China based programs test when necessary or when required by the program protocol. All but Chinese Taipei, Thailand and New Zealand programs conduct ongoing surveillance. All but two of the programs require accreditation or approval of auditors and/or testing facilities. Only three of the programs mention mutual recognition of testing facilities and verifiers from other economies and programs, with Chinese Taipei requiring third-party verification. There is little public information about the Type III environmental labeling programs. Though KEITI's website mentions a Type III program, there is little information available to understand how the program works in terms of EDF's role. However, Chinese Taipei states that their EPD program is based on the International EPD® system (EPD System). The EPD System is a Swedish organization; a representative of the Chinese Taipei Environment and Development Foundation is an expert serving on one of the EPD System's committees. Therefore, he should be familiar with best practices in terms of process and analysis for Type III programs. There is no specific information on who performs the verification of the LCAs or EPDs. Details about the Type I and III conformity assessment procedures, including accreditation requirements, may be found in Appendix L.

Data Variability and Uncertainty

Issues with data variability and uncertainty are similar in the other APEC economies to those in the focus APEC economies. As mentioned, Chinese Taipei is closely connected to the Swedish organization, The International EPD® system (EPD System). This organization has, as a main objective, the ambition to support organizations to communicate the environmental performance of their products in a credible and understandable way.

The EPD System offers a complete program for developing and communicating EPDs and supporting other environmental declaration programs, seeking cooperation and harmonization. A member of the Global Type III Environmental Product Declarations Network (GEDnet), EPD System is currently

revising the PCR for construction materials and systems. They have recently drafted a PCR for construction and are developing two PCRs for "Sanitary wares"; one for sinks, basins, baths, and the like made of iron, steel, copper or aluminum and the other for ceramic sinks, baths, water closet pans, flushing cisterns and similar sanitary fixtures. Development of these PCRs is part of a series in a wide project to develop a complete set of rules for green building in the EPD System.

Market Issues

Government procurement regulations favoring or requiring green products, as well as regulations allowing local jurisdictions to add requirements into their codes, are important drivers of the market for green building products. Some information was verified and additional information was found regarding the mandatory programs in these economies. The March 2011 survey documented information for two APEC economies, Hong Kong, China and Korea, both stating that their green buildings and materials standards are voluntary. Further research indicates that Korea and Chinese Taipei have strong government procurement programs that require the purchase of a percentage of environmentally preferable products (and in the case of Korea, products may be required to be certified by Korea Ecolabel). The Korean government, through KEITI, the manager of the Ecolabel program, sets green purchasing (GP) criteria for government and annual GP targets. National and local governments must purchase a percentage of certified products, including some building materials. Priority purchase of certified products is indicated in the procurement guidelines of municipalities, and construction specifications and incentives are often provided through additional bid points for certified products. The Framework Act on Low Carbon Green Growth establishes GHG reduction targets for business with a certain level of emissions. The scope is widened annually. The government plans to establish GHG reduction targets by industry, including buildings (the final version was to be confirmed with stakeholder input in July 2011). In the March survey, Chinese Taipei indicated that regulations require certified products. Additional research identified specific requirements, including a certain percentage that agencies must purchase of green products, up to a 10% price differential. The first batch of products approved for this purchasing program did not include plumbing fixtures or flooring products.

Except for New Zealand, Green Building rating systems do not appear to be a prime driver of "green" building materials in these economies. However, Russia does plan to include Vitality Leaf certifications into its LEED Green Building standards.

Korea is focused on exports because 70 percent of its products are exported to the EU. Two trends in Europe are influencing their approach: (1) ISO 14067 and (2) the EU. The EU is expanding the concept of energy-utilizing products to include water, now called energy-related products. Energy-related products must meet the requirements of the Conformity European (CE) mark. France's requirement for carbon foot-printing is pushing Korea (as well as Japan, Chinese Taipei, Thailand and China) in the direction of carbon foot-printing. They are using an ISO draft standard, ISO CD 14067, to develop their programs. The only PCRs being developed are for carbon foot-printing (Korea and France will soon meet to discuss CF PCRs).

In Russia, investors, construction companies and design organizations are demanding environmentally preferable products. According to polls conducted in Russian stores CASTORAMA and House Laverne, 30 percent of buyers want to see environmentally friendly products on store shelves. In New Zealand, manufacturers, architects and designers want to earn points with NZGBC. Multinational companies, banks and large local companies are emphasizing environmentally preferable products in their tenders and projects. Governments, both local and national, are also emphasizing certified products in their tendering documents.

5. Standards and Certification Programs in Focus APEC Economies Expanding to Other Markets

Mutual Recognition

There are several programs in the focus APEC economies for mutual recognition. Canada and Japan based programs recognize other specific programs, and the Singapore Green Building Product Certification program recognizes any ecolabeling program, including those that are single-attribute programs. Singapore based Green Label, a Global Ecolabeling Network member, recognizes all GEN members' programs as equivalent (this is true of all GEN members).[9] Programs based in Australia accept other certifications only when it has confidence in the data quality and scope.

Mutual recognition for programs based in other APEC economies is driven mostly by GEN membership, as all of the programs based in these economies are members. In addition, Thailand based Green Label signed agreements with programs in six economies, and Korea's program provides support to programs based in Japan, China, Chinese Taipei, and Thailand in auditing, screening documents and testing for foreign certifications. A unique feature in these other economies is the fact that many of the programs (all but that of Hong Kong, China) have some kind of government affiliation. Additional information about publicly available mutual recognition agreements between programs may be found in Appendix M.

Approach of Developers

Developers of certification programs were interviewed about the other markets that recognize their product certifications and their plans for expanding their programs into other markets. Australia based Green Tag is currently recognized in the Middle East, Southeast Asia, South Africa, India and China and is expanding by making formal applications in several North American and Southeast Asian economies. US based UL Environment and Canada based Ecologo have formed a joint venture to become a global certification organization. Ecologo has been expanding rapidly in the United States and is ramping up to work more in Europe and Asia. Korea's Ecolabel in particular is seeking to certify for products sold in Europe. The carbon foot-printing programs are preparing the economies for increased demand of corporate purchasing programs, though it does not appear that any of these programs currently certify building products. Membership in GEN appears to be the main approach to expanding markets for members of GEN (all but Australia based Green Tag and the U.S. based certification programs). Other

[9] The Global Ecolabeling Network is a nonprofit association of Type I ecolabeling organizations founded in 1994 to improve, promote and develop the ecolabeling of products and services. Since 2001, GEN has developed a mutual recognition approach specific to ecolabeling including agreements, common core criteria for certain products, and participated in ISO meetings. A GEN Internationally Coordinated Ecolabeling System "GENICES" was formulated in 2003. GENICES provides a mechanism for enhanced cooperation and collaboration in product certification, criteria development and review.

