The Future of Energy Codes

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There is no shortage of requirements dictating our day to day tasks as consulting engineers. Adding to the specific conditions of individual jobs and client needs are an ever-changing congregation of codes and standards that have significant impact on how we design mechanical and electrical systems for buildings. And even just the topic of 'energy codes' is quite vast, but this post sets out to lay the groundwork for where we're at now and where the industry is headed.

And as anyone can assume, codes and standards are moving towards more restrictive energy performance requirements. Like we always say here at MEI, the legacy we leave for the owner as design engineers are the utility bills. The amount of energy a building consumes is significant, since cumulatively buildings in the U.S. are responsible for 70% of electricity and 40% of all energy consumption (not to mention 40% of all CO2 emissions and 13% of potable water), according to the U.S. Green Building Council (USGBC). Over the lifetime of a design, this can add up both in economics and environmental impact.

With the prevalence and growing popularity of building rating systems like USGBC's LEED, people often ask the question if these programs will become obsolete as codes like the International Energy Conservation Code and standards like ASHRAE's 90.1 continue on their development cycles. But as we've seen in the past, LEED is constantly evolving as well. And since LEED promotes a whole-building approach to sustainability, even as energy use requirements become more stringent I believe the system as a whole will continue to develop and evolve right along with energy codes.

And speaking of energy codes, while I could write a complete tome on the subject of that alone, for our purposes here we'll have to settle for a quick overview before getting on to the point of this post. Note that for our purposes here, the term 'energy codes' will be used from here on out to describe both ASHRAE 90.1 (technically a standard), the IECC (a code) and other programs, guidelines, standards, rules, laws, etc as a collective group. For a much more detailed background, check out the U.S. Department of Energy's Building Energy Codes Program website at http://www.energycodes.gov/. And while we could go on to discuss other very relevant energy codes like ASHRAE 189, California Title 24, the Oregon Energy Code, ASHRAE Building EQ, Designed to Earn the ENERGY STAR, IGCC and more, to keep things relatively concise, we won't here. Just be aware that they're out there. The following two codes address the energy-efficiency requirements for the design, materials and equipment in nearly all new construction,

addition, renovation projects in the U.S. They apply to walls, floors, roofs, doors, windows, HVAC equipment of all types, lighting systems/controls (both interior and exterior) and water heating.

ASHRAE 90.1 – Energy Standard for Buildings except Low-Rise Residential Buildings

Standard 90.1 covers commercial buildings – excluding single-family dwellings and multi-family buildings three stories or less above grade. 90.1 is developed under guidance of the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) using the ANSI consensus process, which requires a balance of interests. It is updated about every three years, with a supplement published every eighteen months. The most current version is ASHRAE 90.1-2007, estimated to be approximately 5% more stringent its predecessor, the 2004 version.

IECC – The International Energy Conservation Code

This code applies to both residential and commercial projects. The IECC adopted, by reference, ASHRAE 90.1 (so compliance with 90.1 qualifies as compliance with IECC for commercial buildings). The IECC is developed under guidance of the International Code Council (ICC) using a government consensus process. It is updated about every three years as well. The most current version is 2009 IECC.

These two are considered the primary baseline energy codes, typically adopted by states and local jurisdictions to regulate design and construction of new buildings. Research shows that if the 2006 IECC and 90.1-2004 were upgraded to be 30-50% more stringent, adopted in all states, and effectively implemented, primary energy use in buildings would be reduced by 0.5 quadrillion Btu/year by 2015 and 3.5 quadrillion Btu/yr by 2030. That's the equivalent to the power generated by 260 medium sized (450-MW) power plants[1].

So how do we get there?

One program with a long term plan has a schedule… The 2030 Challenge. This solution sets out to meet a target CO2 emission timeline as determined to maintain a planet similar to that on which current life is adapted[2], the goal of which is broken into several phases. The first phase of the Challenge is to bring an immediate halt to the increase of greenhouse gas (GHG) emissions in the building sector by designing all new buildings, developments and major renovations to meet a fossil fuel, GHG-emitting, energy consumption performance standard of 60% the average for that building type, by region; and that at a minimum, an equal amount of existing building area shall be renovated annually to meet that requirement as well. From there, the cumulative

[1] http://buildingsdatabook.eere.energy.gov/TableView.aspx?table=6.2.7
[2] http://www.columbia.edu/~jeh1/2008/TargetCO2_20080407.pdf

reduction standard for all new buildings and major renovations shall be increased to 70% in 2015, 80% in 2020, 90% in 2025 and carbon-neutral (which is slightly different[3] than net zero, both of which are topics for another post) in 2030.

And how do we meet those percentages? Luckily, there's a very useful document called – appropriately enough – 'Meeting the 2030 Challenge Through Building Codes[4]'. This document includes guidance on how to use currently-existing building energy codes to implement the 2030 Challenge targets. So while new energy codes are being developed as we speak, in the meantime the '2030 Challenge Interim Code Equivalents' table is available, and reproduced below, in part and without footnote references. (Refer to the document link for the full table.)

2030 Challenge Interim Code Equivalents	
Code/Standard	**Commercial**
ASHRAE 90.1-2004	30% below
ASHRAE 90.1-2007	25% below
IECC 2006	30% below
California Title 24 2008	10% below
Oregon Energy Code	25% below
Washington Energy Code	25% below
LEED NC v2.2, EAc1	6 pts (new), 8 pts (renovation)
LEED 2009, EAc1	7 pts (new), 9 pts (renovation)

This table includes the most commonly used energy codes as well as rating systems and provides the additional reductions needed beyond the requirements of a particular code to meet or exceed the 50% reduction target of the Challenge.

Did you catch that? Yes… that 50% isn't a typo. That was the initial target, but the window for it closed in 2010. So now we're at 60%, making the aforementioned document somewhat outdated already at only 3 years old. In the meantime, firms that have adopted this challenge can compare their existing portfolio of buildings to the baseline starting point for the Challenge, the 2003 Commercial Building Energy Consumption Survey (CBECS[5]). Those familiar with ENERGY

[3] http://www.betterbricks.com/design-construction/reading/carbon-neutral-and-net-zero
[4] http://www.architecture2030.org/files/2030Challenge_Codes_WP.pdf
[5] http://www.eia.gov/emeu/cbecs/

STAR are likely familiar with this dataset, but in short it's a grouping of buildings that have undergone whole-building energy use measurements that were gathered by the DOE's Energy Information Administration and used to determine a national site energy use intensity using kBtu/gsf/yr as the metric (note that's *site* not *source* for the purposes of 2030*)*.

So really, the progressive sustainability and energy efficiency programs that go above and beyond current code requirements will set the baseline for the energy codes of tomorrow. As these more rigorous requirements transition into current practice and are incorporated into codes, new 'beyond code' programs will evolve as well until the code community's long term goal of zero energy use is achieved.

For the time being, that ultimate goal is still a long ways off, but with progressive codes and more creative solutions we're absolutely moving in that direction.