



Automatic Monitoring and Legislation to meet EPBD requirements

Authors:

Dr Ian Knight

iSERV Project Coordinator

June 2013

Foreword

by Bruce Young, CA Leader for Core Theme on Inspection

A technical session of the CA entitled “*iSERV - Inspection of HVAC Systems through continuous monitoring and benchmarking*” was held in Vienna on 13 December 2011. Automatic monitoring systems are mentioned in the recast Directive no fewer than 3 times, which should be seen as a strong signal to encourage their adoption. Those responsible for implementing the recast Directive were urged to take account of the possibility of introducing automatic monitoring later, even if such schemes are not yet ready. It was important not to close off the opportunity inadvertently.

Participants agreed that schemes based on automatic monitoring systems could be a useful and cost-effective tool when combined with, or complemented by, the work of inspectors. However, presentation of the case for building it into legislation for the transposition of the recast Directive required some development and convincing evidence. They requested further development of the case for regulations that permit automatic monitoring as a partial substitute for inspection, and how it should be presented to those responsible for introducing national legislation.

Following the technical session, Dr Ian Knight contributed the paper below, giving suggestions on how to approach the case for legislation.

1 Introduction

This paper presents the main elements of the argument for why legislators should allow the possibility of automatic monitoring schemes in their transposition of the recast EPBD into National Legislation.

2 Automatic monitoring in implementation of the EPBD-recast

The recast Directive refers to automatic monitoring in 3 places: Articles 8, 14, and 15. Member States are requested to optimise the energy use of Technical Building Systems in existing buildings (Article 8) and to produce recommendations for system specific improvements (Articles 14, 15 and 16). There is a new requirement to encourage the introduction of intelligent metering systems and, additionally, encourage the installation of active control systems such as automation, control and monitoring systems that aim to save energy.

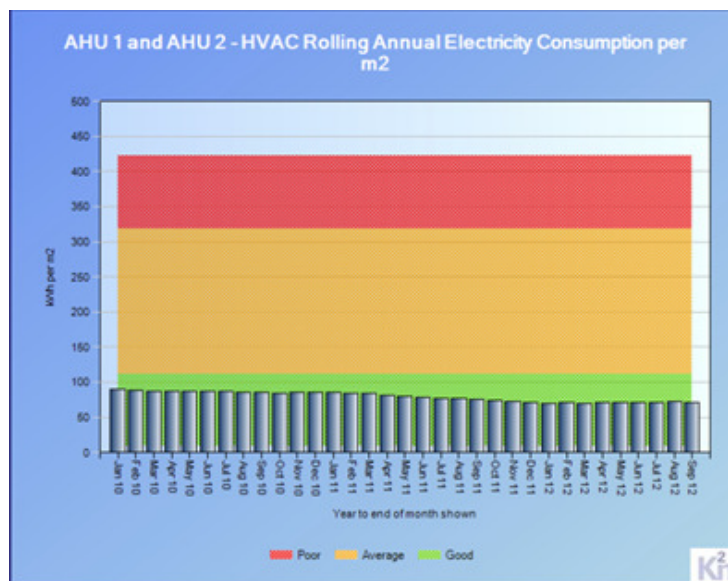
Automatic monitoring systems also provide up-to-date information of value in meeting Articles 6 and 7 - New and Existing Buildings. They also provide information of great assistance in justifying the use of public money in targeted financial assistance, as required by Article 10, to help meet the energy performance requirements for NZEB by 2018 and 2020.

Finally the information generated by automatic monitoring systems can be used to provide not only system-specific targeted advice for participants, but also to generate the advice needed to provide up-to-date guidance to owners and tenants of buildings as required by Article 20.

3 Use of automatic monitoring in implementation of the EPBD-recast

The IEE iSERV project [1],[2] which runs until May 2014, provides an insight into the impact and operation of automatic monitoring schemes. Such schemes have already been shown to be most likely to be considered by those End Users with such systems already in place. Should the iSERV automatic monitoring scheme reveal that a participant's system is performing at an energy consumption level that suggests the need for inspection, compared with consumption by other users of iSERV, then it is anticipated that an inspection would be welcomed for two reasons: firstly because it seems clear there are opportunities for saving energy which an experienced inspector will help elaborate; secondly because an inspection will reveal whether it is possible for the existing system to be practically improved.