GEN members include organizations from Southeast Asia, South Asia, Europe and Brazil. Information about GEN and its members may be found in Appendix N.

An indication of plans to expand Type III EPD programs can be gleaned from analyzing which economies are members of the Global Environmental Declarations Network (GEDnet). GEDnet, founded in 1999, is an international nonprofit association of Type III environmental declaration organizations and practitioners. Japan's Ecoleaf and the Sustainable Choice program based in the United States are members of this organization, as are Korea and Chinese Taipei based EPD programs. China is a member of GEDnet, which is consistent with its plans to develop a Type III labeling program. GEDnet provides a central repository for PCRs as well as a forum for sharing best practices. Information about GEDnet may be found in Appendix O.

Openness of Markets

All APEC economy certification programs are open to any interested manufacturer, but for manufacturers and other market users to gain access to the various certification programs, the first step is to determine the coverage and requirement of the target market. Does an APEC economy's program certify products that are intended to be sold in the target market? As discussed above, the approach varies between economies, including how the information on each standard is presented.

Availability of Information on Criteria and Conformity Assessment Procedures

The standard for the Australia-based Green Tag program is not instantly available on the Ecospecifier website but is available upon completion of a request form acknowledging the purpose of the request. The document details the program rules and procedures, as well as the criteria. All criteria (general and specific) for Green Tag are in one program document and must be requested by completing and submitting the form. For Canada based Ecologo program, a request must be made on line to obtain a copy of the criteria. For the Japan based EcoMark program, most product criteria are listed but some are grouped in categories; building products are repeated in several categories (includes plumbing fixtures). The US based UL Certification and Sustainable Choice programs' criteria are not listed on their websites because they are based 100 percent on NSF 140 and NSF 332 standards, which are available through NSF International. U.S. based Cradle to Cradle criteria apply to all products. China's website lists products where criteria can be accessed, but there is no access to the criteria. Vitality leaf, based in Russia, includes information about one certified wood product, but criteria are not available on the website. All of the other programs, including programs in Hong Kong, China, Singapore, Chinese Taipei, Thailand, and New Zealand, provide a list of products with associated criteria.

Many of the programs in the APEC economies with flooring and plumbing certifications have excellent transparency and access to information about the choice of product categories and criteria development process, actual criteria standards, and their application and conformity assessment practices. Other programs may have good access to some information but not others. For example, the U.S. based SMART program criteria are readily available on the website but there is little to no information about the processes for developing those criteria; and Korea's Ecolabel program has very thorough information. Lastly, some have little information publicly available about their programs, either content or process.

Those with excellent transparency include the Australian based Green Tag/ Green Rate program, which has all relevant information available, including mutual recognition information. Japan's EcoLeaf website contains all relevant information, including mutual recognition agreements, as does the Singapore based Green Label program. The Hong Kong, China based Green Label program has thorough information available as does the Thailand based Green Label program.

Those with what may be termed "medium" transparency include the Australia-based Global Environmental Choice, which has most information available, except for the operating guidelines (these were requested but not received). Canada-based Ecologo has all information about the program but nothing on mutual recognition. Japan-based Ecomark provides the criteria but not much detail on the conformity assessment process. All relevant information is available for the Singapore-based Green Building Product program except for details about testing. Of the U.S. based programs, the Cradle to Cradle program has good information, but the conformity assessment and testing process is unclear, and the same is true for the UL Certification program. The U.S.- based Sustainable Choice program does provide a reference to an ANSI process standard in development that is based on their methodology, but no information about their conformity assessment process. Korea's Ecolabel program has excellent information. The Chinese Taipei based Green Mark program provides criteria but little information on processes. China's Environmental Labeling program website information is poor; though a flow chart of their process is provided, criteria are not available. Information about mutual recognition agreements is not publicly available on most websites.

Stakeholder consultation is an expected part of the certification process. The Australia based Green Tag and Global Environmental Choice programs, as well as Japan's Ecoleaf program, have excellent stakeholder engagement processes that are clearly described on their websites and information posted for public input. Japan based Green Mark, both Singapore programs, and the Thailand based Green Label programs had some information available about stakeholder consultation processes. None of the other programs had sufficient information available on their websites to determine whether there was a process or the extent of stakeholder consultation.

6. Trade Impact of Standards and Certification Programs

Standards and Certification Programs

Environmental labeling and certification requirements can provide important information to consumers and users, but they can also have significant impacts on trade, particularly when requirements differ or there is a lack of transparency in their development and application. Because many APEC economies have used or are considering using environmental labeling and LCA for building products, a discussion of labeling and LCA programs and an awareness of how they differ can be helpful in encouraging cooperation among public and private stakeholders to minimize differences and facilitate trade in environmentally friendly products. Making information about rating requirements more transparent, aligning rating requirements more closely, and other collaborative efforts can make international trade in environmentally friendly products easier. This study also informs APEC member economies of the variety of certification programs available and of trends in environmental labeling and certification.

The wide variety of certification programs in the Asia Pacific gives consumers (both business and government) options to choose from but can also make complying with the various requirements challenging and costly. Companies may have to comply with voluntary standards in markets where consumer preference for products that comply with those standards is strong, or they risk exclusion from those markets. As green product standards continue to be developed in the region, greater alignment to international standards and systems of conformity assessment could facilitate trade. Harmonization or alignment of certification programs to international standards diminishes the potentially trade-restricting effects of such programs. APEC members can continue to participate in the development of international standards for building products and reference such standards in national programs. Differences in certification programs may adversely affect trade in green and LCA for building products. The following areas have potential for standardization which would allow trade in these produces to expand:

- Terms and definitions used in the various certification programs in APEC economies are not standardized. For instance, colors (e.g., gold plus, platinum, and bronze) have different meanings in different programs.

