



**Inspection of
HVAC systems
through
continuous
monitoring and
benchmarking**

www.iservcmb.info

Example – iSERV project

Anita Derjanecz – REHVA

BUILD UP Users and Stakeholders Meeting

27 June 2013

iSERV Partners



<p>Welsh School of Architecture, Cardiff University UK (Project co-ordinator)</p>		<p>K2n Ltd UK</p>	
<p>MacWhirter Ltd UK</p>		<p>National and Kapodistrian University of Athens Greece</p>	
<p>University of Porto Portugal</p>		<p>Politecnico di Torino Italy</p>	
<p>Université de Liège Belgium</p>		<p>Univerza v Ljubljani Slovenia</p>	
<p>University of Pecs Hungary</p>		<p>Austrian Energy Agency Austria</p>	
<p>REHVA UK</p>		<p>CIBSE UK</p>	

Context: Potential Energy Saving and Policy Options



→ Load reduction (24%)

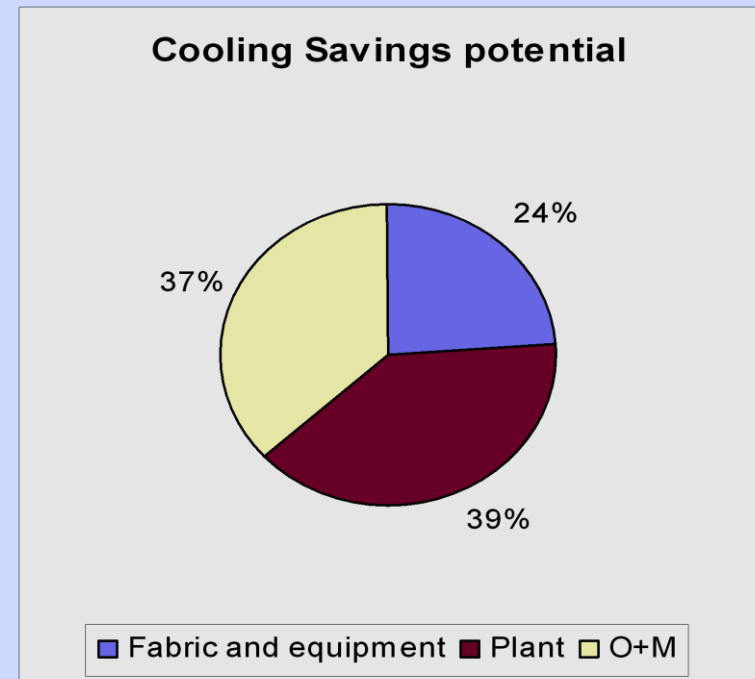
- Building energy standards
- Office equipment and lighting energy standards

→ Improved efficiency (39%)

- System and product efficiency standards

→ Better operation (37%)

- Policy options ??



