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## **Mark Walsh-Cooke - U.S. enhancing requirements to reduce energy consumption and incorporate renewable technologies**

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The recent warming of the climate is unequivocal. Scientific evidence from around the world indicates that this is forced by man-made greenhouse gas emissions, which have dramatically increased atmospheric concentrations of carbon dioxide since the start of the Industrial Revolution in the mid 1700s - roughly 36% increase in 250 years; compared to a less than 1% increase over the previous 1,500 years.

And it's only getting faster - emissions have grown at a faster rate in the last 10 years than during the last 50. Global temperatures have responded, with an increase in average global temperatures of nearly about 1.4 Â°F over the last 100 years. This might not seem like a lot, but scientists have shown that it is enough to change the climate system.

Increasingly, climate scientists urge cuts in carbon emissions from 60 - 80% by mid-century to avoid dramatic, damaging change in the climate system.

A U.S. opinion poll in 2006 found that climate change had moved from sixth to first place in the list of key environmental concerns.

It is therefore not surprising that policies and codes in the US are steadily enhancing the requirements to reduce energy consumption and incorporate renewable technologies in the building design. The American Clean Energy & Security Act 2009, passed by the House, and currently in debate by Senate, requires buildings to be 30% more efficient by 2012; 50% more efficient by 2050. The Energy Independence and Security Act of 2007 requires policies to be put in place for a new commercial building to be net-zero energy starting in 2025, and from 2025 retrofit all existing commercial buildings to be net-zero energy by 2050.

Boston recently joined over 50 towns and cities in Mass. that have adopted the Stretch Energy code which requires a 20% reduction in energy compared to an ASHRAE 90.1: 2007 baseline. In 2012 this stretch energy code will become the minimal energy performance required by the Mass. State Code.

So what does zero net energy mean? The definition depends upon the boundaries imposed upon the project. In the U.S. when one talks about zero net energy the four most commonly used definitions are zero net site energy, zero net source energy, zero net energy cost and zero net energy emissions.

In Mass. the Zero Net Energy Task force initiated by Governor Patrick in 2008 defined a zero net energy building as "one that is optimally efficient and, over the course of a year, generates energy onsite, using clean renewable resources, in a quantity equal to or greater than the total amount of energy consumed onsite". More from the task force can be found at [www.mass.gov/eea](http://www.mass.gov/eea).

Whatever the definition there are two fundamental goals for a zero net energy building; substantial reduction in energy consumption, of around 50 to 70% compared to current codes, and then generation of energy through the use of renewable technologies.

Executive Order 484 was the catalyst for zero net energy in Mass. and other states are starting to follow suit. Earlier this year California launched its 2010-2012 Zero Net Energy Action Plan. Oregon also has a "Path to Net Zero" pilot program.

The Lowell Justice Center Zero Net Energy Feasibility Study was the largest of three pilot projects identified by governor Patrick's Zero Net Energy Buildings Task Force. Arup worked closely with DCAM and Finegold Alexander + Associates to first identify substantial energy reduction measures. We then explored a variety of generation options such as building and site mounted wind turbines, photovoltaic panels, solar thermal heat generation, solar air preheating, small scale trigeneration using biofuels, and hydro electric power generation from the adjacent canal. Based on calculations and energy modeling that examined the individual and combined potential impact of these systems, in concert with an understanding of funding opportunities and permitting issues, the design team was able to recommend a combination that would best serve the clients' needs.

A similar process was implemented for the Franklin Regional Transit Center in Greenfield, Mass. Currently under construction, Arup worked with Charles Rose Architects Inc. and the Franklin County Regional Transit Authority on the 24,000 s/f, two-story building on identifying the best combination of reduction and generation measures. The zero net energy building is expected to be open to the public in 2012.

Additional information and assistance in achieving a zero net energy building can be found on the web sites of the National Renewable Energy Laboratory ( [www.nrel.gov](http://www.nrel.gov)) and the U.S. Department of Energy ([www.energy.gov](http://www.energy.gov) ).

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