LCA programs should use international standards such as ISO and ASTM which have defined concepts and principles for LCA. LCAs for Type III labels are often conducted without PCRs vetted with stakeholders, as required by ISO 14040. Without PCRs, there are no common standards upon which to base an LCA and, importantly, no ability to compare products' environmental impacts on a comparable basis (the functional unit), which is the purpose of a Type III label.

- Independent audits and testing of green buildings are not handled consistently among APEC economies. Not all economies require accreditation of auditors or testing facilities based on international systems of conformity assessment. Some certification organizations—those based in Australia and the United States as well as the the Singapore-based Green Building certification program—require audits, but others—Singapore-based Green Label, Canada-based Ecologo and Japan-

based EcoMark—do not. Of those that require audits, three require third-party audits, and the others do not make audit requirements clear. The program based in Hong Kong, China, does not require audits. Only three programs based in APEC economies—the Green Label program in Hong Kong, China; Chinese Taipei's Green Mark and Korea's ecolabel program—accept audits and testing performed in other economies.

- Testing requirements for certifying green building products are not consistent. Six programs implement testing, and three programs make testing optional. Only one organization accepts test results from a Global Ecolabeling Network (GEN) member (the Singapore-based Green Label Program) although four of the 10 economies are GEN members.
- Accreditation of testing facilities is not consistent. Information about whether the Ecologo program in Canada, the Ecologo program in Japan and the US-based programs (including UL Environment, Cradle to Cradle, SMART and Sustainable Choice) accredit testing facilities was not publicly available.
- Furthermore, ongoing surveillance of product performance post-license is not treated consistently across APEC economies. Programs in Australia, Canada, Chinese Taipei, and Thailand do not conduct post-license surveillance, while other programs do conduct such surveillance. This inconsistency does not promote mutual recognition of private programs.
- Criteria for Type I programs are not aligned or transparent. For example, the programs in focus economies do not share criteria other than health and toxicity. Although the ISO 14040 series suggests regional differences should be taken into account, the differences among the criteria are greater than would be expected, which could hinder mutual recognition.
- There is a lack of transparency in what the certifications represent due to differences in naming conventions for certification levels (e.g. silver, gold, platinum). For example, a product rated "gold" in would rank differently in different systems. This lack of transparency is a barrier to trade. Consistent branding is key to effectiveness of environmental labels, even in business-to-business communication.

Also, the processes used to develop programs were not all open and transparent, based on stakeholder input. The US-based UL certification and SMART programs are based on ANSI standards developed using an open, transparent process and programs based in Australia, Canada-based Ecologo, Environmental Choice in New Zealand, Japan-based EcoMark, Japan's EcoLeaf, both Singapore-based programs, and the Thailand-based Green Label have clear processes for developing criteria that engage all relevant stakeholders. However, the initial process for developing the US-based Sustainable Choice program was not open and transparent (except for the Sustainable Choice Carpet program, which is based on an NSF standard). An ANSI process is in place to develop a standard based on the Sustainable Choice proprietary certification process. It is not clear how the criteria are developed for the US-based Cradle to Cradle program. Programs that are developed without broad stakeholder input may include provisions unique to those programs that could make the certification program a barrier to trade.

Many program websites either do not provide process and content information or make finding the information very difficult. Without process and content information, exporters cannot determine the most cost-effective path to entering new markets. Some information about the SCS Certified program, based in the United States, and other programs in APEC economies such as Korea and China, is difficult to find. The Vitality Leaf program based in Russia did not have criteria on its site. The Korean program's English

site was not discoverable through search engines or links (Ecolabelindex or US EPA listing) and is accessible only if an individual provides the link (though it is a member of GEN).

Even when criteria are available, finding the relevant criteria can be difficult; thus, exporters may not have enough information to choose where to have their product certified. For example, Japan's EcoMark website repeats the "building products" category several times; finding plumbing fixtures requires hunting for them in several places.

Government Procurement

As noted earlier, government procurement regulations in several APEC member economies require construction contractors to achieve certain ratings for buildings that they construct. If regulations can be followed only by providers or products in their own economy, the regulations present a trade barrier to other entrants. These include:

- Korea has a preference for environmental purchase programs for government agencies. These require certification by Korea Ecolabel.
- Chinese Taipei also has mandatory green procurement. Products must be approved and recognized by the government. This makes it more difficult for companies that wish to import into Chinese Taipei.

Harmonizing criteria and recognizing other ratings will keep the market open in a nondiscriminatory manner.

7. Recommendations

Based on the analysis provided in this case study, the following are recommendations for areas where APEC economies could continue to work on measures to ensure an open trading environmental for building products.

- Encourage the use of relevant international standards for voluntary and mandatory LCA and environmental labeling.
- Encourage APEC members to participate in international standards development activities relating to LCA.
- Ensure that labeling schemes are developed in an open and transparent manner, do not inhibit trade, and meet obligations under the WTO TBT Agreement.
- Open participation in product environmental declarations development to all relevant stakeholders.
- Strive for recognition and use of international systems of conformity assessment.
- Strive for transparency improvements pertaining to Type III programs so that the environmental product declarations (EPDs) make the underlying PCRs clear. Type III certification programs should require PCR information in order to certify the EPDs.
- Encourage the APEC SRBs to consider activities that will advance harmonization or alignment of the standards for environmentally preferable building products.
- Consider cooperative arrangements or recognition of equivalence between programs for labeling of building products and materials
- Information about LCA and labeling requirements should be transparent and easily accessible to potential users both within and outside an economy.
- Continue to promote information exchange about LCA and labeling requirements. APEC members should consider sharing their experiences in LCA for green building products in the WTO Committee on Technical Barriers to Trade (TBT).