Current EPBD Regulations

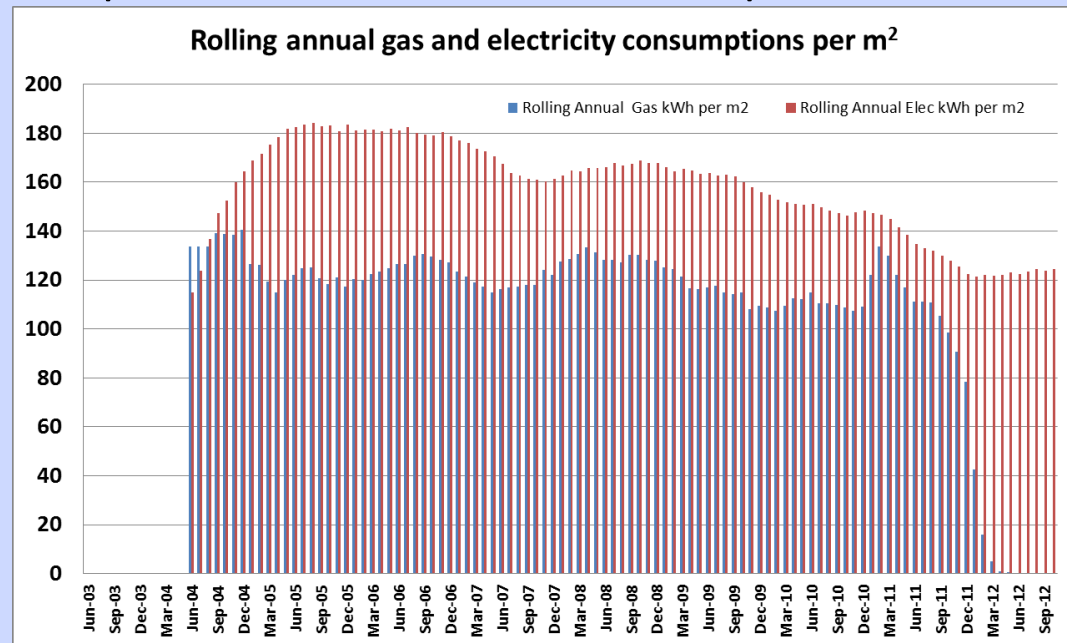


- ➔ EPBD mandates Inspections, Advice or Automatic Monitoring and Feedback
 - ➔ HarmonAC (<http://www.harmonac.info>) showed that Inspections can produce savings, but these:
 - Miss many potential savings as only a snapshot in time
 - Doubtful cost-effectiveness - applied as a requirement to all systems regardless of circumstance
- The impact of advice cannot be evaluated.
- ➔ iSERV is demonstrating how a process can achieve significant energy savings that are **more cost-effective** and **repeatable** than those obtainable from Inspection or Advice

Impacts – Case study: McKenzie House energy use 2003-2012



- ➔ A UK Office Building built in 1923, retrofitted in 1989. Gross internal area 8435 m², 11 floors, 12 HVAC systems
- ➔ Electricity use reduction **from peak of 184 kWh/m² in 08/2005 to 169 kWh/m² in 10/2008** due to the implementation of an Eco-champions network
- ➔ Further reductions **to 124 kWh/m² 10/2012** are **due to improved control of HVAC systems** during HARMONAC and iSERV
- ➔ HVAC savings ~ 25%
- ➔ Eco-champions ~ 8%
- ➔ ~€89,000/a elec. Savings



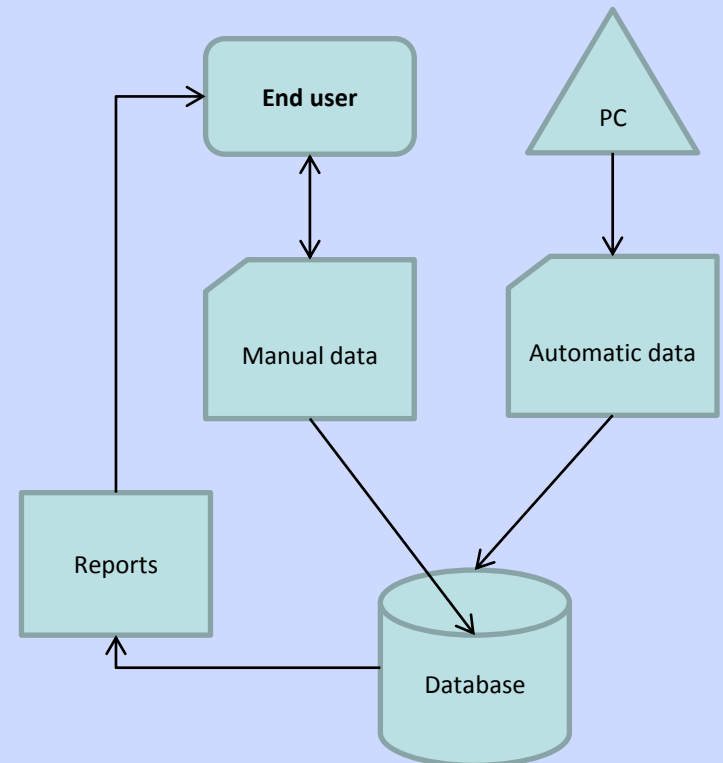
Case study published in BUILD UP: <http://www.buildup.eu/cases/34754>

What iSERVcmb is doing



➔ Remotely monitoring HVAC systems across Europe

- Target 1600 HVAC systems of all types in 16+ EU countries
- All building sectors
- Size: 10's to 10,000's m²
- Sub-hourly data for individual HVAC components
- Mostly using existing or easy-to-add monitoring
- Collating and analysing all data in a web-based database



