Current Trends in Commercial Energy Codes

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In his 2013 State of the Union address President Obama pledged to double energy efficiency by the year 2030. His strategy for accomplishing this, based on a report from the Alliance to Save Energy entitled "Energy 2030," encourages federal, state, and local officials to make policy decisions that will unleash investment in energy productivity while simultaneously increasing energy security. The report recommends, among other measures, that jurisdictions "steadily and aggressively increase the stringency of building energy codes, with quick adoption and effective compliance measures."

ADOPTING ENERGY CONSERVATION STANDARDS

Mandatory energy requirements were introduced into model building codes in the 1970s following the crisis brought on by OPEC oil embargoes. Starting in 1978 the Energy Policy and Conservation Act (EPCA) began requiring any state receiving federal financial assistance to adopt energy conservation standards for new construction. The potential for condensation in building assemblies resulting from new insulation requirements resulted in the introduction of vapor barriers and mandatory ventilation for uninsulated attics and crawl spaces.

The adoption of federal efficiency standards for appliances improved HVAC equipment performance, and building codes incorporated these requirements. Incremental increases in required thermal properties for envelope components gradually became standard practice in successive editions of the code, and in 2012 the International Energy Conservation Code (IECC) introduced a requirement for building thermal envelope sealing to limit infiltration, often referred to as an "air barrier."

Buildings consume approximately 40 percent of the energy used in the U.S., and efficiency is widely recognized to be the most effective means for containing demand and reducing use. Institutions of higher education make up a significant proportion of building area and annual energy and facility-related costs in the United States. The national model energy code applicable to commercial construction such as educational facilities is the IECC, which allows compliance with ASHRAE Standard 90.1 as one option for commercial buildings.

The recently published 2012 IECC achieves an approximate 15 percent increase in efficiency over the 2009 edition, and incorporates additional dimensions for efficiency such as the air barrier. The 2012 version achieves this higher level of performance through requirements for more insulation, a tighter envelope, tighter ducts, windows and skylights with higher solar heat gain coefficients and lower U-values, and more efficient lighting.

INCREMENTAL METHOD

While examples of net zero energy buildings and passive house construction establish a high bar for building performance, the incremental method of increasing requirements in the IECC may be approaching the limits of current technology and effective payback. A new edition of the IECC is scheduled to be published every three years, however past increases in efficiency are unlikely to be replicated in future energy code editions without significant innovations in building technology. A code requirement for net zero energy commercial buildings currently appears to be a distant likelihood, however building technology could follow in the footsteps of smartphone evolution with the right mix of regulatory incentives and market demand.

The International Code Council published the first edition of the International green Construction Code (IgCC) in 2012, which takes a different and more aggressive approach to energy efficiency and also regulates other dimensions of sustainability in the built environment. Central aspects of the IgCC include extensive requirements for commissioning, automated demand response infrastructure and monitoring requirements, and mandatory renewable energy sources. While adoption of this new "green" code has been slow to occur, a recent vote to adopt the IgCC in Washington, D.C. may encourage other jurisdictions to follow suit. Rhode Island allows the use of the IgCC to meet green building requirements for state-owned buildings, and Delaware permits local jurisdictions to adopt the IgCC as a "stretch" or "reach" code beyond base code requirements.

CONNECTIONS TO CONSIDER

Embodied energy is a significant aspect of the overall efficiency issue, and the IgCC tentatively addresses this in several ways through requirements for recycled content and regional materials. The green code also allows the local authority to approve the use of a life-cycle analysis (LCA) as the basis for compliance, although such a process has yet to be standardized in a consensual form. The American National Standards Institute (ANSI) is in the process of developing a standard for LCA and this could be a significant alternative for future construction code compliance as designers become more comfortable with the use of this method and regulators learn to evaluate it properly.

The connection between water use and energy consumption is becoming increasingly evident to regulators and sustainability advocates. Because water use in buildings requires the expenditure of energy, reduction in use has important energy conservation implications. Several major cities have adopted requirements for energy and water use monitoring and reporting (benchmarking), and this process is likely to become mandated through code adoption in the near future. With these potential requirements for ongoing commissioning and benchmarking it seems inevitable that energy code requirements will soon require engineering involvement and code enforcement throughout the lifetime of all buildings.

THE FUTURE OF ENERGY CODES

Does the present trend in energy codes predict future developments? That is difficult to say. Until recently the stringency of energy codes and decisions regarding voluntary improvements to building performance, intended to reduce future energy consumption and the related costs, were predicated far more on the return in investment than they were on creating a less energy dependent, more sustainable built environment. In the current economic and political climate a cost benefit analysis may continue to exclude environmental impacts in favor of the financial bottom line, unless regulatory measures require otherwise.

Code changes are generally incremental and building technology has been able to keep up, although not without protest or concerns. Lighting manufacturers and lighting designers thought we had hit the lower limit for lighting energy, but now we have LED lighting being deployed in a wider range of facilities. Over the past 10 to 15 years, it was not uncommon to see lighting play a "lowest hanging fruit" role in any energy reduction program. Generally a three- to five-year cycle on replacement technology has been more the norm than not. Does it really matter that LEDs have a 30,000+ hour life if this technology will in turn be replaced with better technology in just a few years?

As lighting and internal heat gain loads continue to decrease to low levels, how long will it be before all air ventilation systems require reheat to accommodate the minimum ventilation loads for occupant comfort and safety? Will this then represent the ultimate in HVAC efficiency?

Now we are also starting to see the adoption of measures in the code that address "plug loads." Homes and businesses are increasingly filled with devices such as computers and TVs that use energy even when not in use. These "vampire loads" can make up a significant percentage of a building's energy use, particularly as buildings become more efficient. It is possible to design these devices to operate more efficiently, but until this is mandated by energy codes this is unlikely to happen.

As we look forward, energy reduction goals will continue to be integrated into more aggressive codes and standards just as they have been through regulation in EPA emission standards and vehicle mileage efficiency goals.

- Engineers and architects will continue to model buildings to predict energy performance even as we see plenty of examples where typical building performance has little or no bearing on actual performance of the facility.
- Energy codes will be developed based on construction in various climate zones without clear understanding of the use of the facility or cost effectiveness of the standard.
- Buildings designed and constructed to be energy efficient will be operated and maintained in a manner that does not result in an energy efficient building.
- Higher education institutions will continue to make decisions balancing financial resources between program needs, and their goals for sustainability and energy efficiency.
- Technology and integration into the built environment will continue to evolve based on market forces and regulatory requirements.
- Professionals involved in building design, construction, and regulation will continue to passionately debate the evolution of standards and codes based on safety, economics, impact to the environment, manufactures capability, and personal experiences.

Higher education, with its significant footprint, impact to energy consumption, and financial contribution to a country's GDP, must continue to be involved in the development and evolution of building codes and standards as a steward of the environment and financial resources for future generations.

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