# REHVA Workshop – iSERV Overview

Inspection of HVAC systems through continuous monitoring and benchmarking

www.iservcmb.info

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# Aim of iSERV

- ➔By 2019/2021 all new EU buildings will have to be near zero-carbon, yet we have no comprehensive 'in-use' energy benchmarks for HVAC systems
- ➔iSERV proposes continuous monitoring and benchmarking of HVAC systems as a means of achieving robust in-use energy efficiency
- ➔An alternative route to compliance with EPBD requirements for the Inspection of HVAC systems.
- ➔Providing a solid basis for an on-going benchmarking system for HVAC systems, compatible with BIM

# iSERV Partners

| | | | |
|---|---|---|---|
| **Welsh School of Architecture, Cardiff University**<br>Building energy use experts | | **K2n Ltd**<br>Database experts | |
| **MacWhirter Ltd**<br>Installation, Maintenance and Energy Inspections | | **National and Kapodistrian University of Athens**<br>Indoor Air Quality experts | |
| **University of Porto**<br>HVAC and Engineering experts | | **Politecnico di Torino**<br>HVAC and Engineering experts | |
| **Université de Liège**<br>HVAC and Modelling experts | | **Univerza v Ljubljani**<br>HVAC and Engineering experts | |
| **University of Pecs**<br>HVAC and Engineering experts | | **Austrian Energy Agency**<br>Dissemination and Legislation | |
| **REHVA**<br>HVAC Professional Body | | **CIBSE**<br>HVAC Professional Body | |

# Aim of workshop

➔To involve as many stakeholders in the iSERV project as possible in examining and overcoming the barriers to implementing such an approach:

- Building owner/operators
- HVAC System owner/operators
- HVAC Manufacturers
- Building and HVAC System designers
- HVAC Inspectors
- Legislators
- Monitoring system providers

# ‘Help set the standard’

- ➔ Legislation is increasingly providing standards that HVAC systems have to meet, yet the practical implications and achievement of those standards is not yet well understood.
- ➔ iSERV will allow all stakeholders involved with HVAC systems to participate in setting their practical energy use standards.
- ➔ iSERV allows novel energy efficient approaches to be rapidly demonstrated and included in the benchmarks
- ➔ Standards based on reality not prejudgement
- ➔ Opportunity for all stakeholders to achieve greater value from HVAC systems

# What does iSERV require?

- ➔Data on floor area and activities served
- ➔Hours of use of areas by activities
- ➔Data on HVAC system components, sensors and utility meters
- ➔Connection of all of these together to understand the relationship between activities, HVAC components and utility use
- ➔Ongoing sub-hourly data to be provided
- ➔Ongoing maintenance of information e.g. change in activities, HVAC components, etc

