Testimony of:

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Before the United States Senate Committee on Energy and Natural Resources
“Building Sector Energy Policy Issues”

Thursday, February 26, 2009, 2:15 p.m.
Room SD-366, Dirksen Senate Office Building
Edward Mazria
Founder & Executive Director
Architecture 2030

Brief Biography
Edward Mazria is an internationally-recognized architect, author, researcher and educator with a long and distinguished career. His award-winning architecture and planning projects span over a thirty-five year period and each employs a cutting-edge environmental approach to design. He is the author of numerous published works, including the ‘bible’ of solar design, The Passive Solar Energy Book, which is currently in use worldwide.

Most recently, Mr. Mazria has reshaped the national and international dialogue on energy and climate change to incorporate building design and the Building Sector. He is the founder of Architecture 2030, an innovative and flexible research organization focused on this issue. He developed and issued The 2030 Challenge, a measured and achievable strategy to dramatically reduce global energy consumption and greenhouse gas emissions by the year 2030. He speaks nationally and internationally on the subject of architecture, design, energy and climate change and has taught architecture at several universities including the University of New Mexico, University of Oregon and UCLA. His numerous awards include AIA Design Awards, AIA Design Innovation Award, American Planning Association Award, Department of Energy Awards, the American Solar Energy Society Pioneer Award, first recipient of the Equinox Award, and most recently a 2008 National Conservation Achievement Award from the National Wildlife Federation. He is a fellow of the Design Futures Council.
U.S. Energy Consumption by Sector
(Historic / Projected)
U.S. Energy Consumption by Sector
(2008)

- Buildings: 50.1% (50.6 QBtu)
- Industry: 22.3% (22.5 QBtu)
- Transportation: 27.6% (27.8 QBtu)
U.S. Energy Consumption by Sector
(2008)

- **Building Operations**: 42%
- **Industry**: 22%
- **Transportation – Light Duty**: 17%
- **Transportation – Other**: 11%
- **Building Construction and Building Materials**: 8%
U.S. Electricity Consumption by Sector (2008)

- **Building Operations**: 75% (30.2 QBtu)
- **Industry**: 16% (6.5 QBtu)
- **Building Construction and Building Materials**: 8% (3.3 QBtu)
- **Transportation**: <1% (0.1 QBtu)
Total U.S. electricity consumption in 2008 is 40.56 QBtu. 
Total projected U.S. electricity consumption in 2030 is 47.90 QBtu.
The 2030 Challenge

Energy Consumption Reduction Targets

New Buildings & Major Renovations – 50%

2010 – 60%
2015 – 70%
2020 – 80%
2025 – 90%
2030 – Carbon Neutral (or net-zero)

EIA 2030
49.6 QBtu

EIA 2008
42.5 QBtu

2030 Challenge (2030)
32.2 QBtu

See www.architecture2030.org for a complete explanation of the 2030 Challenge.
The 2030 Challenge
Adopters

FEDERAL GOVERNMENT
Energy Independence and Security Act 2007
   (Federal buildings)

STATES
State of California (all buildings)
State of Illinois (State buildings)
State of New Mexico (State buildings)
State of Minnesota (State funded buildings)
State of Oregon (guide for public buildings / pending legislation)

LOCAL GOVERNMENT
U.S. Conference of Mayors (USCM)
National Association of Counties (NACo)
County of Sarasota, FL
County of Santa Fe, NM
The Boulder Consortium of Cities, CO
County of Fulton, GA
City of Albuquerque, NM
City of Santa Fe, NM
City of Santa Barbara, CA
City of Durango, CO
City of Portland, OR
City of Lafayette, CO
City of Vancouver, Canada
City of Seattle, WA
City of Richmond, VA
City of Dallas, TX

ORGANIZATIONS
The American Institute of Architects (AIA)
U.S. Green Building Council (USGBC)
Royal Architecture Institute of Canada (RAIC)
Residential Energy Services Network (RESNET)
International Council for Local Environmental Initiatives (ICLEI)
World Business Council for Sustainable Development (WBCSD)
National Wildlife Federation (NWF)
Society of Building Science Educators (SBSE)
AIA Committee on the Environment (AIA/COTE)
Association of Collegiate Schools of Architecture (ACSA)
Union Internationale des Architectes (UIA)
American Solar Energy Society (ASES)
American Society of Interior Designers (ASID)
Better Bricks
Rocky Mountain Institute (RMI)
Congress for the New Urbanism (CNU)

SUPPORTERS
Environmental Protection Agency (EPA/Target Finder)
American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
Green Building Initiative (GBI)
Agreeing to act with resolve and urgency, the G8 Heads of State committed to:

“Energy efficiency standards for new buildings should be set by national or state governments and should aim to minimize total costs over a 30-year lifetime.”
Greensburg, Kansas

Estimated First Cost (30% below code) $4,000
Annual Amortized Cost (7%, 30-year mortgage) $211
Annual Utility Bill Savings $723
Net Annual Savings $512

