GREEN BUILDING METRICS, CODES, STANDARDS, RATING SYSTEMS

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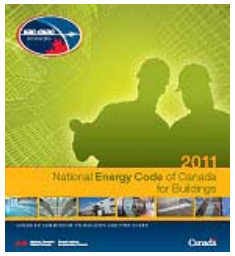
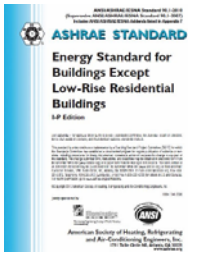
AES Engineering Ltd.

AGENDA





1. Prior Presentations, Sustainability,
2. Green House Gasses, Carbon Neutrality, Adaptation
3. Energy and Green Building Codes and Standards,
4. Energy Codes/Standards/Rating Systems Compared
5. Green Building Rating and Certification Systems
6. Green Building Metrics
7. Green Building Rating and Certification Systems Compared

CANADA GREEN BUILDING COUNCIL · CONSEIL DU BÂTIMENT DURABLE DU CANADA

U.S. GREEN BUILDING COUNCIL LEED USGBC LEED v4

CODE FOR A SUSTAINABLE BUILT ENVIRONMENT BREEAM BRE GLOBAL

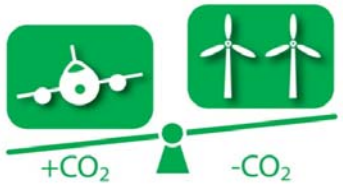
PASSIVEHOUSE CANADA Build better. Feel better.

GREEN GLOBES

LIVING BUILDING CHALLENGE

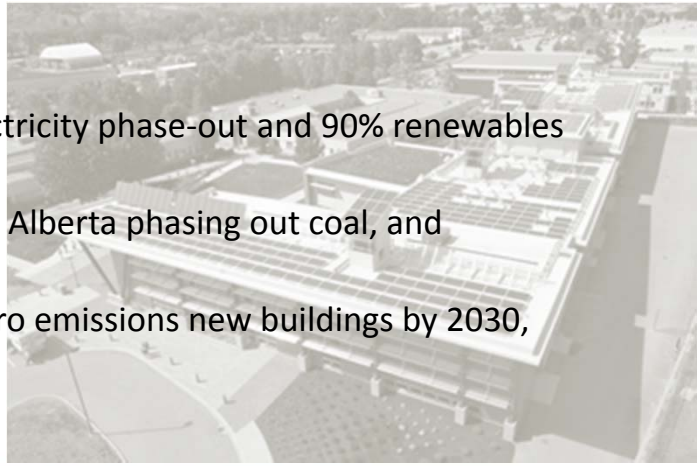
WHAT WE TALKED ABOUT PREVIOUSLY AND SUSTAINABILITY

- 2007 Winter Conference session covered: Sustainability, LEED NC.
- In 2012, 2015, 2016 (twice) we covered Codes and Standards applicable to telecommunications, in Canada and the US.
- Federal definition: “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”:
  - Waste / Pollution
  - Energy / Water
  - Other Resources
- Why Buildings, not transportation or energy industries? In 2020, about 53% of stationary end-uses of energy will be for residential and commercial buildings. Space heating, cooling, hot water, etc. (excluding small equipment). Low cost solution to greenhouse gas reductions with existing technology.

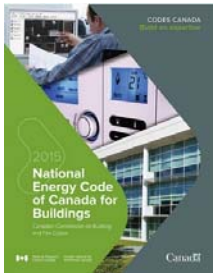


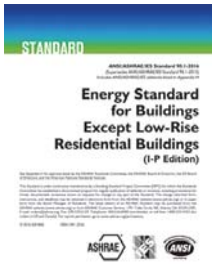
WHAT HAS CHANGED SINCE 2007

- Updates to codes, standards, rating and certification systems, and legislation.
- More widespread acknowledgement that humans contribute to and can therefore mitigate climate change (with a few notable exceptions)
- Shift of focus to Green House Gas emissions, Carbon Neutrality, Renewable Energy.
- Acceptance that we are talking about adaptation vs. avoidance.
- Buildings, Transportation, and Energy Industry all active areas.
- Federal government mandating price on carbon from 2018 to 2022, coal-fired electricity phase-out and 90% renewables government by 2030.
- BC committed to reducing GHG 80% below 2007 by 2050. Carbon Tax since 2008. Alberta phasing out coal, and mandating renewables by 2030.
- Vancouver target to reduce community-based GHG by 33% from 2007 by 2020, zero emissions new buildings by 2030, 100% renewable by 2050.
- Consideration of addressing sick-building syndrome, and other goals.

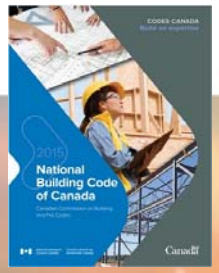


ENERGY CODES AND STANDARDS





- Model National Energy Code for Buildings (NECB) 2015
- ASHRAE 90.1-2016 Energy Standard for Buildings Except Low-Rise Residential Buildings
- Model National Building Code of Canada (NBCC) 2015, BCBC 2012, VBBL 2014
  - Thermal Resistance of Assemblies, Air Leakage, Vapour Diffusion/Condensation Control, Windows, Doors, Skylights, Fenestrations, Exterior Insulation Finish Systems, Service Water Heating, CO control storage garage ventilation, HRVs, reference to NECB
- Material, Product and Equipment standards also factor into building sustainability (windows, building materials, HVAC, SWH, motors, transformers, lighting, appliances, consumer electronics, etc.). Most notable equipment standard is Energy Star or EnerGuide, but others such as CSA, UL, AHRI, AHAM, etc. include efficiency.
- Beyond Energy there isn't much in the way of a national, provincial, or local code or standard regarding sustainability (by-laws not codes or standards).