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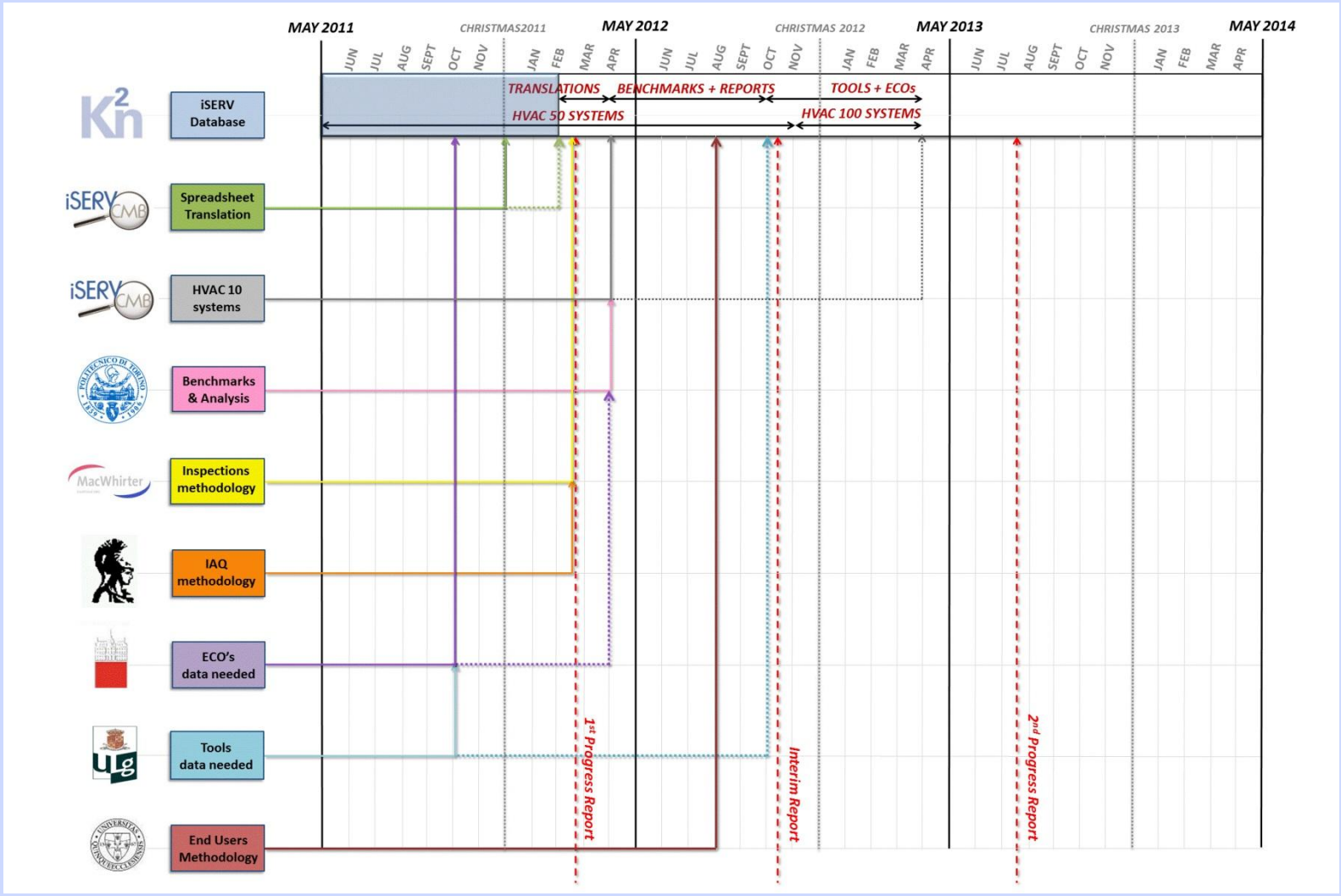
# Current process

- ➔Download iSERV Excel data entry spreadsheet
- ➔Populate with information on areas, activities, HVAC components, utility meters, etc
- ➔Send to iSERV for upload to online database

- ➔Send data regularly
- ➔Receive regular energy use reports and Energy Conservation Opportunity recommendations
- ➔Online interface to manually run reports or make amendments

# iSERV GANTT Chart



# CA III Meeting highlights

➔Vienna, December 2012

➔Presented the case for MS legislators to include possibility of iSERV-type approaches in revision of their National legislation to meet recast EPBD

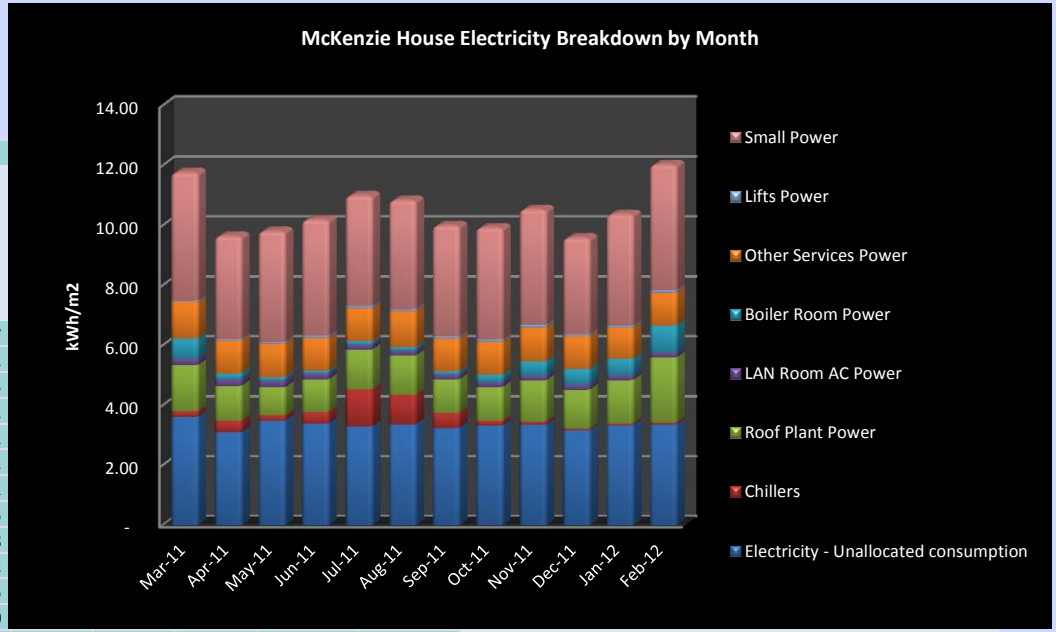
➔An overview paper of the legislative advantages of iSERV was presented to CA III, which was well received.

