ARCHITECTURE 2030 E-NEWS BULLETIN 12

# Senate Committee Calls on Edward Mazria to Testify on Building Energy Efficiency

On February 26, Edward Mazria was called before the United States Senate Committee on Energy and Natural Resources to give expert testimony on reducing energy consumption in buildings.

Following his appearance at the full committee **hearing**, Mr. Mazria responded to a list of questions for the record from U.S. Senators **Lisa Murkowski (R-AK)** and **Maria Cantwell (D-WA)**. Mazria's responses to these questions, with additional written testimony evaluating the NAIOP study, "Achieving 30% and 50% over ASHRAE 90.1-2004 in a Low-Rise Office Building", are provided below.

To watch a video of the hearing, click **here** (Mr. Mazria's testimony begins at 38:30).
To download the Companion Guide, with illustrations referred to in Mr. Mazria's testimony, click **here**.
For the addendum graph with historic and projected U.S. CO2 emissions by sector, click **here**.

**JUMP TO:**

Questions from U.S. Senator Lisa Murkowski (R-AK)

1. Market Forces and Energy Efficiency
2. Government vs. Non-Government Efficiency Programs
3. Applying Stimulus Funds to Energy Reductions
4. Delays in Goverment Funding Distribution
5. Success of the 2030 Challenge
6. Management and Oversight of The Two-Year, Nine-Million-Jobs Investment Plan
7. Other Green Mortgage Products
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Questions from U.S. Senator Maria Cantwell (D-WA)

1. Addressing Green Roof and Cool Roof Strategies
2. Energy Savings Potential of Green Roofs
3. Green Roof Deployment in the Federal Building Sector

Additional Testimony:

**Evaluation of NAIOP Study, "Achieving 30% and 50% over ASHRAE 90.1-2004 in a Low-Rise Office Building"**

## Questions from U.S. Senator Lisa Murkowski (R-AK)

***1. What are some examples where the market has moved energy efficiency in the right direction regardless of government mandates?***

Unfortunately, without government mandates, the market moves the Building Sector towards increased energy efficiency slowly, escalating development only when the country enters a recession and/or the price of energy increases dramatically. This can be seen clearly in the graph on **Page #2** of my testimony. The drop in Building Sector energy consumption is most apparent with the spike in oil prices that began with the 1973 Arab oil embargo and continued through the short recession that followed, and during the early 1980's recession when oil reached the equivalent of $103.76 barrel

March 16, 2009

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## HIGH-LIGHTS

**U.S. Senate Committee on Energy & Natural Resources Hearing**


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**Addendum Graph:** Historic and Projected U.S. CO2 Emissions by Sector.

(today's dollars) following the 1979 Iranian Revolution.

After the crisis ended, lighting and energy management technologies that were initiated during this period continued to develop, albeit slowly, due in part to state initiatives and mandates. For example, lighting technology continued to improve with the introduction of higher efficiency lamps (T-8, T-5, and compact fluorescent bulbs) and electronic ballasts. Several states (California, for example) adopted stricter energy codes for commercial buildings that were partly responsible for the development of markets for these more-efficient lighting products. Over time, these advances in energy-efficient technology were adopted more widely by the building sector. But government programs were instrumental in promoting the early use of these advances and creating markets so the costs for these products could be reduced.

***2. The federal and state governments have been engaged in several standardized programs to promote energy efficiency in the last few decades. It is also true that there have been advances in energy efficient technology without the government playing a role. Please describe the pros and cons of these two approaches.***

Relatively little has been accomplished in building sector energy efficiency over the past few decades, so it is difficult to single out the pros and cons of each approach. The two approaches seem to only work well when they work in tandem. For example, when fossil fuel prices increase dramatically, business and industry look to innovate and deliver alternatives to the marketplace, while governments deliver market incentives, new building codes, and fund R&D and technology transfer through universities, research institutions and national laboratories.

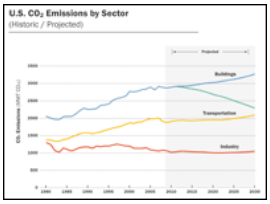
This was evident during the energy crisis of the 1970's and early 1980's. At that time, there were major advances in Building Sector technologies - in glazing materials (heat mirror and low-e coatings), passive and active solar energy systems design and applications, passive and active cooling applications, natural ventilation systems, phase-change materials, moveable insulation, building simulation modeling programs, daylighting systems and controls, energy management systems, night set-back thermostats and occupancy sensors, solar hot water heating, solar thermal electric generation and storage, photovoltaics and advances in low-energy lighting systems, to name just a few. While some of these technologies continued to advance slowly over the past twenty-four years, relatively little has happened in developing innovative new energy efficiency and building energy technologies and systems. The energy intensity of commercial buildings has changed little over this period (total energy use per square foot increased), while a decrease in the energy intensity of housing was offset by an increase in housing size.