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Annex A. Major LCA Tools in Focus APEC Economies—Features and Attributes

Table A7. Geographic Applicability of LCA Tools

Economy Used	BEES	ATHENA EcoCalculator	SimaPro	ATHENA Impact Estimator	GaBI
Australia			X		X
Brunei Darussalam					
Canada		X		X	X
Hong Kong, China					
Indonesia					
Japan			X		X
Malaysia			X		X
Mexico			X		
New Zealand					X
Papua New Guinea					
Peru					
Philippines					
Singapore					
Chinese Taipei					X
Thailand					
United States	X	X	X	X	X
Viet Nam					

Table A2. Qualities of LCA Tools

Qualities, Tool	BEES	ATHENA Eco-Calculator	SimaPro	ATHENA Impact Estimator	GaBI
Development organization	EPA (US)	ATHENA Institute, et al	PRé Consultants	ATHENA Institute	PE Europe,et al
Analysis level	Product	Assembly	Product and Service	Building	Product, Process
Program complexity	Low	Low	High	Medium	High
Model flexibility	Low	Low	High	Medium	Medium
Detail coverage	Low	Low	High	Medium	High
Cost	Free	Free	High	Moderate (free trial)	High
Includes impact of use (or just manufacture)	N	N	Y	Y	Y
Energy consumption	Y	N	Y	N	Y
Environmental impact	Y	Y	Y	Y	Y
Economic costs	Y	N	Y	Y	N
Combined Env + Econ performance	Y	N	N	Y	N
Performance evaluation of product, fitness for purpose	Y	N	Y	N	N

Note 1: Athena Institute, University of Minnesota, Morrison Hershfield Consulting Engineers

Note 2: PE Europe, University of Stuttgart's Fraunhofer Institute for Building Physics (IBP)

Table A3. Environmental Attributes Assessed by LCA Tools

Attributes Evaluated	BEES	ATHENA EcoCalculator	SimaPro	ATHENA Impact Estimator	GaBI
Global warming potential	Y	Y	Y	Y	Y
Acidification potential	Y	Y	Y	Y	Y[1]
Eutrophication potential	Y	Y		Y	Y
Fossil fuel depletion and consumption	Y	Y	Y	Y	Y
Habitat alteration, land use	Y		Y		Y
Criteria air pollutants	Y				
Human health	Y				Y
Smog	Y	Y		Y	
Ozone depletion	Y	Y	Y	Y	Y
Ecological toxicity	Y		Y		Y[2]
Water intake	Y				
Indoor air quality	Y				
Resource use		Y		Y	
Mineral use, extraction			Y		Y

[1] *Athena Institute, University of Minnesota, Morrison Hershfield Consulting Engineers*

[2] *PE Europe, University of Stuttgart's Fraunhofer Institute for Building Physics (IBP)*

Annex B. Type 1 Certification Programs in Focus APEC Economies – Levels of Certification

Table B1. Type I Ecolabels – Levels of Certification

Key Economy	Program Name	Levels	Description
Australia	Green Tag LCARate	Bronze, Silver, Gold, Platinum	• Bronze - Top 25% of market • Silver top 20% • Gold top 15% • Platinum top 10%
Australia	Green Tag GreenRate	Levels A, B or C	• Level A 100% • Level B 80% • Level C 60% of the credit points in the calculator for a particular Green Rating system
Singapore	Green Building Certification	Certified, Good, Excellent, Leader	• Certified 50-60% • Good 61-75% • Excellent 75-85% • Leader 86-100%
United States	UL Certification Program	Resilient: Conformant, Silver, Gold, Platinum, Carpet: Silver, Gold, Platinum	• NSF 140 Silver > 36 pts • Gold > 51 pts • Platinum > 59 pts • NSF 332 Conformant >24 pts • Silver> 34 pts • Gold > 44 pts • Platinum > 59 pts
United States	Cradle to Cradle	Basic, Silver , Gold, Platinum	• Basic • Silver > 50 pts • Gold > 65 pts • Platinum > 80 pts
United States	SMART	Sustainable, Sustainable Silver, Sustainable Gold, Sustainable Platinum	• Sustainable 40 pts • Sustainable Silver 41-60 pts • Sustainable Gold 61-89 pts • Sustainable Platinum 90-155 pts.
United States	Sustainable Choice Carpet	Silver, Gold, Platinum	• NSF 140 Silver > 36 pts • Gold > 51 pts • platinum > 59 pts • NSF 332 Conformant >24 pts • Silver> 34 pts • Gold > 44 pts • Platinum > 59 pts

Annex C. Type 1 Ecolabels Flooring and Plumbing Products in Focus APEC Economies

Table C1. Flooring and Plumbing Products by Program- Type I Ecolabels

Economy	Program	Product Categories	Flooring Products	Plumbing Products
Australia	Green Tag	N/A	Composite wood; textiles and fibers (including carpets); carpets and floor coverings; adhesives and sealants; radiation protection	None
Australia	Global Environmental Choice	N/A	Carpets, floor coverings	None
Canada	Ecologo	Building and construction products	Flooring (modular carpet, non-modular carpet, resilient flooring, virgin wood substitute flooring, rubber-backed textiles, bamboo flooring)	Water-conserving plumbing products, toilets and urinals, toilet retrofits, trickle valves, faucets, and aerators[1]
Japan	EcoMark	Building products (equipment) divided into plumbing and other categories	Wood flooring, access floor, stair treads	Water-saving equipment, water-proof pan
Singapore	Green Label	N/A	Adhesives, modular carpet, products made from recycled fibers, tiles, ceramics	None
Singapore	Green Building Product Certification	N/A	Composite wood, adhesives, access floors	None
United States	UL Certification Program	N/A	Resilient flooring, carpeting	None
United States	Cradle to Cradle	N/A	2	None
United States	SMART	N/A	Sustainable flooring - all types; generic building products	None
United States	Sustainable Choice	N/A	Carpeting, other?	None

[1] *Water-conserving product criteria are being revised.*

[2] *Criteria are provided only by assessment category*

Annex D. Criteria for Type 1 Partial LCA Certification in Focus APEC Economies

Table D1. Criteria for Type 1 Ecolabels (Partial LCA)

Economy	Program	Products Certified	Levels	Global	Health	Materials	Water	Energy	Biodiversity	Waste
Australia	Green Tag Green Rate	Flooring	Yes	x	x[2]	X	x	N/A	x	X
Australia	Global Environmental Choice[1]	Flooring	No	x	x	X	N/A	x	x	X
Canada	Ecologo	Flooring, plumbing	No[3]	N/A	x	N/A	x	x	N/A	x
Japan	EcoMark	Flooring, plumbing	No	x	x	X	x	N/A	x	x
Singapore	Green Label	Flooring	No	x	x	N/A	x	x	x	x
Singapore	Green Building Certification	Access floors, recycled material	Yes[4]	N/A	x	X	x	x	N/A	N/A
United States	UL Certification Program	Adhesives, flooring	Yes	x	x	X	N/A	N/A	N/A	N/A
United States	Sustainable Choice Carpet	Carpet materials, floor coverings, plumbing	Yes	x	x	X	N/A	N/A	N/A	N/A

