

ASHRAE 90.1-2004

ASHRAE 90.1-2007

ASHRAE 189

IECC 2006

CALIFORNIA TITLE 24

OREGON ENERGY CODE

WASHINGTON ENERGY CODE

RESNET HERS INDEX

LEED NC 2.2

LEED 2009

GBI STANDARD

EECC OPTION

NBI OPTION

**Meeting the 2030 Challenge  
Through Building Codes**



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# Acknowledgements

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## Introduction

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In 2007, the baseline for evaluating progress toward meeting the 2030 Challenge targets was established as the 2003 Commercial Building Energy Consumption Survey (CBECS) for commercial buildings<sup>1</sup> and the Residential Energy Consumption Survey (RECS) for residential buildings. Although new building energy standards and rating systems that meet the 2030 Challenge as measured against these baselines are currently in development, they are not yet available. As a result, there is an immediate need and high demand for an interim system that enables cities, counties and states to meet the 2030 Challenge targets using existing building energy codes and standards as baselines.

Architecture 2030 has developed an interim system based on 'code equivalents', which are the additional reductions<sup>2</sup> needed beyond the requirements of a particular code, standard or rating system to meet or exceed the initial 50% target of the 2030 Challenge. The paper also provides suggestions for ordinances that can be used to aid governments in amending their existing building code to incorporate these code equivalents.

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<sup>1</sup> Architecture 2030 (May 4, 2007), "The 2030 Challenge Benchmark Set: Building Design Leaders United on Energy Reduction Targets", Press Release, [http://www.architecture2030.org/news/Press\\_Release\\_5\\_4\\_07.pdf](http://www.architecture2030.org/news/Press_Release_5_4_07.pdf).

<sup>2</sup> The additional percentage reductions provided in Table A are reasonable averages for all buildings. The actual percentage reductions for a particular building will vary by building type and climate zone.



## Rising to the Challenge

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Every crisis needs a hero and in the case of climate change that hero has taken the form of states, local governments and professional organizations. Today:

- 27 states have or are developing climate action plans<sup>3</sup>,
- 839 US cities have signed the Mayors Climate Protection Agreement<sup>4</sup>,
- three regional greenhouse gas (GHG) initiatives<sup>5</sup> have been established and
- the 2030 Challenge<sup>6</sup> has been adopted by the:
  - US Conference of Mayors (USCM)
  - National Association of Counties (NACo)
  - American Institute of Architects (AIA)
  - US Green Building Council (USGBC)
  - American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) (supporter)
  - International Council for Local Environmental Initiatives (ICLEI)
  - Congress for the New Urbanism (CNU)
  - states of Illinois, Minnesota, California and New Mexico
  - numerous counties and cities

Although slower to act, the federal government has also begun to move, adopting the 2030 Challenge targets for all new and renovated **federal buildings**<sup>7</sup>.

The above efforts recognize the critical role that buildings play in the climate change crisis, both in creating the crisis and solving it.

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<sup>3</sup> [http://www.pewclimate.org/what\\_s\\_being\\_done/in\\_the\\_states/action\\_plan\\_map.cfm](http://www.pewclimate.org/what_s_being_done/in_the_states/action_plan_map.cfm).

<sup>4</sup> <http://usmayors.org/climateprotection/agreement.htm>.

<sup>5</sup> [http://www.pewclimate.org/what\\_s\\_being\\_done/in\\_the\\_states/regional\\_initiatives.cfm](http://www.pewclimate.org/what_s_being_done/in_the_states/regional_initiatives.cfm).

<sup>6</sup> The 2030 Challenge calls for 1) all new buildings and developments to be designed to use half the fossil fuel energy they would typically consume, i.e., half the regional or country average for that building type, 2) at a minimum, an equal amount of existing building area be renovated annually to use half the amount of fossil fuel energy they are currently consuming, and 3) the fossil fuel reduction standard for all new buildings be increased to 60% in 2010, 70% in 2015, 80% in 2020, 90% in 2025 and carbon neutral in 2030 (using no fossil fuel GHG-emitting energy). Architecture 2030 recommends the fossil fuel reduction targets be achieved through design, the application of renewable energy technologies and/or the purchase of renewable energy (20% maximum). Additional information is available online at [http://www.architecture2030.org/2030\\_challenge/index.html](http://www.architecture2030.org/2030_challenge/index.html).

