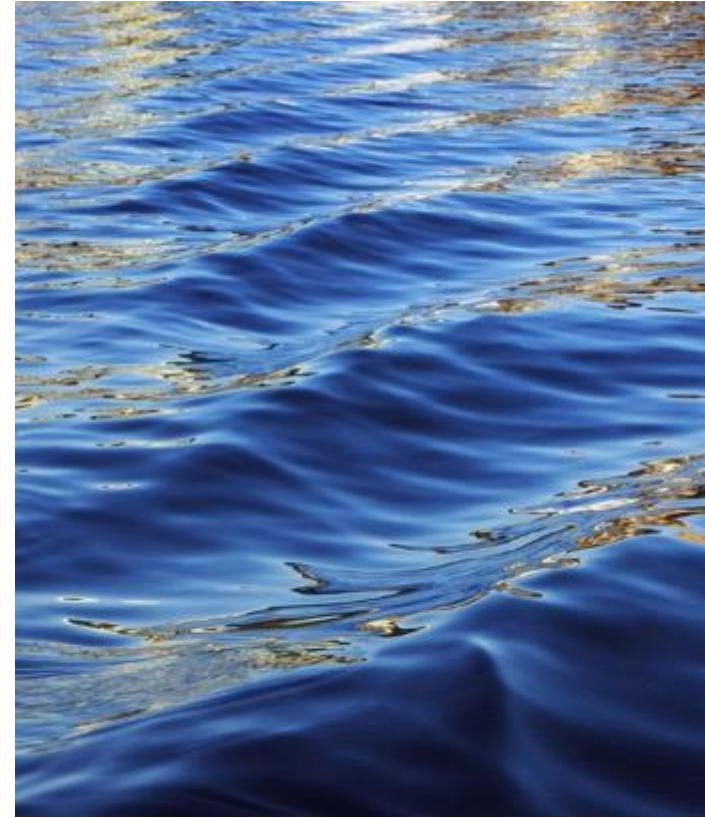


Effective Energy Management – Energy Monitoring and Targeting (M&T)

Tony McDonnell, Northern Ireland Prison Service
EuroPris Real Estate Workshop
Ljubljana, Slovenia – 16 October 2019





Identify where waste occurs and take action



M&T Hardware – Main Items



Utility meter-
Water, Gas, Oil,
Heat or Electricity.