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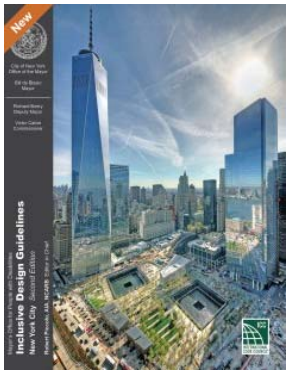
GREEN CODES AND STANDARDS

- International Code Council's International Green Construction Code
- ANSI/ASHRAE/USGBC/IES Standard 189.1 – 2014 Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential
- Neither used in Canada (at least not directly)



LEGISLATION

- Adoption of NECB 2011 (or 2015) or ASHRAE 90.1 2010 (or 2013 or 2016) by BC, AB, MB, ON, NS, VBBL
- LEED GOLD
  - BC new and major renovations public sector buildings since 2007
  - Vancouver requires LEED Gold for rezoning, including some specific points.
- CARBON NEUTRAL
  - Federal Gov't 40% reduction in GHG by 2030, 100% renewable electricity by 2025.
  - BC mandated carbon neutral public sector (since 2011). Some local governments also. Offset.
  - Vancouver zero emissions new buildings by 2030.
- Federal restriction on manufacture, import, sell or lease restrictions on product such as incandescent bulbs (NRC Energy Efficiency Regulations, 2016 - Amendment 13).

Provinces and territories that have adopted regulations based on the 2015 National Model Construction Codes

P/T	NBC 2015	NFC 2015	NPC 2015	NECB 2015
NT	Adopted 15 November 2016	Adopted 15 November 2016		
NS	Adopted	Adopted		Adopted

CODES AND STANDARDS VS. RATING / CERTIFICATION SYSTEMS

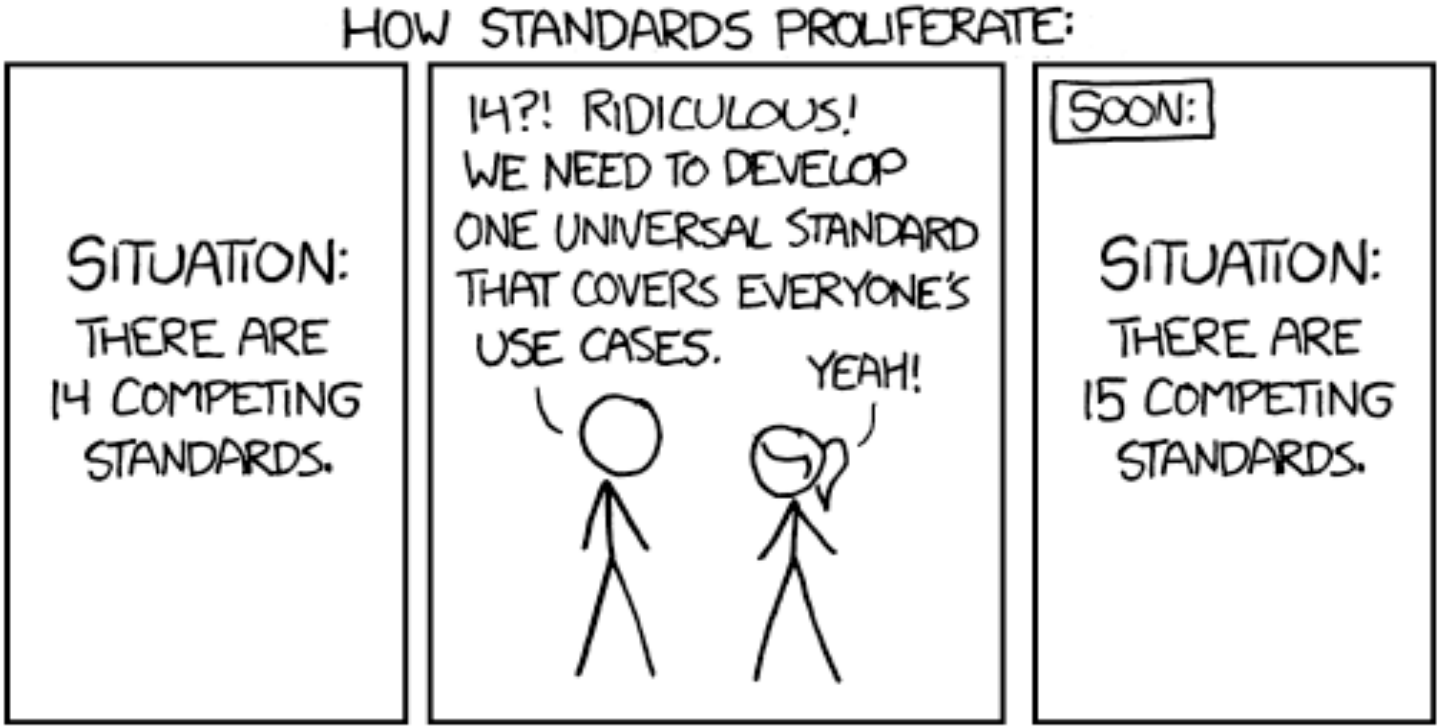
- Legislation, and other legally enforceable requirements, are generally focused on energy efficiency (regardless of type), green house gas emissions (non-renewable energy), or, in the case of LEED, discretionary sustainability.
- Neither ASHRAE 90.1 nor NECB relate specifically to carbon (GHG), rather energy efficiency (NECB Energy Used, ASHRAE Energy Cost). ASHRAE 189.1 covers more topics, as does IgCC. Written to be mandatory.
- Rating and Certification systems measure specific or a variety of sustainability measures that they felt most important but don't put a priority on objectives (discretionary). Not intended to be mandatory.
- Some rating/certification systems such as Passive House (voluntary) out-perform mandatory codes and standards – "code is the minimum standard"