[1] *Includes criteria that apply only to internationally ecolabeled products: fitness for purpose, meet Australian standard, commercial guarantee, evidence of current ecolabeling certificate, comprehensiveness from LCA perspective, performance criteria and audit methodology of GEC, assessors accredited by GEC or RABQSA, suitable sources of information, NATA accredited testing*

[2] *Use ES CAP - ESCAP provides the means for determining key indicator comments for consumers and industry in relation to health, occupational health and safety and ecological toxicity. While these issues are dealt with to varying extents by the LCA methodology within the LCA rating process, ES CAP gives Ecospecifier the ability to provide precautionary statements about possible risks and impacts in a qualitative way that should be easily understood by any member of the public.*

[3] *No levels. Designed to certify only top 20% products in market*

[4] *No levels. However, there is scoring on minimum performance, mandatory criteria and bonus. Normalized to 100%*

Note: Definitions of criteria: Global includes greenhouse gases, global warming potential, carbon offsets, air emissions contributing to air pollution, acidification; Health represents human health and toxicity; Materials includes materials extraction (including minimizing materials), and resource use; water includes water use and efficiency, water quality and pollution; energy includes energy use, renewable energy use; biodiversity includes biodiversity, natural systems, ecosystems, animal welfare and impact on species reproduction; waste includes waste management, waste minimization, recycling and material reutilization

Table D2. Type I Ecolabels (partial LCA), Unique Criteria

Economy	Program	Products Certified	Levels	Product Quality	Regeneration	End of Life Mgt	Social & Legal
Australia	Green Tag Green Rate	Flooring	Yes			X	
Australia	Global Environmental Choice	Flooring	No	x	X		x
Canada	Ecologo	Flooring, plumbing	No (See Note 3)			X	

Note 1: "Environmental Regeneration" (Global Environmental Choice) is defined as materials with lowest environmental load, material use and transport efficiency, carbon neutrality, renewable energy use, sharing of methods across the supply chain, and investment in environmental initiatives.

Annex E. Criteria for Type 1 Full LCA Certification Programs in Focus APEC Economies

Table E1 Criteria for Type I Full LCA Certification Programs in Focus APEC Economies

Economy	Program Name[2]	Products Certified	Levels	Non-LCA Integrated Design Synergy	LCA GHGs, Emissions Energy, Water	LCA Toxicity, Human Health	LCA Eco-points	Non-LCA Bio-diversity, Habitat	Extraction Materials	Manu-facturing	Waste, Haz Waste, Reuse	Corporate Social Respon-sibility	Economic Factors
Australia	Green Tag LCA Rate	Flooring	Yes	x	x	ESCAP[1]	x	x	N/A	N/A	N/A	x	N/A
United States	SMART	Flooring	Yes	N/A	x	X	N/A	x	x	x	x	x	x
United States	Sustainable Choice	N/A*	Unknown	N/A	x	X	N/A	x	x	N/A	x	Fair Trade	x
United States	Cradle to Cradle	Flooring	Yes	N/A	x	X	N/A	N/A	N/A	N/A	x	x	

[1]*The Ecospecifier Cautionary Assessment Process (ESCAP) provides the means for determining key indicator comments for consumers and industry in relation to health, occupational health and safety and ecological toxicity. While these issues are dealt with to varying extents by the LCA methodology within the LCA rating process, ES CAP gives Ecospecifier the ability to provide precautionary statements about possible risks and impacts in a qualitative way that should be easily understood by any member of the public.*

[2]*Green Tag is the only program where the weighting of the categories is mentioned in the standard. GreenTag provides the following weights: 10% IDS, 20% GHS, 20% Es Cap Toxicity, 20% Biodiversity, 15% Corporate Social Responsibility. The Green Tag and Sustainable Choice programs follow the BRE model of calculating the weighted results of the LCA of the eco-preferred building material, compared to a business-as-usual (BAU) or typical product used in the market (typically over 60 years)—between 0 and 1, with the lowest ecological and health impacts earning a 0 score. Sustainable Choice has 27 indicators in 5 categories.*

Annex F. Conformity Assessment Procedures for Type 1 Certification Programs in Focus APEC Economies

Table F1. Type 1 Ecolabeling Programs - Conformity Assessment Procedures

Economy	Program Name	Documents Reviewed	Audits	Testing	Post-License Surveillance
Australia	Green Tag LCA Rate and GreenRate		Second-party verifier	Yes	
Australia	Global Environmental Choice		Third-party audit following ISO 17020	Yes	Regular surveillance and random audits at GECA discretion
Canada	Ecologo		On-site audits “when required”. Quality control and production facilities	Yes, including performance testing	Access to production facilities when required
Japan	EcoMark		Third-party review if deemed necessary. Criteria for determining not available	If deemed necessary by Committee	
Singapore	Green Label	Contents, materials description, photograph, business profile	N/A	Not all product categories require testing. Product samples submitted directly to testing lab by manufacturer before application	

Economy	Program Name	Documents Reviewed	Audits	Testing	Post-License Surveillance
Singapore	Green Building Product Certification	CEO-signed confirmation statements. Depending on process or input, council may require quality control and production documentation, purchase records, supplier certifications and descriptions of management systems, MSDS and other documentation.	SGBC may perform inspections of the applicant's product, place of business or factory without notice at the applicant's cost.	Third-party laboratory reports may be required	
United States	UL Certification Program		Yes	Yes	Retesting is done through Conformity Integrity Services to determine continued compliance.
United States	Cradle to Cradle	Survey and material appendix	Obtain data on chemicals throughout supply chain and site visit to final facility	Unclear	
United States	SMART	Reviews any aspect of product certification at its discretion	Third-party auditing, including manufacturer and supplier facilities. Field audit % requirements - Sustainable 10%, Silver 25%, Gold 100%, and Platinum 100% of certified population.	Unclear	Yes. De-certification for non-compliance and requires continuous improvement.
United States	Sustainable Choice Carpet		Yes	Yes	Retesting is done through Conformity Integrity Services to determine continued compliance.