Wireless Connectivity consists of

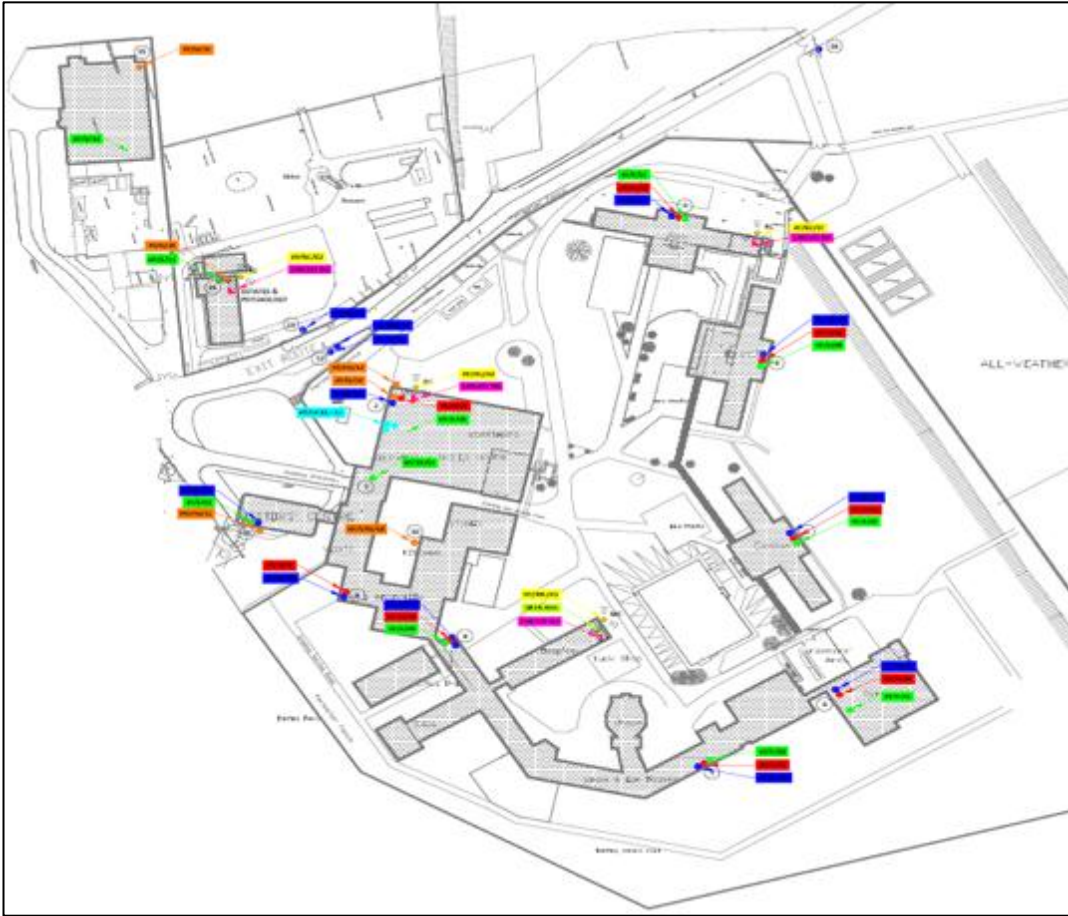
- Data logger,
- Transmitter and a
- Concentrator

Sends half hourly data to Bureau



Web browser to access energy data

Metering Strategy - Hydebank



Meters include
Heat, Gas, Oil, Water and Electricity.