Overview of whole process



Building and system information

Meter/sensor data

Utility costs/tariffs - GBP/EUR/etc

iSERV web database and analysis software

Reports

Energy Saving Opportunities

Benchmarks

What iSERV aims to deliver



- ➔ A procedure and process applicable to all EU Member States
- ➔ Measured annual power and installed energy consumption benchmarks - tailored to HVAC component and activity
- ➔ Automatic identification of energy saving opportunities (ECOs)
- ➔ Energy performance of individual HVAC systems and components as operated, compared to benchmarks derived from these systems as a whole

Reporting



➔ The iSERV database provides key automatic reports on data entry and further reports as required to investigate specific issues.

how energy efficient are you really?

iSERV CMB
Inspection of HVAC Systems through continuous monitoring and benchmarking

McKenzie House Cardiff University

Cardiff University Estate
Cardiff, United Kingdom

Weather Analysis
November Monthly average
MON TUE WED THU FRI SAT SUN
18°C 16°C 14°C 15°C 14°C 14°C 13°C
13°C 12°C 13°C 16°C 13°C 12°C 13°C
13°C 14°C 13°C 15°C 13°C 13°C 14°C
13°C 14°C 13°C 13°C 8°C 9°C 11°C
13°C 13°C 12°C

google map picture bird view Bing map picture

Monthly Overview

www.iservcmb.eu

Monthly kWh Consumption	Monthly kWh Comparison	Monthly CO ₂ Emissions	Cost Analysis
October 2012 +5.2% (vs last year) -33% (vs 2012 record) 90,462 kWh	Week: 10/01/12 - 10/07/12 MWh: 2,820.794 MWh: 2,820.794 MWh: 2,820.794	October 2012 +5.2% (vs last year) -33% (vs 2012 record) 55,480 kgCO ₂ e	Week: 10/01/12 - 10/07/12 GBP: 2,820.794 GBP: 2,820.794 GBP: 2,820.794

Comparison with peer buildings around Europe

McKenzie House predicted best case	McKenzie House at current peak	McKenzie House at 25% peak prediction	McKenzie House at 75% peak prediction	McKenzie House predicted worst case
260,342 kWh/year*	1,026,482 kWh/year*	1,278,139 kWh/year*	3,362,107 kWh/year*	4,411,836 kWh/year*
37,735 £/year	149,130 £/year	185,330 £/year	487,506 £/year	639,713 £/year

DEPRAMB Ranking: 10th most efficient

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Performance Analysis

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Average Rolling Annual Electricity Consumption per m²

Component Level Electricity Consumption in kWh/m²/year against benchmark

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Performance Analysis

www.iservcmb.eu

Monthly Electricity Costs (GBP) by activity

Top 10 Spaces by Electricity Costs (GBP)

Energy Conservation Opportunities

www.iservcmb.eu

Cooling equipment / Free cooling : Replace or upgrade cooling equipment and heat pumps

The aim of this ECO is to reduce the energy consumption of chilled water pumps. The algorithm checks the cold water generator and its load efficiency. This is verified by examining the equipment's measured energy consumption, nominal electric power and operation hours.

Annual GBP Savings*	Annual kWh Savings	Annual Energy Savings**	Annual CO ₂ Savings***
£2,726.00	18,800 kWh	1.2%	11,089 KgCO ₂ e

Energy Conservation Opportunity Category: Energy Conservation Opportunity Name

Annual GBP Savings	Annual kWh Savings	Annual Energy Savings	Annual CO ₂ Savings
£00.00	0 kWh	0%	0 tons

* Calculations made based on February 2012 prices (14.5p/kWh) ** Energy saving as % of building energy use *** 2012 DEFRA Guidelines

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Building overview report with Benchmarks