# System reports

- ➔First example report formats being produced in April 2012
- ➔Reports will evolve over time to meet findings from data collected and to meet end user needs.
- ➔The main items missing at present are benchmarks and Energy Conservation Opportunity (ECO) reports.

# Example outputs from iSERV data – monthly data

| McKenzie House Conditioned Floor Area/m2 = | | | 8434.93 | | |
|---|---|---|---|---|---|
| All Figures in kWh/m2 | | | | | |
| Month | Electricity - Unallocated consumption | Chillers | Roof Plant Power | LAN Room AC Power | Boiler Room Power |
| Mar-11 | 3.62 | 0.18 | 1.54 | 0.21 | 0.67 |
| Apr-11 | 3.10 | 0.38 | 1.17 | 0.21 | 0.21 |
| May-11 | 3.49 | 0.18 | 0.93 | 0.21 | 0.13 |
| Jun-11 | 3.39 | 0.39 | 1.09 | 0.18 | 0.11 |
| Jul-11 | 3.29 | 1.24 | 1.33 | 0.17 | 0.11 |
| Aug-11 | 3.36 | 0.98 | 1.32 | 0.17 | 0.11 |
| Sep-11 | 3.25 | 0.50 | 1.12 | 0.16 | 0.11 |
| Oct-11 | 3.33 | 0.15 | 1.13 | 0.17 | 0.25 |
| Nov-11 | 3.36 | 0.11 | 1.37 | 0.16 | 0.48 |
| Dec-11 | 3.17 | 0.06 | 1.30 | 0.17 | 0.52 |
| Jan-12 | 3.34 | 0.05 | 1.45 | 0.16 | 0.55 |
| Feb-12 | 3.37 | 0.07 | 2.16 | 0.16 | 0.90 |