Table F2. Type 1 Ecolabels Conformity Assessment Procedures: Accreditation of Facilities

Economy	Program Name	Accreditation of Auditors and Testing Facilities	Acceptance of Audits, Testing in other economies
Australia	Green Tag LCA Rate and GreenRate	Testing facilities must be registered by the Australian National Association of Testing Authorities (NATA) or approved by member of International Laboratory Accreditation Cooperation ILAC) or the Asia Pacific Laboratory Accreditation (APLAC)	
Australia	Global Environmental Choice	Conformity Assessment Bodies (CAB) accredited by Joint Accreditation Standards Australia-New Zealand (JAS-ANZ) to audit documentation perform audits (site visits), and testing.	
Canada	Ecologo		
Japan	EcoMark		
Singapore	Green Label	Laboratories accredited by Singapore Green Label	Test results from a GEN member are accepted if performed by a government-accredited laboratory and an independent third party.
Singapore	Green Building Product Certification	Facility, institution subject to SGBC approval	
United States	UL Certification Program		
United States	Cradle to Cradle		
United States	SMART		
United States	Sustainable Choice Carpet		

Annex G. Roles and Services in Type III Environmental Labeling Certification Programs in Focus APEC Economies

Table G1. Roles and Services -Type III EPD programs – Focus APEC economies

Economy	Program Name	LCA Practitioner, Program Operator or Verifier	LCA Tool Used	LCA and EPD Content and Process
Australia	GreenTag	Program Operator and Verifier	LCADetail and LCARAte	Specify assumptions for the LCA and EPD. Ecospecifier conducts an LCI Gap analysis, product specific questionnaire, Complete LCI, LCA EPD report to manufacturer.
Japan	Ecoleaf	Program Operator, (Verify LCA, “hire” EPD verifiers)	Ecoleaf has its own software	Company provides PCR; if none, Ecoleaf develops one. Program has a working group and 3 committees: i) steering committee, composed of experts from academia and industry, consumers, and public authorities; supervise PCR and review committees. ii) PCR Committee and iii) Review committee (LCA experts) delivers judgment on the result of the audit and verification.
United States	UL Certification Program		GaBi	About to issue verified EPDs for laminate flooring and textile carpet tiles; not yet complete so not on website. However, other EPDs are on website.
United States	MTS - Market Transformation to Sustainability	LCA practitioner, “hire” EPD verifiers	No information available	EPD will state the purpose and value of the EPD, limitations on product comparisons and benefit of SMART product comparisons, EPD mandates (France and EU), product description, company description, tables of CO2 emissions, global warming potential, water use by product stage (extraction, transportation, manufacturing, use, reuse and EOL), carbon and water footprint diagrams, and spidergram of LCA product impacts.
United States	Sustainable Choice	LCA practitioner, Program Operator and Verifier	Proprietary tool	If the client does not have an EPD, or if they believe the EPD is not of high enough quality, they develop an EPD. If there is no PCR, they develop a PCR. They also verify the LCA. SCS conducts a complete LCI and impact assessment across all relevant impact category indicators (27 are available).

Note1 : Per ISO 14025, EPDs are supposed to be internationally relevant and publicly available. During EPD verification, to be reviewed by a 3-person panel.

Annex H. Conformity Assessment Procedures for Type III Environmental Labeling Programs in Focus APEC Economies

Table H1. Type III Environmental Labeling Programs – Conformity Assessment Procedures

Economy	Program Name	Verification Process
Australia	Ecospecifier GreenTag	Contract auditing group. Onsite audit of manufacturer for PLUS level certification (included in most certifications).
Japan	JEA Ecoleaf	Contractor or internal verification. Verification can be done internally (for companies that have obtained certification of their data collection system by JEMAI qualified auditors); they can appoint two internal verifiers independent of the LCA preparation, EPD preparation process. If not, external verification is required. Verify data collection and management processes. Qualifications for auditors are included in the Guidelines.
United States	UL Certification Program	UL verifies the EPD; Manufacturer hires LCA verifier
United States	MTS - Market Transformation to Sustainability SMART	EPD must be independently certified by an environmental professional with a minimum of one year of LCA experience as defined by the U.S. EPA.
United States	SCS Certified Sustainable Choice	SCS Certified develops LCAs and verifies LCAs conducted by others. SCS also develops EPDs as well as verifying EPDs developed by others.

Note 1: ISO 14025 requires independent verification of both the EPD and the LCA.

Annex I. Data Variability and Uncertainty

Table I1. Comparison of LCA for InterfaceFlor Microtuft Modular Carpet (ED-IFF-2010211-E) and BRE-certified Interface 2010 Tufted Tiled with Graphlix Backing

Source Category	EPD – IBU PA 6 from InterfaceFlor (Modular Carpet)	Approved Env Profile BRE Interface 2010 Tufted Tiles with Graphlex Backing
Global warming potential (kg CO2 eq (100 yr)	Yes	Yes
Stratospheric Ozone (kg R-11, CFC11 eq)	Yes	Yes
Photochemical Ozone (kg ethen eq)	Yes	Yes
Eutrophication and Nutrification (kg PO4 eq)	Yes	Yes
Primary energy not renewable, fossil fuel (MJ)	Yes	Yes
Acidfication (kg SO2 eq)	Yes	Yes
Primary energy renewable MJ)	Yes	No
Ecotoxicity to Land	No	Yes
Nuclear Waste (higher level)m3 high level waste	No	Yes
Ecotoxicity to Freshwater kg 1.4-DB eq	No	Yes
Human toxicity (kg 1,4-DB eq) (VOC)	Yes	Yes
Mineral Resource Extraction (tonnes)	No	Yes
Water Extraction (m3)	No	Yes

Annex J. Type 1 Ecolabeling Programs Flooring and Plumbing Products Certified in Other APEC Economies