Report Navigator

- AA - Residences - University Hall
- AB - Academic - Glamorgan and Bute
- AC - Residences - Cartwright Court
- AD - Academic - Colum Road and Humanities Site Buildings
- AD - Residences - Colum Road and Humanities Site Buildings
- AE - Residences - Gordon Road and East Grove
- AF - Residences - Hodge Hall
- AG - Residences - Llandaff Boathouse
- AH - Residences - Llanrumney Pavilion and Workshops
- AI - Academic - 3 Lhwyn-y-grant place
- AJ - Residences - Tal-y-bont Court
- AJ - Residences - Tal-y-bont North
- AJ - Residences - Tal-y-bont South
- AJ - Residences - Tal-y-bont Sports and Social
- AK - Academic - Main College
- AL - Maindy
- AM - Outlying Cardiff sites?
- AN - Academic - All Newport Road buildings
 - 1 Howard Gardens
 - 1 Howard Terrace
 - 11-15 Howard Gardens
 - 3 Howard Gardens
 - 3 Howard Terrace
 - 5 Howard Terrace
 - Central Building
 - East Building
 - Eastgate House
 - McKenzie House
 - HVACs
 - Meters
 - Sensors
 - Spaces
 - North Building
 - South Building
 - Trevithick Building
 - West Building
 - West Building Extension
- AO - Academic - Park Place and Museum Place
- AQ - Corbett Road, North Road and odd numbers Colum Road
- AR - Academic - Ranch Site, Cathays Park
- AS - Redwood
- AT - Residences - Roy Jenkins
- AU - Residences - Senghenydd Road Buildings and University Village

McKenzie House

Find

Report Type:

Date Range*:

Report By Area*:

Reports:

Output Type:

Utility:

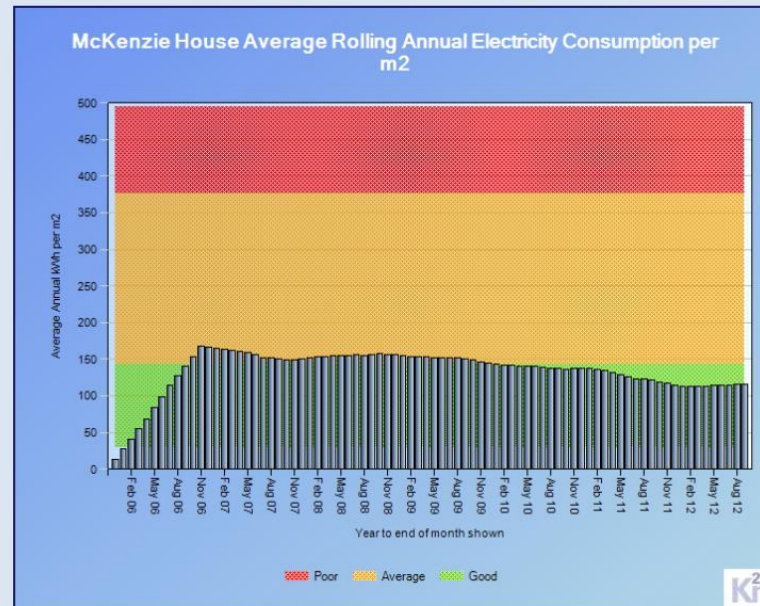
* From:

* To:

Description

Shows monthly rolling annual consumption per m2 for a Building over a configurable date range. The values are calculated by taking the Building's monthly rolling annual consumption and dividing it by the Building area. Rolling Annual Consumption is the sum of the previous 12 months consumption. It allows users to more easily examine trends in consumption by smoothing out annual temperature variances.

