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Innovation for Ireland's Energy Efficiency

Development of an Automated Fault Detection and Diagnosis tool for AHU's

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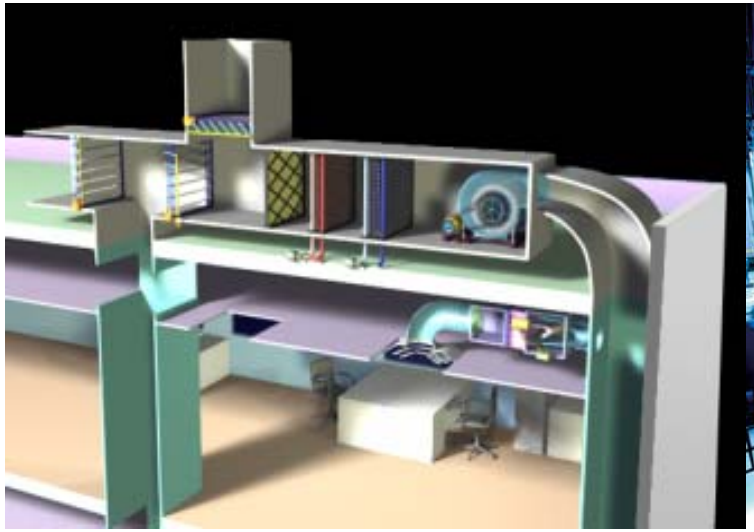
ICEBO 2012



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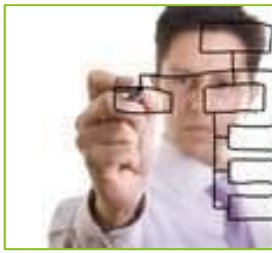
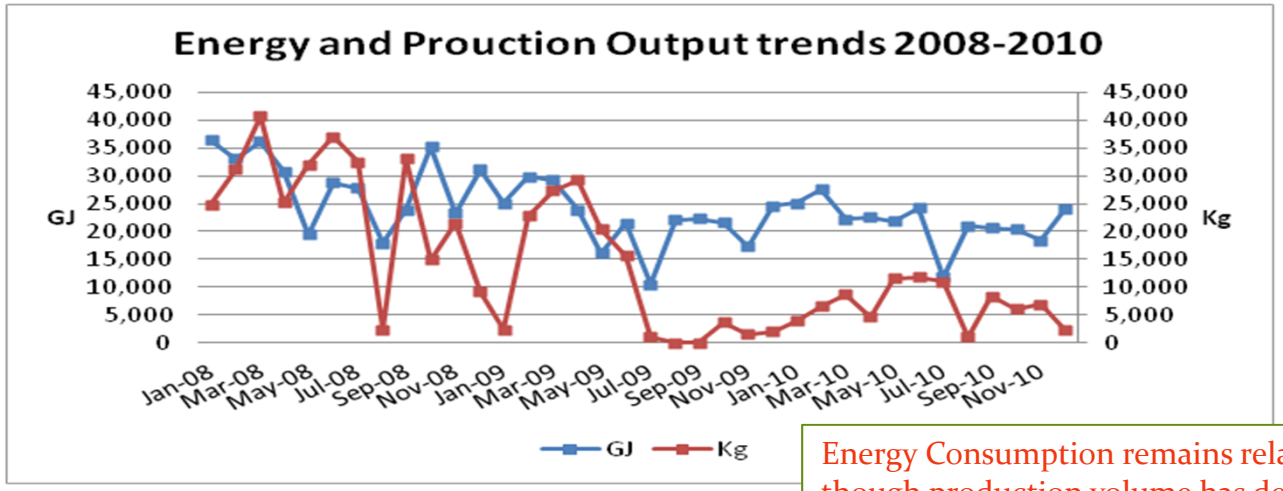
Agenda

- Why does industry need this work?
- Why Focus on HVAC?
- An automated solution
- AFDD techniques and objectives
- Early Pilot Test Results
- The Market Opportunity



Why does industry need this research work?



Energy Consumption remains relatively constant though production volume has decreased significantly

