Effective stakeholder engagement for Low-energy retrofit of public buildings
1.1 Introduction

- Built environment accounts for large proportion of energy and carbon emission;
- Significant proportion of existing buildings were constructed when there was no strong energy efficiency component within the building regulations;
- These existing old buildings are reaching the end of their useful life;
- Significant cost and environmental impact to replace these buildings with new construction;
There are a number of benefits and impacts of undertaking low-energy retrofit:

- Economic: Energy cost savings, economic stimulus, property values and impact on public finances;
- Societal benefits such as improved comfort, health and productivity of building users;
- Environmental benefits: reduced air pollution, carbon savings;
- Energy Systems Benefits: Energy Security, Avoiding need for new generation capacity, reduced peak loads;
1.3 Challenges of low-energy retrofit

• Performance gap;

• Unintended consequences of building energy efficiency improvements;

• Therefore low energy retrofit requires an all-inclusive approach considering building fabric, systems and users behavior;

• A systematic process of pre and post intervention performance evaluation is necessary to deliver the desired comfort, energy reduction;.
REtrofitting Solutions and Services for the enhancement of Energy Efficiency in Public Edification
1. General overview

• Starts in **July 2013**

• **Duration:** 4 years/48 months

• **25 partners:** From **10 different EU countries**

• **Categories of partner organisation:** Demo-sites, research institutions, industrial partners, social housing companies

• Specialised in **diverse disciplines:** Engineering, energy efficiency, building construction, housing management
1. General overview

• Aims:
  • To improve building energy performance through retrofitting
  • To set up a diagnosis methodology for an integrated renovation of public buildings, at building and district level (Replicability of the solutions)
  • Development of a systemic view for selection of the most empowering retrofitting mix: low energy renovation of existing public districts.
  • To adapt, demonstrate and validate the technologies in different demo-sites

• In figures:
  • Achieve 50% energy savings accross different types of sites;
  • Energy consumption reduction of 66 kWh / m² year
  • CO2 emissions reduced to 48,15 kg / m² year
  • A rehabilitation cost under 19% of investment costs associated with new construction of an equivalent building
Demo Buildings

Demo-sites location

John Laing Building, Coventry University, UK

Richard Crossman Building, Coventry University, UK

Hospital Parc Tauli, Sabadell, Barcelona, SP

Hospital de Terassa, Barcelona, SP

Balderskollan, Skellefteå, SW
Demo Buildings

John Laing Building
- Total floor area – 3,660m²
- Current energy use - 223 kWh/m²
- Demo site used for prototype testing

Richard Crossman Building
- Total floor area – 9,400 m²
- Current energy use - 242 kWh/m²
- Conventional retrofitting solutions
RESSEEPE Mix of technologies

**Envelope Elements**
- Aerogel mortar
- VIP
- Ventilated Facade
- BIPV System
- EC Glazing
- High Efficiency Glazing

**Building Services**
- HVAC system optimization
- PCM cooling and storage
- Seasonal thermal storage

**Lighting**
- LED lighting

**Renewables**
- Solar thermal collectors
- Solar PV panels
Innovative Technologies – Richard Crossman Building

- LED lighting
- Photovoltaic panels
- Double Glazed Window Unit
- Curtain wall
- Roof improvement
- BMS panels
Innovative Technologies – John Laing Building

PCM – Phase Change Materials
PV – Photovoltaics
VIP – Vacuum Insulated Panels
DGU – Double Glazed Unit
ETICS – External Thermal Insulation Composite System
EPS – Expanded polystyrene

JL139
PCM

JL137
PCM

JL136- JL137
Ventilated façade: PV + VIP + DGU

JL134- JL135
ETICS with VIP

JL121- JL122
PCM

JLG38
ETICS with EPS

JLG38. ETICS with Aerogel mortar

JLG38
ETICS with EPS
Building Performance Evaluation: User Satisfaction Assessment

• Seeks to ensure that RESSEEPE solutions meet the real needs of end users

• The evaluations will cover: thermal comfort, visual comfort and acoustic comfort of occupants, efficiency of control systems and energy management strategies

Expected results:

• Based on the results of end-user acceptance surveys, guidelines and tailored solutions will be produced.

• It is expected that RESSEEPE technologies will significantly improve indoor environmental quality in the demonstration sites.
# User satisfaction: Evaluation Process

<table>
<thead>
<tr>
<th>1</th>
<th>User perception before retrofitting</th>
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<tbody>
<tr>
<td></td>
<td>User satisfaction survey</td>
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<td></td>
<td>User characteristics</td>
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<tr>
<td></td>
<td>User experience: Thermal, aural, and lighting comfort; IAQ, level of control, general maintenance</td>
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<td></td>
<td>Performance data analysis</td>
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<th>2</th>
<th>User acceptance of the selection process</th>
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<tbody>
<tr>
<td></td>
<td>Selection of building typology</td>
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<td></td>
<td>Technology selection</td>
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<td></td>
<td>Performance assessment</td>
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<td>Cost evaluation</td>
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<tr>
<th>3</th>
<th>User acceptance of the installation process</th>
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<tbody>
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<td></td>
<td>User satisfaction survey</td>
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<tr>
<td></td>
<td>User characteristics</td>
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<td></td>
<td>User experience: Level of disruption, Information and communication, Engagement and participation, Satisfaction / User acceptance</td>
</tr>
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<td></td>
<td>Performance data analysis</td>
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<tr>
<th>4</th>
<th>User perception after retrofitting</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>User satisfaction survey</td>
</tr>
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<td>Performance data analysis</td>
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</table>
User acceptance event  before retrofitting

• 1st Stakeholder engagement meeting (11.11.2015)
  ▪ Participants: Internal stakeholders

• Aim:
  ▪ Explain what the project is about and to engage them in the project
  ▪ Get stakeholder feedback

**Communication:**
- Are you familiar with the project? Have you been provided with any information about the project before today?
- What information would you have liked to have? And at what stage of the project?