1 of 1

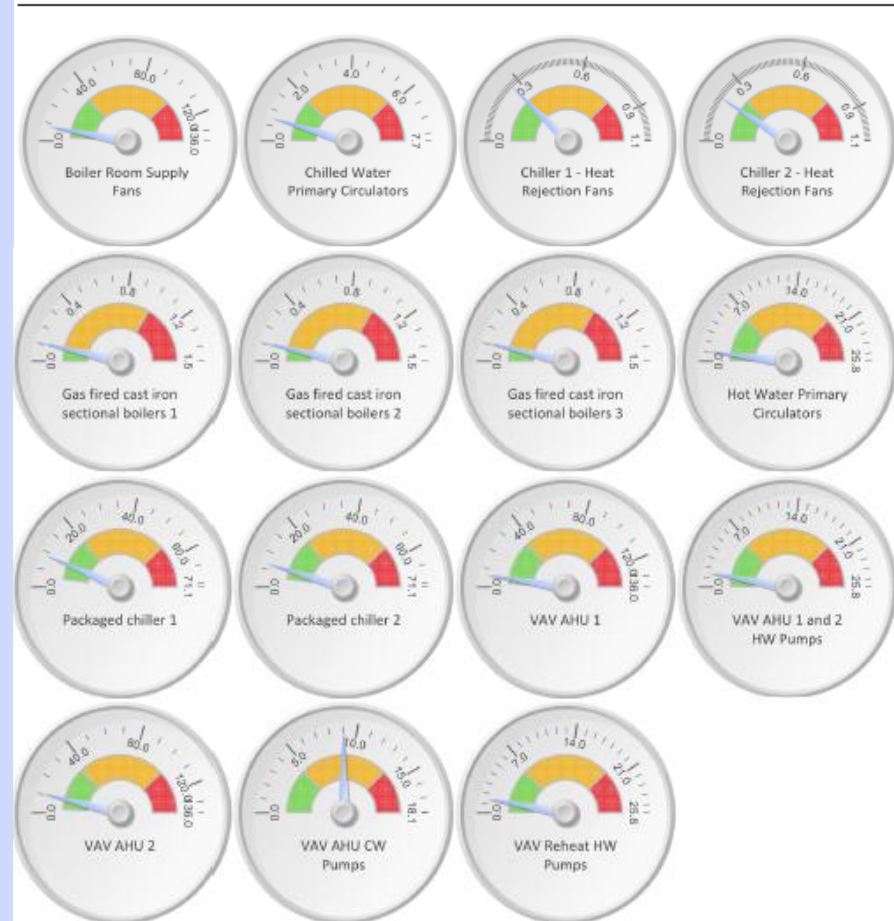


HVAC Component Reports



➔ Individual HVAC component normalised annual energy use against energy use ranges predicted by component for the mix of activities and areas served by that component

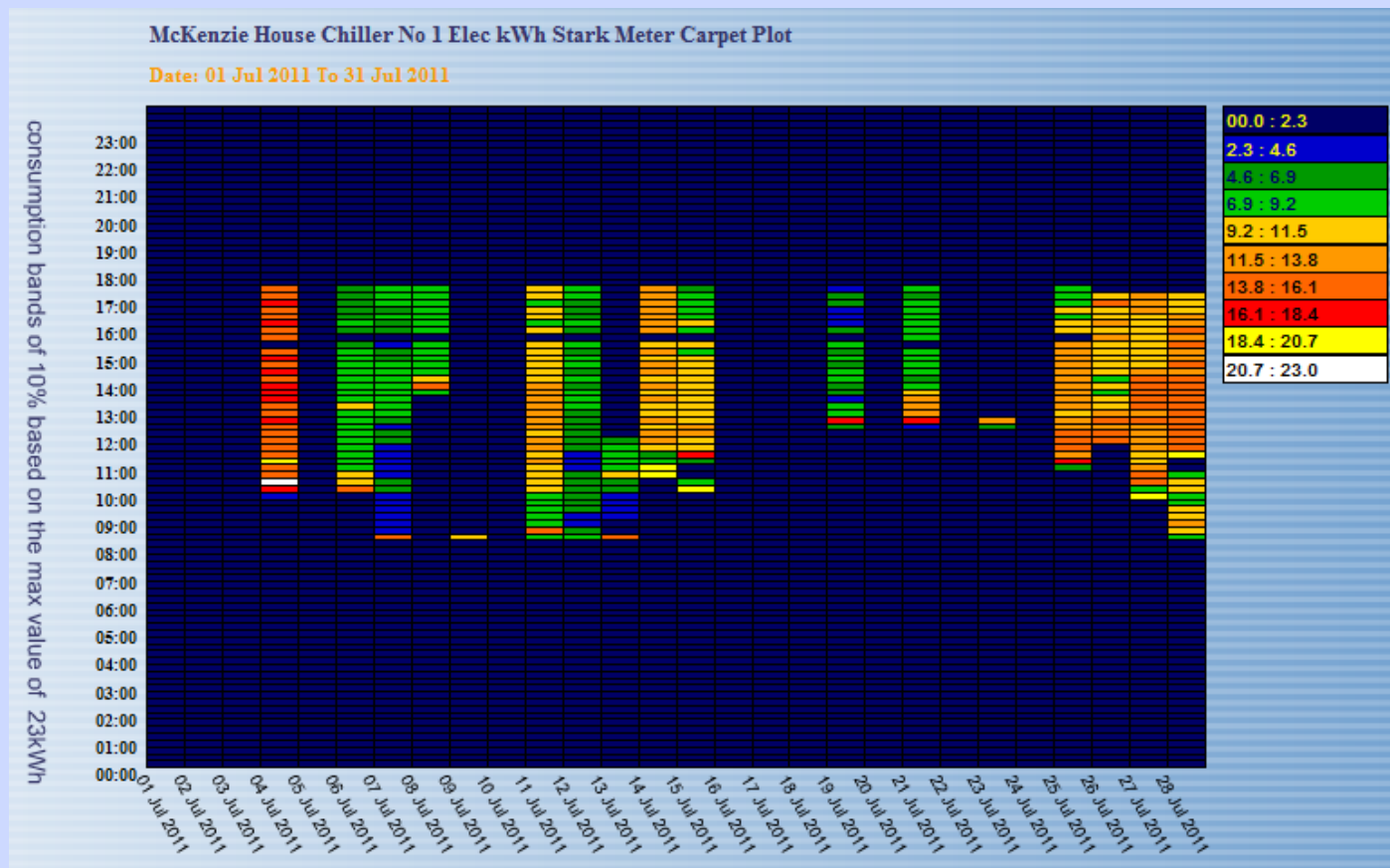
Component Level Electricity Consumption in kWh/m²/year against benchmark