GetCertified

SOME CURRENT BUILDING RATING / CERTIFICATION SYSTEMS (Excluding Homes)

- LEED V4 BD+C NC, C+S, SCHOOLS, RETAIL, HOSPITALITY, DATA CENTERS, WAREHOUSES & DISTRIBUTION CENTERS, AND HEALTHCARE; LEED V4 ID+C, COMMERCIAL INTERIORS, RETAIL, HOSPITALITY; LEED V4 O&M, EB, SCHOOLS, RETAIL, HOSPITALITY, DATA CENTERS, WAREHOUSES & DISTRIBUTION CENTERS; LEED V4 HOMES & MULTIFAMILY LOWRISE, AND MULTIFAMILY MIDRISE; LEED V4 NEIGHBORHOODS
- GREENGLOBES (NC or Sustainable Interiors by ECD JLL, and Cont.Imprv.EB aka BOMA BESt in Canada for single building or portfolio)
- PASSIVE HOUSE
- LIVING BUILDING CHALLENGE (by Cascadia Green Building Council / International Living Future Institute) (incl optional Net Zero Energy Building Certification (by ILFI)
- ENERGY STAR (energy and water use)
- BREEAM (Building Research Establishment Environmental Assessment Method)
- SITES (Sustainable SITES Initiative, by Green Building Certification Inc.)
- WELL Building Standard (by International WELL Building Institute)
- Fitwel (Center of Active Design)
- MANY Others

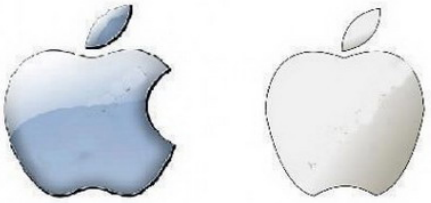
WHY SO MANY?



According to Apple.

Apple Samsung

According to Samsung.



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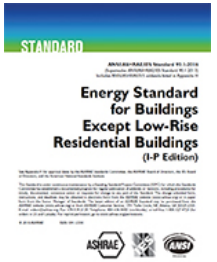
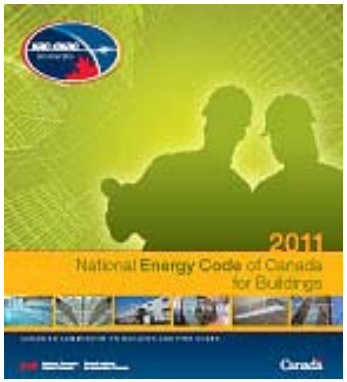
ASHRAE 90.1-2010 (2013 & 2016)

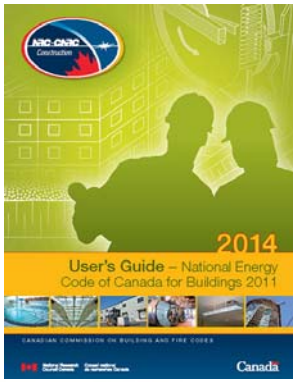


- Energy Efficiency Standard
- Building Envelope, Power, Lighting, Mechanical (HVAC, SWH)
- New bldgs., new portion of bldgs., new systems and equip. in exist. bldgs., specific new equip of industrial or manufacturing processes.
- Excludes single-family, and three stories or fewer.
- Mandatory Provisions, Prescriptive or Trade-Off (Envelope only), Energy Cost Budget Method
- References other standards for non-energy performance such as lighting levels and ventilation requirements

NECB 2011 (2015)

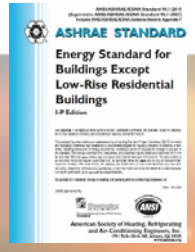
- Energy Code
- Building Envelope, Lighting, Mechanical (HVAC, SWH)
- Prescriptive, Trade-off (envelope, ltg, HVAC, SWH), or Performance compliance paths
- Building Energy Performance target (not cost)
- Written in conjunction with NBCC, NPC, NFC, CEC, etc.

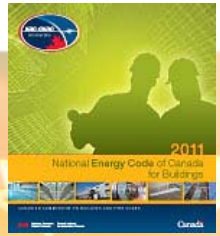




ASHRAE 90.1 vs. NECB vs. PH, LBC-NZEB

- ASHRAE balances heating and cooling efficiency; NECB is biased toward heating. In Canada the bias is toward heating (3/4 of the time) so NECB typically results in an operational saving over ASHRAE.
- ASHRAE looks at energy cost, NECB looks at energy consumed. At the building level in a low-carbon world the building uses more electricity since fossil fuels are excluded, but neighborhood energy, biomass, and other low-carbon sources are options. Low-carbon typically increases energy cost whereas heat pumps decrease energy consumed at expense of capital cost.
- Passive House typically exceed energy cost and energy use performance of either. Similarly a NZEB would be the best.