2000 square foot, 2-story, 16% window to floor ratio, unconditioned basement.
Evaluated relative to the minimum 2003 IECC.
Assumes marginal tax bracket of 28% and includes present value of future replacements of equipment over 30 year life of mortgage.
### 30% Energy Savings Below Code (2006 IECC)

<table>
<thead>
<tr>
<th>CITY</th>
<th>ANNUAL SAVINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Houston</td>
<td>$577</td>
</tr>
<tr>
<td>Phoenix</td>
<td>$412</td>
</tr>
<tr>
<td>Chicago</td>
<td>$407</td>
</tr>
<tr>
<td>Atlanta</td>
<td>$577</td>
</tr>
<tr>
<td>Denver</td>
<td>$408</td>
</tr>
<tr>
<td>New Orleans</td>
<td>$403</td>
</tr>
<tr>
<td>Seattle</td>
<td>$472</td>
</tr>
</tbody>
</table>

Annual saving evaluated relative to the 2006 International Energy Conservation Code, using average utility rates and climate data for each location. Based on a 2,500 square foot new home, 30-year mortgage at 7% APR.
Federal Energy Legislation:

Update National Model Building Energy Code Standards

**2010** – **30% below code** (below IECC 2006, ASHRAE 90.1-2004)
**2016** – **50% below code** (performance code)
**2022** – **75% below code** (performance code)
**2028** – **carbon neutral** (performance code)

Performance codes do not pick clean-energy technology winners and losers.
Federal Energy Legislation:

Incorporate Voluntary Performance “Reach Codes”

2010 - 2016  • 30% below code – national standard
               • 50% below reach code
               • 75% below reach code
               • carbon neutral reach code

2016 - 2022  • 50% below code – national standard
               • 75% below reach code
               • carbon neutral reach code

2022 - 2028  • 75% below code – national standard
               • carbon neutral reach code

2028  • carbon neutral code – national standard

A Reach Code, when adopted by a state or local government, must take precedence over federal minimum appliance and equipment standards.
Public Building Sector 7%
Government +6%
Schools +6%

Private Building Sector 93%
Residential -39%
Commercial -17%

Economic Recovery

U.S. building stock is approximately 254.3 billion square feet. Public buildings is approximately 17.8 billion square feet.
$96 Billion Federal Investment
(each year for two years)

1. Housing mortgage interest rate buy-down
2. Commercial building accelerated-depreciation program

For buildings that meet:

3. Energy reduction targets:
   • 30% below code (HERS 70)
   • 50% below code (HERS 50)
   • 75% below code (HERS 25)
   • carbon neutral
Investment Plan Benefits

- 9 million new jobs
- $1 trillion in new private spending
- $236 billion/year new renovation market
- $44 – $69 billion in consumer savings
- 2.16 QBtu U.S. energy consumption reduction
- New tax base pays for the Plan
Economic Recovery
The Two-Year, Nine-Million-Jobs Investment Plan

Homes
(housing example)

<table>
<thead>
<tr>
<th>Mortgage Interest Rate</th>
<th>Energy Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Existing</strong></td>
<td><strong>New</strong></td>
</tr>
<tr>
<td>4.0%</td>
<td>4.5%</td>
</tr>
<tr>
<td>3.5%</td>
<td>4.0%</td>
</tr>
<tr>
<td><strong>2.5%</strong></td>
<td>3.0%</td>
</tr>
<tr>
<td>2.0%</td>
<td>2.5%</td>
</tr>
</tbody>
</table>
$272,300 Mortgage Loan @ 6%
Mortgage balance = $260,300
Equity = $12,000

$1,632.58 month
Economic Recovery
The Two-Year, Nine-Million-Jobs Investment Plan

75% energy reduction
Cost = $51,250

Mortgage loan @ 6% = $272,300
Mortgage balance = $260,300

$1,632.58 month
Economic Recovery
The Two-Year, Nine-Million-Jobs Investment Plan

75% energy reduction
Cost = $51,250

INVESTMENT

2.5% mortgage
$7,000 tax credit

$1,632.58 month

Mortgage loan @ 6% = $272,300
Mortgage balance = $260,300

Page 20 “Building Sector Energy Policy Issues”
Economic Recovery
The Two-Year, Nine-Million-Jobs Investment Plan

75% energy reduction
Cost = $51,250

INVESTMENT

2.5% mortgage
$7,000 tax credit

New Mortgage
$304,550

Mortgage loan @ 6% = $272,300
Mortgage balance = $260,300

$1,632.58 month
$1,203.34 month
Economic Recovery
The Two-Year, Nine-Million-Jobs Investment Plan

Mortgage Loan $304,550 @ 2.5%

Original monthly payment = $1,632.58
New monthly payment = - $1,203.34
Mortgage savings = $429.24
Monthly energy savings = + $145.94
TOTAL MONTHLY SAVINGS = $575.18
## Economic Recovery

