Retrocommissioning
For Building Performance
Why Technical Retrocommissioning:

1. The vast majority of existing buildings do not meet their CFR.
2. Majority of existing buildings are consuming more energy than necessary to meet their CFR.
3. Simple ROI is typically less than 18 months.
Commercial Building Energy Consumption 2004

Source: EIA, 2006: Annual Energy Outlook
## Current Building Stock

### 3.1.8 Commercial Delivered Energy Consumption Intensities, by Vintage

<table>
<thead>
<tr>
<th>Year Constructed</th>
<th>Square Foot (thousand Btu/SF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior to 1960</td>
<td>84.4 23%</td>
</tr>
<tr>
<td>1960 to 1969</td>
<td>91.5 12%</td>
</tr>
<tr>
<td>1970 to 1979</td>
<td>97.0 18%</td>
</tr>
<tr>
<td>1980 to 1989</td>
<td>100.0 19%</td>
</tr>
<tr>
<td>1990 to 1999</td>
<td>90.3 19%</td>
</tr>
<tr>
<td>2000 to 2003</td>
<td>81.6 8%</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>91.0</strong></td>
</tr>
</tbody>
</table>


### 3.1.9 2003 Commercial Delivered Energy Consumption Intensities, by Principal Building Type and Vintage (1)

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Consumption (kBtu/SF)</th>
<th>Building Type</th>
<th>Consumption (kBtu/SF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Care</td>
<td>178.1</td>
<td>216.0</td>
<td>135.7</td>
</tr>
<tr>
<td>Inpatient</td>
<td>230.3</td>
<td>255.3</td>
<td>253.8</td>
</tr>
<tr>
<td>Outpatient</td>
<td>91.6</td>
<td>110.4</td>
<td>84.4</td>
</tr>
<tr>
<td>Food Sales</td>
<td>205.8</td>
<td>197.6</td>
<td>198.3</td>
</tr>
<tr>
<td>Lodging</td>
<td>88.2</td>
<td>111.5</td>
<td>88.1</td>
</tr>
<tr>
<td>Office</td>
<td>93.6</td>
<td>94.4</td>
<td>88.0</td>
</tr>
<tr>
<td>Mercantile</td>
<td>80.4</td>
<td>91.8</td>
<td>94.4</td>
</tr>
<tr>
<td>Retail (Non-Malls)</td>
<td>74.1</td>
<td>63.7</td>
<td>86.4</td>
</tr>
<tr>
<td>Retail (Malls)</td>
<td>N.A.</td>
<td>103.9</td>
<td>99.5</td>
</tr>
</tbody>
</table>

Note(s): 1) See Table 3.1.3 for primary versus delivered energy consumption.
Existing Building Energy Consumption

<table>
<thead>
<tr>
<th>Year of Construction</th>
<th>Percent of Total Floor Space</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior to 1919</td>
<td>6%</td>
</tr>
<tr>
<td>1920 – 1959</td>
<td>23%</td>
</tr>
<tr>
<td>1960 – 1979</td>
<td>34%</td>
</tr>
<tr>
<td>1980 – 1989</td>
<td>21%</td>
</tr>
<tr>
<td>1990 – 1999</td>
<td>16%</td>
</tr>
<tr>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: DOE 2005a: Buildings Energy Databook, Table 2.2.8

Source: EIA 1999: Commercial Buildings Energy Consumption Survey (CBECs)
## Existing Building Energy Consumption