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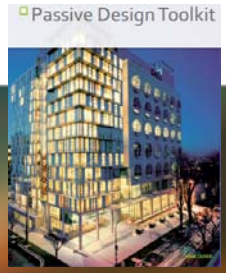

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ASHRAE/USGBC/IES Std.189.1 - 2014

- Standard for the Design of High-Performance Green Buildings Exc. Low-Rise Resi. Bldgs.
- Site Sustainability, Water Use Efficiency, Energy Efficiency, IEQ, Materials & Resources, Building's Impact on the Atmosphere (Construction and Operations Plans).
- Goes beyond energy requirements of ASHRAE 90.1
- Not just an energy standard, but not a rating or certification system.
- Not used in Canada directly

Passive House

- Certification system: Outcome-based (not prerequisites and optional credits) design standard, low-energy consumption through passive solar design, superinsulation, high-tech windows, airtightness, premium efficiency HV, ltg., & appliances.
- Some jurisdictions are looking to Passive House as an alternative to NECB/ASHRAE 90.1 because building energy performance is so good (dramatically less heat, significantly less cooling). Well suited to Canadian climate.

CanPHI Canadian Passive House Institute

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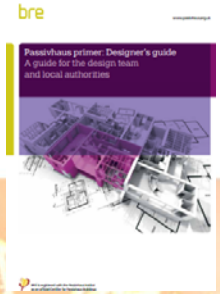

naphn North American Passive House Network

iPHA Affiliate

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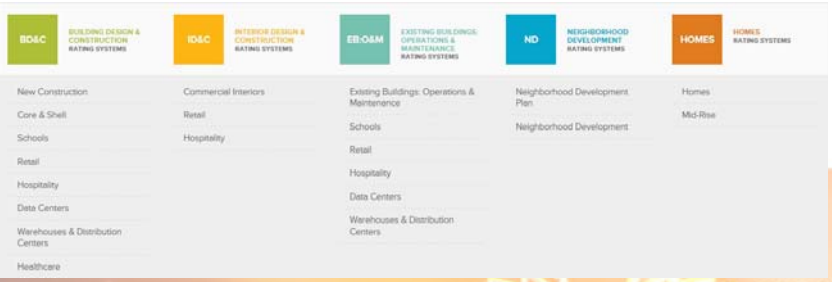
USGBC LEED V4

- Rating/Certification system: multiple construction types, multiple aspects of sustainability. Mature system. Quoting City of Vancouver such systems are “widely proven, have broad credibility, and are third party verified”.
- LEED started by USGBC in 1998
- NC has multiple market segments & categories (performance areas): Sustainable sites, water efficiency, energy & atmosphere, materials & resources, indoor environmental quality, Integrative Strategies, Regional Priority, and Location & Transportation. Pre-requisites and credits. Certification levels.



Living Building (Challenge)

- Performance-based standard (certification) with flexibility for building type and region. Seven performance areas or “petals”: Place (site), Water, Energy, Health (& Happiness), Materials, Equity, Beauty. Twenty Imperatives.
- Four scales: building, neighborhood, village/campus, and city.
- Four typologies: buildings, renovations, landscape or infrastructure, neighborhood.
- Targets Net Zero (Energy, water, waste) and on-site renewable energy. Net Zero Energy Building is a certification option. Others are Full Living, Petal, & LB Challenge.
- Third-party Auditor for document review and onsite verification.

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Green Globes

- Online Rating/Certification System (1-5 Green Globes in Canada). Based on 1996 CSA BREEAM Canada, 2000 (EB), NC 2013 based on ANSI/GBI 01-2010, next expected GBI 01-2017. GBI an ANSI SDO. Used by DND, PWGSC and US GSA.
- Green Building Initiative (BOMA – EB, NC now ECD JLL in CA).
- Seven key areas (NC): energy, indoor environment, site, water, materials & resources, emissions, and project/environmental management (emissions). No prerequisites, just credits.
- Assessment Tools: New buildings and significant renovations (NC), Office fit-up (CI - Comm.Int.), existing buildings (EB, aka BOMA BESt in Canada).
- Assessor provide 3rd party certification services.

BREEAM

- Rating System – one of the very first for buildings, basis of many others.
- Building Research Establishment's Environmental Assessment Method (developed for UK in 1990s, but now also used in EU and elsewhere).
- Multi-attribute scores for Management, Health & well-being, Energy, Transport, Water, Land use & ecology, Materials, Waste and pollution are weighted for a rating.
- Multiple schemes including Communities, Courts, Education, Health care, Offices, Prisons, Retail, etc.

BREEAM®

GREEN CONSTRUCTION RATING /CERTIFICATION METRICS

- How many key areas could the different rating/certification systems cover?
- 27 to 28 requirements from Energy Independence Security Act (US EISA) Study in 2012:
- New Buildings: Integrated Design, Commissioning, Indoor Water, Process Water, Outdoor Water, Storm Water, Water-Efficient Products, Energy Efficiency, On-Site Renewable Energy, Measurement and Verification, Benchmarking, Recycled Content, Biobased Content, Environmentally Preferable Products, Waste and Materials Management, Ozone Depleting Compounds, Low-Emitting Materials, Ventilation, Thermal Comfort, Daylighting, Environmental Tobacco Smoke Control, Protect Indoor Air Quality during Construction, Moisture Control, Acoustic, Building System Controls, Siting, Greenhouse Gas
- Existing Buildings: as above except Integrated Assessment, Operation, and Management vs. Design, adds Integrated Pest Management
- Includes energy efficiency, greenhouse gas, & renewables covered by legislation, codes & standards.