The example figure below, taken from the first version of the iSERV online web-based tool, shows how the actual consumption of a specific HVAC system can be related to bespoke benchmarks derived from its components and the activities it serves.



It is immediately clear how the system is performing from an energy consumption viewpoint, against performance being achieved in other existing HVAC systems serving those activities. This is a simple indicator to interpret, and is therefore accessible by all actors interested in this performance.

4 Advantages of using automatic monitoring to implement the EPBD-recast

4.1 Government

These are variable as it depends on how each Member State intends to administer such a scheme. However, the overall costs, including End Users and manpower, should be neutral or show a saving. The direct advantage to Governments is that the number of physical inspections can be reduced, thereby reducing the size and cost of operating an inspection scheme with visits to site by qualified inspectors.

The direct advantage to building owners should be far greater, as in most cases they would no longer have to bear the high cost of physical inspection.

Indirect advantages are that the ongoing collection and analysis of data provides clear evidence of where savings can and have been achieved - allowing the causes to be understood and supported in further legislation. The data is valuable in assessing the achieved impacts of initiatives and better targeted interventions. It also allows a clear evidence base for use in showing the impact of compliance with the EU Directive.

As a separate initiative, a number of Member States are now actively minimising their legislative requirements to ease the regulatory burden on their companies and building owners. It is suggested that allowing automatic monitoring schemes as a means of meeting information requirements for a number of aspects of the recast EPBD such as EPCs, etc., will actually prove less of a burden for those already collecting this information, and that they would welcome this approach as a way of consolidating their data collection and reporting activities.

4.2 Market

Many buildings already have automatic monitoring installed or could install the additional metering needed at little extra cost. The personnel to operate the systems already exist. It is anticipated that End Users opting for this route to compliance will do so in anticipation of many benefits to them, not least of which is an ability to show Corporate Social Responsibility.

In many cases, monitoring schemes will cost less than periodic inspection once the expected energy reduction benefits demonstrated by HARMONAC [3],[4] have been achieved. HARMONAC showed that inspection revealed only 37% of the potential energy savings that could be seen by analysis of the sub-hourly data for those HVAC systems studied in HARMONAC. This figure comes from Section 4.3.1 of the final Public report for HARMONAC [3], which notes the following:

“More than 3000 Energy conservation opportunities (ECOs) were detected in the 42 Case Studies and 400 Field Trials undertaken during the HARMONAC project. This gives an average of around 7 ECOs¹ detected for each Study.”

The same section of the report goes on to suggest that control measures based on automatic monitoring and targeting are the key to practical energy savings. It was shown that one ECO alone (“*Shut off A/C equipment when not needed*”) was capable of achieving energy reductions of over 3% of the annual energy use of all buildings, and it occurred in 45% of the sample.

This statement depends on automatic monitoring and targeting systems being in universal use. The summary of this section of the HARMONAC report further notes that the HVAC related ECOs could reduce the primary energy use of buildings as a whole by over 10% when allowing for all energy use in the building, including heating.

The summary section goes on to conclude that, without this detailed monitoring information, many of the plant and envelope ECOs will not be considered as the data will not be available to identify them. This would reduce the ECOs to Operational and Maintenance issues alone (potentially 3.8% rather than 10.4% savings), therefore neglecting 62% of the potential savings to be had.

It can be seen that the potential energy savings are substantial, and it is estimated that achieving all these savings would reduce the overall electricity use in the EU by around 2% [1].

Previous experience by K2n Ltd, the database provider for iSERV, with an automatic monitoring and control scheme, indicates that if the End Users are charged for the service, then annual costs could run from tens of Euros for smaller systems through to low thousands of Euros for the largest systems. The results from HARMONAC [3], combined with initial estimates on the costs of such a service arising from iSERV, indicate that, on average, the benefits achieved from reduced energy use, better understanding of maintenance needs, better choice of replacement equipment, etc., make the service cost neutral or return a net cost saving to the End User - assuming that the building operatives and monitoring already

¹ ECO - Energy Conservation Opportunity

exist, as they do in many buildings².

iSERV will, in conjunction with Professional Bodies, End Users and Industry, help establish a basis for such a scheme.

