The role of Energy Management System for heating consumption in office buildings – a case study of the Danish Building and Property Agency

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BUILDINGS

36% of global energy
40% CO2 emissions

NON-RESIDENTIAL
At least 40% higher

Environmental impacts during buildings' life cycle

- Construction
- Use
- Demolition

Maslesa et al. (2018)
BYGNINGSSTYRELSEN

Governmental real estate agency

4,000,000 m² – over 800 buildings

Universities, State properties, Private leases

800,000 m² office buildings

IWMS (5 modules) + integrations (EMS)

Consistent, valid data across organisation

Knowledge-based decision making

Aalborg University

DENMARK

4th International Conference on Smart Energy Systems and 4th Generation District Heating 2018
#SES4DH2018
Status on heating data from the cities in which BYGST has its buildings

October 2018

Source: Bygningsstyrelsen
https://www.bygst.dk/viden-om/energi/digitale-energidata/

- Delivers hourly data
- Ongoing negotiations
- Not ready to deliver hourly data
ENERGY MANAGEMENT

IWMS
- Property data
- Building data
- Tenant data
- Energy budgets
- Energy labels

EMS
- Consumption data
- Meter management

Webservice
- Weekly & Monthly consumption data

Aggregated consumption
- GHG emissions

Detailed consumption
- KPI reporting (consumption/m²)

Individual consumption
- Actual vs. expected consumption

Bygst employees
- Bygst management

Energy department
- Energy consultants

Tenants/Custoners
ENERGY MANAGERS (EMS)

<table>
<thead>
<tr>
<th>Period</th>
<th>Budget</th>
<th>Adjusted Budget</th>
<th>Consumption</th>
<th>Savings</th>
<th>Savings [%]</th>
<th>Ref.</th>
<th>Cooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 2017</td>
<td>23,350.60</td>
<td>21,796.03</td>
<td>23,399.91</td>
<td>-1,603.88</td>
<td>-7.4</td>
<td>530.31 m²</td>
<td>37.9 °C</td>
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<td>Jun 2017</td>
<td>11,949.15</td>
<td>8,262.12</td>
<td>7,600.09</td>
<td>662.03</td>
<td>8.0</td>
<td>194.39 m²</td>
<td>33.6 °C</td>
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<tr>
<td>Jul 2017</td>
<td>6,026.21</td>
<td>5,685.64</td>
<td>5,820.32</td>
<td>-134.68</td>
<td>-2.4</td>
<td>159.61 m²</td>
<td>31.4 °C</td>
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<td>Aug 2017</td>
<td>6,818.50</td>
<td>4,208.56</td>
<td>5,469.72</td>
<td>-1,161.16</td>
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<td>151.09 m²</td>
<td>31.1 °C</td>
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<td>Sep 2017</td>
<td>17,279.79</td>
<td>15,384.45</td>
<td>19,350.10</td>
<td>-3,965.65</td>
<td>-25.8</td>
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<tr>
<td>Oct 2017</td>
<td>33,567.67</td>
<td>26,918.36</td>
<td>37,029.79</td>
<td>-8,111.43</td>
<td>-28.0</td>
<td>964.70 m²</td>
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<td>Nov 2017</td>
<td>54,298.15</td>
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<td>63,640.13</td>
<td>-12,644.02</td>
<td>-24.8</td>
<td>2,017.69 m²</td>
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<td>Dec 2017</td>
<td>68,809.34</td>
<td>61,612.97</td>
<td>74,740.24</td>
<td>-13,127.27</td>
<td>-21.3</td>
<td>1,709.00 m²</td>
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<tr>
<td>Total</td>
<td>484,847.08</td>
<td>435,864.39</td>
<td>502,920.41</td>
<td>-67,056.02</td>
<td>-15.4</td>
<td>12,407.09 m²</td>
<td>34.9 °C</td>
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<tr>
<td>Prognosis</td>
<td>484,847.08</td>
<td>435,864.39</td>
<td>502,920.41</td>
<td>-67,056.02</td>
<td>-15.4</td>
<td>12,407.09 m²</td>
<td>34.9 °C</td>
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<tr>
<td>kWh/m²</td>
<td>86.46</td>
<td>79.52</td>
<td>91.76</td>
<td></td>
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<td>2.26 m²/m²</td>
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</tr>
</tbody>
</table>
OTHER EMPLOYEES – MANAGERS – END-USERS

OVERVIEW

The calculation is based on the period January 1, 2018 - April 1, 2018.

Lejemaal 1

12,129 kWh

Your consumption is 12,129 kWh below what was expected.

HOURLY CONSUMPTION

The calculation is based on the period October 1, 2018 - October 8, 2018.

5,888 kWh

Standby 27 kW per hour
Traffic light model

HOFOR & Bygningsstyrelsen

Red, Yellow, Green and Green plus

Red > 130 kWh/m2
Yellow = 100-130 kWh/m2
Green = 70-100 kWh/m2
Green Plus < 70 kWh/m2
CURRENT PRACTICE

Data maturity levels:
- Electricity: national datahub
- Heating: ? (mixed picture)
- Water: ? (backlog)

Energy efficient building operation requires efficient consumption data!

Karl et al. (2019)
ISSUES AND POTENTIALS

- Utility companies have data, but the building owners do not
- Lack of act on data
- Building operation according to customer needs/usage patterns
THANK YOU

REFERENCES/RELEVANT PUBLICATIONS:

Indicators for quantifying Environmental Building Performance: A systematic literature review.
Maslesa, Esmir; Jensen, Per Anker; Birkved, Morten.

Environmental performance assessment of the use stage of buildings using dynamic high-resolution energy consumption and data on grid composition.
Karl, Asger Alexander Wendt; Maslesa, Esmir; Birkved, Morten.

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