SUSTAINABLE DEVELOPMENT GOALS

- UN SDG

CRITERIA FOR EVALUATING RATING / CERTIFICATION SYSTEMS

- So, how do you compare so many different rating systems?
- US EISA Green Building Certification System Study 2012 (ASHRAE 189.1 supplemented 2012, LEED v4 supplemented 2014) by US Gen.Svcs.Admin.
  - Robustness of the technical components of the certification system to address Federal high-performance design and operational requirements for Federal facilities: whole building evaluation, addressing key sustainable design and operations metrics
  - Independence and availability of technically qualified auditors or assessors.
  - Documented verification method
  - Transparency of certification systems' approach to collecting and addressing public comments
  - Consensus-based standard for documenting a development and revision process
  - System maturity
  - Usability of the system, especially in a particular jurisdiction
  - National recognition within the building industry

CRITERIA FOR EVALUATING RATING / CERTIFICATION SYSTEMS – cont'd

US EISA 2012

Criteria included 3rd party verification, whole-building analysis, availability in US

ASHRAE 189.1, and LEED v4 added later by supplement.

To be updated in 2017 (but . . .)

Certification System	Owner	Whole-building sustainability	Building Types	Third-party Certification
Green Globes®	Green Building Initiative (GBI)	Green Globes is comprised of seven key areas: energy, indoor environment, site, water, resources, emissions, and project/ environmental management.	Green Globes certifies new buildings and significant renovation, existing buildings, building emergency management, building intelligence, and fit-up.	Green Globes Assessors provide third-party certification services.
LEED®	U.S. Green Building Council (USGBC)	LEED is comprised of five key areas: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality.	LEED certifies new construction and major renovations, existing buildings, commercial building interiors, core and shell construction, schools, retail, healthcare, and homes.	The Green Building Certification Institute (GBCI) provides third-party certification services.
Living Building Challenge™	International Living Building Institute (ILBI)	Living Building Challenge is comprised of seven performance areas: site, water, energy, health, materials, equity and beauty.	Living Building Challenge certifies development at four scales: building, neighborhood, village/campus, and city.	A third-party auditor is responsible for performing document review and onsite verification.

CRITERIA FOR EVALUATING RATING / CERTIFICATION SYSTEMS – cont'd

- Whole Building Design Guide (US National Institute of Building Sciences)
  - Who is assessing? First-party, second-party, or third-party?
  - Multi-attribute program?
  - Overall environmental performance: Water, energy, emissions, toxicity
- RSMeans
  - Science-based – reproducible results and decisions by others
  - Transparent – standard and process for recognition open and transparent
  - Objective – certification body free of conflict of interest
  - Progressive – should advance industry practices
- International Facility Management Association (IFMA) (2015)
  - Formal certification program?
  - Multi-attribute program?
  - Original program (vs. derivative of other system)?
  - Mature system (not in development or pilot)

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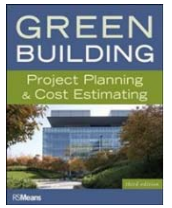
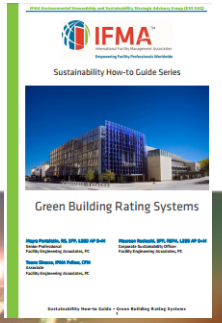
WBDG Whole Building Design Guide®

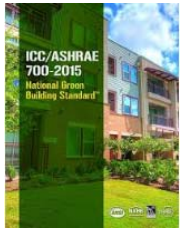
RSMeans data from GORDIAN

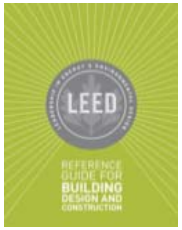




US EPA Green Building Standards

- Reviewed IgCC 2012, ASHRAE/USGBC/IES 189.1-2011, 2012 National Green Building Standard, Green Globes, USGBC LEED, ILFI LBC ver. 2.1 (2012)
- Code or Rating/Certification System, Intended Application (Mandatory/Voluntary), Building Types (e.g. Comm., Resi., . . .), Project Types (e.g. NC, Alterations, . . .), Subject Areas (e.g. Site, Energy, IEQ, . . .), Certification/Compliance Process (by AHJ, 3rd party, . . .), Relationship to Standards (ASHRAE 90.1, 189.1, etc.).





EPA Green Bldg. Std. - List

Green Building Standards

American communities have more options than ever for encouraging greener building and development. Many organizations have developed model codes or rating systems that communities can use to develop green building programs or revise building ordinances. Learn about some of the major options, which are listed below. You can view a side-by-side comparison by selecting the checkboxes of options that interest you, then clicking the *Compare* button below the table.