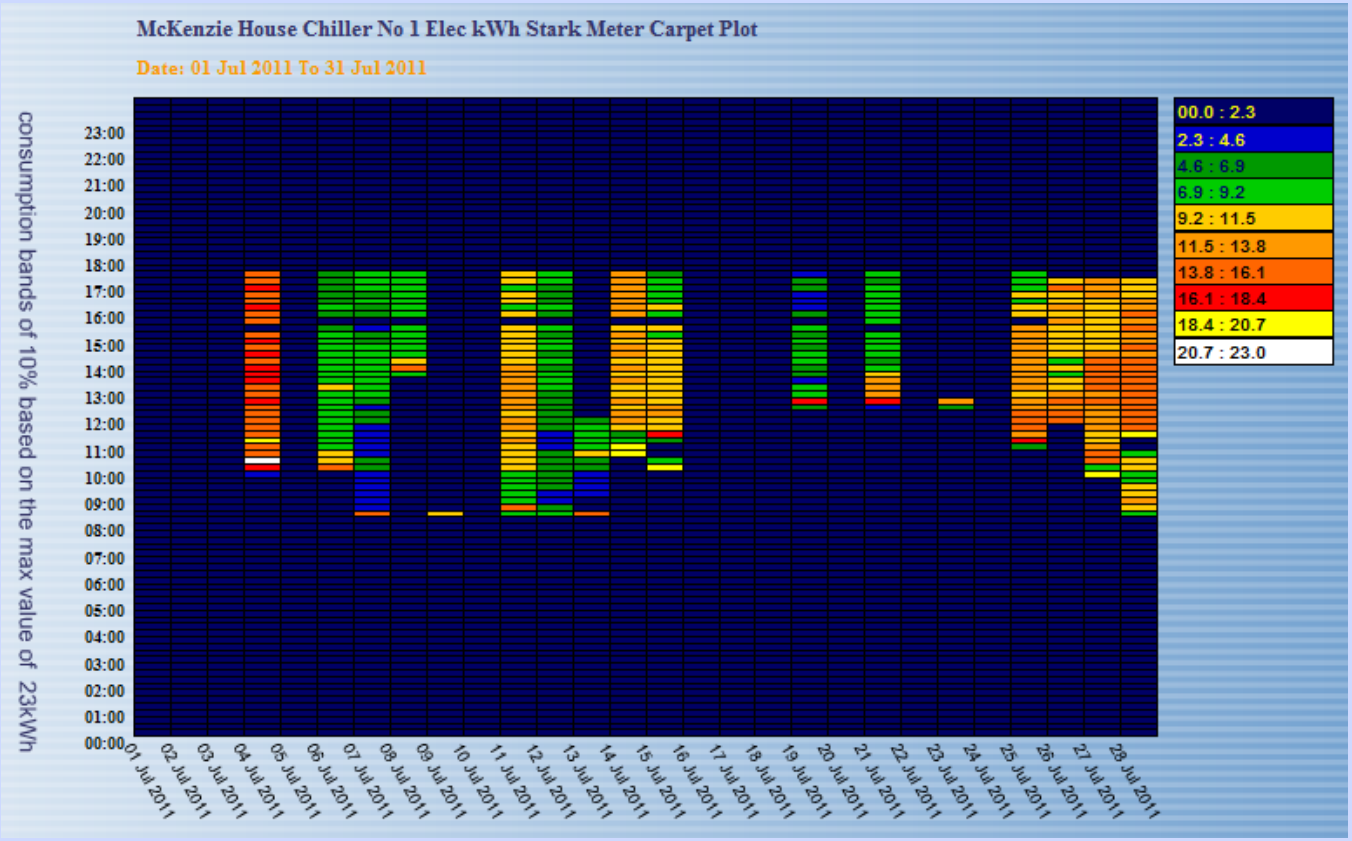



| Sum of Std_Month_Consumption | C | L | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Mar-11 to Feb-12 | | | 40.1 | 4.3 | 15.9 | 2.1 | 4.1 | 13.3 | 0.8 | 45.0 | 125.7 | 257.0 |