Table J1. Flooring and Plumbing Products – Type I Ecolabel Programs

Economy	Program	Product Categories	Flooring Products	Plumbing Products
China	China Environmental Labeling		Ceramic tiles	Sanitary wares
Hong Kong, China	Green Label	See Note 1	Flooring (modular carpeting, wood flooring)	None
Korea	Ecolabel		Indoor floor covering, access floor	Water-saving faucets, showerheads and faucet appendages, toilets, components for toilets, urinals, bidets
Russia	Vitality Leaf[1]			
Chinese Taipei	Green Mark	N/A	Products made from recycled plastics or waste rubber, products made from recycled wood, Building material from recovered waste (incl floor tiles), textiles produced from recycled PET plastic	Dual flush water-saving toilets (2 with different criteria), water-saving faucets, devices
Thailand	Green Label	N/A	Produced made from recycled plastics, products made from rubberwood	Flushing toilets, faucets & sanitary accessories
New Zealand	Environmental Choice	N/A	wood and wool-rich pile carpets, floor coverings, synthetic carpets	None

1. *No criteria available on website.*

Annex K. Criteria for Type 1 Ecolabeling Programs in Other APEC Economies

Table K1. Type 1 Eco-labels (Partial LCA) Criteria

Economy	Program Name	Products Certified	Levels	Local Laws	Health	Natural Resources	GHGs	Material	Energy	Waste	Water
China	Environmental Labeling	Wood-based panels, ceramic tiles & sanitary products	No	N/A	x	x	x	x	x	N/A	N/A
Hong Kong, China	Green Label	Recycled flooring, carpet, tile	No	N/A	x	N/A	N/A	x	N/A	x	N/A
Russia	Vitality Leaf	Flooring	No	N/A	x	x	X	N/A	x	x	x
Thailand	Green Label	From recycled plastic, plumbing	No	x	x	N/A	N/A	N/A	N/A	x	N/A
New Zealand	Environmental Choice	carpet, floor coverings	No	x	x	N/A	N/A	x	x	x	x

Note: Health represents toxicity and other harmful substances and indoor air; Natural resources is self-explanatory; GHGs represents global and local air pollution; Material represents material use and conservation; Energy represents energy reduction, efficiency and renewable energy; Waste represents waste minimization and recycling; Water represents water use and quality

Table K2. Type 1 Eco-labels (Partial LCA) Unique Criteria

Economy	Program Name	Products Certified	Levels	Sustainable Wood	Transport	Radiation	Resources	Regional	Consumer	Advertising	Innovation	Performance
China	Environmental Labeling	Wood-based panels, ceramic tiles and sanitary products	No				x	x				
Hong Kong, China	Green Label	Recycled flooring, carpet, tile	No			x						
Russia	Vitality Leaf	Flooring	No		X						x	x
New Zealand	Environmental Choice	Carpet, floor coverings	No	X								x

Note: Transport represents use of transport; Resources represents "use of all resources", Regional represents "regional environmental impacts", "Consumer" represents consumer information; Advertising represents "Truth in Advertising"

Table K3. Ecolabels (Full LCA) Criteria

Based on Full LCA	Program Name	Products Certified	Levels	% recycled Wood	Toxics	Certified Wood Sourcing	Air Emissions	Product Quality
Korea	Ecolabel	Flooring, plumbing	No	x	x	x	x	x
Chinese Taipei	Green Mark	Products from recycled materials, Plumbing	Yes	x	x	N/A	x	

Annex L. Type I and III Certification Conformity-Assessment Procedures and Accreditation in Other APEC Economies

Table L1. Type 1 Ecolabels – Conformity Assessment Procedures

Economy	Program Name	Documents Reviewed	Audit	Testing	Surveillance Audits Post-license
China	China Environmental Labeling		On-site inspection by technical experts	Testing protocol varies by attribute (radiation, heavy metals, water)	An annual inspection is held and if warranted, there may be a de-certification.
Hong Kong, China	Green Label	Collect information from manufacturers	Audit and interviews if necessary	Testing when necessary. Applicant can submit own test report or be referred to third party. Third-party testing per ISO 17025	May include a random sample check of production and/or on-site assessment; if found non-compliant, rectification or de-certification occurs
Korea	Ecolabel		Third-party auditor	Yes	Ongoing audits and surveillance are scheduled (including surprise site investigations and collections of products on the market) are required. A dispute resolution process exists.
Russia	Vitality Leaf		Yes	Yes	Continuous supervisory control after certification.
Chinese Taipei	Green Mark	Domestic? Foreign companies' documents verified [3]	Yes	Yes	
Thailand	Green Label		Yes	Yes	
New Zealand	Environmental Choice	Checklists are submitted with a Statement of Compliance Form	Third-party auditor		Yes. Failure to meet terms of label will require a reassessment within six months. A dispute resolution process is provided.

Table L2. Type 1 Ecolabel Conformity Assessment Procedures for Accreditation of Facilities

Economy	Program Name	Approval and Accreditation of Auditors and Testing Facilities	Acceptance of Audits, Testing in other economies
China	China Environmental Labeling	Sampling and testing of sampled products by authorized institutions. Which organization is not clear.[1]	
Hong Kong, China	Green Label	Analytical testing should be performed by accredited laboratories that meet the requirements of EN45001 IEC, ISO, EN 17025 or EN45001 standards or any equivalent systems, e.g., HOKLAS and CNAS. List is available on website.[2]	Hong Kong, China also has mutual recognition arrangements with 53 laboratory accreditation bodies in 42 economies.
Korea	Ecolabel	Verifiers in country are authorized in accordance with Clause 2, Article 23 of the National Standards Basic Act and Article 16 of its Enforcement Decree or authorized by the head of a central administrative agency in accordance with the law. If any other organizations conduct the testing, it must be confirmed and verified by experts assigned by Ecolabel while the test is being conducted.	Verifiers in other economies must meet the provisions of ISO, IEC 17025.
Russia	Vitality Leaf		
Chinese Taipei	Green Mark	All audits must be completed by laboratories authorized by the Republic of China laboratory system found at www.cnla.org.tw. Pollution analysis must be completed by laboratories authorized by the Environmental Protection Administration	Importers must have third-party verification of tests.
Thailand	Green Label		
New Zealand	Environmental Choice	Verifiers are accredited by the NZ Ecolabeling Trust.	