Standard	Standard Type[1]	Mandatory/ Voluntary[2]	Building Type(s)	Project Type	Subject Areas	Compare
International Code Council's *2012 International Green Construction Code* **(IgCC)** A model code that contains minimum requirements for increasing the environmental and health performance of buildings sites and structures. Generally, it applies to the design and construction of all types of buildings except single- and two-family residential structures, multi-family structures with three or fewer stories, and temporary structures. More information about 2012 IgCC	• Model code	• Mandatory	• Commercial: all • Industrial: all but manufacturing systems and equipment • Mixed use: all • Residential: multi-family with more than 3 stories	• New construction • Additions • Alterations	• Sustainable sites • Energy efficiency • Water efficiency • Materials and resource use • Indoor environmental quality • Emissions • Operations and maintenance	☑ Compare IgCC with other standards
ANSI/ASHRAE/USGBC/IES Standard 189.1-2011: *Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings* **(ASHRAE 189.1)** A model code that contains minimum requirements for increasing the environmental and health performance of buildings sites and structures. Generally, it applies to the design and construction of all types of buildings except single-family homes, multi-family homes with 3 or fewer stories, and modular and mobile homes. More information about ASHRAE 189.1	• Model code	• Mandatory	• Commercial: all • Industrial: all • Mixed use: all • Residential: multi-family with more than 3 stories	• New construction • Additions	• Sustainable sites • Energy efficiency • Water efficiency • Materials and resource use • Indoor environmental quality • Construction and operations plans	☑ Compare ASH with other standards
ICC 700-2012: *2012 National Green Building Standard* **(ICC 700)** A rating and certification system that aims to encourage increased environmental and health performance in residences and residential portions of buildings. Its criteria apply to the design and construction of homes and subdivisions. More information about ICC 700	• Rating and certification system	• Voluntary	• Mixed use: residential space • Residential: all except institutional uses	• New construction • Additions • Alterations	• Sustainable sites • Energy efficiency • Water efficiency • Materials and resource use • Indoor environmental quality • Operations and maintenance • Building owner education	☑ Compare NGBS with other standards
Green Globes™ A series of rating and certification systems that encourage improved environmental and health performance for all types of buildings except residential structures. Green Globes™ is administered in the U.S. by the Green Building Initiative. More information about Green Globes	• Rating and certification system	• Voluntary	• Commercial: all • Mixed use: all • Residential: multi-family	• New construction • Additions • Alterations • Existing buildings	• Sustainable sites • Energy efficiency • Water efficiency • Materials and resource use • Indoor environmental quality • Emissions • Project/environmental management	☑ Compare GBI with other standards
US Green Building Council's *Leadership in Energy and Environmental Design* **(LEED®)** A series of rating systems aimed at increasing the environmental and health performance of buildings sites and structures and of neighborhoods. LEED® covers the design, construction, and operation of all types of buildings. More information about LEED	• Rating and certification system	• Voluntary	• Commercial: all • Industrial: all • Mixed use: all • Residential: all	• New construction • Existing buildings • Additions	• Sustainable sites • Energy efficiency • Water efficiency • Materials and resource use • Indoor environmental quality • Emissions • Operations and maintenance	☑ Compare LEED with other standards
The International Living Future Institute's *Living Building Challenge™*, **version 2.1 (May 2012)** A certification system that advocates for transformation in the design, construction, and operation of buildings. In addition to encouraging improved environmental and health performance, it supports building structures that are restorative, regenerative, and an integral component of the local ecology and culture. More information about the *Living Building Challenge*	• Certification system	• Voluntary	• Commercial: all • Industrial: all • Mixed use: all • Residential: all	• All	• Sustainable sites • Energy efficiency • Water efficiency • Materials and resource use • Indoor environmental quality • Equity • Aesthetics	☑ Compare ILFI with other standards