The Two-Year, Nine-Million-Jobs Investment Plan

### BUILDING SECTOR

**Products / Materials / Industries**

<table>
<thead>
<tr>
<th>Demolition</th>
<th>Plaster / Gypsum Board</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Work</td>
<td>Paints</td>
</tr>
<tr>
<td>Equipment Rental</td>
<td>Tile / Carpet</td>
</tr>
<tr>
<td>Concrete</td>
<td>Coatings / Sealants</td>
</tr>
<tr>
<td>Masonry</td>
<td>Mech. / Elect. Equipment</td>
</tr>
<tr>
<td>Steel</td>
<td>Hardware</td>
</tr>
<tr>
<td>Metals</td>
<td>Lighting</td>
</tr>
<tr>
<td>Wood</td>
<td>Furnishings</td>
</tr>
<tr>
<td>Plastics / Rubber</td>
<td>Trees, Shrubs, Grasses</td>
</tr>
<tr>
<td>Waterproofing</td>
<td>Architects / Engineers</td>
</tr>
<tr>
<td>Insulation</td>
<td>Planners / Interior Designers</td>
</tr>
<tr>
<td>Doors</td>
<td>Contractors</td>
</tr>
<tr>
<td>Windows / Skylights</td>
<td>Construction Workers</td>
</tr>
<tr>
<td>Glass / Solar Systems</td>
<td>Banking / Real Estate</td>
</tr>
</tbody>
</table>
U.S. Electricity Consumption by Sector
(Historic / Projected)

Projected
Buildings
Transportation
Industry

2030 Challenge
(Codes + Reach Codes)
Notes

BUILDING SECTOR ASSUMPTION
To create a U.S. Building Sector, the Residential buildings (operations) sector, Commercial buildings (operations) sector, Industrial sector - building operations estimate and the Industrial sector - annual building construction and materials embodied energy estimate were combined.

PAGE 2: U.S. ENERGY CONSUMPTION BY SECTOR
Notes:

Sources:

PAGE 3: U.S. ENERGY CONSUMPTION BY SECTOR
Sources:

PAGE 4: U.S. ENERGY CONSUMPTION BY SECTOR
Sources:
U.S. Energy Information Administration, Annual Energy Outlook 2009 Early Release, Table 2 Energy Consumption by Sector and Source and Table 7 Transportation Sector Key Indicators and Delivered Energy Consumption; http://www.eia.doe.gov/oiaf/aeo/aeoref_tab.html.
Notes

PAGE 5: U.S. ELECTRICITY CONSUMPTION BY SECTOR
Sources:

PAGE 6: U.S. ELECTRICITY CONSUMPTION BY SECTOR
Sources:
U.S. Energy Information Administration, Annual Energy Review (AER), Tables 2.1a, 2.1b, 2.1c, 2.1d and 2.1e; http://www.eia.doe.gov/emeu/aer/consump.html.

PAGE 7: THE 2030 CHALLENGE
Sources:
See Architecture 2030 at: www.architecture2030.org

PAGE 8: THE 2030 CHALLENGE
Notes:
For a complete list of adopters see: www.architecture2030.org

PAGE 9: GLENEAGLES G8 SUMMIT. JULY 2007
Source:
Notes

PAGE 10: U.S. DEPARTMENT OF ENERGY
Source:

PAGE 11: U.S. DEPARTMENT OF ENERGY
Source:

PAGE 12: FEDERAL ENERGY LEGISLATION
Notes:
Update Section 304 of the Energy Conservation and Production Act (42 U.S.C. 6833), SEC. 304. UPDATING STATE BUILDING ENERGY EFFICIENCY CODES to the 2030 Challenge targets.

PAGE 13: FEDERAL ENERGY LEGISLATION
Notes:
Update Section 304 of the Energy Conservation and Production Act (42 U.S.C. 6833), SEC. 304. UPDATING STATE BUILDING ENERGY EFFICIENCY CODES to the 2030 Challenge targets, incorporate Reach Codes, and provide incentives for States and local governments that adopt Reach Codes.

PAGE 14: ECONOMIC RECOVERY
Source:
McGraw Hill Construction report, December 18, 2008. From January through November 2008, construction of infrastructure projects grew by 2%. Construction of institutional buildings grew by 6%, helped by public and government buildings (up 6%) and educational buildings and schools (up 6%). Construction of residential buildings declined 37% and commercial buildings 17% over this same period.
Notes

PAGES 15 - 23: ECONOMIC RECOVERY

Source:

PAGE 24: U.S. ENERGY CONSUMPTION BY SECTOR

Assumptions:
Assumes that new codes become effective as follows (year codes come into effect - percent better than code):

2010 - 30%  2016 - 50%  2022 - 75%  2028 - carbon neutral

Assumes 25% of all new buildings meet the new code the first year it becomes effective; that 50% of all new buildings meet the new code the year after; and that 100% of all new buildings meet the new code every following year until a new base code is adopted.

Assumes the amount of existing building square footage renovated annually is equal to the square footage built new. Also assumes that of this square footage, 25% of renovations meet the new code the first year it becomes effective; that 50% of renovations meet the new code the year after; and that 100% of all renovations meet the new code every following year until a new code is adopted.

Assumes aggressive Reach Code implementation and incentives.

Sources: