air academy Swegon

iSERV Project – November 28th 2013, Lisbon

Inspection of HVAC systems through continuous monitoring and benchmarking

www.iservcmb.info

iSERV – how to achieve long-term energy reductions in buildings

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EFRIARC Talk

Lisboa, November 2013

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Supported by INTELLIGENT ENERGY EUROPE

Content of talk

➔ **Long-term** energy savings can be achieved through a process.

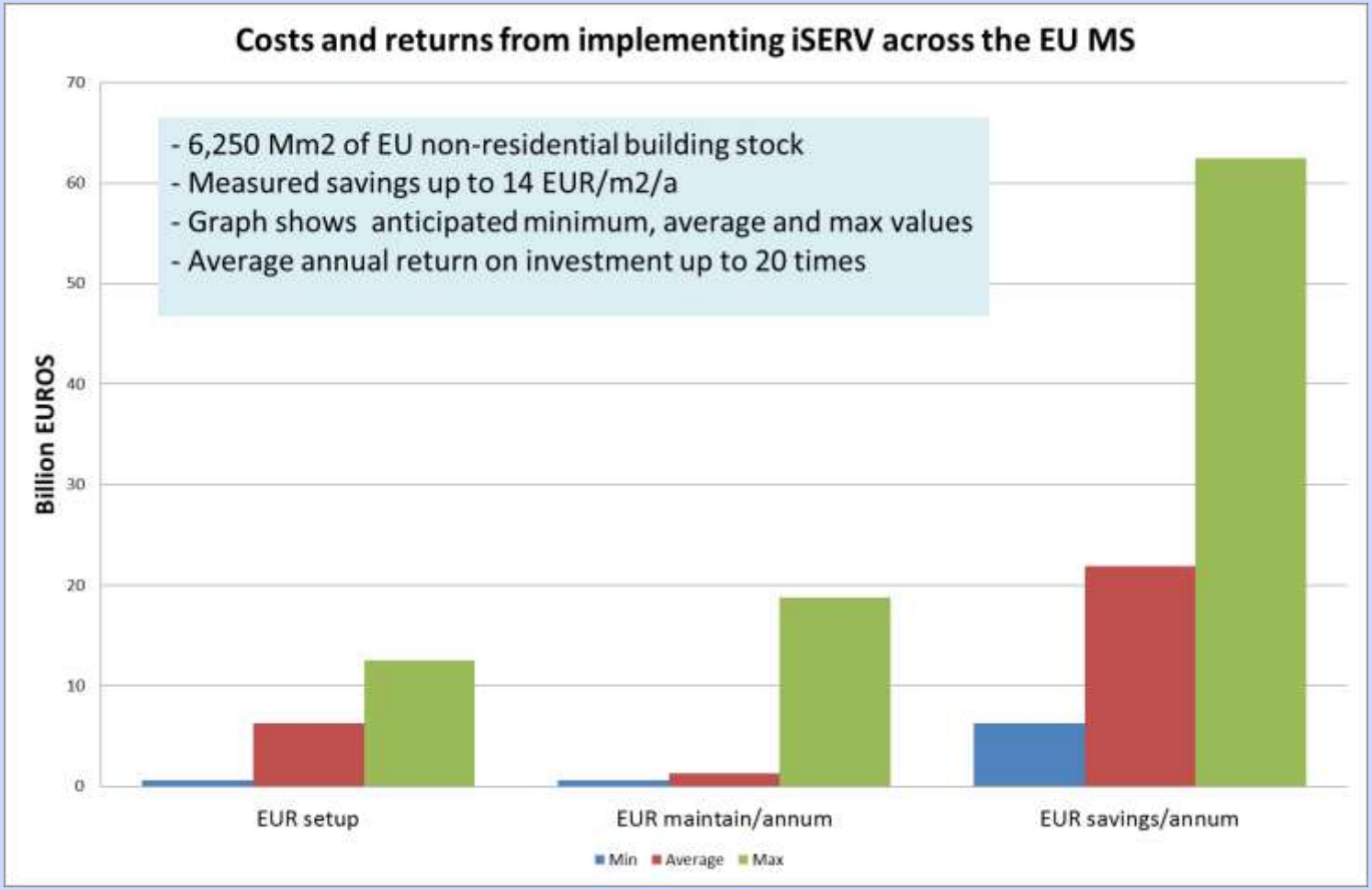
➔ This process needs to be in legislation for full impact

➔ The process needs to know:

- What activities the buildings contain
- How the services are arranged
- The sub-hourly energy use in the building and services
- Energy benchmarks for buildings and components servicing activities

➔ There is a strong commercial case for monitoring buildings

Value at stake at EU scale



Fossil fuel and water savings are not included in this figure.

End User interests

➔ LEGISLATION COMPLIANCE – What MUST be done

➔ RISK – Money, business continuity

➔ EFFORT – Time, cost

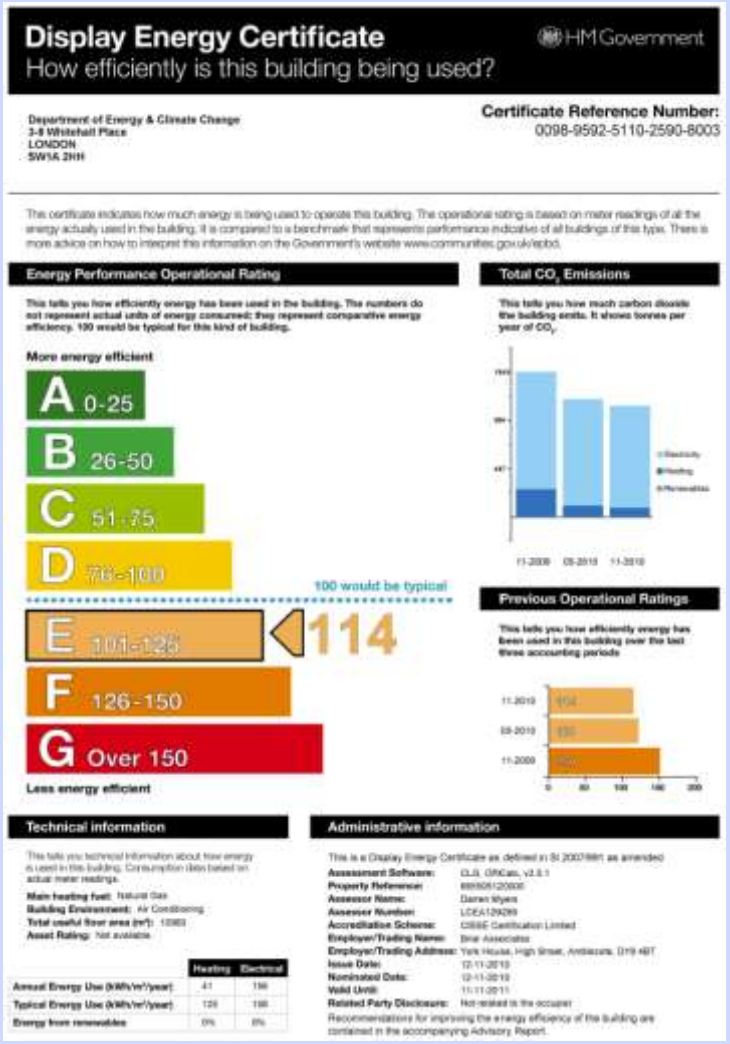
➔ REWARD – Business continuity, money, energy, marketing