Government programs also play a critical role in advancing building sector technologies due to the relationship between construction costs and energy costs. For many commercial or leased building projects, capital costs for construction and operating costs for energy use are budgeted and paid for from different accounts. The project owner pays for the building design and construction, while the tenants pay for the resulting operating costs for energy and resource use. In this fiscal environment, government programs (state energy codes and tax credits, for example) have been very important in advancing the adoption and promoting the improvement of cost-effective, energy-efficient technologies.

The situation we find ourselves in today, with three major crises converging at the same time – foreign energy dependence, climate change and a deep economic recession – is very different from anything we have ever experienced before. I believe both approaches to the Building Sector, which is at the center of all three crises, must play a critical role if we are to successfully meet these challenges.

***3. The recent stimulus bill directs billions to energy efficiency measures. How can these funds be targeted to be most effective?***

I have carefully read through the American Recovery and Reinvestment Act 2009, specifically to analyze the bill's requirements on energy efficiency. I find that only in some cases are there requirements, and that the few programs with requirements are somewhat vague. There are no benchmarks or energy reduction targets (which are essential to attaining real and significant

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**A Hog in a Tuxedo is Still a Hog:**
NAIOP Disinformation Study

**Mazria's Rebuttal (original)**
**Senate Evaluation (new)**

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reductions) mentioned in the bill.

What this means is that many of the building projects put forward in response to the bill will have minimal energy reduction strategies, and as a result, minimal energy reductions.

The following language, if included in the energy bill, would help to prioritize projects and serve as a guideline for projects submitted for grants. While the language does not prohibit any projects from going forward, it makes clear that projects will be competing for funds and meeting specific energy reduction targets will be a priority consideration in the judgment criteria.

This language also sets the benchmark based on i) CBECS and RECS for federal and federally-owned buildings as called for in the Energy Independence and Security Act 2007, and ii) ASHRAE and IECC for other buildings. In addition, it also allows the Secretary of Energy to set other benchmarks and reduction targets, since there are states that have their own codes with specific criteria.

The following language would send a strong message to the building community that significant energy reductions are important, and that the federal government will lead the way:

> **A.** That any new and renovated federal buildings receiving stimulus money be required to meet the 2010 energy reduction standard set by the Energy Independence and Security Act of 2007. Funding preference will be given to projects that achieve overall energy savings compared to the Commercial Building Energy Consumption Survey 2003 for commercial buildings and Residential Energy Consumption Survey 2005 (RECS) for residential buildings (or other comparable codes, standards or measurement protocols authorized by the Secretary of Energy) of, in the following order of priority—(1) carbon neutral, (2) 85 percent, (3) 70 percent, (4) 55 percent.
>
> **B.** For any new building construction or renovation project grants made with stimulus money by state and local governments, preference shall be given to projects that achieve overall energy savings compared to ASHRAE 90.1-2004 for commercial buildings and IECC 2006 for residential buildings (or other comparable codes, standards or measurement protocols authorized by the Secretary of Energy) of, in the following order of priority—(1) 75 percent to carbon neutral, (2) 50 percent, (3) 30 percent.

***4. Also, as you know, $3.1 billion of energy efficiency block grants came with preconditions, namely energy efficiency rulemaking measures and updating building codes. Are you concerned with the inevitable delay in getting the energy efficiency funding out to states and localities?***

The answer to this question is multifaceted and requires some explanation.

Since professional architects and engineers design most commercial and public buildings and large-scale housing developments, it is instructive to look at A/E firm billings to project future Building Sector construction activity. It takes 6 months to a year or two to design and prepare construction documents for a building project, a few months for bidding, a month or two for contract negotiations and another month or two for construction start up. Billings for housing began to decline sharply at the end of 2007, followed by a decline in commercial and industrial project billings in early 2008. It was not until August of 2008 that we began to see a decline in public building project billings. At the end of 2008, while construction in housing and commercial buildings were in steep decline, construction in the public sector was steady with school construction up 6% and government building construction up 6% (Page 14 of my testimony).

Most of the stimulus money and energy efficiency block grants for buildings are slated for the public building sector. Projects that have been designed but shelved for lack of tax dollars will be pulled off the shelf as shovel ready. Other projects will begin the design process taking advantage of efficiency block grant monies. As a result, the public building sector should continue on without a construction downturn for another few years.