<sup>7</sup> H.R.6: "Energy Independence and Security Act of 2007", US Representative Nick Rahall (D-WV), sponsor, <http://thomas.loc.gov/cgi-bin/bdquery/z?d110:HR00006:@@L&summ2=m&>.

## Buildings: The Problem and the Solution

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### *The Problem: The Major CO<sub>2</sub> Culprit*

Buildings are responsible for approximately half of all US energy consumption and CO<sub>2</sub> emissions annually. Building operations alone, i.e., heating, cooling, lighting, hot water and the plug load, account for 43%<sup>8</sup> of total US CO<sub>2</sub> emissions and 76%<sup>9</sup> of total US electricity consumption. Therefore, to have any real impact on climate change, it is essential to address CO<sub>2</sub> emissions in the Building Sector.

### *The Solution: The 2030 Challenge*

Of the many solutions offered today, the one that has shown itself to be aggressive enough to meet the demanding **timeline**<sup>10</sup> set by scientists, while remaining economically and technically **feasible**<sup>11</sup>, is the 2030 Challenge. The initial phase of the Challenge, the 50% reduction target, is designed to bring an immediate halt to the increase of GHG emissions in the Building Sector; subsequent phases are designed to incrementally and systematically reduce CO<sub>2</sub> emissions in this sector.

To meet scientists' timeline, measurable action must begin today. Significant progress can be made immediately by using existing building codes and standards to implement the 2030 Challenge targets for all new and renovated buildings.

## Codes: Starting Where You Are

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### *An Interim Solution*

As mentioned, new building energy standards and rating systems that meet the 2030 Challenge as measured against CBECS and RECS are currently in development, but are not yet available. Due to the high demand for an interim system that allows states and local governments to meet the Challenge targets using their current building energy codes and standards as baselines, Architecture 2030 has developed the '2030 Challenge Interim Code Equivalents' shown in Table A below.

Table A includes the most commonly used energy codes and standards<sup>12</sup> and rating systems. Because the states of California, Oregon and Washington have their own energy codes, these have been included as well. This table provides the additional reductions needed beyond the requirements of a particular code to meet or exceed the initial 50% reduction target of the 2030 Challenge.

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<sup>8</sup> [http://www.pewclimate.org/global-warming-in-depth/all\\_reports/buildings](http://www.pewclimate.org/global-warming-in-depth/all_reports/buildings).

<sup>9</sup> [http://www.architecture2030.org/current\\_situation/building\\_sector.html](http://www.architecture2030.org/current_situation/building_sector.html).

<sup>10</sup> Hansen, J. et al., "Target Atmospheric CO<sub>2</sub>: Where Should Humanity Aim?", April 7, 2008, [www.columbia.edu/~jeh1/2008/TargetCO2\\_20080407.pdf](http://www.columbia.edu/~jeh1/2008/TargetCO2_20080407.pdf).

<sup>11</sup> Commission for Environmental Cooperation (CEC), "Green Building in North America", March 13, 2008, [http://www.cec.org/files/PDF//GB\\_Report\\_EN.pdf](http://www.cec.org/files/PDF//GB_Report_EN.pdf).

<sup>12</sup> [http://www.energycodes.gov/implement/state\\_codes/index.stm](http://www.energycodes.gov/implement/state_codes/index.stm).