If all the above show there is a strong case:

➔ HOW to implement

A 20th Century approach to a 21st Century problem

- Most EU MS Energy Legislation looks at whole buildings and annual energy use
- So we know WHAT we are using, but not WHY we are using it.
- Most organisations JUST comply with legislation
- We lack DETAIL on benefits and savings
- Therefore RISK increases



Display Energy Certificate
How efficiently is this building being used?

HM Government

Department of Energy & Climate Change
3-8 Whitehall Place
LONDON
SW1A 2HH

Certificate Reference Number:
0098-9592-5110-2590-8003

This certificate indicates how much energy is being used to operate this building. The operational rating is based on meter readings of all the energy actually used in the building. It is compared to a benchmark that represents performance indicative of all buildings of this type. There is more advice on how to interpret this information on the Government's website www.communities.gov.uk/epbd.

Energy Performance Operational Rating

This tells you how efficiently energy has been used in the building. The numbers do not represent actual units of energy consumed; they represent comparative energy efficiency. 100 would be typical for this kind of building.

More energy efficient

A 0-25
B 26-50
C 51-75
D 76-100

100 would be typical

E 101-125 — 114
F 126-150
G Over 150

Less energy efficient

Total CO_2 Emissions

This tells you how much carbon dioxide the building emits. It shows tonnes per year of CO_2.

Previous Operational Ratings

This tells you how efficiently energy has been used in this building over the last three accounting periods

Technical information

This tells you technical information about how energy is used in this building. Consumption data based on actual meter readings.

Main heating fuel: Natural Gas
Building Environment: Air Conditioning
Total useful floor area (m²): 13983
Asset Rating: Not available

	Heating	Electrical
Annual Energy Use (kWh/m²/year)	41	156
Typical Energy Use (kWh/m²/year)	128	156
Energy from renewables	0%	0%

Administrative information

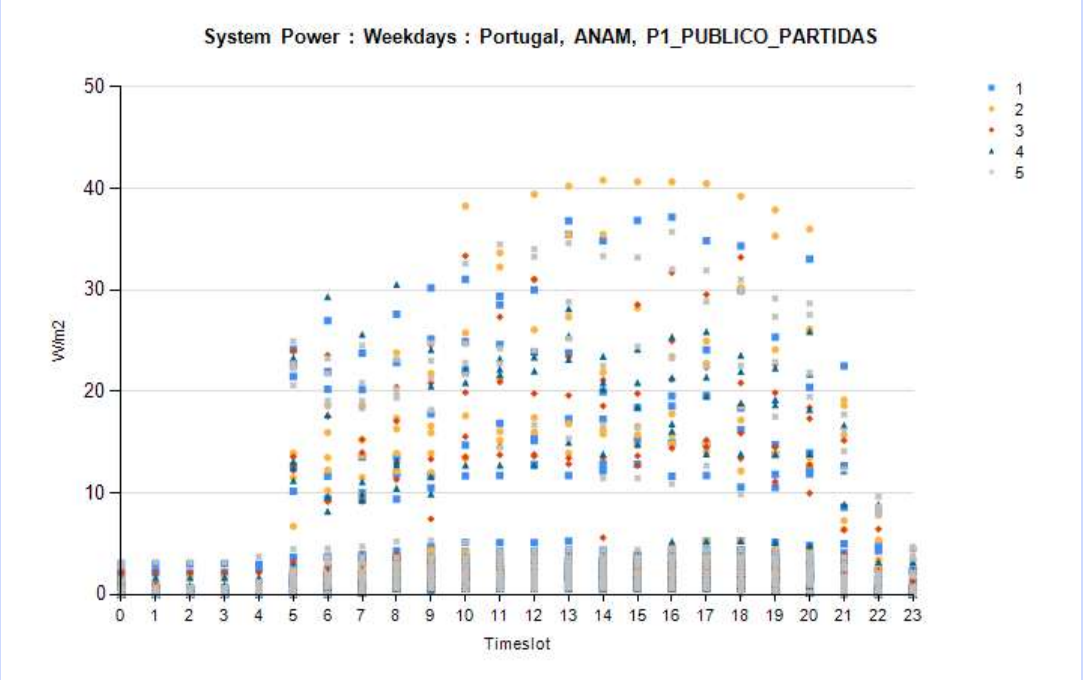
This is a Display Energy Certificate as defined in SI 2007/991 as amended

Assessment Software: CLG, ORCalc, v2.3.1
Property Reference: 68808120000
Assessor Name: Darren Myers
Assessor Number: LCEA129289
Accreditation Scheme: OSSE Certification Limited
Employer/Trading Name: Briar Associates
Employer/Trading Address: York House, High Street, Ambleside, DY9 4BT
Issue Date: 12-11-2010
Nominated Date: 12-11-2010
Valid Until: 11-11-2011
Related Party Disclosure: Not related to the occupier

Recommendations for improving the energy efficiency of the building are contained in the accompanying Advisory Report.