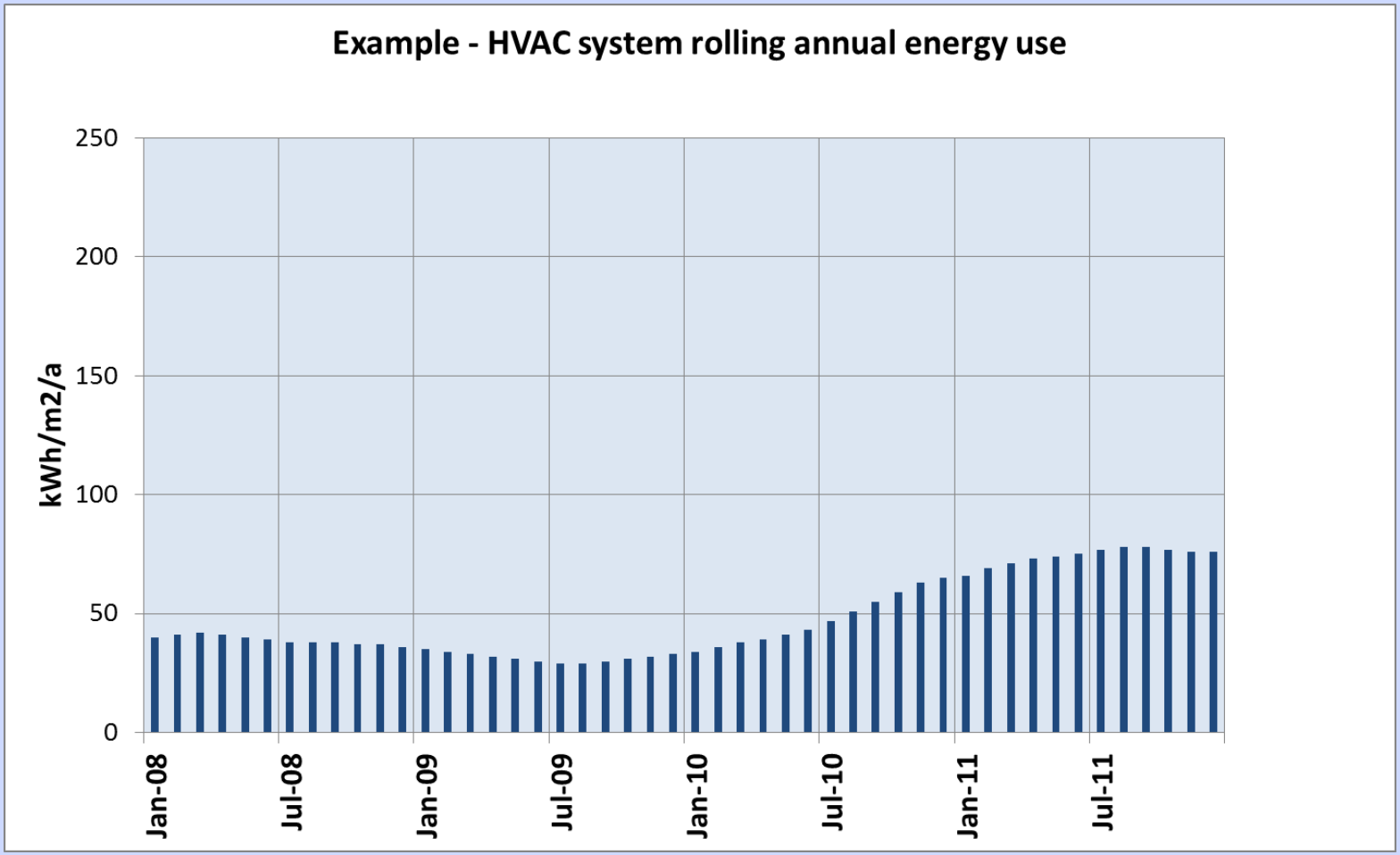
| Month | Blr 1 Cumulative | Blr 2 Cumulative | Blr 3 Cumulative | Chiller 1 cum power | Chiller 2 cum power | Clean Supply DB cum power | DB Floor 2 cum power | DB Floors 1&3 cum power | DB Ground cum power | Fire Panel cum power | Lan Room AC cum power | Landlords DB cum power | Lift 1 cum power | Lifts 2&3 cum power | Main Incomer CP | MCP 4th Plant cum power | MCP Boiler Plant cum power | MCP Central services | MCP Dining cum power |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mar-11 | 5,956.81 | 316,373.75 | 9,614.31 | 986 | 561 | 37 | - | 10,993 | - | 1 | 1,792 | - | 206 | 253 | 99,253 | 207 | 5,623 | 567 | 622 |
| Apr-11 | 2,919.58 | 18,340.97 | 3,903.47 | 1,846 | 1,374 | 47 | - | 9,154 | - | 1 | 1,734 | - | 1 | 412 | 81,365 | 177 | 1,772 | 534 | 628 |
| May-11 | 791.39 | 3,443.61 | 1,058.75 | 1,042 | 464 | 49 | - | 9,661 | - | 1 | 1,792 | - | 24 | 490 | 82,732 | 188 | 1,062 | 561 | 859 |
| Jun-11 | - | - | - | 1,868 | 1,382 | 12 | - | 9,904 | - | 1 | 1,543 | - | 249 | 416 | 85,947 | 176 | 907 | 574 | 559 |
| Jul-11 | - | - | - | 5,326 | 5,092 | 22 | - | 9,299 | - | 2 | 1,400 | - | 276 | 388 | 92,747 | 185 | 930 | 537 | 488 |
| Aug-11 | - | - | - | 4,555 | 3,730 | 1 | - | 9,455 | - | - | 1,401 | - | 259 | 371 | 91,448 | 182 | 961 | 560 | 548 |
| Sep-11 | 224.58 | 224.58 | - | 2,561 | 1,651 | 13 | - | 9,341 | - | 2 | 1,356 | - | 270 | 382 | 84,318 | 177 | 935 | 542 | 529 |
| Oct-11 | 2,481.11 | 246,988.19 | 3,443.61 | 806 | 498 | 17 | - | 9,422 | - | 1 | 1,403 | - | 272 | 378 | 83,722 | 185 | 2,079 | 536 | 514 |
| Nov-11 | 4,320.56 | 73,631.25 | 6,523.61 | 561 | 354 | 10 | - | 10,019 | - | 1 | 1,358 | - | 282 | 403 | 88,882 | 179 | 4,018 | 541 | 523 |
| Dec-11 | 242,218.47 | 294,749.58 | 12,533.89 | 288 | 189 | 110 | - | 7,816 | - | 2 | 1,402 | - | 217 | 305 | 80,854 | 198 | 4,373 | 522 | 556 |
| Jan-12 | 71,075.28 | 266,901.25 | 10.69 | 261 | 190 | 145 | - | 8,854 | - | 1 | 1,359 | - | 252 | 364 | 87,521 | 215 | 4,628 | 498 | 515 |
| Feb-12 | 277,756.11 | 76,197.92 | 225,684.86 | 316 | 234 | 109 | - | 10,176 | - | 2 | 1,362 | - | 277 | 407 | 101,491 | 248 | 7,620 | 510 | 534 |
| Mar-12 | 19,378.33 | 20,982.50 | 19,378.33 | 93 | 58 | 46 | - | 3,337 | - | - | 454 | - | 89 | 133 | 30,778 | 63 | 2,577 | 165 | 175 |
| Grand Total | 627,122.22 | 1,317,833.61 | 282,151.53 | 20,509 | 15,777 | 618 | - | 117,431 | - | 15 | 18,356 | - | 2,674 | 4,702 | 1,091,058 | 2,380 | 37,485 | 6,647 | 7,050 |

