USE EFFICIENCY: A First Level Audit Analysis of Selected University Buildings from 9 EU Countries

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Outline

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- Energy management and policies in University partners
- Description of the 1st level audit of University buildings
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- Conclusions



Introduction

USE Efficiency is a project supported by the Intelligent Energy Europe Programme II (IEE II), SAVE Action.

IEE is an EU support programme promoting increased energy efficiency and the use of renewable energy sources by overcoming the non-technological barriers (legal, financial, institutional, cultural, social barriers)



Towards intelligent energy use and more renewables



The USE Efficiency Project

Facts:

- USE Efficiency Universities and Students for Energy Efficiency
- Started June 2009, Duration 32 Months (www.useefficiency.eu)
- > 13 partners from 10 European countries
- 9 Universities and 4 market players
- Currently in the middle of the project duration
- Wide geographical coverage 3 geographical regions
 - Italy, Greece, Spain
 - Germany, UK, Ireland
 - Denmark, Sweden , Lithuania

GEOGRAPHICAL COVERAGE



The USE Efficiency Project: Aims

To train University students in energy efficiency issues, through the participation in a realistic implementation activity on energy saving plan.

To create an interaction among Universities and experts, promoting good practices in energy saving field and disseminating knowledge and shining examples among Europe.

To improve energy performance in University buildings

At a long term, to improve consciousness of energy efficiency in buildings, through engineering students who will be future market actors in this field.



The USE Efficiency Project: Flowchart



University Analysis

| University | DEC available | Energy Management office | Specific targets set by administration |
|------------------------|------------------|-----------------------------|----------------------------------------------|
| Thessaloniki (AUTH) | No | Νο | No |
| Brunel (UNBRUN) | Yes | Yes | Yes |
| Dublin (DIT) | Yes | Yes | Yes |
| Hamburg (HCU) | Yes | No (relocating) | Yes (concerning the new campus) |
| Aarhus (IHA) | No | No (relocating) | To be set |
| Valencia (UPVLC) | No | No | Yes |
| Vilnius (VGTU) | Some | Yes | Yes |
| Rome (UNITOV) | Yes | Yes | Yes |



Intelligent Energy 💽 Europe

Why a 1st level audit?

- During the project we needed to identify 2 out of 6 University campus buildings that will be used for a more detailed 2nd level analysis-the case studies of students training.
- To assess large building blocks and sort out "critical" buildings quickly, a simple and robust approach would be more suitable than a detailed audit.
- Energy Performance Building Directive (EPBD) does not explicitly distinguish between different level of audits. BUT:
 - A detailed audit would be necessary when a major renovation is due
 - A less detailed one would be adequate e.g. when a building is rent
- An approach that does not require a lot of input data and that could be easily transferable to similar situations was
 preferred.



Specific Approach to 1st level audit

Procedures should be characterized by:

- Easily manageable data acquisition in large building blocks where detailed data are usually scarce.
- Operating personnel can do it without external experts.
- No on-site inspection is necessary

An approach was chosen that takes advantage of data collected anyway, for reasons apart from this project and mainly to comply with EPBD, which require the use of DECs for University buildings. \rightarrow This was an OPERATIONAL RATING procedure, for the sake of simplification of data collection and comparability between partners.

1st level audit-Operational Rating (OR)

A typical OR procedure would require:

- Building data
 - 3 main types of utilization, year of construction, location,
 - Number of storey, rough sketch and floor plan
 - Reference area e.g. net floor area, conditioned floor area
 - Building envelope(i.e. U-values, fraction of total window area etc)
 - Technical installations (i.e. type of ventilation, air conditioning etc)
- Energy Data (should be available via DECs)
 - Accounting period, measured consumption of electricity last 3 years
 - Measured consumption of fuels last 3 years
 - Utilizations of electricity and thermal energy included in the values (i.e. heating, hot water, ventilation, elevators, lighting etc).
 - Energy generation in building for the last 3 years

1st level audit-Operational Rating (OR)

A typical OR procedure would require also:

- Weather correction
 - To rule out accidental biases in data assessment and comparison with benchmarks
 - Most common is a *degree days* scheme.
 - Reference area e.g. net floor area, conditioned floor area
 - Building envelope i.e. U-values, fraction of total window area etc
- Benchmarks
 - Benchmarks for building energy consumption are usually derived from statistics of many comparable buildings
 - Energy consumption benchmarks are differentiated according to typical building utilizations, weather corrected and related to some reference area
- Criteria to define "critical" buildings \rightarrow details in the paper

1st level audit-Special issues

- All previous data required for a typical OR were not available for all buildings → Practical solutions were given through an "engineer look" and some simplifications, leaving detailed analysis for the 2nd level audit.
- In many cases the buildings did not have unique metering system but instead several buildings shared the same meter
 - In this case, the benchmark to compare was the weighted mean of the different buildings
- More data would be necessary in order to differentiate buildings with respect to their utilization → office buildings are compare to laboratories or lecture halls etc.



Results from 1st level audit





Results from 1st level audit







Remarks

- Partners provided the available DECs for the building or generated DECs according to national procedures official at the time of the study.
- All building data were given using a Common Evaluation Data Structure from the DATAMINE IEE project, allowing for an easier overall data analysis and comparability.
- A large document with analysis, data and results from each University is available at the website of the project → <u>www.useeffiency.eu</u>



Remarks

- An established energy policy and management unit in an institution results in considerable better energy performance (check the difference between DIT and others).
- The critical buildings, e.g. those having the worst energy performance can be easily identified.
- Some values seem very high:
 - Incorrect readings from energy meters and input data?
 - Incompatible weather data?
 - Are some national benchmarks more difficult to achieve than others?
 - Or, are these buildings really so inefficient?
- All these questions will be answered during the detailed 2nd level audit with the active involvement of the students.



Conclusions

• A simple, less detailed energy audit (i.e. 1st level audit) can be a really useful tool when:

- There is the need to identify critical buildings in between large building stocks
- ✓ Lack of time for a detail audit, esp when the building number is high
- We don't want to involve lots of resources and workload, but instead we can use mostly readily available data collected for other purposes
- The use of suitable data structures for the collection of different building data, enables data analysis and enhances comparability between even different type of buildings.



THANK YOU FOR YOUR ATTENTION!