5 Conditions for implementing automatic monitoring in legislation

5.1 Who oversees the operation of such a scheme?

Options are:

- Existing bodies overseeing inspection and other aspects of EPBD compliance.
- A commercial company.
- A Professional Body.
- A government department or local authority.

5.2 What about data protection and liability for the data?

The rules for data protection will be the same as for existing schemes such as EPCs and inspection lodgement. It is possible for the same body to be responsible for the automatic monitoring data as for those data. It is assumed that liability for the data can be dealt with similarly.

5.3 Who monitors the correct operation of the scheme by End Users?

Where inspection, F-Gas, or other schemes exist, then the logical route is to train the assessors for those schemes to undertake assessment of data accuracy and completeness in End Users opting for the automatic monitoring route. It is anticipated that random testing of End Users can be undertaken as for current systems such as inspection, so these routes are already established. However, automatic monitoring also allows data anomalies to be more easily found and used to assist checking of unusual data patterns. This allows a further route to reducing costs on the principle of “inspecting only what really needs inspecting”.

The costs for these random inspections can be covered from the End User cost of involvement in such a scheme or by the responsible authority as part of its support for the End User. It is assumed that existing mechanisms will form the basis of this support.

6 Preparation for automatic monitoring when no scheme is yet available

It is suggested that the legislation be framed to allow approved schemes to emerge once the MS has been able to understand their impact and operating costs. This understanding may be gained from the iSERV project.

A form of words that might allow this could be along the lines of:

“Compliance with this part of the legislation can also be demonstrated through formal involvement in an approved automatic monitoring scheme” (approval being defined by the MS).

This would allow details on how an approved scheme would work to be defined at a later date. Crucially,

² *Post-meeting note:* further data now suggests that simple payback times for such an approach will be significantly less than a year in many cases - and it is now anticipated that significant energy savings will be achieved in conjunction with significant cost savings.

it follows the spirit of the recast EPBD in requesting Member States to encourage the introduction of intelligent metering systems and, additionally, encourage the installation of active control systems such as automation, control and monitoring systems that aim to save energy.

7 Advantages of automatic monitoring for energy saving in general

- Provides targeted guidance down to the level of HVAC components, which HARMONAC [3] demonstrated should unlock the potential for further savings of 60%+ compared to those achievable from inspection alone.
- Allows the End Users to help set the standards for what is possible, rather than legislation setting minimum standards to which all End Users will design. This approach allows for ambition to be shown by End Users who wish help to set the standards for what is possible. There are numerous organisations who wish to help in this respect but feel divorced from any means of helping set standards at present. The table below lists the multi-national organisations who are currently either providing information to iSERV or have expressed an interest in doing so. There are also a significant number of non-multinationals participating.

Company	Sector	Company	Sector
Honeywell	HVAC Manufacturer	British Telecom	Telecommunications
First Facility	Facility Management	Allianz	Financial services
Baxter	Pharmaceutical	Schneider Electric	HVAC Manufacturer
Energieeffizienzgmbh		Socomec	HVAC Manufacturer
Cofely	Facility Management	Rhoss	HVAC Manufacturer
Spar	Retail	MTA	
Unicredit	Banking	Lennox	HVAC Manufacturer
McDonalds	Restaurant	IKEA	Retail
Falkensteiner	Hotels	Toshiba	HVAC Manufacturer
Best Western	Hotels	Carel	HVAC Manufacturer
Austria Trend Hotel Fieberbrunn	Hotels	Johnson Controls	HVAC Manufacturer
Romantikhotel	Hotels	Belimo	HVAC Manufacturer
ArCotel	Hotels	LG Electronics	HVAC Manufacturer
Relais & Chateaux	Hotels	Metro AG	Retail
Marriott	Hotels	Tesco	Retail
NH Hoteles	Hotels	Carrier	HVAC Manufacturer
Ibis Hotels	Hotels	Eurobank	Banking
Mercure	Hotels	Media markt	Retail
Swegon	HVAC Manufacturer	Trane	HVAC Manufacturer
Eversheds	Law Firm	France Air	Building Materials
DAIKIN	HVAC Manufacturer	H&M	Retail
TERMODECK	HVAC Manufacturer	Santander	Banking
MITIE	Facility Management	ALDI	Retail
WALDNER	Fume Cupboard manufacturer	FNAC	Retail
Grupolnditex (ZARA, MANGO etc)	Retail	Siemens	HVAC Manufacturer
SKANSKA UK	Building Developer	Vodafone	Telecommunications