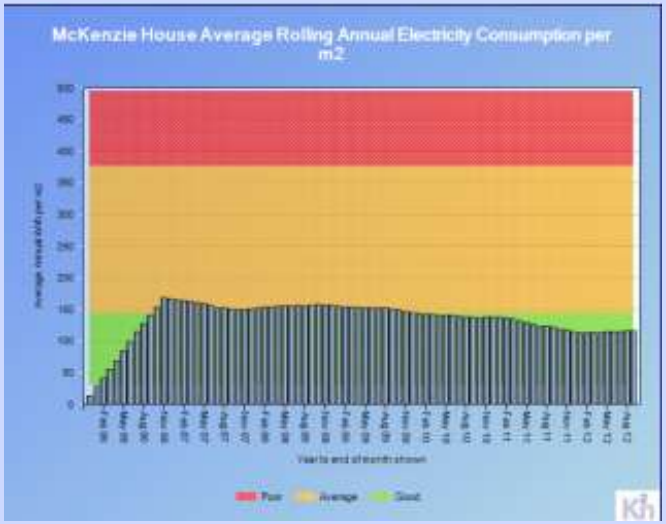
A 21st Century approach to a 21st Century problem

- ➔ New data sources allow us detailed insights
- ➔ This level of detail reduces RISK
- ➔ iSERV utilises these new data sources to propose a new practical approach to achieving long-term energy reductions



iSERV

➔ Shows the energy savings possible for REAL BUILDINGS



➔ Uses an empirical process based on physical items that can be measured and found in all buildings

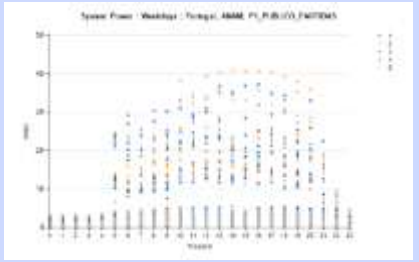
➔ This means that reports can refer to actual items in a building

➔ Reduces RISK – therefore enables INVESTMENT

The iSERV recipe

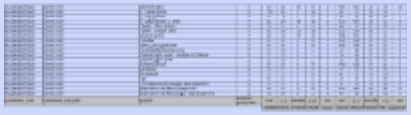
A Spreadsheet

+ Sub-hourly data

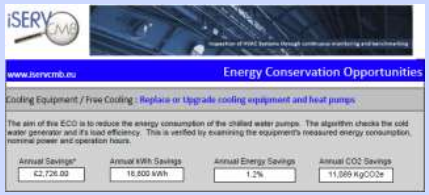


+ A database

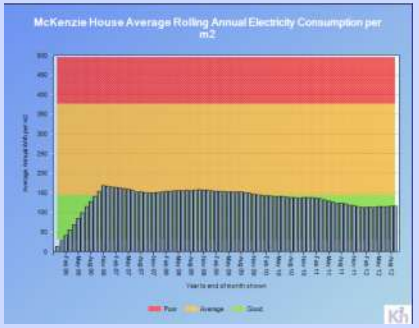
+ Component benchmarks



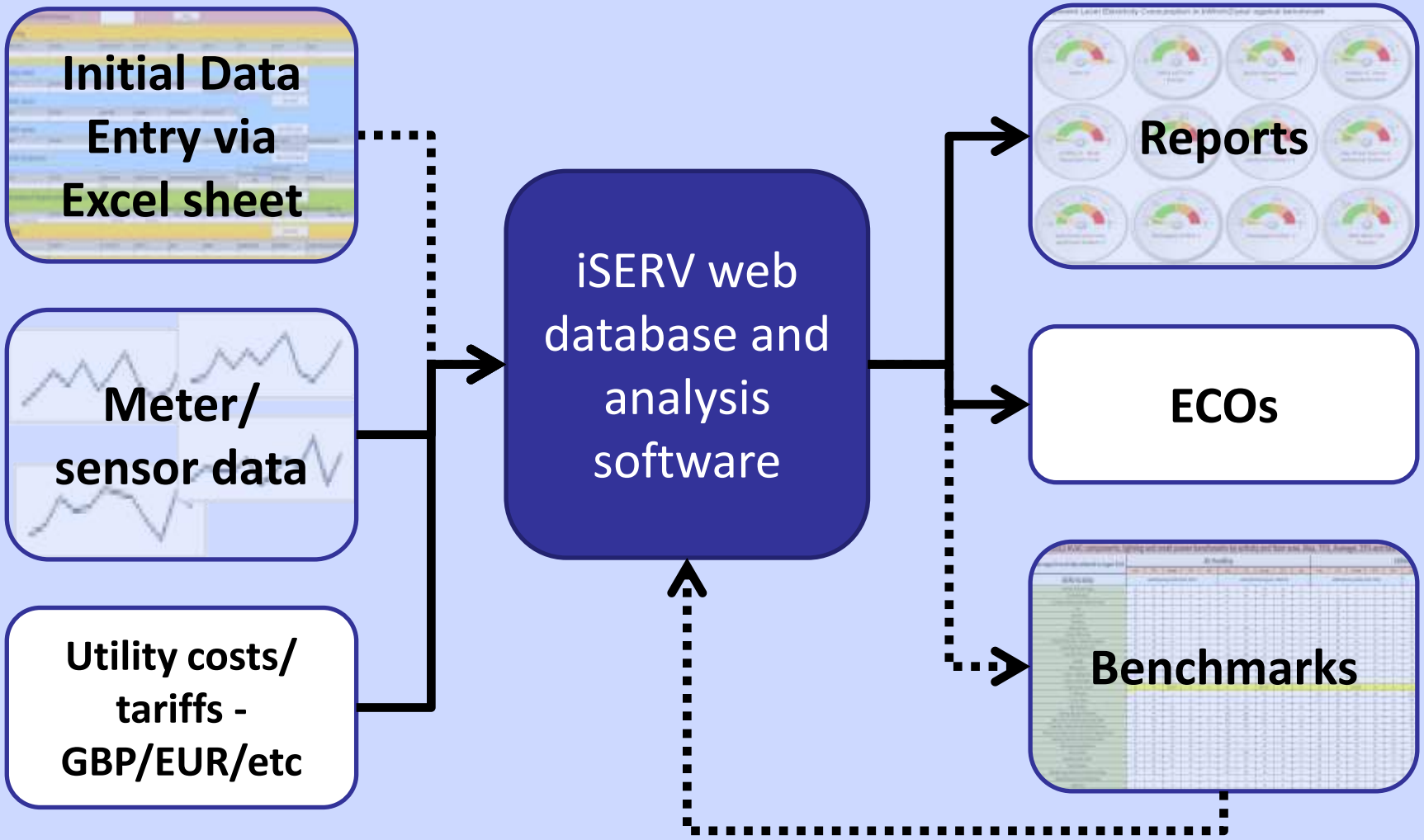
+ Targeted reports



= Energy savings



Overview of basic process



Collect information on the building

- ➔ Floor area and activity for each space in the building
- ➔ Networked utility meters/ sensors
- ➔ Unique Identifiers for the sub-hourly data collected
- ➔ All HVAC Components and where they serve