Carpet plot



A plot showing sub-hourly consumption of components, systems or buildings during the days → Identification of ECOs



Current project status



- ➔ 89 buildings providing 351 HVAC systems, 1653 HVAC components, 477 Meters, 3221 Spaces, 48 Activities and 387,027 m² of floor area.
- ➔ **Still recruiting buildings** <http://www.iservcmb.info/how-participate-iservcmb>
- ➔ Algorithms under development and test
- ➔ Energy Conservation Opportunities (ECOs):
 - 40% already under test
 - 20% still under development
 - 40% yet to do

iSERV in BUILD UP posts



→ We uploaded information to attract more participants

HERO; HVAC Energy Reporting and Optimisation tool

Like {0} Tweet {0} Share Share 507 visits

<http://www.buildup.eu/tools/34757>

iSERVcmb Best Practice

+1 {0} Like {0} Tweet {1} Share Share 342 visits

<http://www.buildup.eu/cases/34754>

→ iSERV is mentioned in:

OVERVIEW - Europe's buildings: a continued focus of IEE projects

+1 {0} Like {3} Tweet {10} Share {18} Share 2334 visits

<http://www.buildup.eu/news/35442>

iSERV in BUILD UP Communities



→ We regularly propose content in the relevant Buildup Communities



► **Inspection of heating and air-conditioning systems (42 Members)**

42 Members | 1 Facilitators | Last activity: 13.06.13 14:35 (6 days ago)

Join

<http://www.buildup.eu/communities/aircond>



► **Energy efficient ventilation for healthy buildings (119 Members)**

119 Members | 5 Facilitators | Last activity: 13.06.13 14:35 (6 days ago)

Join

<http://www.buildup.eu/communities/healthybuildings>

iSERV in BUILD UP Communities



→ We uploaded information to attract more participants

Latest Cases and Tools

[VIEW ALL CASE](#)

HERO; HVAC Energy Reporting and Optimisation tool

25 February 2013 | United Kingdom

HERO is an online Energy Reporting and Optimisation application for HVAC systems developed by the iSERVcmb. By collecting sub-hourly energy use data from around 1600 HVAC systems in EU ...

Submitted by [Anita Derjanecz \(REHVA\)](#) | 511 visits

Tags: [HVAC control](#) | [energy efficiency of buildings](#) | [online monitoring](#) | [benchmarking energy data of buildings](#) | [HERO project](#)

25 February 2013 | United Kingdom

iSERVcmb Best Practice

Electricity savings of 33 % per year through awareness measures and optimised control of the HVAC system. The summarizes the results of Cardiff University's participation to the iSERVcmb ...

Submitted by [Anita Derjanecz \(REHVA\)](#) | 345 visits

Tags: [energy savings](#) | [behaviour change and energy efficiencies in buildings](#) | [building energy efficiency and performance](#)

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Inspection of heating and air-conditioning systems

Sharing information on inspection of boilers, heating installations and air-conditioning systems as required by the EPBD and its recast.

[Mission statement](#)

Facilitators: [François Durier](#)

[Unsubscribe from the community](#)



BUILD UP tools to be used in the future



➔ REHVA is interested to publish an **overview article** on iSERV

➔ REHVA is planning to host a **webinar** on project results





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www.iservcmb.info



**Thank you for your
attention**

www.iservcmb.info

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