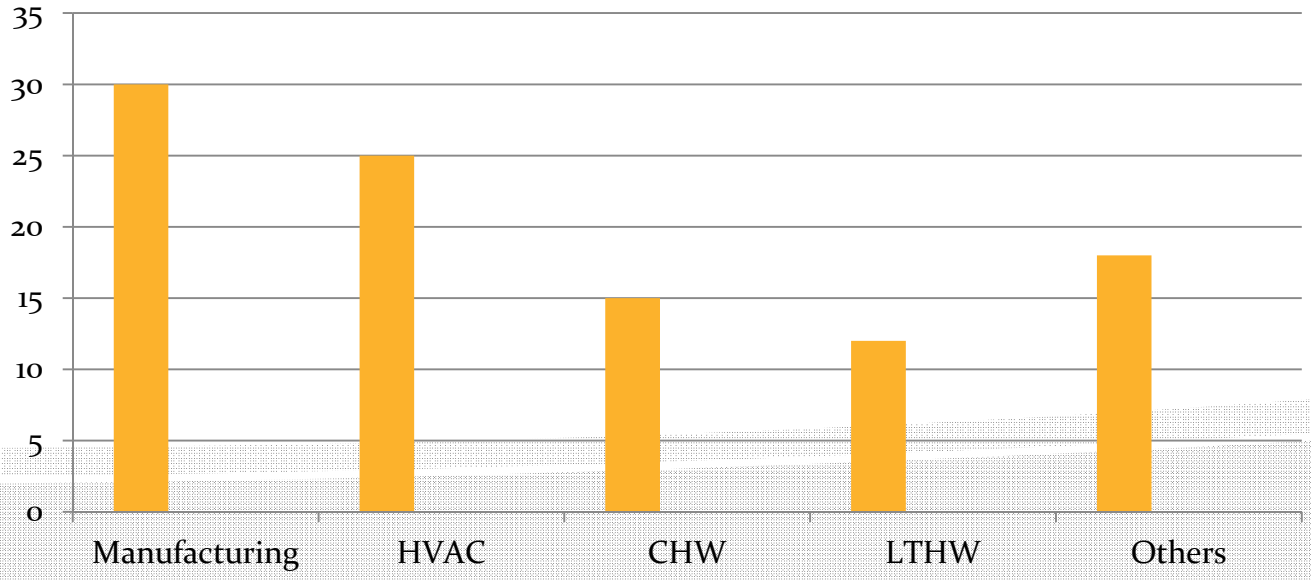
Focus on production output in lieu of efficiency for the last decade

Difficult to automatically track efficiency due to islands of information

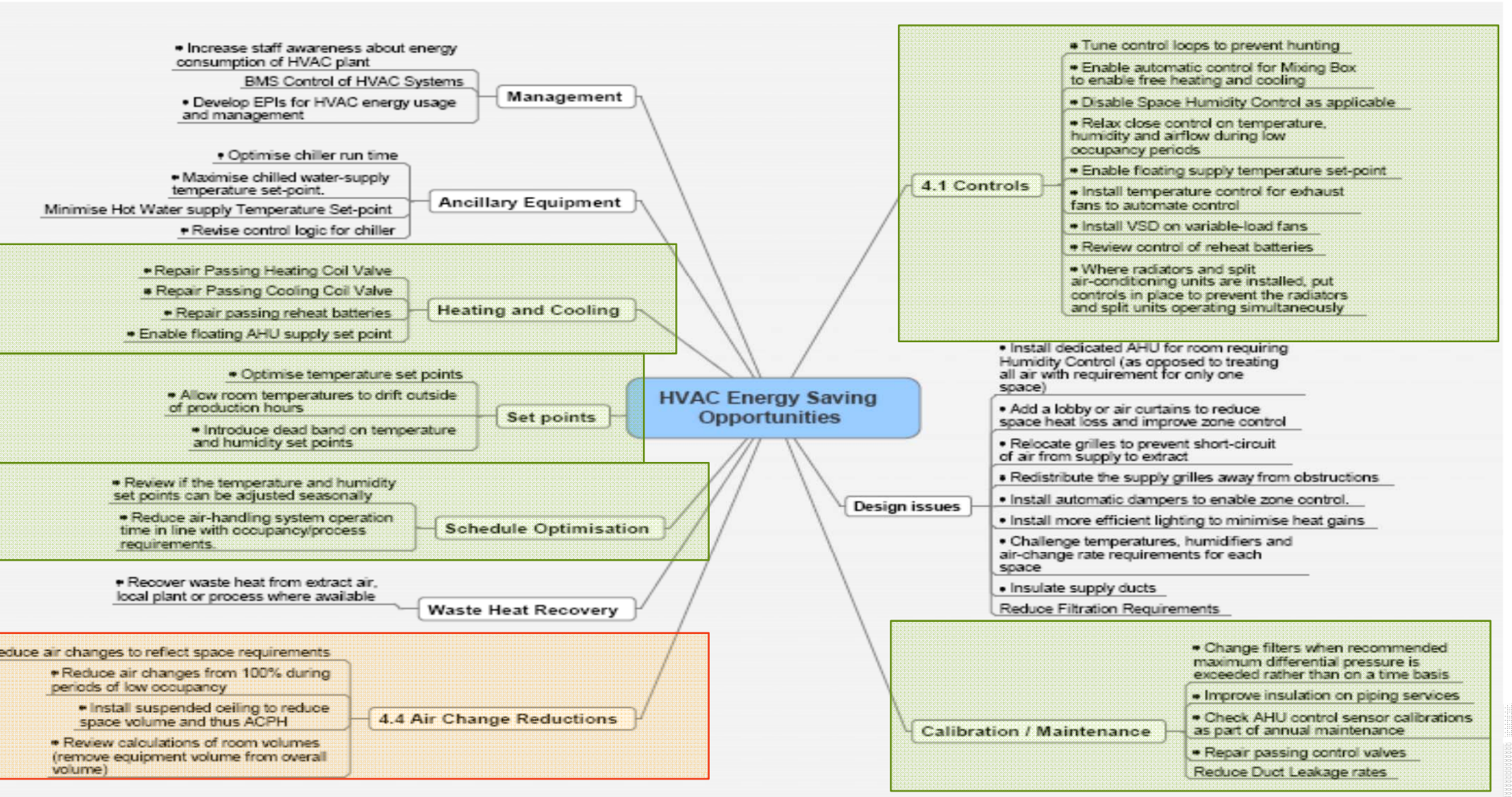
Competition from lower cost economies for investment

Why Focus on HVAC Systems?

