Introduction the presentation outline

- Overview of Building Energy Facts
- How Building Management Systems Work
- Discuss Examples of Who is Using BMS
- Benefits, Challenges, Cost/Finances
- Future of BMS
BUILDING FACTS regarding energy consumption

Buildings have the capacity to reduce energy by 30%

US BUILDINGS ACCOUNT FOR

- **40%** All Energy Consumption
- **38%** Carbon Dioxide Emissions
- **71%** Electricity Consumption

BUILDINGS HAVE A SIGNIFICANT IMPACT ON AMERICA’S NATURAL RESOURCES

- **US$100B** Amount that US businesses spend on energy for their offices every year
- **US$25+B** Smarter buildings up to $25B in annual energy costs by putting into practice green building practices

$$$ ENERGY COST SAVINGS

Source: Siemens “Sustainable Solutions for Commercial Real Estate”
HOW BMS WORKS it's like boosting your buildings IQ

“Buildings need a brain to intelligently control the many systems and thousands of data points they can generate. Building Management Systems provide that brain.” Schneider Electric

Full System Integration

The BMS integrates and manages all building systems
- Heating
- Ventilation
- Air Conditioning
- Security
- Refrigeration
- Lighting

Image Source: Green Building Design Vancouver
"Building controls can be set, operated, and maintained from the central computer interface, and this computing power can be used to calculate optimal operational settings. When the controls on this system are optimized and able to respond quickly to changes in building conditions." BC Comfort
WHO USES BMS?

INDUSTRIES

- Education
- Healthcare
- Government
- Life Sciences
- Airports
- Retail
- Office
- Many Others

NEW CONSTRUCTION
Building managers optimize the design of the facility plan for integration at the inception and planning stage.

RETOFORMS
Great opportunity for existing buildings and portfolios to save in energy and consumption.

LA JOLLA COMMONS
Johnson Controls Metasys with data analytics integration dashboard

MICROSOFT CAMPUS
500-acre campus was retrofitted by inventing a data driven software
Expense or cost per square foot are really challenging to estimate as there are many variables involved. Equipment used, systems integrated, age, technical installations, and building envelope.

### Savings Potential and Amortization

<table>
<thead>
<tr>
<th>Category</th>
<th>Measures, e.g.</th>
<th>Saving potential [%]</th>
<th>Amortization [years]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Building automation</strong></td>
<td>- Installation and optimized tuning of energy functions&lt;br&gt;- Optimization during operation by efficient use of BACS and weak point analysis&lt;br&gt;- Dynamic energy management</td>
<td>5-30</td>
<td>0-5</td>
</tr>
<tr>
<td><strong>Technical installations</strong></td>
<td>- HVAC, refrigeration, lighting&lt;br&gt;- Controls, motors, actuators, Power generation</td>
<td>10-60</td>
<td>2-10</td>
</tr>
<tr>
<td><strong>Building envelope</strong></td>
<td>- Insulation, windows&lt;br&gt;- Thermal bridges, construction physics</td>
<td>&gt;50</td>
<td>10-60</td>
</tr>
</tbody>
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**Points of Consideration**
- Type of HVAC: geothermal, central plant, AHQ, VAV, etc. — this is the crux of the cost
- Complexity of the HVAC system
- Amount of meters
- Number and type of sensors

**Average $/SF**

$2.00-$3.00/SF

Image Source: Siemens
**OBJECTIVE:**
More control over tenant invoicing

**RESULTS:**
- Installed 135 T-stats to control the VAV Boxes
- 43% LEED Certified
- 12.5 million square feet
- 1.9M under construction
- $1.1B portfolio

**RETURN ON INVESTMENT:**
4-5 years

**KILROY MISSION VALLEY BMS EXAMPLE**

<table>
<thead>
<tr>
<th>SQ. FT</th>
<th>COST</th>
<th>COST / SQ. FT</th>
</tr>
</thead>
<tbody>
<tr>
<td>50425</td>
<td>$115,810.00</td>
<td>$2.30</td>
</tr>
<tr>
<td>96436</td>
<td>$210,871.00</td>
<td>$2.19</td>
</tr>
<tr>
<td>51516</td>
<td>$127,518.00</td>
<td>$2.48</td>
</tr>
</tbody>
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*Portfolio wide BMS in the next 5 years spearheaded by Jim Rosales
Portfolio Chief Engineer San Diego

Source: Kilroy Realty*
## BENEFITS

**you can’t manage what you can’t measure**

A well designed BMS will help all of a buildings systems run as efficiently and safely as possible.

<table>
<thead>
<tr>
<th><strong>Save on Costs</strong></th>
<th><strong>Real Time Information</strong></th>
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<td>Lower energy consumption and subsequently lower energy</td>
<td>Rapid availability of up-to-date information on system status</td>
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<table>
<thead>
<tr>
<th><strong>Longer Asset</strong></th>
<th><strong>Operational Efficiency</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited/Reduced wear and tear on building systems</td>
<td>Efficiency in management across assets – manage multiple systems through one website portal</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th><strong>Comfort</strong></th>
<th><strong>Marketing/Brand</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Alignment of building performance with users due to closely monitored temperature control</td>
<td>Aligning your company with sustainable building practices and energy efficiency is a powerful brand message today</td>
</tr>
</tbody>
</table>

A well designed BMS will help all of a buildings systems run as efficiently and safely as possible.
In most cases the benefits outweigh the challenges as there is so much room for cost and energy savings.

- **System Failure**: They fail and the proper backup systems aren't in place. This can be catastrophic.

- **Data Analysis**: Companies are not using this data properly to optimize their infrastructure.

- **Cost to Convert**: Or perceived cost to convert; incentives not yet sufficient.
**Future**

**More Data More Intelligence**
Aggregate information from a wide range of applications & data sources

**Channel Companies**
Companies like Google's Nest is moving into the space

**Internet of Things**
By having a comprehensive catalogue of objects and point buildings can optimize its role to suit the purposes of that state and time

**Smart Cities**
Taking the concept of Microsoft's smart campus to a new level by pushing Governments and Cities to use the technology

“Smart buildings will become smart cities and smart cities will change everything.”
Darrel Smith
Microsoft
“Quite simply, companies seeking to enhance their bottom line need to look no further than the offices they’re sitting in.”

Accenture
REFERENCES

• Siemens Industry (2012). “Sustainable Solutions for Commercial Real Estate”.

• Image Source on “Green Building Design Vancouver: Building Management Systems”.


• Rosales, Jim (2014). Informational Interview with Portfolio Chief Engineer at Kilroy Realty Corporation.