The Opportunity

– Energy management is the quickest, cheapest, cleanest way to extend world energy supplies

– Energy management can provide 4 times the environmental impact of renewable energy

– Each $1 of overhead savings is worth $3 to $10 of new revenue
The Problem

- Managing ever-increasing portfolio of sites, equipment
- Finding ways to reduce energy as equipment ages
- Maintenance is a misnomer; “filter flippers”, run to failure
- Lack of enabling infrastructure for managing information
## Common Faults in Commercial Buildings

### Top faults causing energy inefficiencies in commercial buildings (Top 13 of 100+ faults identified)

<table>
<thead>
<tr>
<th>Fault Description</th>
<th>Energy Waste (Quads, primary/year)</th>
<th>Electricity equivalent (BkWh/year)</th>
<th>Cost ($billion/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duct leakage</td>
<td>0.3</td>
<td>28.6</td>
<td>2.9</td>
</tr>
<tr>
<td>HVAC left on when space unoccupied</td>
<td>0.2</td>
<td>19.0</td>
<td>1.9</td>
</tr>
<tr>
<td>Lights left on when space unoccupied</td>
<td>0.18</td>
<td>17.1</td>
<td>1.7</td>
</tr>
<tr>
<td>Airflow not balanced</td>
<td>0.07</td>
<td>6.7</td>
<td>0.7</td>
</tr>
<tr>
<td>Improper refrigerant charge</td>
<td>0.07</td>
<td>6.7</td>
<td>0.7</td>
</tr>
<tr>
<td>Dampers not working properly</td>
<td>0.055</td>
<td>5.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Insufficient evaporator airflow</td>
<td>0.035</td>
<td>3.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Improper controls setup / commissioning</td>
<td>0.023</td>
<td>2.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Control component failure or degradation</td>
<td>0.023</td>
<td>2.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Software programming errors</td>
<td>0.012</td>
<td>1.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Improper controls hardware installation</td>
<td>0.01</td>
<td>1.0</td>
<td>0.1</td>
</tr>
<tr>
<td>Air-cooled condenser fouling</td>
<td>0.008</td>
<td>0.8</td>
<td>0.1</td>
</tr>
<tr>
<td>Valve leakage</td>
<td>0.007</td>
<td>0.7</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Total (central estimate)</strong></td>
<td>1.0</td>
<td>94.6</td>
<td>9.6</td>
</tr>
<tr>
<td><strong>Total (range)</strong></td>
<td>0.34-1.8</td>
<td>32.4-171.4</td>
<td>3.3-17.3</td>
</tr>
</tbody>
</table>

Adapted from Roth et al. (2005) assuming 10,500 BTU/kWh, and $0.10/kWh
Example

- 9 roof top units; less than 5 years old
- 4 out of 9 economizers failed
- Annual excess energy cost associated with failed economizers = $4,800
- Cost to correct (replace) actuators = $1,200

29 of 55 economizers stopped working within 2 years - Energy Design Resources

Coils, boilers, chillers:
“cost savings upwards of 15 percent.” - energystar.gov
Multi-Site Challenges

- Too much data
- Difficult to organize
- Hard to manage
- Not easy to spot problems
- Reactive versus proactive

*Drowning in data, starving for information*
Lifecycle and Savings Potential

1. Building Operating Management Survey — 2003
3. Tiax Report for the DOE — 2005
How?

• **Efficiency Improvements**
  – Audits
  – Retro-Commissioning
  – Controls and Automation
  – Mechanical and Electrical System Upgrades

• **Sustainability Improvements**
  – Operations and process improvements
  – Asset and resource management
  – Energy analysis
  – Education

• **Intelligent Technology and Applications**
  – Common, interoperable system architecture
  – Analytics / Continuous Commissioning
  – Metering and sub-metering
Analytics

- At the enterprise level
  - Analytics work on real time or historical data
  - Analysis of data on a wide scale
  - Analytics also work on meta data

- Not system dependent
  - Uses csv, RDBMS or oBIX
  - Output to reports, dashboards or UI
Retail Energy Management

Investment — $6,559,232
Annual Savings — $3,920,956
Net Present Value — $8,304,276
Internal Rate of Return – 53%

Where did the savings come from?
– Retro-commissioning
– Fault Detection (continuous commissioning)
– Analytics to ensure results and spot future problems
– Interface with CMMS
There is no “silver bullet”

Improving building performance is

A holistic view of the building and enterprise

a coordinated set of activities and investments

a life cycle approach to construction and operations
ADVANCED UTILITY METERING

GSA REGION 4

Presented By

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President
IEC Systems, Inc

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www.iecsystems.com
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• SUPERVISORY HOSTED CONTROLS
• PEAK DEMAND CONTROL A MAJOR FEATURE
• DC AREA OFFICE OPENED IN 1980
• CSI (TAC/SCHNEIDER) PARTNER IN 1985
• INDEPENDENT LON SYSTEMS INTEGRATOR IN 2004
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  ▪ CORPS OF ENGINEERS
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- CURRENT CONTRACTS – OVER 70 BUILDINGS IN 8 STATES
- ALL METERS CONNECTED TO GSA WAN
HARDWARE AND SOFTWARE

- ELECTRIC-LON WATTNODE LOGGERS
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- GAS – HOT TAP PULSE AND MODBUS
- RHEA WEB APPLIANCE W/INETSUPERVISOR
- VIRTUAL REGIONAL SERVER W/INETSUPERVISOR
- MS SQL SERVER DATABASE
GSA Region 4 Network Architecture
Advanced Utility Metering
GSA Region 4 Network Architecture
Advanced Utility Metering Showing ION EEM SQL Server Transaction
GSA Region 4 Network Architecture
Advanced Utility Metering Showing Local Rhea Data Transaction
Questions?

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