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While I do not foresee a delay in using the efficiency block grant money, the anticipated building energy consumption reductions will fall short unless the actions recommended in answer #3 above are implemented.

***5. In the 2007 Energy Independence and Security Act, Congress authorized an initiative for the development and establishment of zero net energy commercial buildings which applies to any commercial building newly constructed in the United States by 2030 as well as 50% of the of the commercial building stock of the United states by 2040. Groups such as the American Institute of Architects (AIA) have endorsed an immediate 50% reduction in fossil fuel-generated energy and a 10% reduction target every five years until new and renovated buildings achieve carbon neutrality in 2030.***

***Have we made any progress on these initiatives?***

Yes, interest in the 2030 Challenge energy reduction targets has increased significantly since we issued the 2030 Challenge in January of 2006. Many state and local governments, professional organizations, A/E firms and institutions have adopted the targets and have begun to implement them, and many more would like to do so. However, without clear and sustained leadership and support from the federal government, these efforts will not be enough. Specifically, we will not see any significant reductions in the *rate of increase* in building sector energy consumption, let alone a decline, until the National Model Building Energy Code Standards are updated as indicated on Pages 12 and 13 of my testimony.

My emphasis on performance standards is deliberate. By setting performance rather than prescriptive standards, Congress will *not* be picking energy and efficiency technology winners and losers. The marketplace, individual practitioners and building owners will determine the most cost-effective strategies that meet the performance standards. Many new strategies and technologies will emerge (and existing ones will re-emerge) to meet the particular conditions of various climatic regions and economic conditions. Performance standards bring out the best in our competitive and entrepreneurial spirit and create a level playing field for all technologies.

For this approach to be most effective, performance standards and 'reach codes' must preempt federal minimum appliance standards to insure the emergence of new technologies, systems and design practices.

Also, I would ask that the Committee be mindful of the dates for the Model Energy Code updates specified on Page 12 of my testimony. The dates correspond with the 2007 Energy Independence and Security Act's initiative for the development and establishment of zero net energy commercial buildings in the United States by 2030 as well as 50% of the commercial building stock of the United States by 2040. They also coincide with the code standard update cycles set by IECC and ASHRAE. For example, the 2016 date for the 50% standard is critical and is set to coincide with the 2018 IECC code release date of April 2017. The next IECC code cycle is not until 2024. The dates specified on Page 12 - 2016, 2022, and 2028, giving the states two years to adopt the code standards – meets both the 2030 Congressional target date and code cycle upgrade timelines.

***6. As part of your vision to stimulate the economy, you provide a plan that would adjust interest rates on homes, pursuant to their energy reduction capability, and an accelerated depreciation schedule for commercial buildings, who demonstrate energy savings. Please describe who would manage these mortgage and depreciation programs.***

The Plan would leverage the benefits of energy reductions by offering for both existing and new homes, through Fannie Mae and Freddie Mac, mortgage financing with reduced interest rates in proportion to the energy reduction target reached. The Treasury Department is currently doubling its financial support to Fannie Mae and Freddie Mac. It will buy as much as $200 billion of preferred stock in the two mortgage companies, twice as much as previously promised. This support provides the capital to implement the Plan and tie the Treasury's support of Fannie and Freddie to private investment and job creation.

The new 'conforming' mortgages would be no larger then that allowed by law. The interest rate

buy-down schedule would be determined by available funds and the level of job creation desired. For existing homes, a minimum amount of private investment in efficiency would be required according to the energy reduction target and mortgage rate offered. Homeowners taking advantage of the Plan would be required to have an energy audit and a certification that the work was performed properly. Equity can be built into the Plan by allowing existing efficiency and solar tax credits to be used up to a maximum mortgage amount or home value. *Tying the mortgage rate buy down to minimum energy reduction targets insures that every federal dollar spent will stimulate private investment and create jobs.*

Since my testimony, the US Treasury and the Federal Reserve are expected to offer refinancing through the Term Asset-backed Loan Facility (TALF) next month to help free up money for the commercial real estate sector. Given this new development, the way to create jobs through commercial building energy reductions is through existing federal, state and local programs. At the federal level we recommend increasing The Energy Efficient Commercial Buildings Deduction from $1.80 per square foot for the 50% energy consumption reduction (cost savings) to 1) $3.50 per square foot for meeting a minimum 50% energy consumption reduction target below ASHRAE 90.1-2004, 2) $5.00 per square foot for meeting a minimum 75% energy consumption reduction target, and 3) $6.50 per square foot for a building that is carbon neutral.