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Total Floorspace</th>
<th>Total Buildings</th>
<th>Primary Energy Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>18%</td>
<td>16%</td>
<td>22%</td>
</tr>
<tr>
<td>Warehouse/Storage</td>
<td>16%</td>
<td>13%</td>
<td>8%</td>
</tr>
<tr>
<td>Mercantile</td>
<td>15%</td>
<td>14%</td>
<td>15%</td>
</tr>
<tr>
<td>Education</td>
<td>13%</td>
<td>7%</td>
<td>10%</td>
</tr>
<tr>
<td>Public Assembly</td>
<td>7%</td>
<td>7%</td>
<td>6%</td>
</tr>
<tr>
<td>Lodging</td>
<td>7%</td>
<td>7%</td>
<td>7%</td>
</tr>
<tr>
<td>Service</td>
<td>5%</td>
<td>10%</td>
<td>6%</td>
</tr>
<tr>
<td>Health Care</td>
<td>4%</td>
<td>3%</td>
<td>8%</td>
</tr>
<tr>
<td>Food Service</td>
<td>3%</td>
<td>7%</td>
<td>7%</td>
</tr>
<tr>
<td>Public Order/Safety</td>
<td>3%</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>Food Sales</td>
<td>1%</td>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td>Vacant</td>
<td>8%</td>
<td>12%</td>
<td>2%</td>
</tr>
<tr>
<td>Other</td>
<td>2%</td>
<td>2%</td>
<td>3%</td>
</tr>
</tbody>
</table>

Source: DOE 2005a: Buildings Energy Databook, Table 2.2.2
Retrocommissioning For Performance

What Retrocommissioning is NOT:

1. The Commissioning Process applied to an existing building.
2. An Energy Audit (Level I, Level II or Level III)
3. A Facility Condition Assessment (FCA)
4. A Systems Performance Study
Retrocommissioning For Performance

Deliver Solutions that are Meaningful to the Owner and Occupants of the Facility
Retrocommissioning For Performance

Proper Retrocommissioning Will:

- Result in an improvement in the Owner’s Business Operation:
  - Employee Productivity
  - Lower Maintenance Costs
  - Risk Management
  - Lower Energy Consumption
Retrocommissioning For Performance

Commissioning

RetroCommissioning

0% 50% 100%
0% 50% 100%
Retrocommissioning For Performance

Systems Retro-Commissioned:
- HVAC
- Controls
- Electrical
- Elevators
- Plumbing
- Roofs
- Envelope
Retrocommissioning For Performance

Retrocommissioning Team:

Team Leader (Certified Professional)

System Experts

Facility Maintenance Staff
Retrocommissioning For Performance

Current Facility Requirements (CFR) Development:

Team Leader (Certified Professional)
  Owner/Key Occupants
  System Experts
  Facility Maintenance Staff (May be separate Meeting)
Retrocommissioning For Performance

CFR Document Should Contain Detail Performance Criteria:

- Space Allocation
- Environmental Specifics
  - Temperature
  - Humidity
  - Air Change Rates
  - Acoustic Requirements
- Occupancy Data
- Life Expectancy
Retrocommissioning For Performance

When and Why:

1. Facility does not meet CFR.
   a. HVAC Issues
   b. Electrical Issues
   c. Plumbing Issues
   d. Lighting Issues
   e. Vertical Transportation Issues
   f. Envelope Issues
   g. Space Allocation Issues
   h. Specialty System Issues
   i. High Energy Consumption
   j. Change of Use/Function
   k. High Energy Consumption
Retrocommissioning For Performance
The Process

Planning Phase

- RCx Plan Development
- RCx Kickoff Meeting
- Document Procurement & Review
  - Drawings & Specifications
  - O&M Manuals
  - TAB Reports
  - Utility Bills
  - Maintenance, Repair & Replacement Orders
- Interviews
  - Management
  - Maintenance Personnel
  - Occupants
Retrocommissioning For Performance

Site Investigation Phase

- Systems Review
- HVAC Equipment & System Assessment
- Building Envelope
- Controls Systems
- TAB
- IAQ
- Electrical Equipment & Systems
- Plumbing Equipment & Systems
Retrocommissioning For Performance

Issue Analysis

- Issue Analysis – Identification of the issues
- Issue Synthesis – Resolution of issues
- Recommendations
  - Report Preparation
  - Presentation of Corrective Action Report
Retrocommissioning For Performance

Corrective Action Phase

- Remedial Design
- Construction
- Commissioning

Follow Up

- Lessons Learned
- Performance Verification
Retrocommissioning For Performance
Retrocommissioning For Performance

Estimated Energy Reduction:

• ~ $11,750 Per Month, or
• ~ $141,000 Per Year