- Typically greater than 20% of an industrial site or buildings' energy consumption
- HVAC systems get less efficient over time
- Studies have indicated that 20-30% energy savings are achievable by re-commissioning HVAC systems to rectify faulty operation



Typical HVAC Projects

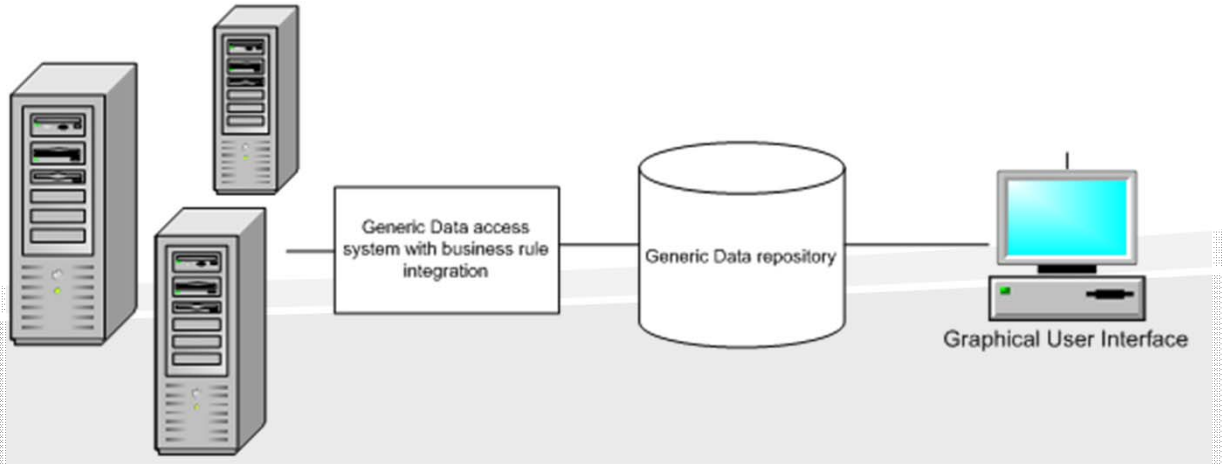


Why an automated tool?

- The number AHU's in a typical industrial site often outnumbers those maintaining the system by 20 to 1
- Onsite personnel may not have the "knowledge" required to effectively maintain the system
- HVAC systems are growing in complexity