Collate information on the building

- ➔ iSERV has set up a spreadsheet to act as a data collection focus for the building, meters and services physical elements
- ➔ The spreadsheet also acts as a means of **connecting** all the elements

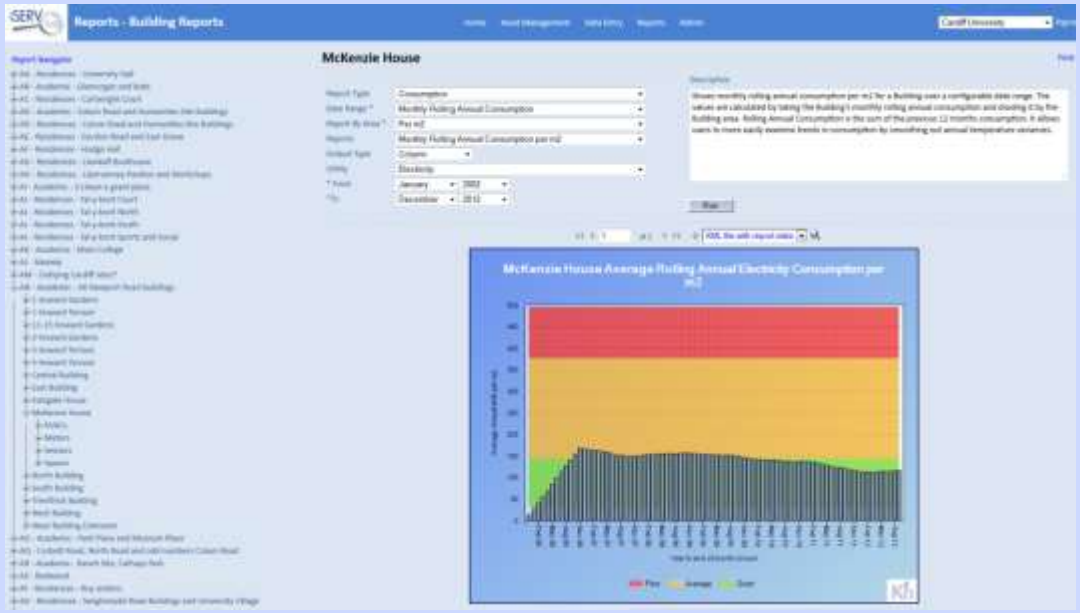
Database

➔ A bespoke database has been written for the project

➔ Based on a commercial product

➔ Acts as the focus for the iSERV project elements:

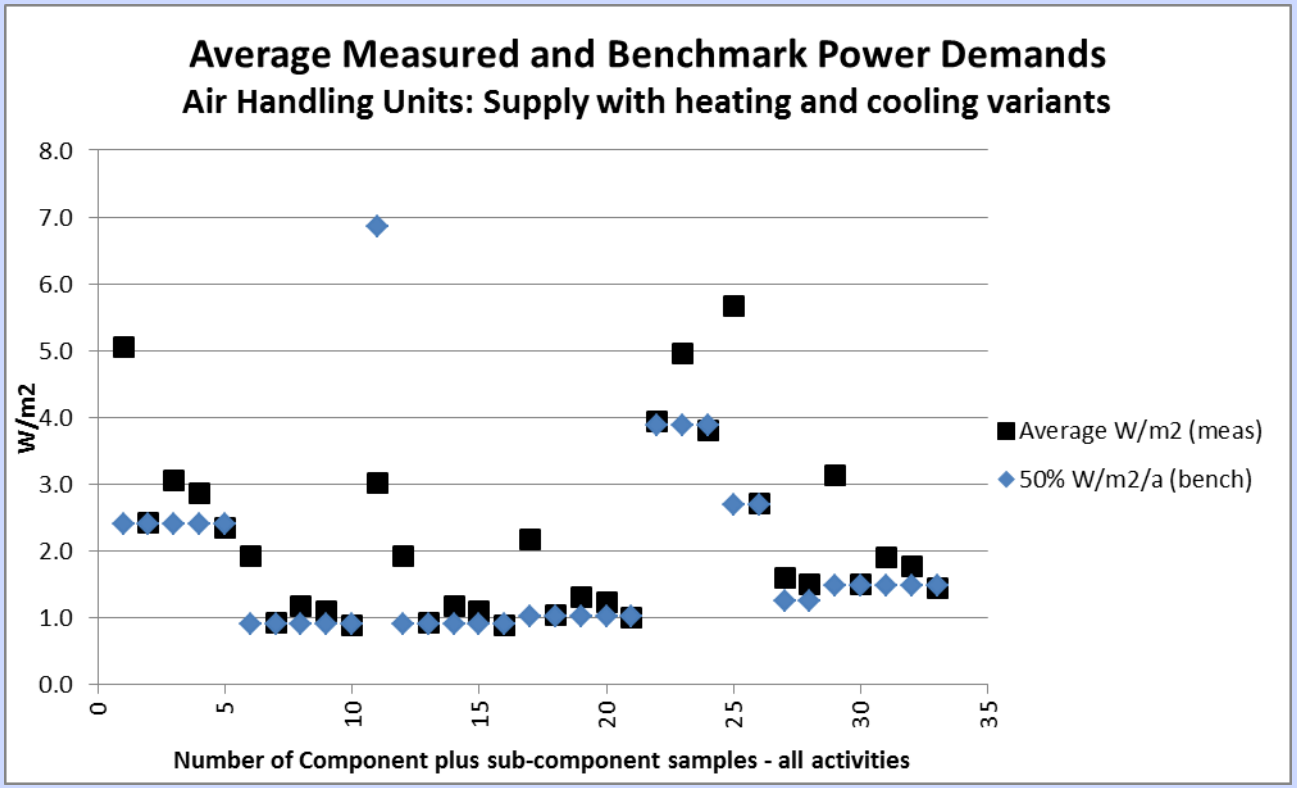
- Data collection
- Benchmark use
- Benchmark generation
- Reports
- Energy Conservation Opportunity algorithms