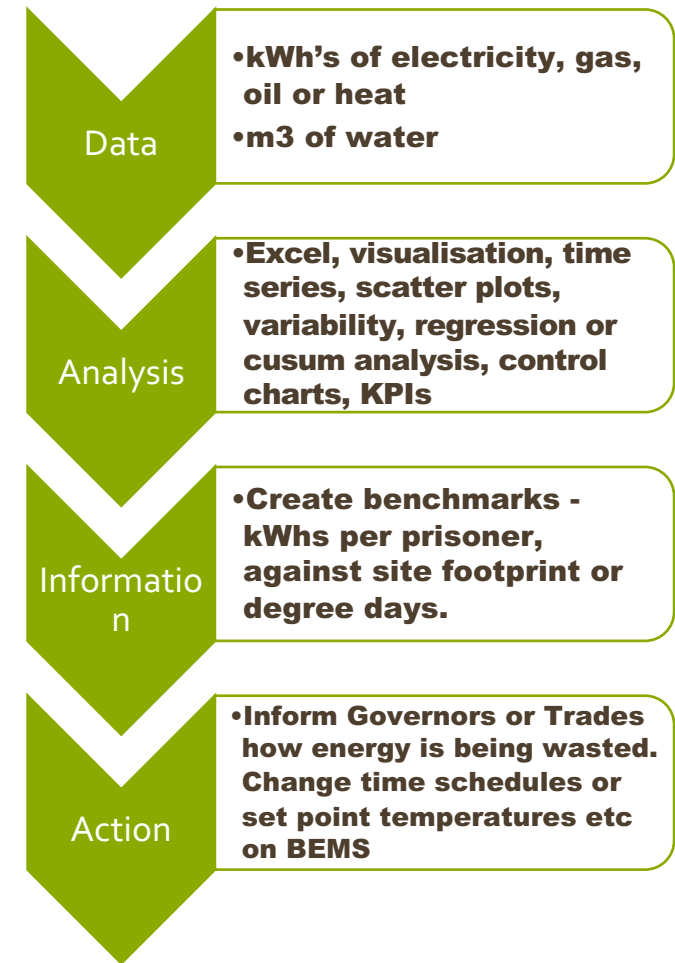
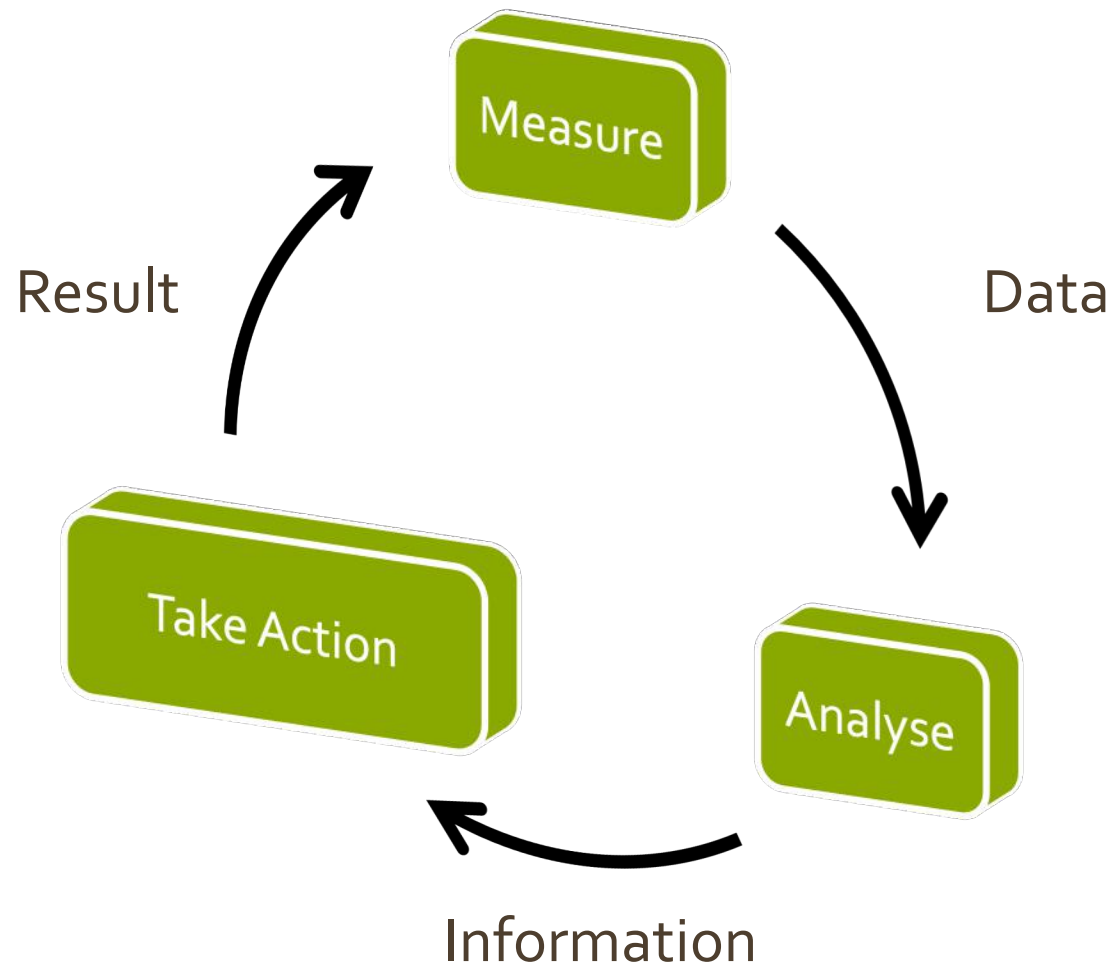
Not all buildings are monitored by the Energy Manager.

Prior to installing an M&T system each building should be assessed to determine the merits against capital outlay.

Sub metering may be advantageous in selected buildings.

Remember – Too much data is time consuming and unrewarding!