Table L3. Type III Environmental Labeling Programs, Conformity Assessment Procedures for other APEC Economies

Other APEC Economies	Program Name	Program Operator or Verifier?	Tool Used	LCA and EPD Process, Results
Korea	Korea EPD	Unclear	No information available	No information available
Chinese Taipei	unknown	Unclear	No information available	Based on International EPD system; EPDs declared through GEDNet website. Certified EPDs found on GEDNET website

Notes: China is developing an EPD Program

Per ISO 14025, EPDs are supposed to be internationally relevant and publicly available. During EPD verification, to be reviewed by a 3-person panel.

Table L4. Type III Environmental Labeling Programs - Verification: other APEC Economies

Economy	Program Name	Verification Process
Korea	Korea EPD program	No information available
Chinese Taipei	Unknown	No information available

ISO 14025 requires independent verification of both the EPD and the LCA.

Annex M. Mutual Recognition Agreements among Programs in Focus APEC Economies

Table M1. Mutual Recognition for Type I Labeling programs in Focus APEC Economies

Focus Economy	Program Name	GEN Member (See Note 1)	Recognize as Equivalent	Programs that Recognize as Equivalent
Australia	Green Tag LCA Rate and GreenRate	No	Where data quality and scope of other schemes is equal to GreenTag, existing third party data can be used.	No information
Australia	Global Environmental Choice	Yes	No information	No information
Canada	Ecologo	Yes	Env Choice NZ, Green Seal	
Japan	EcoMark	Yes	Korea Ecolabel and NZ Env Choice	Certification on behalf of Korea Ecolabel, Thai Green Label, Chinese Taipei Green Mark, and NZ Env Choice
Singapore	Green Label	Yes	GEN members	GEN members
Singapore	Green Building Certification	No, applying for membership	Any ecolabeling program, single or multiple criteria	
United States	UL Certification Program	No	No	No
United States	Cradle to Cradle	No	No information	No information
United States	SMART	No	No information	No information
United States	Sustainable Choice Carpet	No	No information	No information

Note: The Global Ecolabeling Network is a nonprofit association of Type I ecolabeling organizations founded in 1994 to improve, promote and develop the ecolabeling of products and services. Since 2001, GEN has developed a mutual recognition approach specific to ecolabeling, including agreements, common core criteria for certain products, and participatation in ISO meetings. A GEN Internationally Coordinated Ecolabeling System "GENICES" was formulated in 2003. GENICES provides a mechanism for enhanced cooperation and collaboration in product certification, criteria development and review.

Table M2. Mutual Recognition for Type I Labeling programs in Other APEC Economies

Economy	Program Name	GEN Member?	Recognized as equivalent to	Programs that recognize as equivalent
China	Environmental Labeling Program	Yes	GEN members	GEN members
Hong Kong, China	Green Label	Yes	GEN members	GEN members
Korea	Ecolabel	Yes	GEN Members. Provide “support” to Japan, China, Chinese Taipei, and Thailand programs (assign auditors, screen documents, testing, all plus report send to foreign certification body. See Government agreements	same
Russia	Vitality Leaf	Yes	GEN members	GEN members
Chinese Taipei	Green Mark	Yes	See Government agreements	same
Thailand	Green Label	Yes	Signed MRA with programs in six economies, including Chinese Taipei, Japan EcoMark, Korea, NZ, Australia Good Environmental Choice and China. MRAs include recognition on laboratory testing, product certification system including site audits, specific criteria. All MRAs are publicly available.	Same
New Zealand	Environmental Choice	Yes	Gen Members, if they trust their processes and local conditions, where criteria are the same. Even if they accept their work, they may request additional information if criteria are lower or do not cover areas they wish to cover. Accept Chinese Taipei Green Label and HK Green Label.	If Chinese Taipei or HK are exporting to NZ, they seek the NZ label.

Annex N. Global Ecolabeling Network Membership

Economy	GEN Member
Australia	Good Environmental Choice
Brazil	Associacao Brasileira de Normas Tecnicas (ABNT)
China	China Environmental United Certification Center
Croatia	Ministry of Environmental Protection and Physical Planning
Czech Republic	Ministry of the Environment
EU	European Commission - DG Environment
Germany	Federal Environmental Agency (FEA)
Hong Kong, China (GC)	Green Council
Hong Kong, China (KGFEP)	HK Federation of Environmental Protection Ltd.
India	Central Pollution Control Board
Indonesia	Ministry of Environment
Israel	Standards Institution of Israel (SII)
Japan	Japan Environment Association (JEA)
Korea	Korea Environmental Industry & Technology Institute (KEITI)
Malaysia	SIRIM QAS International Sdn Bhd
New Zealand	Environmental Choice New Zealand
Nordic 5 Countries	Nordic Ecolabelling Board
North America (Canada)	TerraChoice Group - Ecology Program
North America (United States)	Green Seal
Philippines	Clean & Philippine Center for Environmental Protection & Sustainable Development)
Russia	Saint-Petersburg Ecological Union
Chinese Taipei	Environment and Development Foundation (EDF)
Singapore	Singapore Environmental Council
Sweden	Swedish Society for Nature Conservation (SSNC)
Sweden	TCO Development
Thailand	Thailand Environment Institute (TEI)
Ukraine	Living Planet

Annex O. GEDNet Membership

Denmark

Danish Standard, www.mvd.dk
Representative: Kim Christiansen

Chinese Taipei

Environment and Development Foundation (EDF) www.edf.org.tw
Representative: Ning Yu

China

Environmental Certification Center of China State Environmental Protection
www.sepacec.com
Representatives: Xiaodan Zhang and Lily Yin

Germany

Institut Bauen und Umwelt e.V. (IBU)
www.bau-umwelt.com
Representative: Eva Schmincke

Japan

Japan Environmental Management Association for Industry (JEMAI) www.jemai.or.jpf
Representative: Hanako Negishi

Korea

Korean EDP and Carbon Labeling Program (KEITI) www.keiti.re.kr
Representative: Jun-hyuk Hur

United States

Scientific Certification Systems (SCS)
www.scscertified.com
Representative: Stanley Rhodes

Underwriter´s Laboratories (UL)
www.ulenvironment.com

Sweden

International EPD System
www.environdec.com
Representative: Joakim Thornéus

Associate members

Sweden

IVL Swedish Environmental Research Institute Ltd www.ivl.se

Representative: Elin Eriksson

The Netherlands

PRé Consultants www.pre.nl
Representative: Mark Goedkoop