Benchmarks

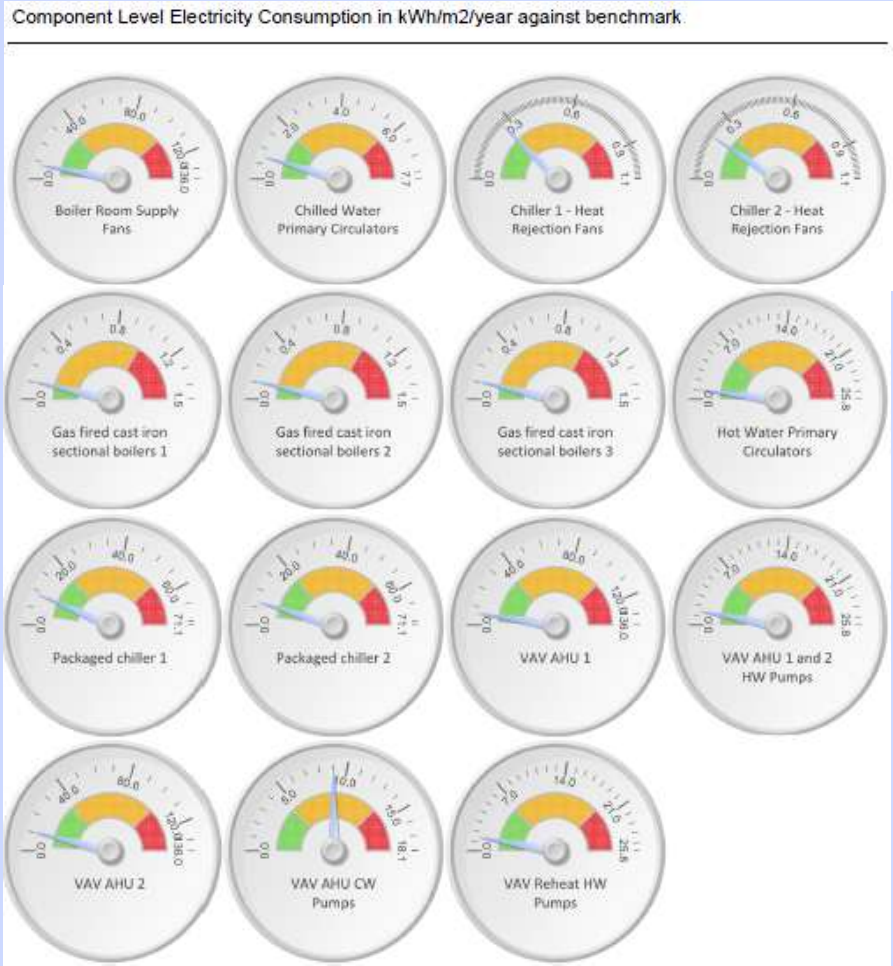
➔ Three types of benchmark being produced and explored:

- Annual energy/m^2 – kWh/m^2.a
- Monthly energy/m^2 – kWh/m^2.month
- Power demands/m^2 – W/m^2



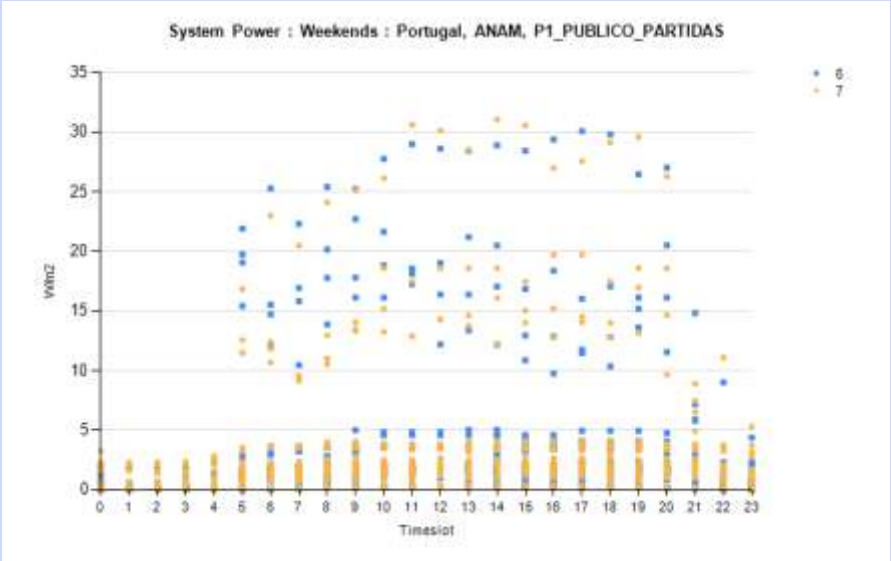
Three ways to save energy – regularly show performance

- **Regularly show performance** against benchmarks derived from the details of the building and services
- Monthly reports advised
- Benchmarks reflect current practice so reduce risk



Three ways to save energy – better control of existing plant

- **Better control of what you already have** e.g. use of ECO algorithms or scatter graphs/carpet plots to identify when systems and components are running outside of expected hours

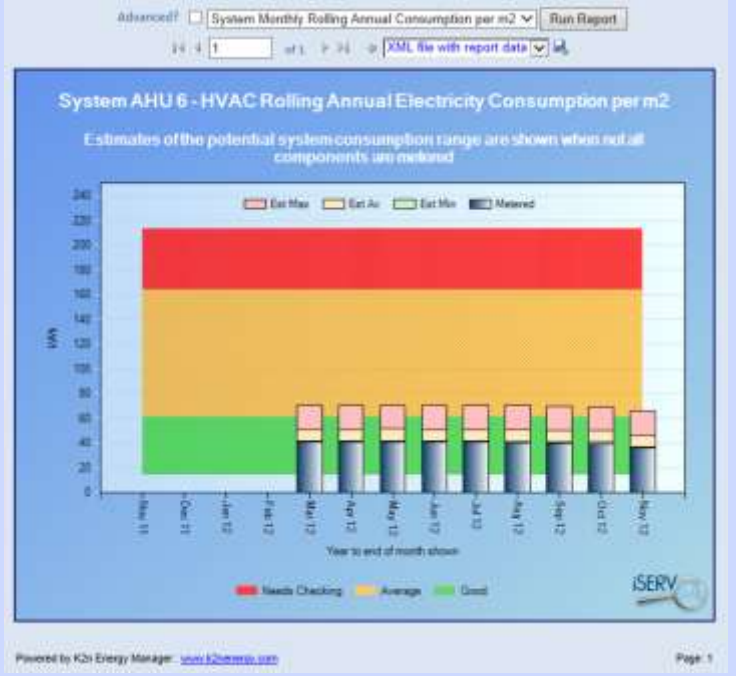


- Can use the data directly to calculate potential savings, therefore reduced risk