Overview of typical M&T Model to Reduce Consumption



How M&T Pays for itself

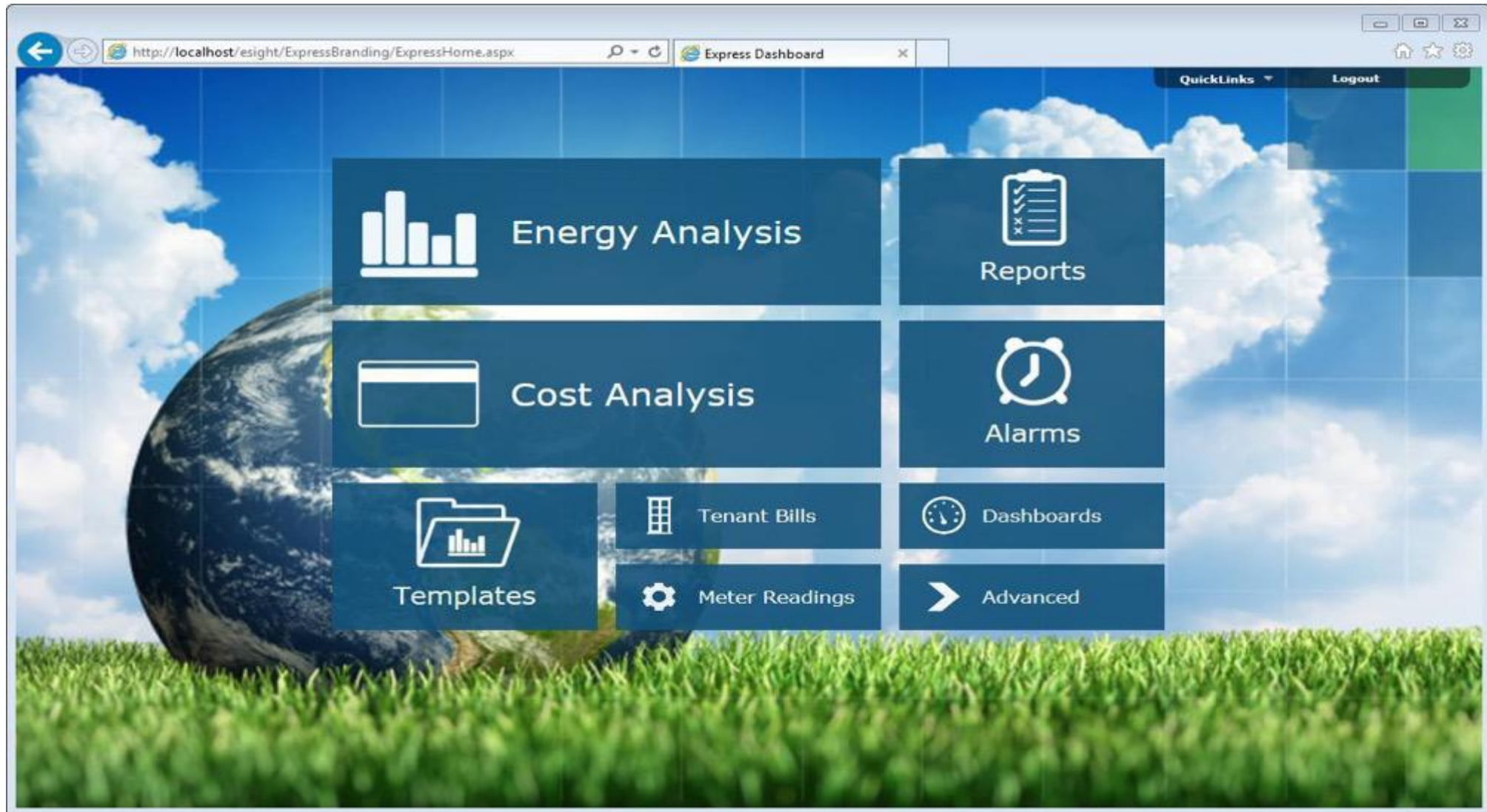


Bill Validation

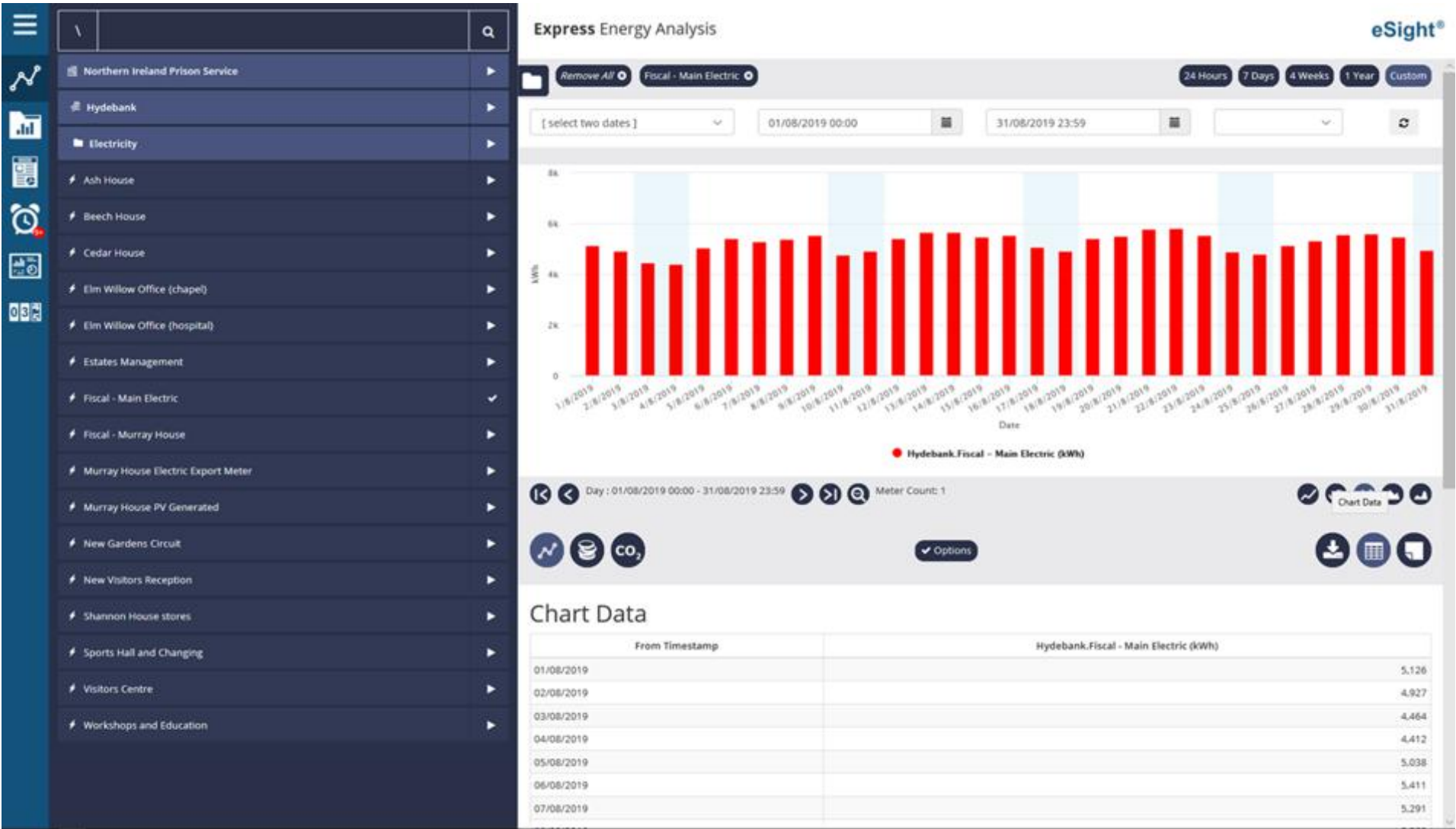