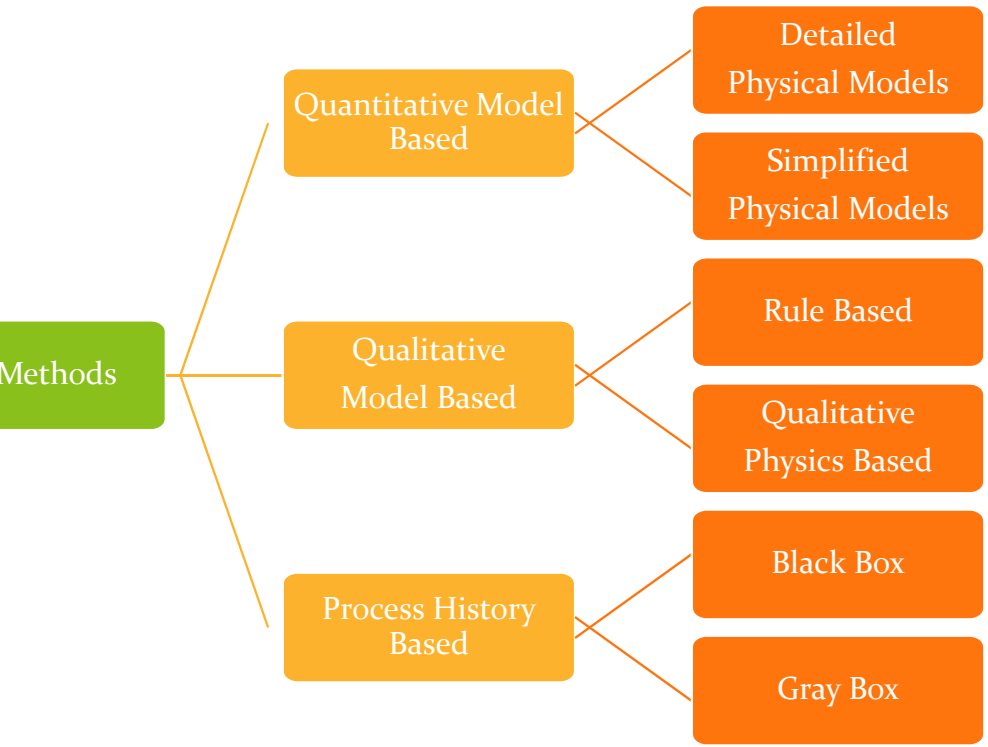
AFDD tool objectives

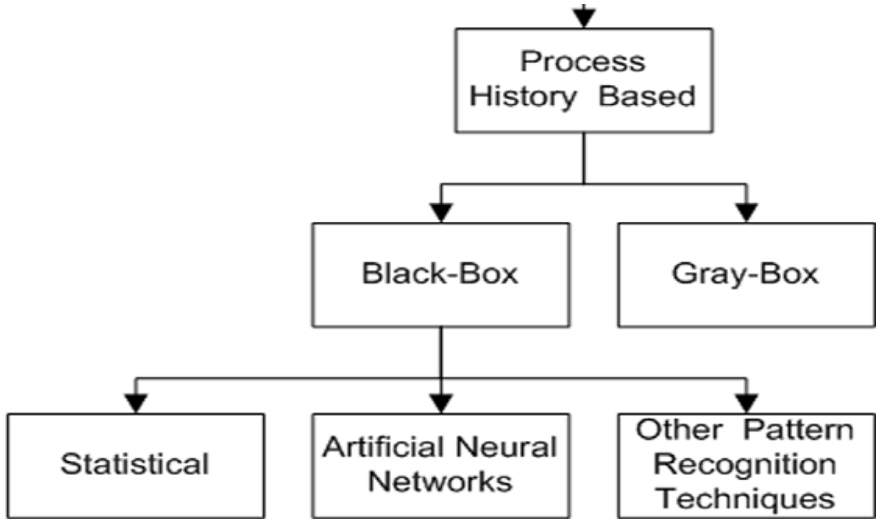
- Flexibility to work with any BMS
- Flexibility to work with any combination of sensors and components found in typical AHUs
- To use already available measurement
- Capable of evaluating the ongoing performance of AHUs
- Minimal setup time per AHU
- Economic quantification and prioritisation of the diagnosed faults



FDD Techniques

DD automates the process of detecting and diagnosing faults





rule based FDD tool can be developed and implemented in dustry relatively quickly utilising existing equipment

The Business Layer

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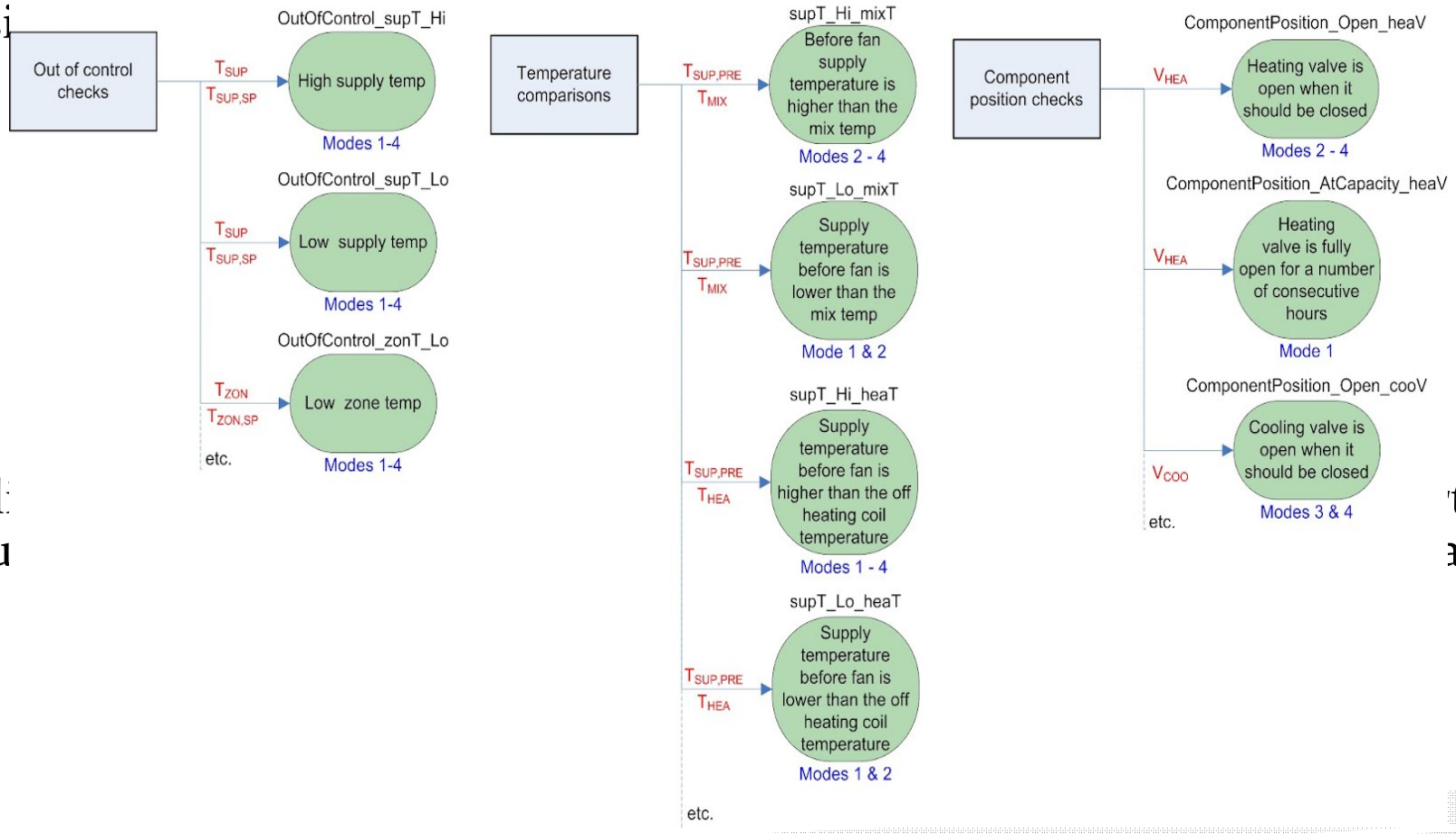