Three ways to save energy – install more efficient equipment

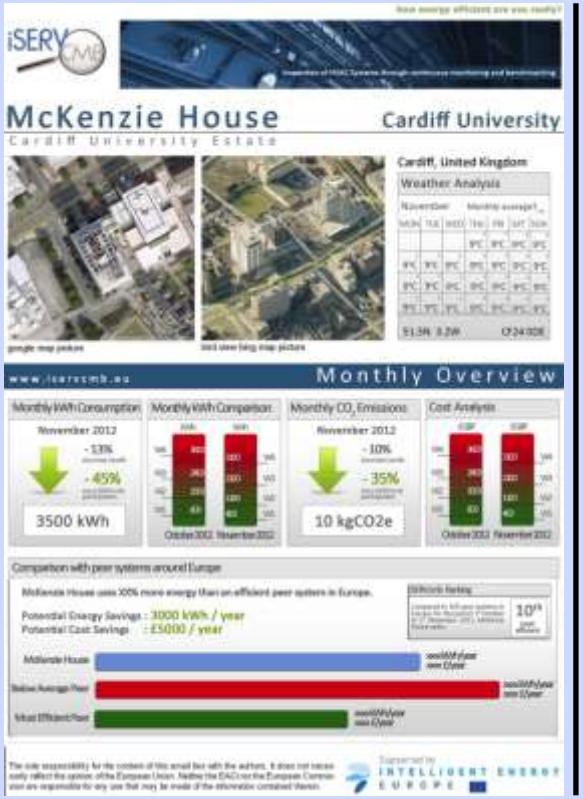
- **Install more efficient equipment**. Even if equipment is well controlled it may use more power in use than state-of-art kit

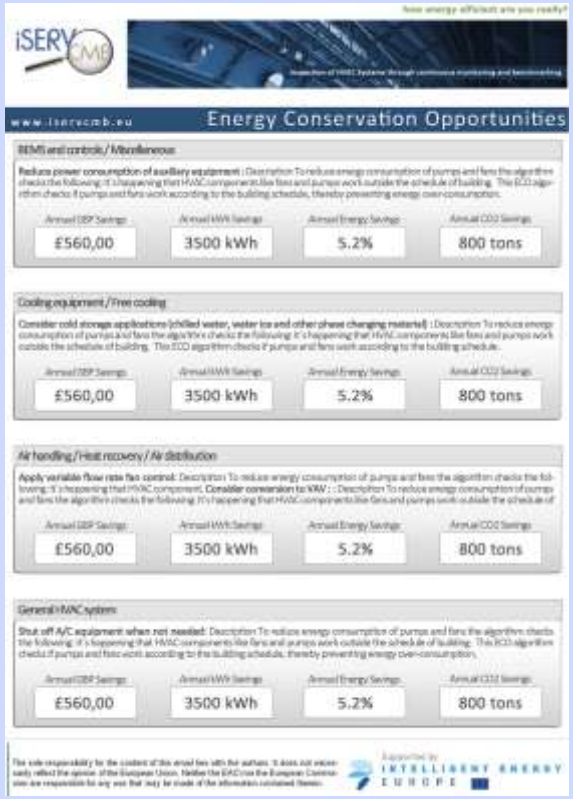
- Benchmarks based on 'in use' power demands show this difference and again reduce risk from upgrading



Reports

- ➔ Reports should interpret data with respect to the situation in the real building
- ➔ A number of report sets are being trialled to see which provide the information in the best form to allow decisions



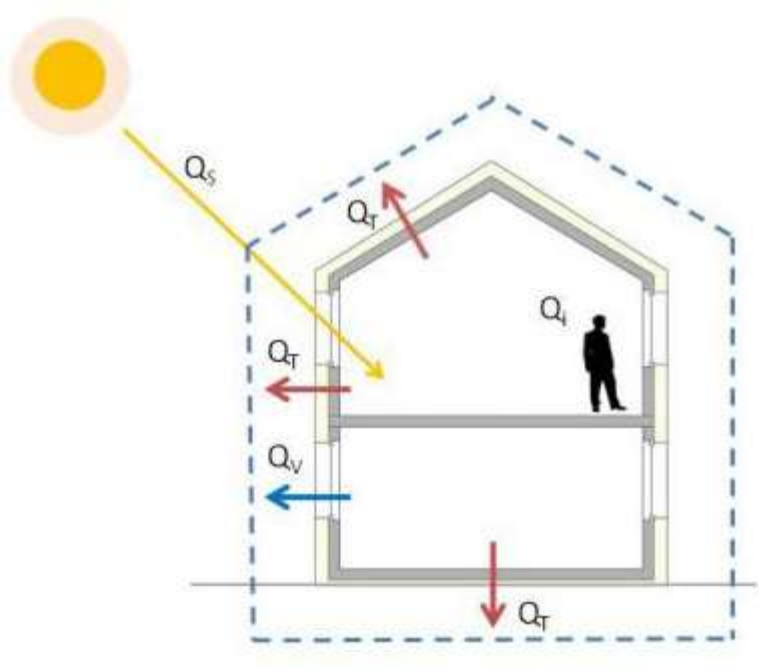


The near future

➔ Near zero energy buildings (nZEB's) will require us to understand building loads

➔ With highly insulated structures this balance is about Solar, Ventilation and Internal Gains

➔ The most controllable parameter is Ventilation



Ref: https://www.educate-sustainability.eu/portal/content/thermal-balance-buildings