# Example outputs from iSERV data – subhourly data

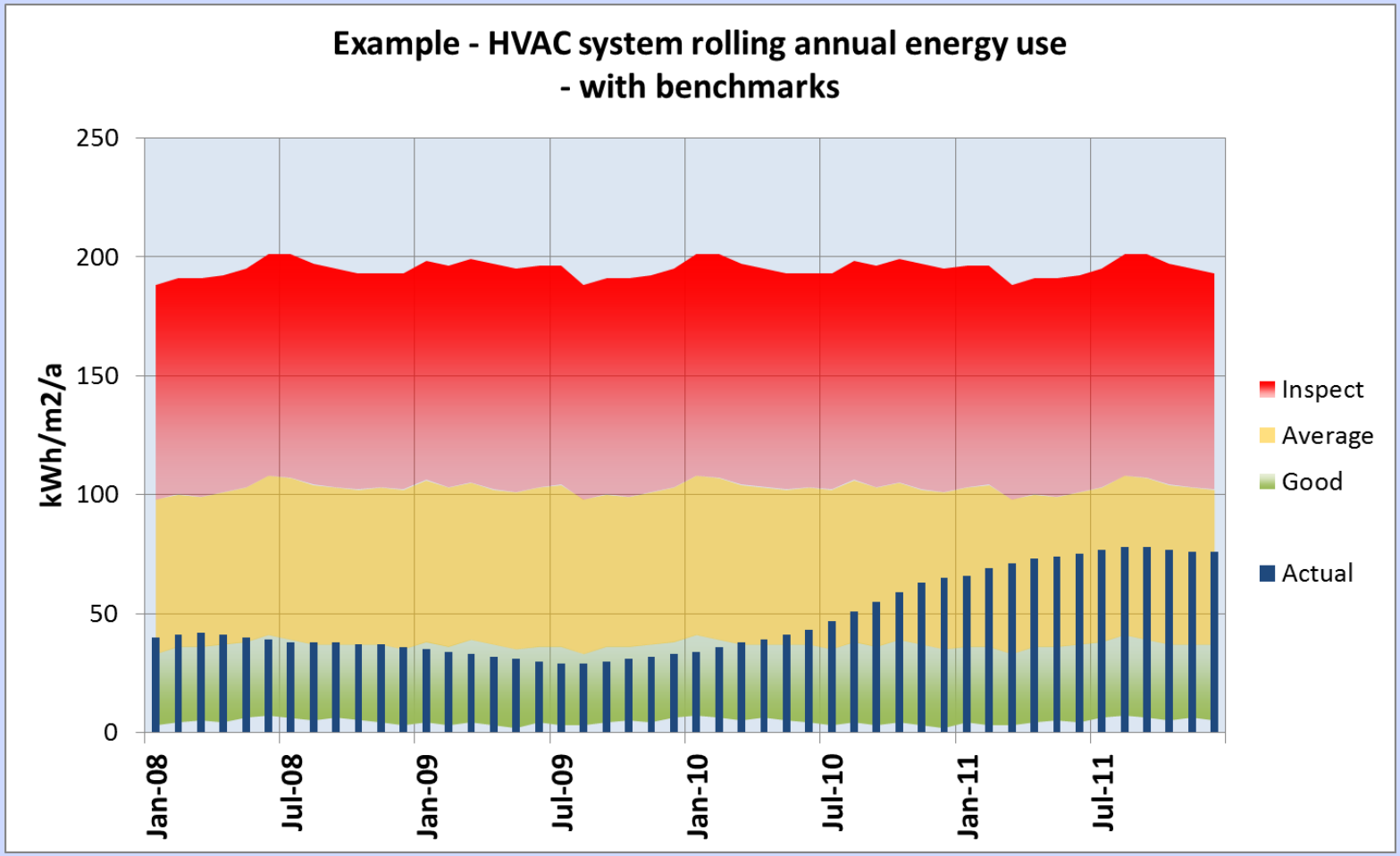
➔Example for Chiller 1 for July 2011 showing good control both inside and out of occupancy hours