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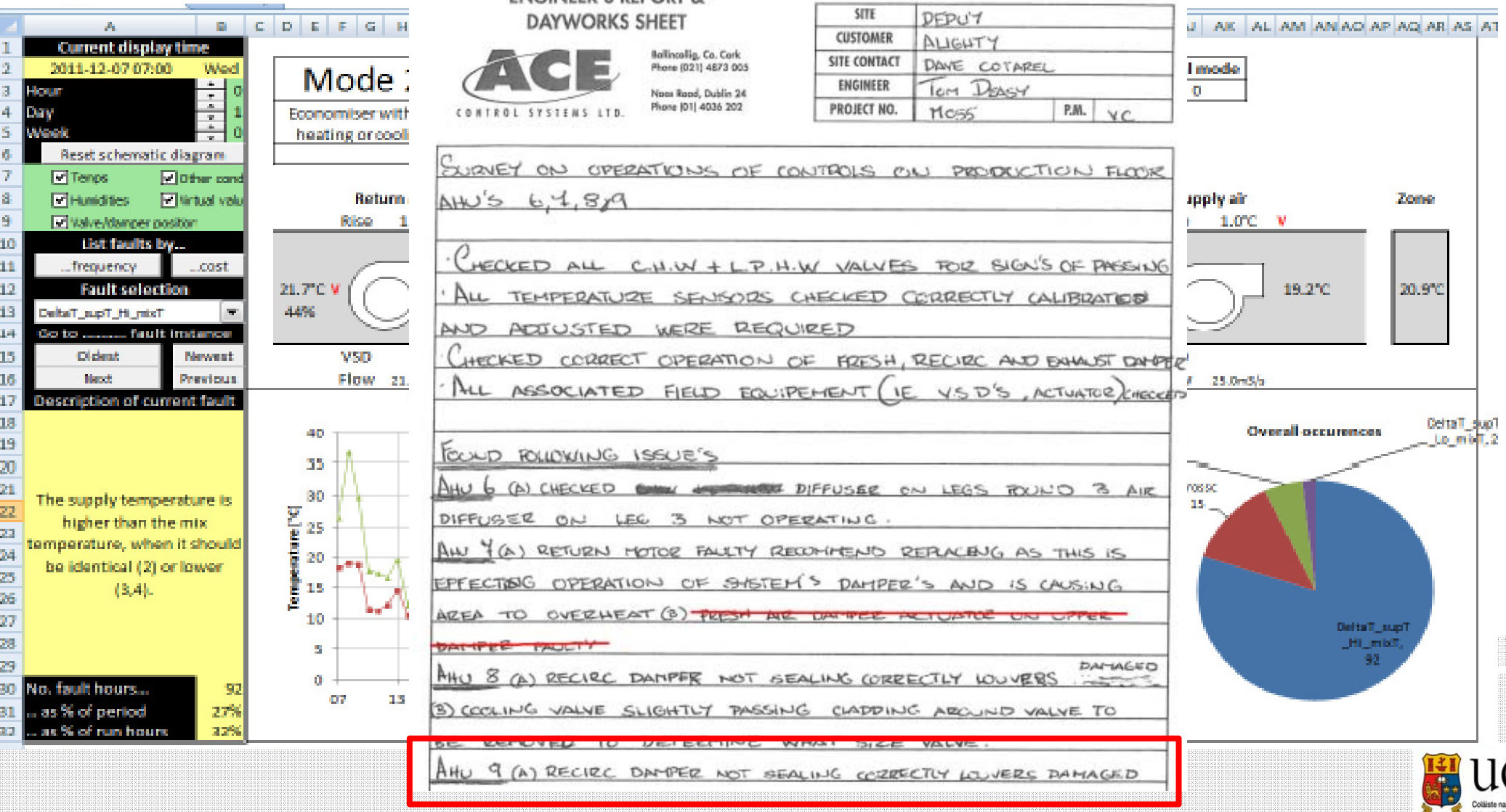
Pilot Study

- Hundreds of AHU's were available across 7 industrial and commercial sites for inclusion in the study
- AHU's were selected for the purpose of developing and validating the tool using the following criteria;
  - Different component and sensor layouts in order to ensure that the AFDD tool could be applied effectively and comprehensively
  - Varying levels of instrumentation in order to alleviate concerns regarding the level of instrumentation needed to perform AFDD effectively
  - The potential for duplication to ensure scalability to maximise savings