Building energy consumption from non-depletable energy sources collected on site or provided from within a development would be considered an energy reduction. The tax deduction should be offered for a period of 3 years.

***7. I understand that there have been several green mortgage products developed to assist homeowners interested in these types of improvements. How different would your program be from these types of products?***

Interest in ‘green’ homes has increased dramatically in the past few years. There are rebates, tax breaks and cash incentives for green homes offered by states and local governments. Fannie Mae provides a 'green mortgage' program where the added value of a home’s energy efficiency translates into more buying power not necessarily a lower net monthly outlay. The program is for both new construction and existing properties.

The problem is very few people are applying for these incentives and mortgages. Right now, the public is averse to purchasing big-ticket items and increasing their monthly outlay, regardless of how small.

Our Plan is very different. By tying the mortgage interest-rate buy-down proposed in our Plan to specific energy reduction targets and homeowner investments, three highly beneficial and desired results are achieved: 1) new demand for Building Sector jobs is immediately generated, benefiting not only the Building Sector, but all the industries and sectors that support the Building Sector, 2) a homeowner’s monthly mortgage payments and energy bills are significantly reduced, providing disposable income and making it much more likely that they can meet their payments, and 3) creation of a new $236 billion per year renovation market that does not currently exist. A mortgage buy-down that is not tied to aggressive energy reduction targets and private investment will not create many jobs or new business opportunities.

***8. Is it reasonable to demand Net Zero Energy performance from existing buildings, regardless of size, and geographic location? What obstacles exist in practice, to obtain net zero energy?***

In the 2007 Energy Independence and Security Act, Congress authorized an initiative for the establishment of 50% of the commercial building stock of the United States to be zero net energy by 2040. In the Act, the definition of a ‘zero-net-energy commercial building’ is:

> “a commercial building that is designed, constructed, and operated to— (A) require a greatly reduced quantity of energy to operate; (B) meet the balance of energy needs from sources of energy that do not produce greenhouse gases (GHG); (C) therefore result in no net emissions of greenhouse gases; and (D) be economically viable.”

Given this definition, I believe it is possible to achieve zero-net-energy for 50% of the commercial building stock of the United States by 2040 for the following reasons; i) over the next 30 years three quarters of the built environment in the US will be either new or renovated; ii) low-rise commercial buildings, which are easier to renovate to zero-net-energy, make up 77% of total US commercial building stock; iii) most existing buildings can reduce their energy consumption using economically viable and readily available, strategies, technologies and equipment; and iv) the definition allows for existing buildings that cannot produce as much clean (non-GHG emitting) energy on-site as they consume, to purchase clean energy from a local or central utility.

## Questions from U.S. Senator Maria Cantwell (D-WA)

***I believe another promising area for improving the efficiency and many other aspects of our nation's buildings is adding on green roofs. On efficiency benefits in particular, according to the EPA, the surface temperature of a green roof can be as much as 90 degrees Fahrenheit cooler than the surface of a traditional rooftop.***

***1. Since your testimony did not specifically address green roofs, could you talk about what potential roles do you see for green roofs in achieving higher levels of building energy efficiency?***

Green roofs and cool roofs (solar reflective roofing membrane or surface) are part of a new generation of roofing strategies that have a high potential to reduce energy consumption in buildings. Each has advantages and disadvantages that are well documented in government literature. It must be noted however, that green roofs provide benefits beyond energy savings, such as storm-water management, filtering and reducing the temperature of water runoff, cooling ambient air temperatures (heat island effect), and increasing green space (see: Reducing Urban Heat Islands: Compendium of Strategies, EPA 2008).

***2. What is the energy savings potential of green roofs and what federal incentives and programs might help to accelerate the deployment of green roofs nationwide?***

The energy savings potential of green roofs depends on local climatic conditions and individual building and roof characteristics, such as size, use and insulation values. Greater energy savings are weighted toward a reduction in summer heat gain through shading, thermal mass and evapotranspiration, rather than in winter heat loss. Of critical importance in low-rise green-roofed buildings is their thermal resiliency, or their ability to maintain acceptable interior conditions when exterior conditions reach extremes (heat waves and cold spells), especially during a blackout or brownout.

The Cities of Portland, OR and Chicago, IL have been very successful with their green roofing efforts by offering density bonus incentives in their zoning codes. This type of policy promoted nationally may accelerate green roof deployment. Federal tax credits to building owners are another avenue. We believe however, that updating the National Model Building Energy Code Standards (Page 12 of my testimony) will lead to the greatest deployment of all building energy savings strategies and technologies.