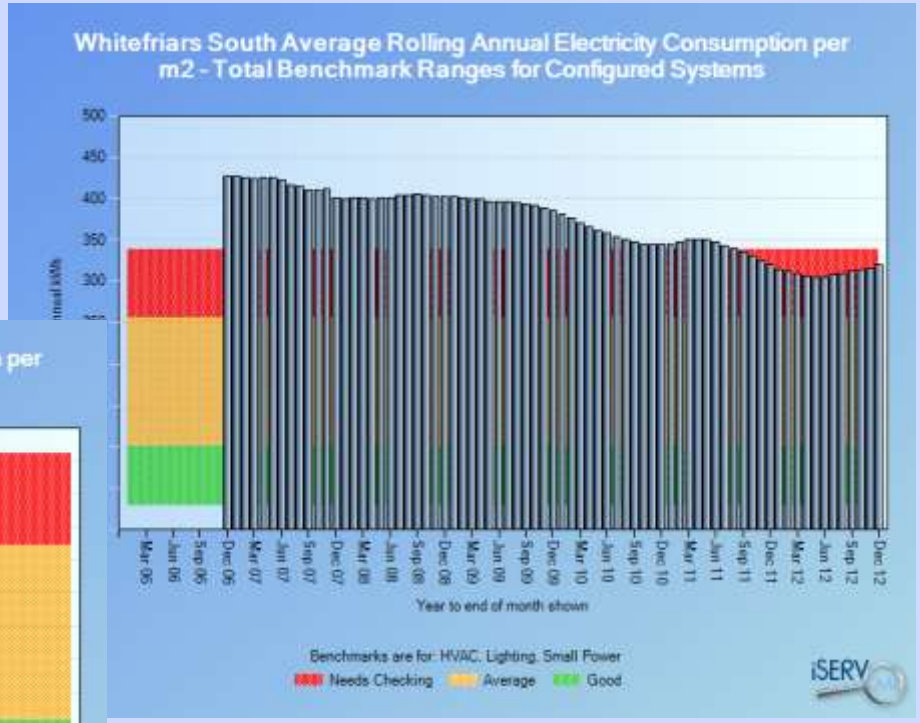
➔ RISK: energy efficiency can be achieved by MINIMISING ventilation rates. Potential for IAQ problems and Health

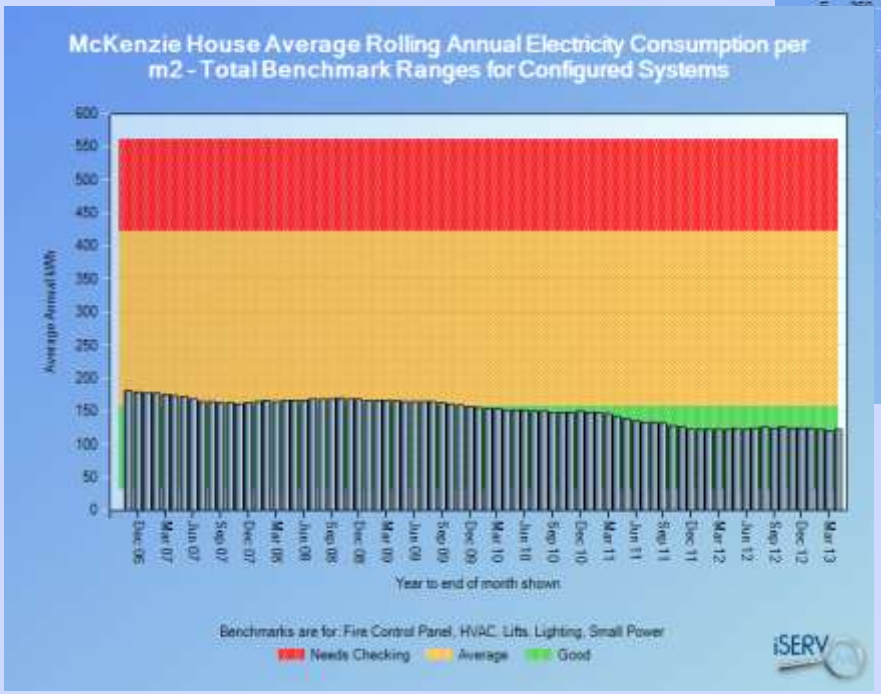
Understanding what is reasonable for existing buildings

- ➔ The sunk resources in existing buildings are huge. There is rarely a justification for demolition on energy grounds alone
- ➔ What energy is it reasonable for HVAC system components to consume when servicing existing buildings?
- ➔ Targets for existing buildings are of little value if there is no information on how they are being achieved in the real world
- ➔ There are real, significant savings to be made – and lessons to be learnt for NEW buildings

Savings in real buildings

➔ Two buildings showing the electrical savings achieved since first participating in HARMONAC





Monitoring savings: 3 Case Studies

- ➔ **Building electrical savings of between 19% to 33% p.a.**
- ➔ **Building electrical savings/m^2 between 61 to 100 kWh/m^2/a**
- ➔ No Fossil Fuel figures yet

- ➔ In economic terms:
  - **Measured** recurrent **savings of 9 to 14 EUR/m^2/a**
  - **Recorded** 'one-off' **setup costs between 0.1 to 2 EUR/m^2**
  - **Estimated 0.1 – 3 EUR/m^2/a to maintain.**

  - **Net returns between 7 – 13 EUR/m^2/a**

- ➔ Exceeding the HARMONAC predicted building electrical savings of 1 – 5%
- ➔ These 3 buildings show significant ACTUAL savings achievable in practice.

Inspection vs Monitoring: Costs and Savings

- European MS Inspection costs are between **100 – 250 EUR**. Primarily for compliance i.e. a cost with no real benefit.
- The cost of a 'proper' Inspection appears **~0.5 – 2.5 EUR/m²**
- Savings from 'proper' Inspections are unclear. HARMONAC suggests **savings of 2.0 – 3.2 EUR/m² at best.** Without feedback, these savings expected to last ~ 6 months.
- Monitoring costs **~0.5 – 2 EUR/m²/a**
- **Annual** costs are less for Inspection than Monitoring.