AFDD tool in BETA testing



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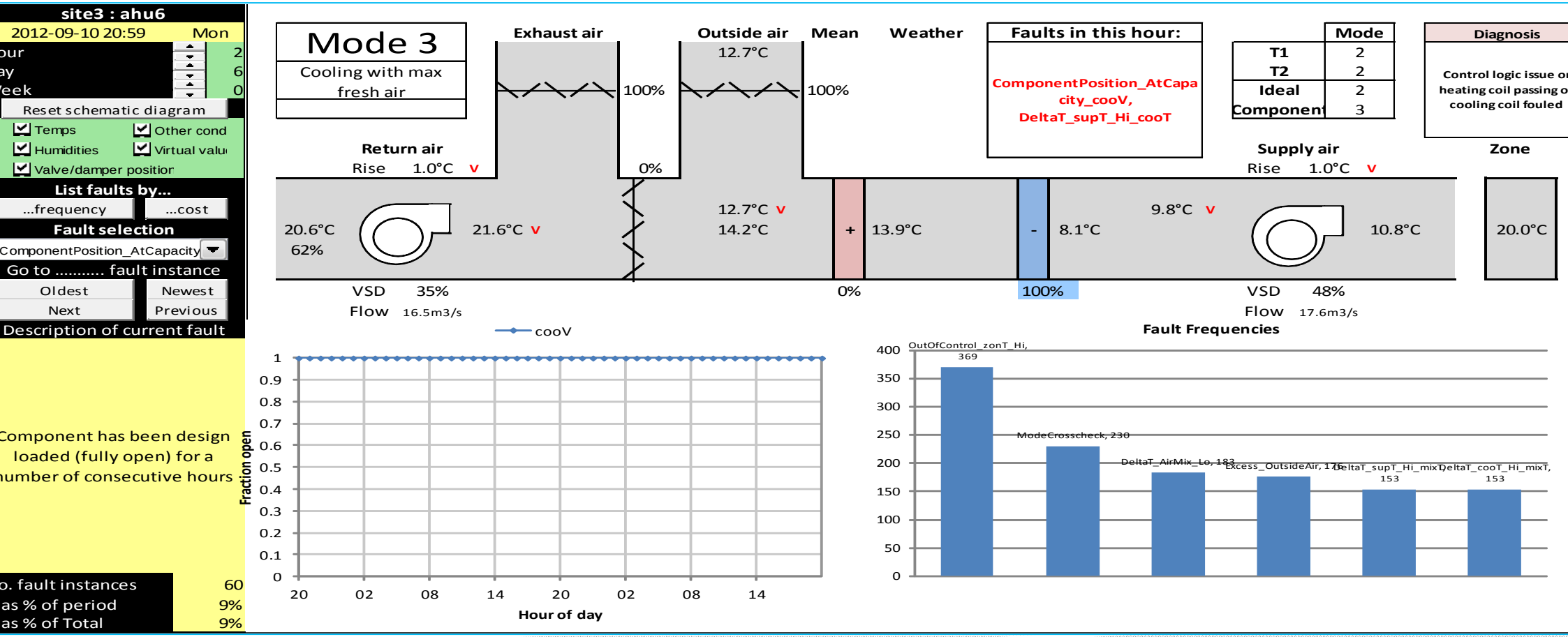
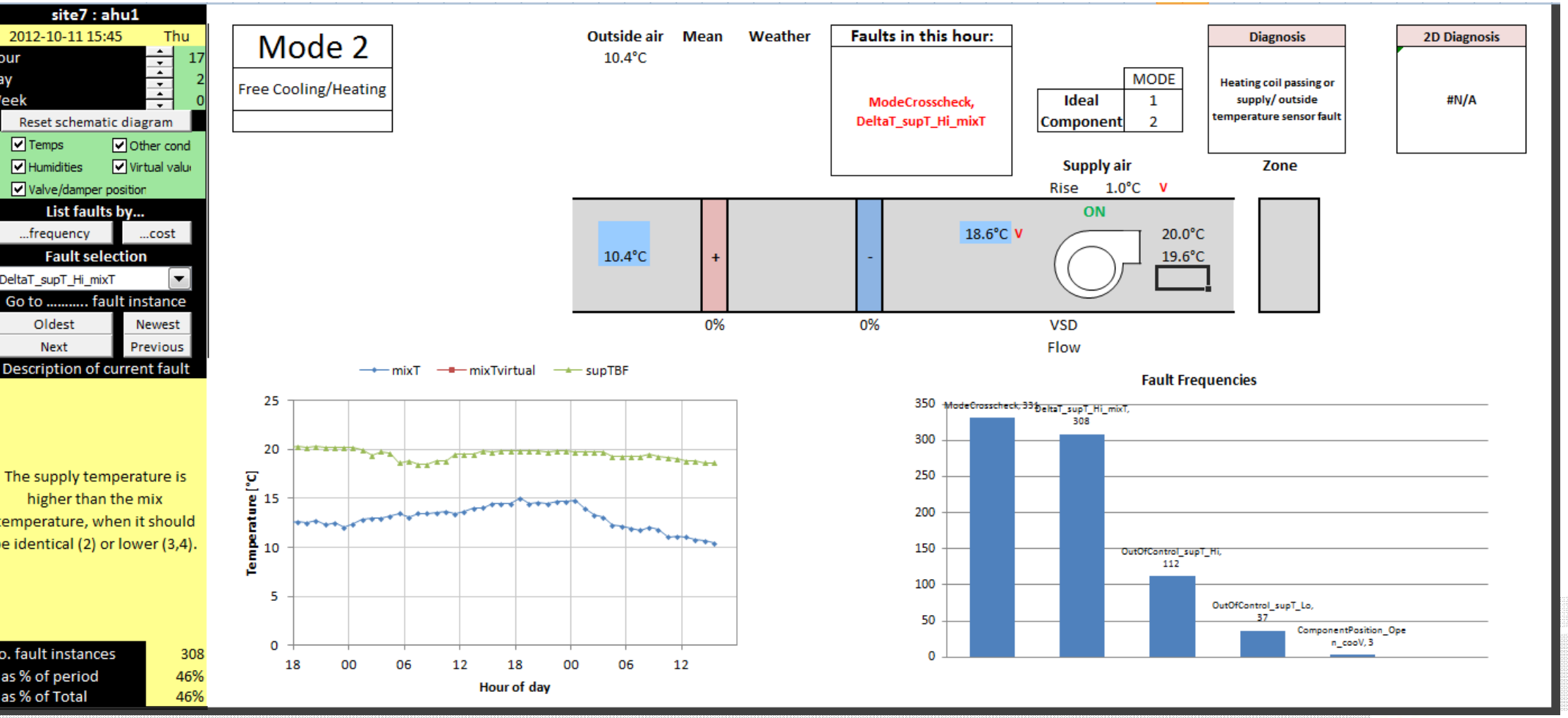


