From Paris to the US: Connecting Up Low-Carbon High Performance Buildings & Communities

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Learning Objectives:
1. First hand report from a participating delegate to the 1st Conference of the Parties (COP21) of the U.N. Framework Convention on Climate Change (UNFCC)
2. Review of significant US commitments regarding the Paris COP 21 and COP 22
3. Learn how the American Business Act on Climate Change and EPA Clean Power Plan and Energy Efficiency contribute to 2°C Paris COP21 Energy Efficiency Goals
4. Rethink concepts on driving Designing Low Carbon Buildings
5. Understand the barriers to Building Energy Efficiency
6. Expand your Climate Change vision beyond Energy Efficiency tied to the Paris COP21 and COP22
Conference of Parties (COP) 21
GHG Reduction Goals

Keeping global warming below 2°C.
The Paris Agreement - Signing

- April 22, 2016 - Signed by leaders and representatives of 175 countries at the UN Headquarters In New York City, NY

Required 55 countries joining the Agreement
Representing 55 % of global GHG emissions
COP 22 – November 2016
Marrakech Climate Change Conference

• Met its main agenda – to establish a work plan for the next two years
• *Nationally Determined Contributions (NDCs)*
• The U.S. government is launching an NDC Leadership Compact a bi-lateral effort led by the US Department of State, USAID and National Renewable Energy Laboratories, will partner with a dozen countries to assist in meeting their targets
What the US Committed at COP21

- Reduce GHG emissions 26 to 28 % below 2005 by 2025

Energy Efficiency: America’s Greatest Resource

* A Quiet History of Huge Success

U.S. Energy Resources Used in 2014

- Energy Efficiency and Conservation
- Petroleum
- Natural Gas
- Coal
- Nuclear Power
- Biomass
- Hydroelectric
- Wind, Geothermal, and Solar
- Other

Energy Savings, Domestic Production, Net Imports

Slide provided by ASE

Production and Net Imports: EIA 2014 Data
EEC Estimate: ACEEE
Guiding Principles for Sustainable Federal Buildings

Optimize Energy Performance (in part)

a. Energy Efficiency
b. Renewable and Clean Energy
c. Metering
d. Benchmarking

National Performance-Based Design Guide (NPBDG)
http://npbdg.wbdg.org

The Council on Environmental Quality - February 2016
US EPA Clean Power Plan to Contribute 26 to 28% GHG Emissions below 2005 by 2025

The State Energy Efficiency Scorecard

2.9.16 Supreme Court issues a STAY on the CPP

http://aceee.org/state-policy/scorecard
Programs Contributing to Deliver 26 to 28% GHG Emissions below 2005 by 2025

2007: 11% U.S. ORGANIZATIONS - CARBON REDUCTION GOAL
2013: 41%
2016: 64%

2016 Johnson Controls Energy Efficiency Indicator
Building Codes & Energy Efficiency to reduce demand side energy and related GHG Emissions
Green Building Rating Systems and Energy Standards to reduce Demand Side Energy & related GHGs

LEED v4 TECHNICAL IMPROVEMENTS: ENERGY & ATMOSPHERE

Up to 33 points

90.1, 189.1

IECC

Net Zero Certification
Benchmarking and Disclosure to Reduce Demand Side Energy & Related GHGs

Figure 3. About half of all commercial buildings were constructed before 1980


Building Enclosure/Building Science relative to delivering 2ºC Goals

• Support Functions
  – Gravity
  – Wind
  – Impact
  – Expansion
  – Etc.

• Control Functions
  – Air
  – Moisture
  – Heat
  – Light
  – Sound
  – Etc.

Source: Peter Baker, Building Science Corporation
Reducing Energy Loss

Building Science/Physics

• Modeling for more informed enclosure decisions early in the project
• Thermal and Hygrothermal Analysis and Thermal Bridging
• Enclosure Commissioning

Over 50%

Commercial Primary Energy End-Use Splits, 2005

- 5.5% Lighting
- 14.2% Space Heating
- 6.3% Electronics
- 6.8% Water Heating
- 6% Ventilation
- 13.1% Space Cooling
- 4.1% Refrigeration
- 3.2% Computers
- 2% Cooking
- *5.5% Other
Comparative System Thermal Performance
Off-Site Construction vs Site Built

Source: Building Science Corporation
Embodied Energy of Materials

Energy and Material Resources

Renewable and Non-Renewable Primary Energy flows, secondary material, and water use are presented in Table 5, Figure 10, Figure 11, Figure 12, Figure 13, Figure 14, and Figure 15. Since no secondary fuels are associated with insulated metal panels, these categories are not shown.

<table>
<thead>
<tr>
<th>Energy and Resource Flows</th>
<th>Kingspan CPL</th>
<th>Kingspan Laminated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renewable primary energy, excluding those used as raw materials [MJ]</td>
<td>1,979</td>
<td>4,382</td>
</tr>
<tr>
<td>Renewable primary energy used as raw materials [MJ]</td>
<td>890</td>
<td>938</td>
</tr>
<tr>
<td>Renewable primary energy, total [MJ]</td>
<td>2,668</td>
<td>5,320</td>
</tr>
<tr>
<td>Non-Renewable primary energy, excluding those used as raw materials [MJ]</td>
<td>5,969</td>
<td>19,094</td>
</tr>
<tr>
<td>Non-renewable primary energy used as raw materials [MJ]</td>
<td>59,714</td>
<td>69,499</td>
</tr>
<tr>
<td>Primary Energy, Non-renewable [MJ]</td>
<td>65,682</td>
<td>88,593</td>
</tr>
<tr>
<td>Secondary Material [kg]</td>
<td>499</td>
<td>600</td>
</tr>
<tr>
<td>Water use [m3]</td>
<td>710</td>
<td>2686</td>
</tr>
</tbody>
</table>

Table 7: Energy and Resources

ASHRAE 189.1
Deep Energy Enclosure Retrofit

- Case Study: Castle Square – Boston 1960 - No insulation

Super Insulate Over Existing Exterior Wall/Roof
Air Seal
Replacement Windows and AC units

Building Enclosure Commissioning w/Functional Mockups

52% - 60% improvement over baseline
Envelope was 30%

Deep Energy Retrofits (DER) with envelope first improvements have longer payback periods and upfront investment.

Castle Square photos provided by Elton Hampton Architects

Graphic by Kingspan
Distributed Energy, Micro Grids and Building Energy Efficiency

- Buildings need positioned as part of Infrastructure development

Review of the Federal disaster recovery spending over the previous ten-year period concluded that every $1 spent on hazard mitigation saves society an average of $4.
Conclusions

• Climate Change and the Paris Agreement are driving High Performance Energy Efficient buildings for a low carbon world
• States are considering the benefits of Jobs and & Economy of Energy Policies beyond the CPP
• The Action is at the State and Local levels
• Beyond Climate Change, Energy Efficiency remains high on the list of Owner Requirements
• The Energy Codes are progressing to Outcome Based performance codes
• The Finance and Insurance Industries are engaged in this movement
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