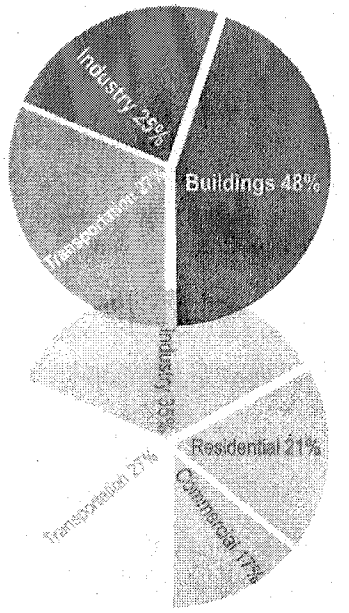
AIA Architects and Climate Change



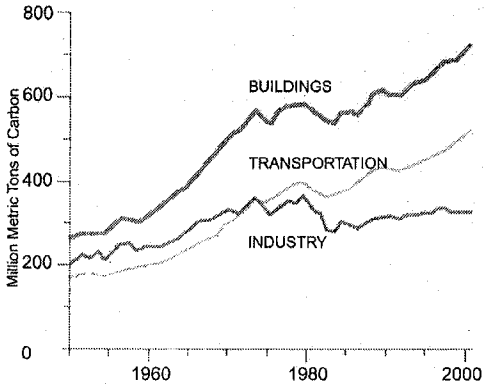
GRAPHIC 1: Combining the annual energy required to operate residential, commercial, and industrial buildings along with the embodied energy of industry-produced building materials like carpet, tile, glass, and concrete exposes buildings as the largest energy consuming and greenhouse gas emitting sector.

Key Points

- *The biggest source of emissions and energy consumption both in this country and around the globe: buildings.*

- *The Building Sector, as the major U.S. and global source of demand for energy and materials that produce by-product greenhouse gases, is poised to fuel the world's rush toward climate change.*

Buildings Account For Half Of All Greenhouse Gas Emissions



GRAPHIC 2: U.S. CO2 Emissions by Sector.

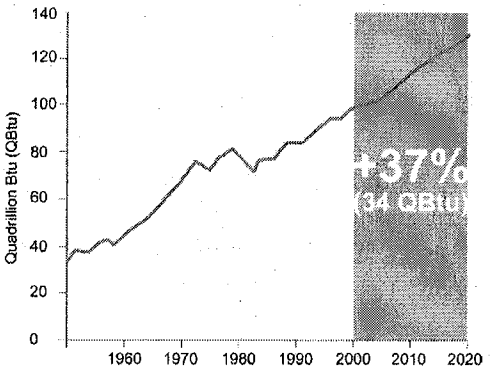
In our quest to dramatically cut greenhouse gas emissions and lessen our dependence on fossil fuels, we have overlooked the biggest source of emissions and energy consumption both in this country and around the globe: buildings and the energy they consume each year. Buildings and their construction account for nearly half of all the greenhouse gas emissions and energy consumed in this country each year. This includes energy used in the production and transportation of materials to building construction sites, as well as the energy used to operate buildings, Globally the percentage is even greater. The Building Sector is the key source of demand for energy and materials that produce by-product greenhouse gases.

U.S. annual energy consumption is projected to increase by 37% (34 quadrillion Btu) and greenhouse gas emissions by 36% over the next twenty years. Annual global energy consumption is projected to increase by 54% (230 quadrillion Btu) over this same period.

Building Sector Emissions Are Increasing Dramatically

Buildings have a lifespan that lasts for 50 to 100 years throughout which they consume energy and produce emissions. The Building Sector as the major U.S. and global greenhouse gas emitting sector, is poised to fuel the world's rush toward climate change. The U.S. alone is projected to need 1,300 to 1,900 new power plants over the next 20 years (about one power plant per week). Most of this new energy will be needed to operate buildings.

The United States will add 22 million buildings that will not only consume electricity produced at a central power plant, but also directly burn oil, natural gas and/or propane in boilers, furnaces and hot water heaters. In fact, 58% of end-use energy needed to operate a building is consumed by the burning of fuel onsite.



GRAPHIC 3: U.S. Energy Consumption Projections

1 quadrillion Btu is equal to annual energy output of 40 - 1,000MW power plants.

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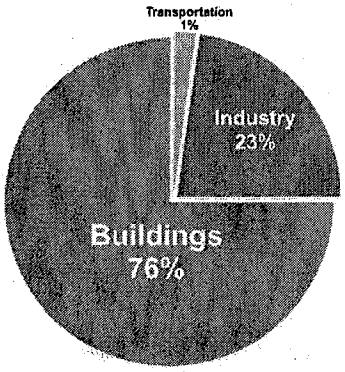


GRAPHIC 4: 76% of all power plant generated electricity is used just to operate buildings.

Key Points

- *Architects know that buildings can be designed to operate with less than half the energy of today's average U.S. building at little or no additional cost*

- *By the year 2035, three quarters of the built environment in the U.S. will be either new or renovated.*

This Background Sheet was prepared in collaboration with Edward Mazria AIA, founder of Architecture 2030. For further information see www.architecture2030.org or contact: info@architecture2030.org. The AIA, through its Sustainable Design Task Force and its Committee on the Environment, is working to develop a detailed action plan to meet the greenhouse gas reduction goals set out above.

A Perspective On How To Curb Emissions

Scientists tell us that in order to avoid dangerous climate change we must keep global warming under 2°C above pre-industrial levels (we are currently at 0.7°C above pre-industrial levels). To avoid exceeding this threshold a way forward would involve:

- Promoting sustainable design including resource conservation to achieve a minimum 50 percent reduction from the current level of consumption of fossil fuels used to construct and operate new and renovated buildings by the year 2010.