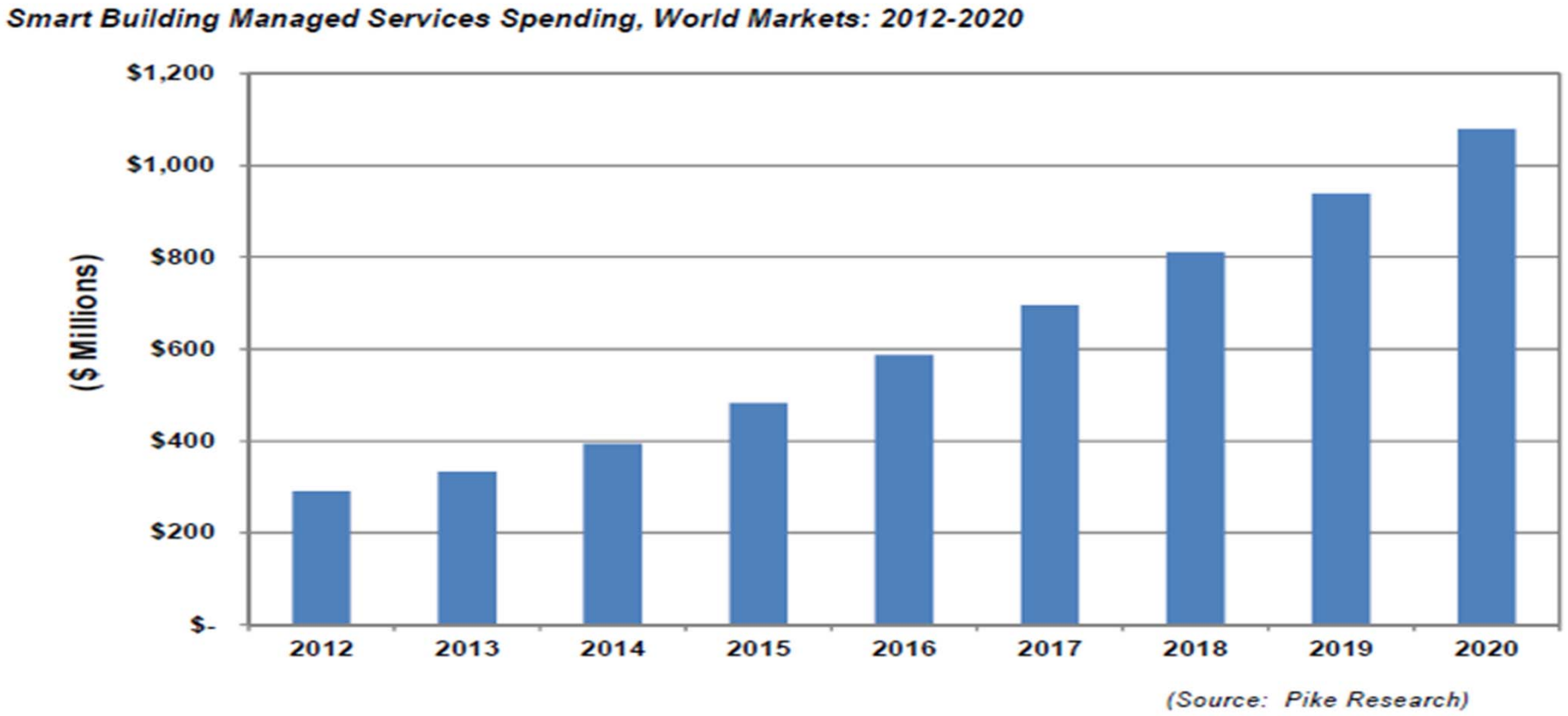
AFDD tool in BETA testing



Early Results

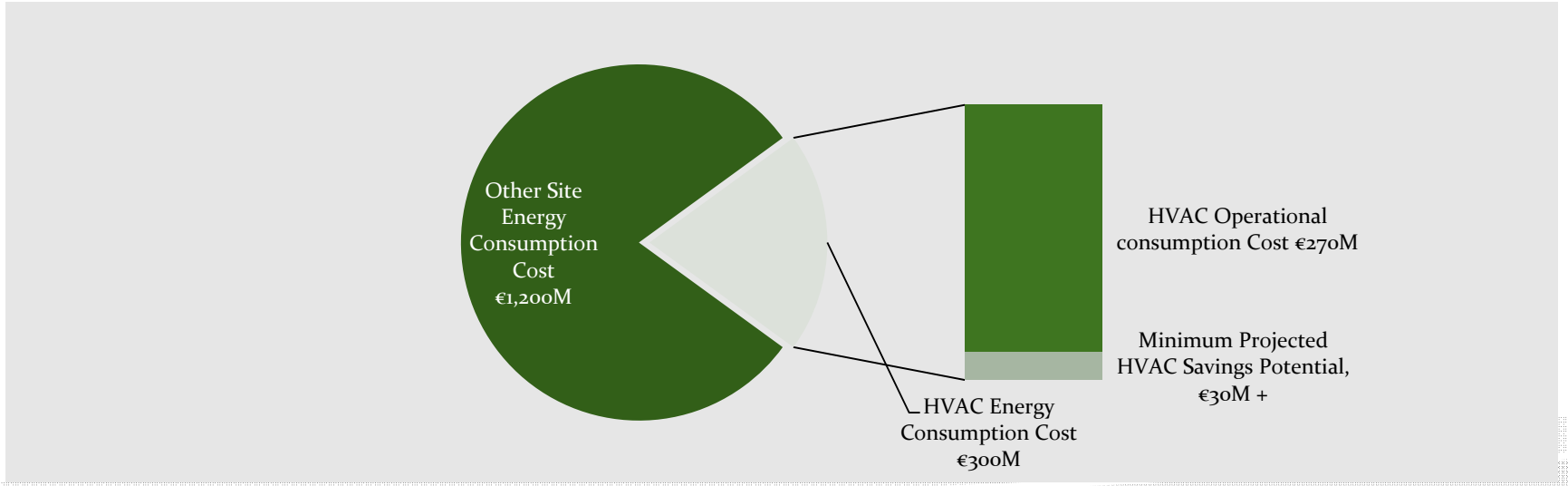
Site	No. of AHUs investigated	Faults identified by the FDD tool	Annual savings opportunities (approx)	Verification method
1	2	Passing heating coils	€48k	Physical (airside) survey by the authors
3	4	Damaged dampers, low supply temperature, passing cooling coil	€23k	Physical (airside) survey by the authors
4	4	Damaged dampers	€3k	Physical (airside) survey by the authors
5	4	Poor design, passing frost coils & incorrect set-points	€44k	From extensive BMS data and confirmed independently
6	1	Passing heating coil, poor frost protection control setup, leaking dampers	€3k	Independent physical survey

The Market


Smart Building Managed Services Spending, World Markets: 2012-2020
($ Millions)
$1,200
$1,000
$800
$600
$400
$200
$-
2012
2013
2014
2015
2016
2017
2018
2019
2020