**Engagement:** Have you been asked to give your opinion or to contribute to the process?
  If not, how would you have liked to have been engaged?

**Disruption:**
- Have you experienced some kind of disruption during the refurbishment?
- In what ways do you think the project has caused disruption to building users?

**User acceptance:** What is your overall assessment of the refurbishment process?
User acceptance event after retrofitting

• **2\textsuperscript{nd} Stakeholder engagement meeting**
  ▪ Participants: Internal stakeholders

• **Aim:**
  ▪ Explain what the project is about and to engage them in the project
  ▪ Get stakeholders feedback
Stakeholder Engagement - Responses

Communication:
• They were not familiar with the details of the project before that day.
• They had not been provided any information before.

Level and Timeliness of Engagement
• Lack of awareness of the various technologies and their potential impact;
• The participants would have liked more information at an early stage;
• The need to engage a wide group of stakeholder – both internally and externally;
Stakeholder engagement. Lessons learnt

Lessons learnt from the stakeholder engagement:

- We should have held wider engagement event at an earlier stage;
- Engage wider stakeholders in the technology selection process;

why is this engagement important?

- To know the real needs of the end users
- The aesthetics impact of the technologies and equipment installed
- The engagement of users in the entire process will help long term performance of the Technologies;
User satisfaction survey

John Laing Building

Academics
20
18 valid

Students
40
32 valid
6. User acceptance assessment – User satisfaction survey

Overall Conditions In Winter Pre-retrofit

Overall Conditions In Winter Post-retrofit
6. User acceptance assessment – User satisfaction survey

**Overall Conditions In Summer Pre-retrofit**

- Frequency of Votes
- Uncomfortable < --------------- > Comfortable
- Conditions In Summer

**Overall Conditions In Summer Post-retrofit**

- Frequency of Votes
- Uncomfortable < --------------- > Comfortable
- Conditions In Summer
6. User acceptance assessment – User satisfaction survey

**Key indoor environmental problems before refurbishment**

<table>
<thead>
<tr>
<th>Problem</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal comfort</td>
<td>27</td>
<td>34.2%</td>
</tr>
<tr>
<td>Visual comfort</td>
<td>17</td>
<td>21.5%</td>
</tr>
<tr>
<td>Air quality</td>
<td>7</td>
<td>8.9%</td>
</tr>
<tr>
<td>Noise</td>
<td>11</td>
<td>13.9%</td>
</tr>
<tr>
<td>Lighting</td>
<td>17</td>
<td>21.5%</td>
</tr>
</tbody>
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**What are the key improvements after refurbishment**

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<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal comfort</td>
<td>4</td>
<td>6.3%</td>
</tr>
<tr>
<td>Visual comfort</td>
<td>10</td>
<td>15.6%</td>
</tr>
<tr>
<td>Air quality</td>
<td>1</td>
<td>1.6%</td>
</tr>
<tr>
<td>Noise</td>
<td>3</td>
<td>4.7%</td>
</tr>
<tr>
<td>Lighting</td>
<td>6</td>
<td>9.4%</td>
</tr>
<tr>
<td>Aesthetics</td>
<td>22</td>
<td>34.4%</td>
</tr>
<tr>
<td>Toilets</td>
<td>11</td>
<td>17.2%</td>
</tr>
<tr>
<td>Other</td>
<td>7</td>
<td>10.9%</td>
</tr>
</tbody>
</table>
Challenges and lessons learnt: Installation process

**International project coordination**
- High Complexity – Therefore need systematic and coordinated process
- Non awareness of local regulations or systems such as Health and safety

**Industrial Partners – Technical challenges**
- Whole system interaction is unknown;
- Challenge with preparing method statements to install state of the art technologies;
- Experts in technology may not be aware of construction techniques and vice versa; local contractors are unfamiliar with state of art technology specification;
- Just manufacturing and distribution of the product;
- Lack of accurate existing building data;

**Aesthetics:**
- Matching the aesthetic of existing design when using innovative technology
Meeting with External Stakeholders, Professional bodies and SMES

Findings as part of our courses
Outreach events; Focus Groups, Event for all External Stakeholders
Invitations to Demo Sites, Workshops targeting external stakeholders
THANK YOU FOR YOUR ATTENTION!
Useful links

http://www.ressseepe-project.eu/

https://twitter.com/RESSEEPE

http://www.linkedin.com/grp/home?gid=6504902

https://www.youtube.com/user/ressseepe