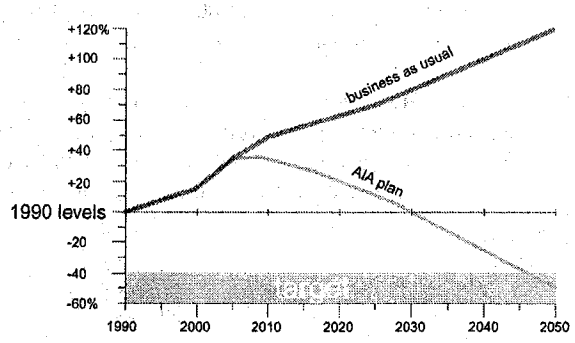
- Promoting further reductions of fossil fuel consumption by 10 percent or more in each of the following five year intervals so that the cumulative reduction from today's baseline is:

  60% in 2010
  70% in 2015
  80% in 2020
  90% in 2025
  carbon-neutral by 2030 (Meaning that the construction and operation of buildings will no longer require the consumption of fossil fuel energy or the emission of greenhouse gases.)

- Driving these reductions through: 1) creating building performance standards in building codes and standards to address private sector structures, and 2) creating governmental mandates that federal and state buildings meet energy efficiency targets.

- Supporting government action to use incentive-based regulatory means to reduce greenhouse gas emissions.

Architects know that buildings can be designed to operate with far less energy than today's average U.S. building at little or no additional cost. This is accomplished through proper siting, building form, glass properties and location, material selection and by incorporating natural heating, cooling and ventilation and day-lighting strategies.



GRAPHIC 5: By enacting a Building Sector initiative like this we can meet a greenhouse gas reduction target of 40% to 60% below 1990 levels by 2050.

With about 5 billion square feet (sf) of new construction, 5 billion sf of renovation and 1.75 billion sf of demolition taking place in the U.S. each year, by the year 2035, three quarters of the built environment in the U.S. will be either new or renovated. This transformation over the next 30 years represents a historic opportunity for the U.S. architecture and building community, with the support of the federal government, to lead in addressing greenhouse gas emission reductions.

Meeting the 2030 Challenge Through Building Codes

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Introduction

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[1] 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[2] 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.

[1] 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.

[2] 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

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[3],
- 839 US cities have signed the Mayors Climate Protection Agreement[4],
- three regional greenhouse gas (GHG) initiatives[5] have been established and
- the 2030 Challenge[6] 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[7].

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

[3] http://www.pewclimate.org/what_s_being_done/in_the_states/action_plan_map.cfm.

[4] http://usmayors.org/climateprotection/agreement.htm.

[5] http://www.pewclimate.org/what_s_being_done/in_the_states/regional_initiatives.cfm.

[6] 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.

[7] 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

The Problem: The Major CO_2 Culprit

Buildings are responsible for approximately half of all US energy consumption and CO_2 emissions annually. Building operations alone, i.e., heating, cooling, lighting, hot water and the plug load, account for 43%[8] of total US CO_2 emissions and 76%[9] of total US electricity consumption. Therefore, to have any real impact on climate change, it is essential to address CO_2 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[10] set by scientists, while remaining economically and technically feasible[11], 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_2 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

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[12] 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.

[8] http://www.pewclimate.org/global-warming-in-depth/all_reports/buildings.

[9] http://www.architecture2030.org/current_situation/building_sector.html.

[10] Hansen, J. et al., "Target Atmospheric CO_2: Where Should Humanity Aim?", April 7, 2008, www.columbia.edu/~jeh1/2008/TargetCO2_20080407.pdf.

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

[12] http://www.energycodes.gov/implement/state_codes/index.stm.

Table A: 2030 Challenge Interim Code Equivalents

CODE / STANDARD	COMMERCIAL	RESIDENTIAL
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[13]
California Title 24 2008	10% below[14]	
Oregon Energy Code[15]	25% below	30% below
Washington Energy Code	25% below	25% - 30% below[16]
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	why is this higher than v2.2?
GBI Standard (in progress)[17]	PATH A, 8.1.1.1: 150pts	
EECC Option[18] (prescriptive path)		EC - 154
NBI Option[19] (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.

[13] 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.

[14] Based on preliminary code analysis for the California Energy Commission by Charles Eley of Architectural Energy Corporation.

[15] Oregon Department of Energy, "Comparison of Oregon Energy Code 2005 & ASHRAE Standard 90.1-2004".

[16] For residential buildings east of the Cascade Mountains, use 25% below. For residential buildings west of the Cascades, use 30% below.

[17] Green Building Initiative, Proposed American National Standard 01-2008P.

[18] 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.

[19] 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[20] 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. EECC Option, incorporating and complying with the prescriptive requirements of EC-154, the Energy Efficient Codes Coalition's[21] voluntary appendix to IECC 2009, or
3. HERS Index, achieving a HERS Index[22] 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[23] 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[24] 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[25] 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.

[20] http://www.iccsafe.org/.

[21] http://ase.org/extensions/eecc/proposals.php.

[22] http://www.natresnet.org/.

[23] http://www.energystar.gov/index.cfm?c=new_bldg_design.bus_target_finder.

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

[25] 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[26] 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.[27] 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.[28]

Conclusion

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.

[26] http://www.usgbc.org/DisplayPage.aspx?CMSPageID=220.

[27] 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.

[28] http://www.energy.ca.gov/title24/2005standards/ordinances_exceeding_2005_building_standards.html.