EPA Green Bldg. Std. - Comparison

Comparison of Green Building Standards

Standard	International Code Council's 2012 *International Green Construction Code* (IgCC), 2012 edition	American Society of Heating, Refrigeration, and Air-Conditioning Engineers' ANSI/ASHRAE/USGBC/IES Standard 189.1-2011, *Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings* (ASHRAE 189.1), 2011 edition	National Association of Home Builders' ICC 700 *National Green Building Standard* (NGBS), 2012 edition	Green Building Initiative's ANSI/GBI 01-2010: *Green Building Assessment Protocol for Commercial Buildings* (Green Globes), 2010 edition	US Green Building Council's *Leadership in Energy and Environmental Design* (LEED®)	The International Living Future Institute's *Living Building Challenge*, version 2.1 (May 2012)
Description	A model code that contains minimum requirements for increasing the environmental and health performance of buildings' sites and structures. Generally, it applies to the design and construction of all types of buildings except single- and two-family residential structures, multifamily structures with three or fewer stories, and temporary structures. For more information, go to: www.iccsafe.org/international-green-construction-code EXIT.	A model code that contains minimum requirements for increasing the environmental and health performance of buildings' sites and structures. Generally, it applies to the design and construction of all types of buildings except single-family homes, multifamily homes with three or fewer stories, and modular and mobile homes. For more information, go to: https://www.ashrae.org/resources--publications/bookstore/standard-189-1 EXIT.	A rating and certification system that aims to encourage increased environmental and health performance in residences and residential portions of buildings. Its criteria apply to the design and construction of homes and subdivisions. For more information, go to: www.nahbgreen.org/NGBS/default.aspx EXIT.	A series of rating and certification systems that encourage improved environmental and health performance for all types of buildings except residential structures. Green Globes is administered in the United States by the Green Building Initiative. For more information, go to: www.thegbi.org/green-globes-certification EXIT.	A series of rating systems aimed at increasing the environmental and health performance of buildings' sites and structures and of neighborhoods. LEED® covers the design, construction, and operations of all types of buildings. For more information, go to: www.usgbc.org/DisplayPage.aspx?CMSPageID=1988 EXIT.	A certification system that advocates for transformation in the design, construction, and operation of buildings. In addition to encouraging improved environmental and health performance, it supports the building of structures that are restorative, regenerative, and an integral component of the local ecology and culture. For more information, go to: https://ilbi.org/lbc/standard EXIT.
Standard Type[1]	• Model code	• Model code	• Rating and certification system	• Rating and certification system	• Rating and certification system	• Certification system
Mandatory/Voluntary[2]	• Mandatory	• Mandatory	• Voluntary	• Voluntary	• Voluntary	• Voluntary
Building Type(s)	• Commercial: all • Industrial: all but manufacturing systems and equipment • Mixed use: all • Residential: multifamily with more than three stories	• Commercial: all • Industrial: all • Mixed use: all • Residential: multifamily with more than three stories	• Mixed use: residential space • Residential: all except institutional uses	• Commercial: all • Mixed use: all • Residential: multifamily	• Commercial: all • Industrial: all • Mixed use: all • Residential: all	• Commercial: all • Industrial: all • Mixed use: all • Residential: all
Project Type	• New construction • Additions • Alterations	• New construction • Additions	• New construction • Additions • Alterations	• New construction • Additions • Alterations • Existing buildings	• New construction • Existing buildings • Additions	• All
Subject Areas	• Sustainable sites • Energy efficiency • Water efficiency • Materials and resource use • Indoor environmental quality • Emissions • Operations and maintenance	• Sustainable sites • Energy efficiency • Water efficiency • Materials and resource use • Indoor environmental quality • Construction and operations plans	• Sustainable sites • Energy efficiency • Water efficiency • Materials and resource use • Indoor environmental quality • Operations and maintenance • Building owner education	• Sustainable sites • Energy efficiency • Water efficiency • Materials and resource use • Indoor environmental quality • Emissions • Project environmental management	• Sustainable sites • Energy efficiency • Water efficiency • Materials and resource use • Indoor environmental quality • Emissions • Operations and maintenance	• Sustainable sites • Energy efficiency • Water efficiency • Materials and resource use • Indoor environmental quality • Equity • Aesthetics
Community Adoption/Use	• Designed to be incorporated into a jurisdiction's codes and ordinances and function as an overlay to other International Code Council model codes. • Requires adoption by a governing jurisdiction before it becomes mandatory. • Jurisdictions that do not have other International Code Council codes in place might want to make a detailed review of local building ordinances to ensure that they adequately correlate with this code. • In addition to the mandatory requirements, IgCC offers jurisdictions a range of options for increasing the stringency of the code or encouraging improved levels of performance in areas of particular importance to the community.	• ASHRAE 189.1 is designed to be used and enforced with a jurisdiction's other building codes and ordinances. • Requires adoption by a governing jurisdiction before it becomes mandatory. • Jurisdictions might want to make a detailed review of local building ordinances to ensure that they adequately correlate with this standard.	• Communities could use this standard as the basis for a voluntary program to encourage construction of greener homes.	• Communities could use this protocol as the basis for a voluntary program that encourages construction of greener commercial buildings.	• Communities could use the rating systems to encourage greener construction of commercial buildings, homes, or neighborhoods.	• Communities could use this system as the basis for a green building program.
Certification/Compliance Process	• Designed to be incorporated into a jurisdiction's codes and ordinances and enforced by building officials and inspectors. • All provisions of the model code are designed to be mandatory, except those the jurisdiction indicates are not applicable or those designated as project electives. Project electives give jurisdictions the flexibility to encourage the consideration and implementation of beneficial practices without making those particular practices mandatory.	• Designed to be incorporated into a jurisdiction's codes and ordinances and enforced by building officials and inspectors. • Based on mandatory requirements with two compliance path options: Prescriptive Path (considered to be the simpler option with minimal choices and few calculations) and Performance Path (considered to be the more sophisticated option that provides flexibility and more options but also requires greater effort).	• There are four green certification levels for homes: Bronze, Silver, Gold, and Emerald. Land Developments can earn One, Two, Three, or Four Stars. • NGBS contains few minimum criteria but allows the builder or developer great flexibility in selecting green building practices. • Projects receive points in each subject area for reaching certain performance or construction goals. • Certification requires verification by third-party inspectors accredited by the National Association of Home Builders (NAHB) at the rough-in stage and on completion. Inspector verifies that every criterion cited by the builder in the NAHB's online scoring tool has been met.	• Certification to one of four levels (i.e., 1 to 4 globes) requires achieving minimum thresholds of 1,000 points. • Has no minimum criteria (i.e., does not require any specific practices), but instead rates buildings on the green building practices that the builder has chosen to include. • Does not require any ongoing documentation, but it might be required as proof of compliance during the third-party assessment. • Requires third-party review of building documentation and onsite walk-throughs.	• LEED® points are awarded on a 100-point scale, and credits are weighted to reflect their potential environmental impacts. Ten bonus credits are available, four of which address regionally specific environmental issues. A project must satisfy all prerequisites and earn a minimum number of points to be certified. Third-party certification is required. • Includes four levels of certification: Certified, Silver, Gold, or Platinum.	• Projects must meet up to 20 requirements to achieve full certification. However, partial recognition is attainable, including a Net Zero Energy Building Certification. • The certification process involves a review of written elements and a site visit by an independent auditor.
Relationship to Other Standards	• ANSI/ASHRAE/USGBC/IES Standard 189.1-2011, *Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings* (ASHRAE 189.1) is an alternate compliance path to IgCC, i.e., in jurisdictions that adopt IgCC, a builder has the option to design and construct a building in accordance with the provisions of ASHRAE 189.1 rather than those of IgCC. • IgCC provides jurisdictions with options for mandating that residential structures comply with the National Association of Home Builders' *National Green Building Standard* (ICC-700). • IgCC is designed to coordinate and integrate with the family of International Code Council codes and complement voluntary green building rating systems. • Some provisions reference standards published by other organizations, e.g., ASTM International, National Science Foundation, and South Coast Air Quality Management District.	• It is an alternate compliance path for the International Green Construction Code (IgCC), i.e., in jurisdictions that adopt IgCC, a builder has the option to design and construct a building in accordance with the provisions of 189.1 rather than those of IgCC. • ASHRAE 189.1 is designed to complement voluntary green building rating systems. • Some provisions reference standards published by other organizations, e.g., ASTM International, National Science Foundation, and South Coast Air Quality Management District.	• Includes a separate green rating system for entire subdivisions, similar to the LEED for Neighborhood Development system. • Many of the mandatory measures found in the ICC 700 National Green Building Standard are consistent with the family of International Code Council's codes.	• Modeled after Building Research Establishment Environmental Assessment Method (BREEAM).	• Meeting or achieving ASHRAE standards is necessary for achieving several of the LEED® credits, including ASHRAE 90.1-2007 and 62.1-2007.	