***3. Do you believe the Federal Energy Management Program is an effective vehicle for the acceleration of green roof deployment in the federal building sector?***

Yes, the Federal Energy Management Program is charged with assisting federal agencies to use energy, water, and other resources wisely; green roofing is an effective design option that accomplishes these goals.

## EVALUATION OF STUDY Titled "Achieving 30% and 50% over ASHRAE 90.1-2004 in a Low-Rise Office Building", Prepared for NAIOP (Commercial Real Estate Development Association), Published December 2008

After a thorough review of the NAIOP-commissioned energy efficiency study, it is my professional opinion

that the study is of no value and is intentionally misleading for the following reasons:

1. The study analyzes a square-shaped, four-story office building configuration with completely sealed windows and an equal amount of un-shaded glass on all four sides of the building. In other words, the study analyzes an extremely inefficient and outdated building design typology.

2. The study looks at only three cities and climates - Newport Beach, Chicago and Baltimore – and does so without changing the design of the building to respond to these very different climates.

3. Of the numerous energy saving measures that can be applied to, or integrated into a building design, the study analyzes only five measures.

4. The study intentionally does not analyze any of the readily available (and well known) low-cost, no-cost and cost-saving measures that reduce a building's energy consumption. For instance, the study does not investigate changing the shape of the building, its orientation or form; redistributing windows or using different windows to take advantage of natural light for daylighting or sunlight for heating (office buildings are day-use facilities); shading the glass in summertime to reduce the need for air-conditioning; using operable windows for ventilation (not even in Newport Beach with its beautiful year-round climate); or using low-e glazing. It also does not investigate employing a heat recovery system, cost-effective solar hot water heating system or energy management control system. In fact, the study fails to analyze so many of the no-cost and inexpensive energy-saving options available, that it is impossible for the building configuration studied to reach commonly achievable energy-consumption-reduction targets.

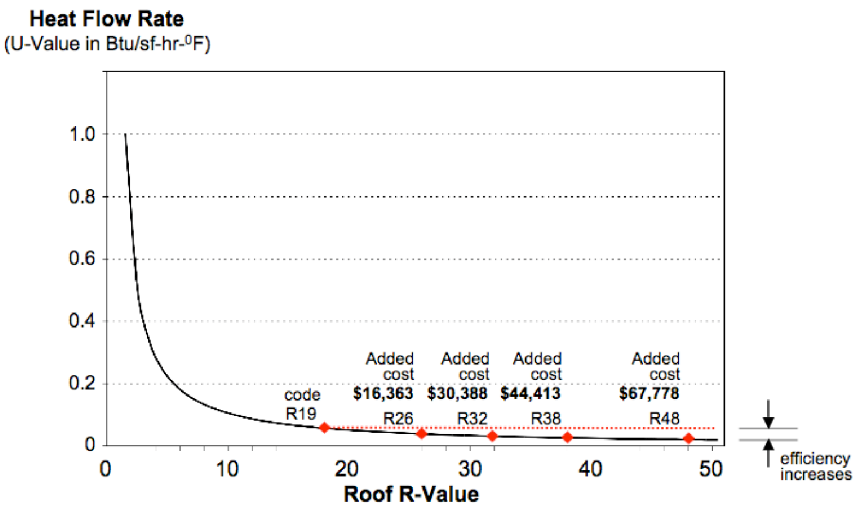
5. NAIOP contends that its analysis is "aimed at understanding the practical and economical impacts" of energy efficiency measures available. Yet, the study intentionally analyzes high-cost, low-energy-reduction measures to falsely demonstrate that increases in efficiency are expensive and unachievable. For example, the roof area in a four-story building is only 25% of the building floor area. Increasing the insulation values in the roof well beyond code will yield only marginal efficiency results and at steep costs. However, seven roof insulation options are analyzed in this category (see Graph 1. below).

6. Upgrading to commonplace low-e double glazing is 6.5 times more efficient at half the cost per square foot than upgrading to R-38 roof insulation, yet the study does not consider this option.

7. The study is statistically irrelevant. A four-story office building represents less than one percent (approx. 0.29%) of commercial building square footage and 0.08% of all building square footage in the US*. A four-story, square office building with equally distributed sealed glazing on all four sides is a small fraction of this 0.08%.

   * Source: US Energy Information Administration, 2007 Building Energy Data Book, Tables 2.2.2, 2.2.3 and 7.4.2, and the EIA AEO 2008, Tables 4 and 5.

**GRAPH 1. ROOF INSULATION**




**ROOF INSULATION**
**Insulating Properties** (R-Values) **vs. Added Cost** (NAIOP)