- Comparison of performance with real systems undertaking servicing of similar end-use activities is very persuasive in encouraging investment and adoption of best practice at the design stage.
- Where owner/operators of HVAC systems are already committed to monitoring schemes, it seems sensible to allow them to use them as a means of demonstrating compliance with a number of

aspects of the EPBD. This allows them to maximise their existing investment and causes minimum disruption, or even reduces disruption.

- For those owner/operators considering automatic monitoring schemes but not convinced by the investment returns, this might help swing the balance in favour of an approach which HARMONAC has demonstrated can achieve clear benefits in terms of energy savings.
- The requirements to ‘meet legislation’ are often cited as the only reasons for activity in this area by many energy managers. A lighter regulatory touch should not come at the expense of removing a requirement for owners/operators to consider energy use as an important component of their operations.
- Including automatic systems as a means of meeting legislative requirements will allow End Users to embrace such systems and the energy saving benefits they bring.

8 Other useful applications of automatic monitoring (concerning EPBD)

The information on systems actually delivering low-energy services in practice is an essential element of any move towards Near Zero Energy Buildings (NZEB). Without understanding of which systems actually achieve high levels of performance it will be almost impossible for many new buildings - particularly in dense urban settings - to achieve the requisite levels of performance in practice by the 2018 and 2020 target dates. Part of a government’s role in aiding companies and other actors to achieve low or zero carbon buildings is to provide them with the information and guidance they need, applicable to the local conditions they face. iSERV-type schemes [1], i.e. ones that can measure energy use across comparable systems in order to establish achievable benchmarks against which to measure performance, can provide essential information in this respect, and will help avoid costly and unnecessary design errors in trying to achieve NZEB.

Automatic monitoring systems are also very useful in helping establish cost-optimal levels of performance that might be achievable in practice - and because they are continually gathering data they help to inform all actors when state-of-the-art technology becomes cost-optimal.

9 Acknowledgement

The author would like to acknowledge the invaluable contribution of the CA participants at the iSERV session to the production of this paper.

10 References

[1] iSERV CMB website. URL: www.iservcmb.info/. Accessed 09/01/2013

[2] Knight I -“*Assessing Electrical Energy Use in HVAC Systems*”, REHVA Journal (European Journal of Heating, Ventilating and Air Conditioning Technology), Volume 49, Issue 1, January 2012
www.rehvajournal.com/ ISSN: 1307-3729

[3] HARMONAC Final Project Report. Available from HARMONAC website download page. URL:
www.harmonac.info/index.php?id=289. Accessed 09/01/2013

[4] Knight I and Masoero M -“*Inspection of air-conditioning systems - results of the IEE HARMONAC Project*”, REHVA Journal (European Journal of Heating, Ventilating and Air Conditioning Technology), Volume 48, Issue 2, March 2011 www.rehvajournal.com/ ISSN: 1307-3729

*This report is funded by the Community's
Intelligent Energy Europe programme
under the contract IEE/CA/07/333*



The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the official opinion of the EACI, the European Commission or other European Institutions. Neither the EACI, nor the European Commission nor any other European Institutions are responsible for any use that may be made of the information contained herein. The content is given for information purposes only and does not legally bind any of the parties involved.

© European Union, 2011

More details on the IEE Programme can be found at
ec.europa.eu/intelligentenergy

This report can be downloaded from
www.epbd-ca.eu and also from www.buildup.eu