Limit impact of Water Leaks

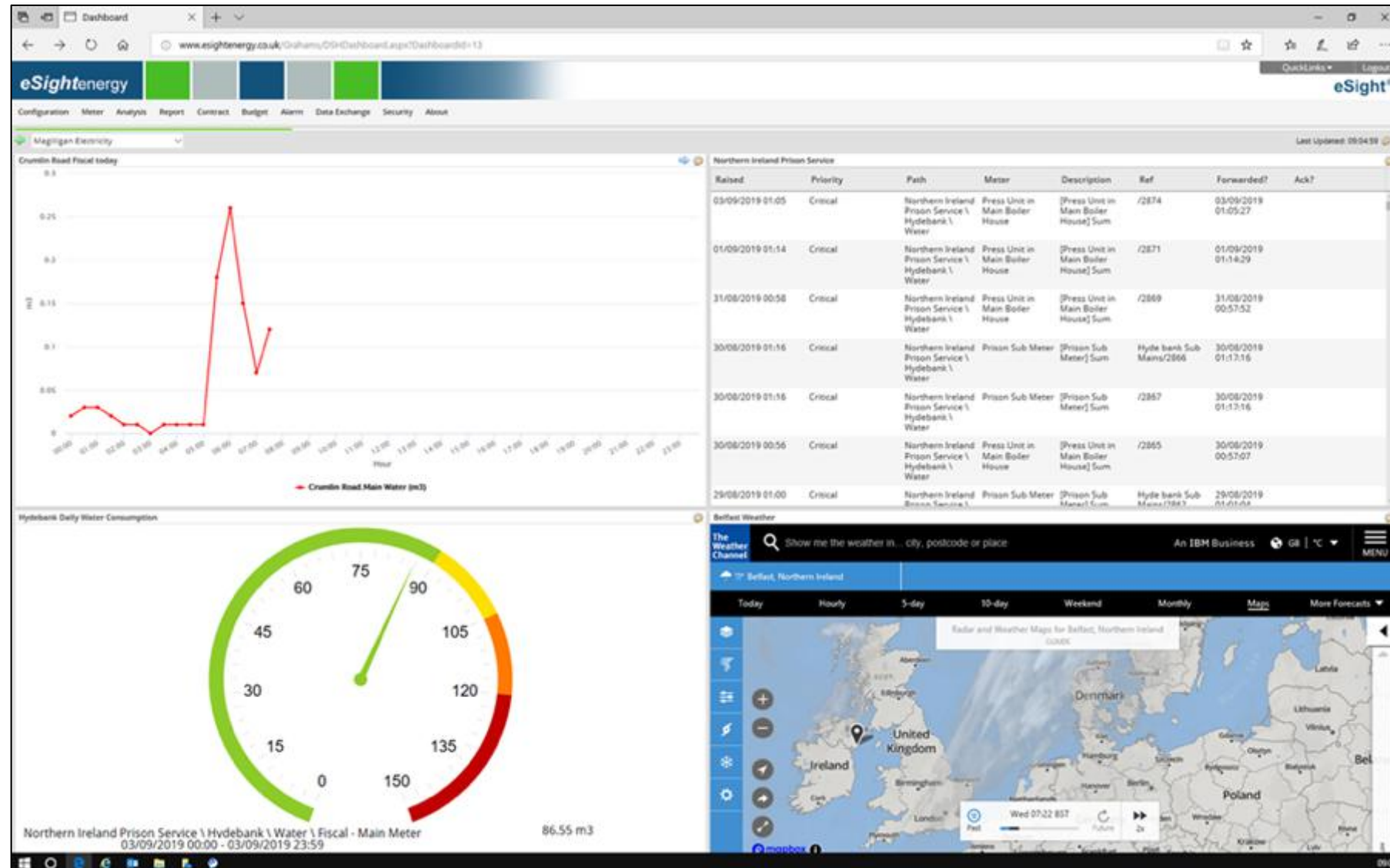
M&T Web Link – Typical M&T Front Screen



M&T – Onscreen Information showing a months Electricity data



Typical Dashboard on NIPS M&T system



E-mail notification highlighting high water consumption

This Alarm has been produced by the eSight Alarm Report Service.