**Table A: 2030 Challenge Interim Code Equivalents**

<b>CODE / STANDARD</b>	<b>COMMERCIAL</b>	<b>RESIDENTIAL</b>
ASHRAE 90.1-2004	30% below	
ASHRAE 90.1-2007	25% below	
ASHRAE 189 (in progress)	0	
IECC 2006	30% below	30% below
California Title 24 2005		15% - 20% below <sup>13</sup>
California Title 24 2008	10% below <sup>14</sup>	
Oregon Energy Code <sup>15</sup>	25% below	30% below
Washington Energy Code	25% below	25% - 30% below <sup>16</sup>
RESNET HERS Index		65 or less
LEED NC 2.2 / Homes	New - EA Credit #1: 6 pts Renovation - EA Credit #1: 8pts	HERS Index: 65
LEED 2009 (in progress)	New - EA Credit #1: 7 pts Renovation - EA Credit #1: 9pts	
GBI Standard (in progress) <sup>17</sup>	PATH A, 8.1.1.1: 150pts	
EECC Option <sup>18</sup> (prescriptive path)		EC - 154
NBI Option <sup>19</sup> (prescriptive path)	New - Core Performance w/ enhanced measures	

NOTE: Table A above represents a set of guidelines. Each entity should assess its particular code and building energy consumption patterns and adjust the code equivalents provided in the table as appropriate. For example, those entities with aggressive GHG and energy reduction initiatives may want to increase the recommended percentage reductions. Entities with detailed information on code performance compared to their building stock are encouraged to adjust the percentage reductions to meet the 2030 Challenge targets.

<sup>13</sup> The City of Santa Barbara established meeting the 2030 Challenge target for single-family residential units at 20% below Title 24 and, for high-rise residential, at 15% below Title 24.

<sup>14</sup> Based on preliminary code analysis for the California Energy Commission by Charles Eley of Architectural Energy Corporation.

<sup>15</sup> Oregon Department of Energy, "Comparison of Oregon Energy Code 2005 & ASHRAE Standard 90.1-2004".

<sup>16</sup> For residential buildings east of the Cascade Mountains, use 25% below. For residential buildings west of the Cascades, use 30% below.

<sup>17</sup> Green Building Initiative, Proposed American National Standard 01-2008P.

<sup>18</sup> Alliance to Save Energy, Energy Efficient Codes Coalition (EECC), "The 30% Solution"/EC-154. This option provides a method for modifying the prescriptive path of the code to meet or exceed the 2030 Challenge 50% reduction target.

<sup>19</sup> New Buildings Institute, Advanced Buildings Core Performance Guide with enhanced measures. This option provides a method for modifying the prescriptive path of the code to meet or exceed the 2030 Challenge 50% reduction target.



The following examples further explain the information provided in Table A:

**IECC 2006:**

To meet or exceed the 2030 Challenge 50% reduction target, those currently using IECC 2006<sup>20</sup> must achieve an additional 30% improvement beyond the requirements of this code.

For residential buildings, this would be demonstrated by using the:

1. IECC 2006 Section 404 Simulated Performance Alternative, requiring a 30% improvement in the proposed residence (design) performance as compared to the standard reference design,
2. EEC Option, incorporating and complying with the prescriptive requirements of EC-154, the Energy Efficient Codes Coalition's<sup>21</sup> voluntary appendix to IECC 2009, or
3. HERS Index, achieving a HERS Index<sup>22</sup> rating of 65 or less.

For commercial buildings this would be demonstrated by using the:

1. IECC 2006 Section 506 Total Building Performance, requiring a 30% improvement in the proposed building (design) performance as compared to the standard reference design, (Architecture 2030 recommends that architects/engineers be given the option to use EPA's Energy Star-Target Finder<sup>23</sup> to determine the 50% Energy Reduction Target as the baseline standard reference design for their building type, if available.)
2. ASHRAE 189 Standard (in development), incorporating and complying with the prescriptive requirements in this standard, or
3. NBI Option, incorporating and complying with the prescriptive requirements of the New Building Institute's Advanced Buildings<sup>24</sup> Core Performance Guide with enhanced measures.