Costs and Savings for Monitoring

Costs

➔ Energy monitoring welcomed by many organisations as a compliance route as they already do it. Extra costs from:

- The cost of any additional metering needed
- The cost of belonging to an accredited scheme
- The initial costs of entering the scheme

➔ The cost of implementing Monitoring system recommendations

Savings

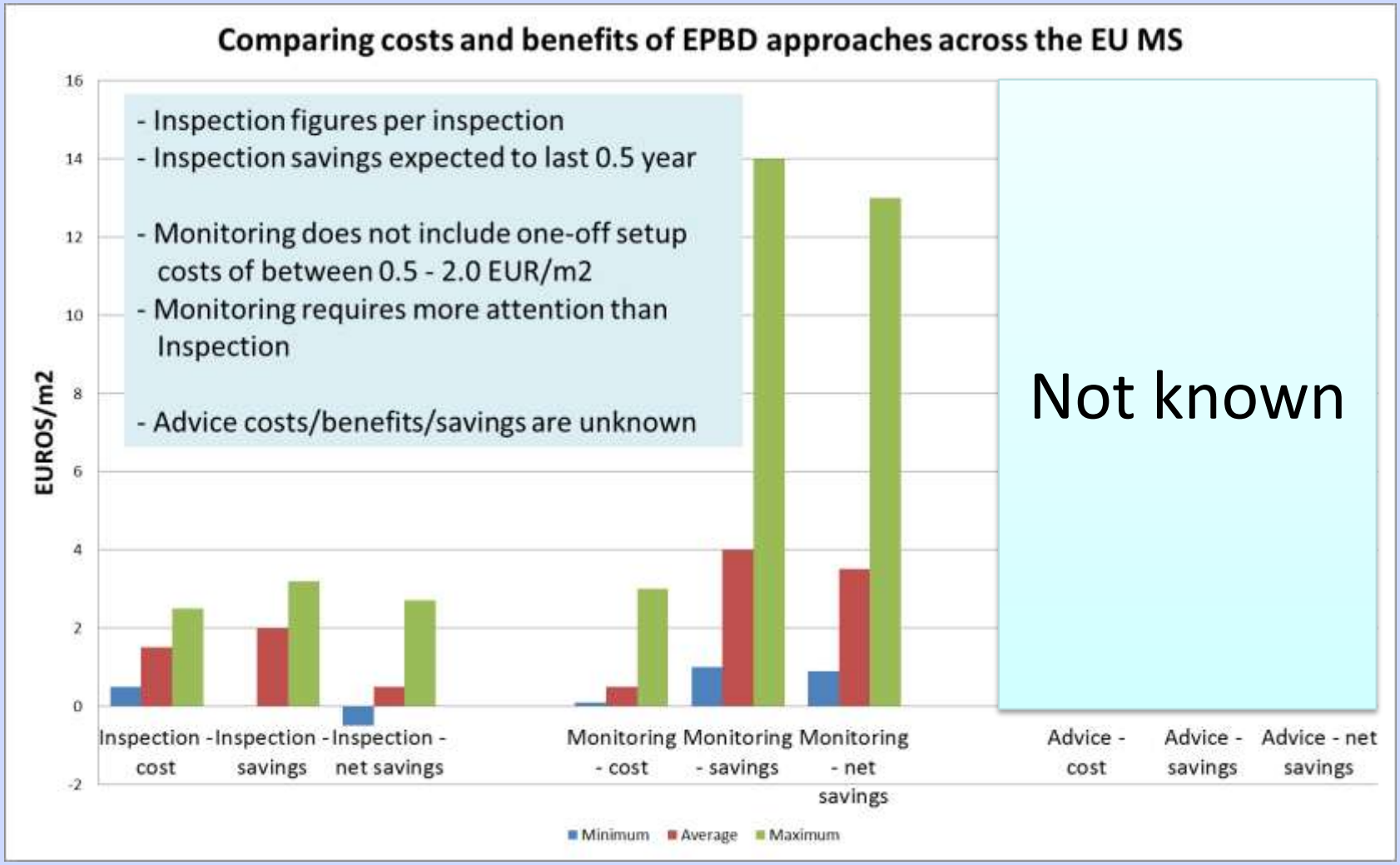
➔ Savings achieved from focussed feedback

➔ Savings due to reduction of risk for investments

➔ Collateral savings from increased confidence in returns

➔ Savings from maintaining reductions achieved

Cost comparison of 3 acceptable recast EPBD approaches



Benefit comparison of 3 acceptable recast EPBD approaches

Topic	Inspection	Monitoring	Advice
Impact assessment	No feedback route	Data allows precise 'before' and 'after' impact studies	No feedback route
Comments	Difficult to show impact. Savings not likely to be sustainable where intervention is needed. Savings difficult to maintain.	Initial setup can be costly. Requires more attention than inspection or advice. Provides detailed understanding of energy use. Reduces investment risk. Proven real energy savings. Helps maintain savings Provides data for design decisions	Difficult to show impact. No mechanism for drawing attention to energy use. Not clear how it will help maintain energy savings.

Monitoring as a complement/alternative to Inspection and Advice

- ➔ Monitoring and Feedback is acceptable as an alternative route to compliance for recast EPBD Articles 14 and 15

- ➔ EC have funded iSERV and are aware of the savings found.

- ➔ Inspection and Advice are complementary processes

- ➔ **Monitoring requires the iSERV spreadsheet to be completed and, at a minimum, this data should be required by legislation as it informs both Inspection and Advice**

Monitoring - practical aspects

➔ Are there schemes to which building owners can sign up now?

- It is believed iSERV is the only scheme of its type at present.
- iSERV can be still joined and used for free but will become a commercial service from April 2014 when funding ends.
- iSERV will work with MS to provide a scheme if required

➔ How can monitoring services be formally recognised in legislation?

- Legislation needs only refer to monitoring schemes meeting required criteria as being an acceptable alternative to mandatory Inspection. This does not preclude Inspection being required where performance benchmarks are not met.
- iSERV will provide the outline working details for such a scheme.

➔ What are the main conditions for an owner to participate?

- Completion of the iSERV spreadsheet and acceptable sub-metering

Monitoring - Conclusions

➔ Monitoring brings:

- Clarity and Certainty
- Proven energy and cost savings to the end user and MS
- End user engagement and ability to contribute to 2020 targets
- Proof of impact achieved
- Increased use of energy efficient products
- Reduced Risk
- Ability to use Smart Metering data which is coming

➔ **So the real question is not 'Should a MS use this route to compliance?' but 'Why would any MS not want to offer this as a route to compliance?'**

➔ **As a commercial prospect monitoring makes sense already**

Thank you

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Talk available from: www.swegonairacademy.com