# Basic monthly online report



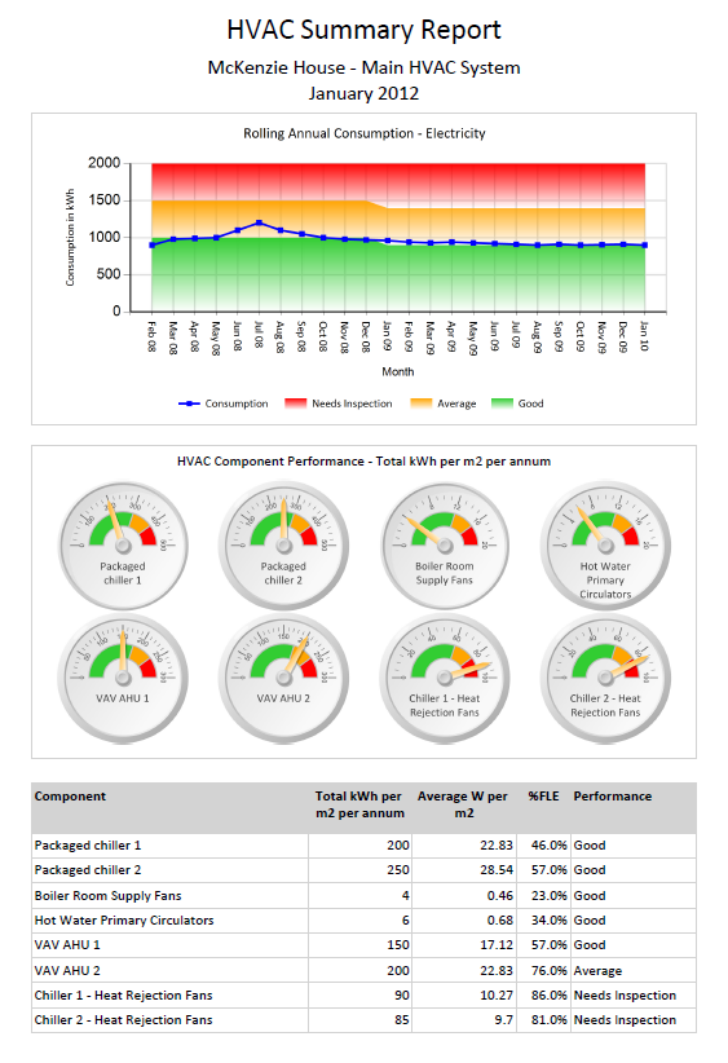
# Monthly report with benchmarks



# iSERV potential reports

➔The image to the right shows a mock-up of the type of report possible from iSERV:

