Co-designing with office workers to reduce energy consumption and improve comfort

Tomasz Jaskiewicz & David Keyson
CO₂ reduction potential

Energy use in non-residential buildings across Europe (BPIE survey)
CO$_2$ reduction potential

*Figure 1C2 – CO$_2$ emission per useful floor area*

Source: BPIE survey, Eurostat database
### Relative Assessment Weights

<table>
<thead>
<tr>
<th></th>
<th>ESTIDAMA</th>
<th>BREEAM</th>
<th>LEED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site selection &amp; natural systems</td>
<td>16%</td>
<td>Site selection &amp; ecology</td>
<td>20.5%</td>
</tr>
<tr>
<td>Water</td>
<td>25%</td>
<td>Water</td>
<td>2.5%</td>
</tr>
<tr>
<td>Energy</td>
<td>25%</td>
<td>Energy</td>
<td>33%</td>
</tr>
<tr>
<td>Materials</td>
<td>16%</td>
<td>Materials</td>
<td>13.5%</td>
</tr>
<tr>
<td>Indoor env. quality</td>
<td>20%</td>
<td>Indoor env. quality</td>
<td>13%</td>
</tr>
<tr>
<td>Innovation</td>
<td>2%</td>
<td>Innovation</td>
<td>6.5%</td>
</tr>
<tr>
<td>Integrated design process</td>
<td>7%</td>
<td>Facility management</td>
<td>12%</td>
</tr>
</tbody>
</table>
## Stages of assessment

<table>
<thead>
<tr>
<th></th>
<th>Design Stage Assessment</th>
<th>Construction Stage Assessment</th>
<th>Post Occupancy Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estidama</td>
<td>Assessor</td>
<td>Assessor</td>
<td>Operational rating</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>After 2 years, 80% occupancy</td>
</tr>
<tr>
<td>BREEAM</td>
<td>Assessor</td>
<td>Assessor</td>
<td>In use certificate (optional)</td>
</tr>
<tr>
<td>LEED</td>
<td>Online or Assessor</td>
<td>Online or Assessor</td>
<td>USGBC access to LEED data</td>
</tr>
<tr>
<td>Minergie</td>
<td>-</td>
<td>Building compliance standard</td>
<td>not certificate</td>
</tr>
</tbody>
</table>

**CO₂ reduction potential**
Two-prong strategy

- Large-scale impact using standardized occupancy certification
- Local impact by improvement of energy occupancy feedback
BOCS as service / product

System for subjective and objective measurement of energy occupancy in buildings
Building occupancy certification

- Inexpensive and easy to deploy
- Non-obtrusive in work environment
- Yearly monitoring intervals
Approach

- Exploring & identifying solutions
- Prototyping in context using the monitoring, self-reporting & feedback platform
- Engineering & implementing solutions
- Context researching & testing solutions
Situation now:

office culture

- satisfaction
- feeling

meanings

- comfort
- time of day
- weather
- season
- natural light
- artificial light
- temperature
- equipment

practices

- brainstorming
- focused desk-work
- cooperation
- casual meeting
- understanding HVAC
- personal productivity

materials

- energy (invisible in practice)

skills

office type

work type

Things we aim to add to influence practices:

meanings

- +sustainability

practices

reflection

materials

+energy (visible, directly involved)

sensor device

feedback

+ability to use energy efficiently (maximising efficiency, minimising energy use)

skills

self-reporting
Sketchy storyboard: observed practices vs. data.
SusLab Sensor

Light, Noise, Humidity, Motion, Dust, Temp, CO²
Flexible approach to hardware and software
allows modification and adaptation of the system iteratively throughout the development
Rapid Co-Design

Self-reporting, feedback displays, and sensor units
BOCS as service / product

Next steps

• Self-reporting app that will be engaging and simple to use
• Inexpensive sensors primarily for self-reporting verification
• Embedded within the social practices of the office environment
• Not relying on any specific building infrastructure, though BMS link potential for area comfort

source: www.cubesensors.com