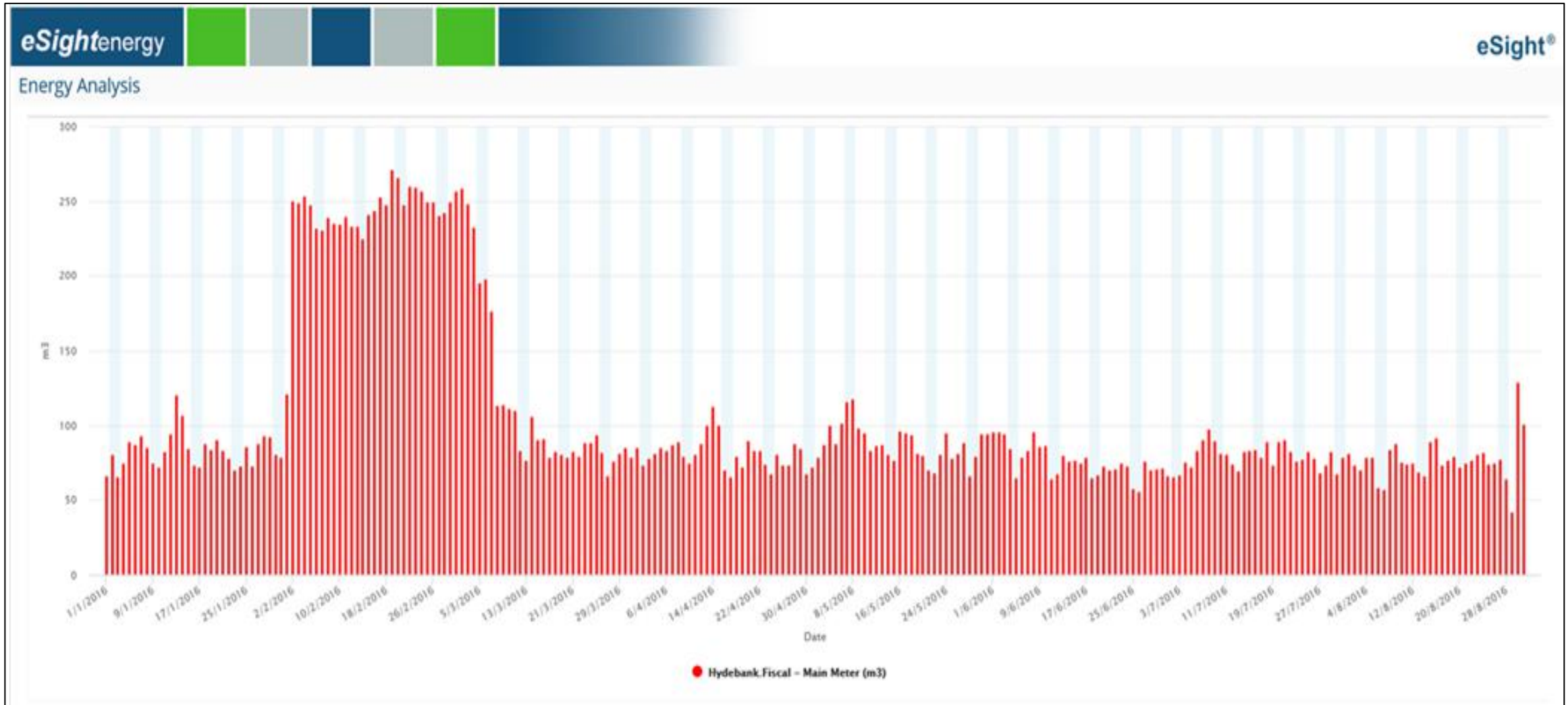
Alarm Ref:	/2886
Priority:	Critical
Meter Name:	Press Unit in Main Boiler House
Site Name:	Hydebank
Description:	Hydebank Pressurization Unit
Logged on:	08/09/2019 01:15
Further Action:	
Further Detail:	The total value of 0.41 for reads between 2019-09-07 00:00 and 2019-09-07 23:59:00.000 should remain between 0 and 0.05.