BUILDING RATING OR CERTIFICATION SYSTEM	SINGLE- OR MULTI-ATTRIBUTE	TYPE OF STANDARD OR CERTIFICATION	MANAGING ORGANIZATION	ISSUES / AREAS OF FOCUS
Energy Star	Single-Attribute	Government certification using a benchmarking method	U.S. EPA and U.S. DOE	Building energy and water use
Leadership in Energy and Environmental Design (LEED)	Multi-Attribute	Green building rating and certification system through independent third-party verification for: • New Construction (NC) • Existing Buildings, Operations & Maintenance (EB O&M) • Commercial Interiors (CI) • Core & Shell (CS) • Schools (SCH) • Retail • Healthcare (HC) • Homes • Neighborhood Development (ND)	U.S. Green Building Council	Performance in: • Sustainable Sites • Water Efficiency • Energy & Atmosphere • Materials & Resources • Indoor Environmental Quality • Locations & Linkages • Awareness & Education • Innovation in Design • Regional Priority through a set of prerequisites and credits
Green Globes	Multi-Attribute	Green building guidance and assessment program for: • Existing buildings • New construction	Green Building Initiative in the U.S. BOMA Canada	Environmental assessment areas to earn credits in: • Energy • Indoor Environment • Site • Water • Resources • Emissions • Project/Environmental Management No prerequisites
Living Building Challenge	Multi-Attribute	Performance-based standard, and certification program for: • Landscape and infrastructure projects • Partial renovations and complete building renewals • New building construction • Neighborhood, campus and community design	International Living Future Institute	Performance areas include: • Site • Water • Energy • Materials • Health • Equity • Beauty All areas are requirements.
NZEB	Multi-Attribute	Certification program using the structure of the Living Building Challenge which can be applied to any building type.	International Living Future Institute	One hundred percent of the project's energy needs must be supplied by on-site renewable energy on a net annual basis, without the use of on-site combustion. NZEB certified buildings must also meet the following requirements of the Living Building Challenge: • the first half of Imperative One, Limits to Growth, dealing with appropriate siting of buildings • Imperative 19, Beauty and Spirit • Imperative 20, Inspiration and Education
SITES	Multi-Attribute	Third party verified rating system for development projects located on sites with or without buildings.	Administered by GBCI	Performance criteria in the areas of: • Water • Wildlife Habitat • Energy • Air Quality • Human Health • Outdoor recreation opportunities
WELL Building Standard	Multi-Attribute	Performance based standard and certification program for • New and Existing Buildings • New and Existing Interiors • Core and Shell Retail • Education Facilities • Restaurant • Commercial Kitchen • Multifamily Residential	Administered by the International WELL Building Institute™ (IWBI)	Measures attributes of buildings that impact occupant health by looking at seven factors: Air, Water, Nourishment, Light, Fitness, Comfort, Mind

WBDG SUMMARY

- Whole Building Design Guide, Resources Pages
  - Criteria included single and multi-attribute systems
  - This summary excludes International Programs including BREEAM

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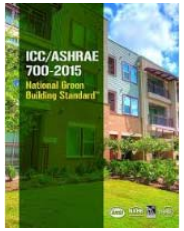
WBDG Whole Building Design Guide®

5. QUESTIONS


THANKS!


Standard for
the Design of
High-Performance
Green Buildings
Except Low-Rise
Residential Buildings


ICC/ASHRAE
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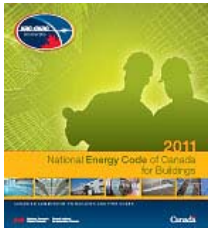
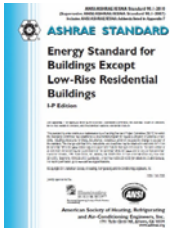
National Green
Building Standard


2011
National Energy Code of Canada
for Buildings


ASHRAE STANDARD
Energy Standard for
Buildings Except
Low-Rise Residential
Buildings

BREEAM
BRE GLOBAL


GREEN
GLOBES


LEED
v4


PASSIVEHOUSE
CANADA
Build better.
Feel better.


LIVING
BUILDING
CHALLENGE


INTERNATIONAL
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INSTITUTE