(Source: Pike Research)

Commercial Opportunity

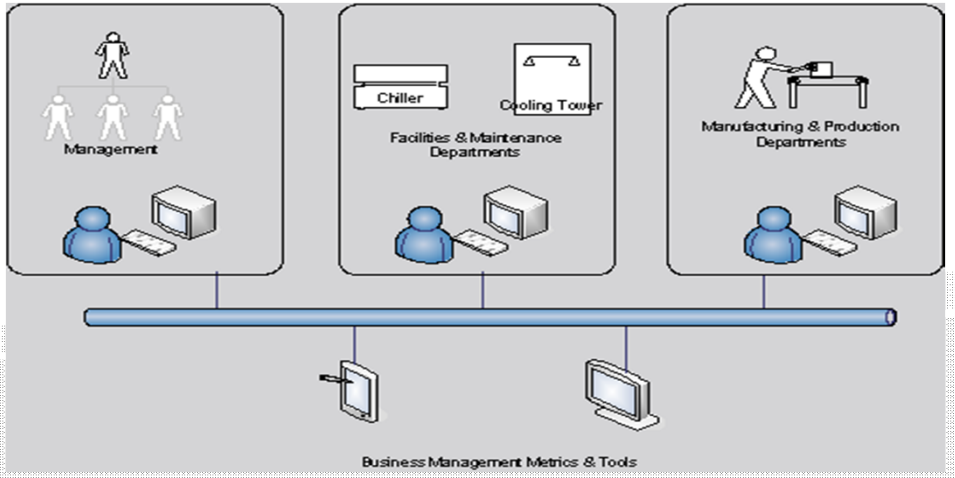
- Only a small number of automated AFDD tools on the market
- These tools are not generic and are time consuming and costly to install
- Proposed solution is not vendor specific and requires little set up
- Potential for over €600,000 savings in the 7 sites taking part in the project



- Potential savings in the wider Large Industry Energy Network (LIEN) of 135 companies of greater than €30M

Next Steps

- Expand rule library and ensure it is extensible
- Quantify and prioritise faults
- Transition to a cloud based solution
- Develop prognostic capabilities
- Integrate with third party applications
- Expand capabilities of AFDD tool
- Measure & verify savings



If we knew what it was we were doing, it would not be called research, would it?

Albert Einstein

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