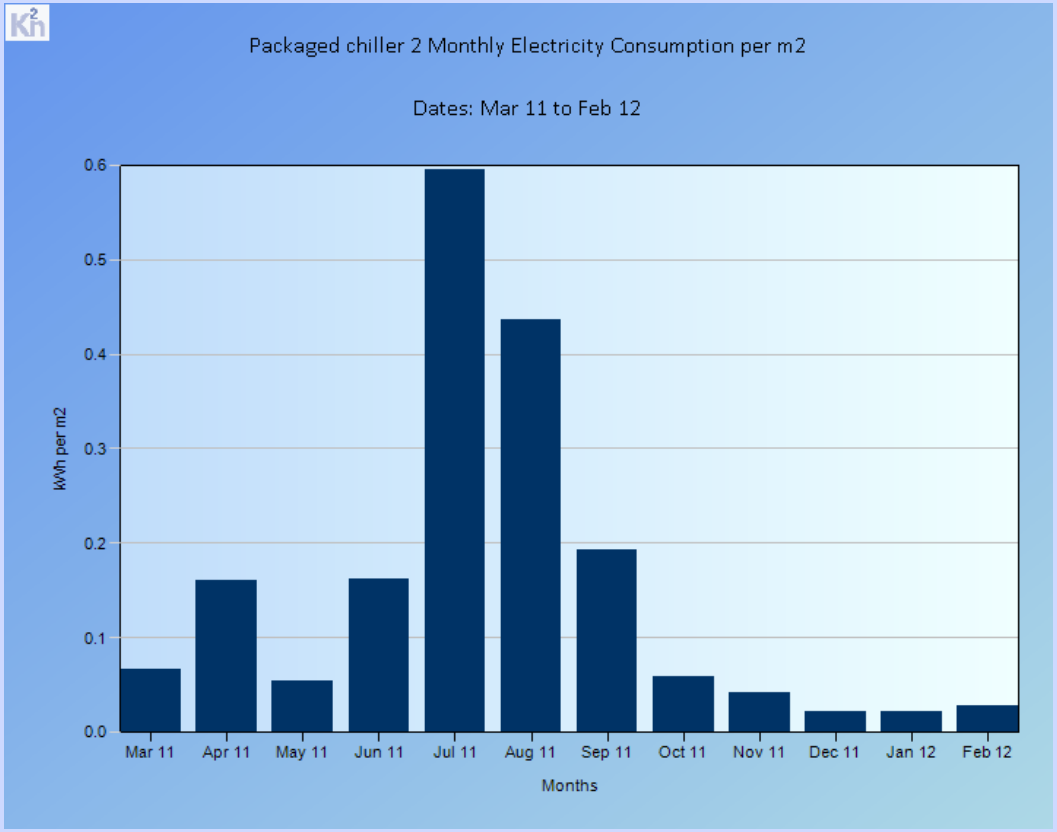
- Benchmark ranges as background to actual
- Performance of components against bespoke benchmarks for given activity mix
- Tabular information




| Component | Total kWh per m2 per annum | Average W per m2 | %FLE | Performance |
|---|---|---|---|---|
| Packaged chiller 1 | 200 | 22.83 | 46.0% | Good |
| Packaged chiller 2 | 250 | 28.54 | 57.0% | Good |
| Boiler Room Supply Fans | 4 | 0.46 | 23.0% | Good |
| Hot Water Primary Circulators | 6 | 0.68 | 34.0% | Good |
| VAV AHU 1 | 150 | 17.12 | 57.0% | Good |
| VAV AHU 2 | 200 | 22.83 | 76.0% | Average |
| Chiller 1 - Heat Rejection Fans | 90 | 10.27 | 86.0% | Needs Inspection |
| Chiller 2 - Heat Rejection Fans | 85 | 9.7 | 81.0% | Needs Inspection |

# Energy use by component

➔ iSERV will also calculate/estimate the consumption of individual HVAC components PER UNIT AREA SERVED and PER ACTIVITY where their supply meter is recorded.



# Summary

➔The project overall is progressing well.

➔The critical part of the project is the next 6 months. In this time we must recruit and start getting data from a substantial number of HVAC systems to enable all the project elements to be achieved.

➔iSERV is actively looking for new stakeholders to participate in this exciting project which has the interest and attention of the EU MS legislators.

# Enabling the approach

- ➔For this workshop we'd like to hear what you find clear and unclear, what you like and what you don't like, and what you think needs to be done to convince **the stakeholders in this area** to actually want to use such an approach
- ➔If the iSERV approach does not work then by 2019 we will have HVAC standards imposed which may have no link to what is practically possible.
- ➔iSERV is the only large scale approach which can provide real-world benchmarks in time for 2019

# Workshop topics

➔Topic 1: Acceptable levels of data requirements to enable participation

➔Topic 2: Barriers to participation other than data requirements

➔Topic 3: Data collection systems

➔Topic 4: Stakeholder information required to drive systematic improvements in HVAC system energy efficiency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# Thank you for your attention

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