**ASHRAE/IESNA Standard 90.1-2004:**

To meet or exceed the 2030 Challenge 50% reduction target, those using ASHRAE/IESNA Standard 90.1-2004<sup>25</sup> as their code standard for commercial buildings would need to achieve an additional 30% improvement beyond the requirements of the standard, which would be demonstrated by using the:

1. ASHRAE/ IESNA Standard 90.1-2004 Building Performance Rating Method (performance path) in Appendix G, requiring a 30% improvement in the proposed building performance rating compared to the baseline building performance rating, (Architecture 2030 recommends that architects/engineers be given the option to use EPA's Energy Star-Target Finder to determine the 50% Energy Reduction Target as the baseline building performance rating for their building type, if available.)
2. ASHRAE 189 Standard (in development), incorporating and complying with the prescriptive requirements in this standard, or
3. NBI Option, incorporating and complying with the prescriptive requirements of the New Building Institute's Advanced Buildings Core Performance Guide with enhanced measures.

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<sup>20</sup> <http://www.iccsafe.org/>.

<sup>21</sup> <http://ase.org/extensions/eec/proposals.php>.

<sup>22</sup> <http://www.natresnet.org/>.

<sup>23</sup> [http://www.energystar.gov/index.cfm?c=new\\_bldg\\_design.bus\\_target\\_finder](http://www.energystar.gov/index.cfm?c=new_bldg_design.bus_target_finder).

<sup>24</sup> For more information on the Advanced Buildings Core Performance Guide with enhanced measures, contact the New Building Institute at <http://www.advancedbuildings.net/>.

<sup>25</sup> <http://www.ashrae.org/technology/page/548>.

### **LEED 2.2 for New Construction and Major Renovations:**

To meet or exceed the 2030 Challenge 50% reduction target, those using the LEED 2.2<sup>26</sup> rating system as a building performance standard would require

1. six (6) mandatory points in EA (Energy & Atmosphere) Credit 1: Optimize Energy Performance for New Buildings or
2. eight (8) mandatory points for Existing Building Renovations.

#### *Amending Your Code*

Amending the local or state building energy code to meet the initial 50% reduction target of the 2030 Challenge via the above code equivalents is the first step to reducing emissions in the Building Sector. When amending an energy code, it is important to amend both the prescriptive and performance paths of the code, or to use only the performance path for compliance.<sup>27</sup> The EECC (residential) and NBI (commercial) options listed in Table A provide a method for amending the prescriptive path of a code, so that it meets the 50% target.

In most cases, local governments can amend their code as long as it meets or exceeds the state standard. A sample ordinance, which can be modified to incorporate the code equivalents, is provided as part of the ASHRAE Standard and IECC to help state and local governments in this process. Additional help can be obtained by reviewing the 'Architecture 2030 Energy Ordinance' unanimously approved by the city council of Santa Barbara, the first city to officially incorporate the 2030 Challenge into their building energy code. The ordinance can be found online at the California Energy Commission [website](#).<sup>28</sup>

## Conclusion

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Given the shortening timeline for dramatically reducing greenhouse gas emissions, it is imperative that governments committed to doing so have a readily assessable way to begin realizing reductions in their building sector. The 2030 Challenge code equivalents listed in Table A provide a simple, practicable solution using existing building energy codes and rating systems. By amending existing codes based on these code equivalents, governments can be confident that their codes meet the initial 50% reduction target of the 2030 Challenge.

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<sup>26</sup> <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=220>.

<sup>27</sup> All energy codes have two paths to demonstrate compliance, a prescriptive path and a performance path. The prescriptive path, which addresses items such as building envelope, insulation requirements, types of glazing and equipment requirements, makes up the bulk of the code. The requirements for the prescriptive path change as codes are updated and as each newer code or standard is released. The performance path, on the other hand, is only a few pages in length and remains basically the same with each new code update or release. The performance path requires that a building performance baseline be determined and the building design be quantified through a whole building simulation to demonstrate that it consumes less delivered energy as compared to that baseline.

<sup>28</sup> [http://www.energy.ca.gov/title24/2005standards/ordinances\\_exceeding\\_2005\\_building\\_standards.html](http://www.energy.ca.gov/title24/2005standards/ordinances_exceeding_2005_building_standards.html).