This is a typical **e-mail alert** sent by e-Sight . This one indicates that the heating system requires make-up water above the alarm parameters. This is a concern because fresh water could be drawn into the system causing corrosion, obviously increasing water costs and requiring additional boiler power to heat the cold water.

An alarm like this needs urgent investigation and action to repair.

Illustrates detection and repair of a major water leak at Hydebank.

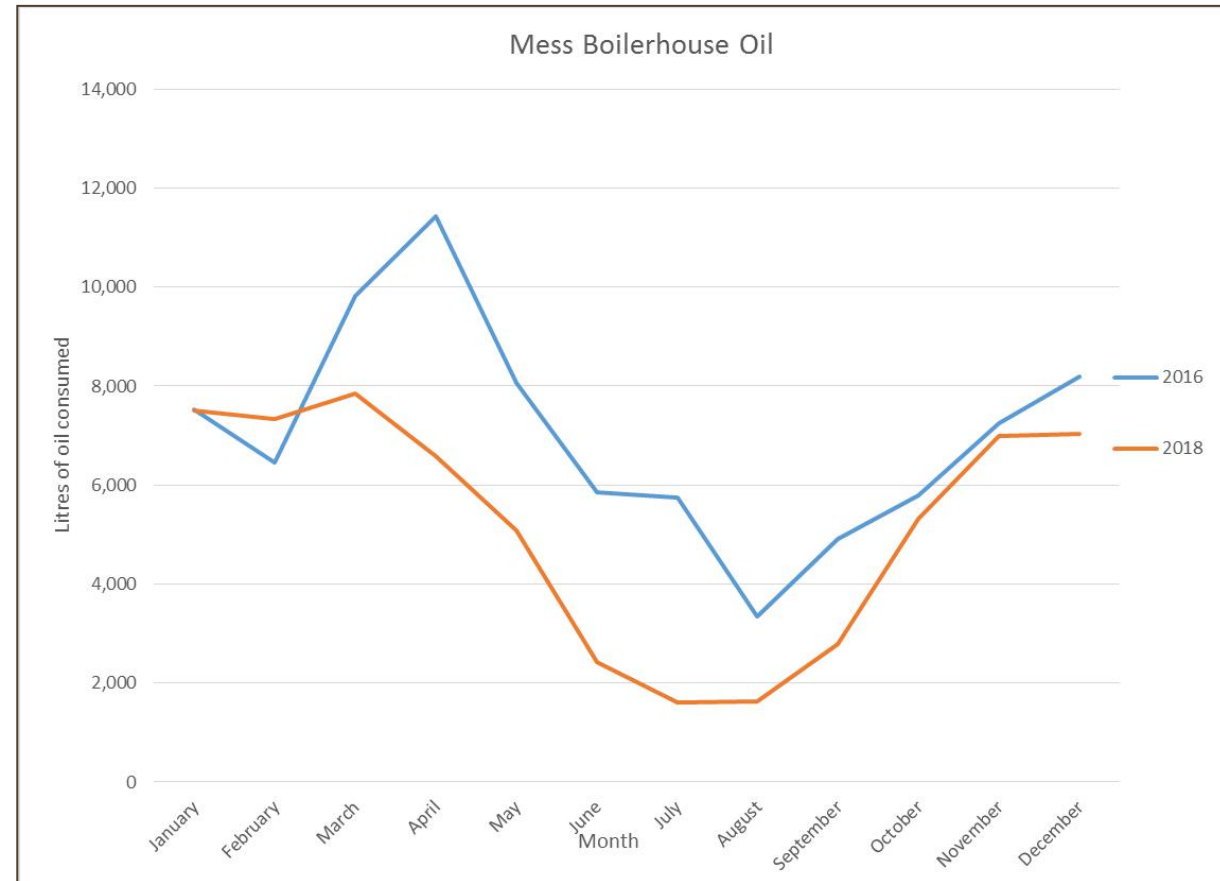
Undetected this could have continued for much longer



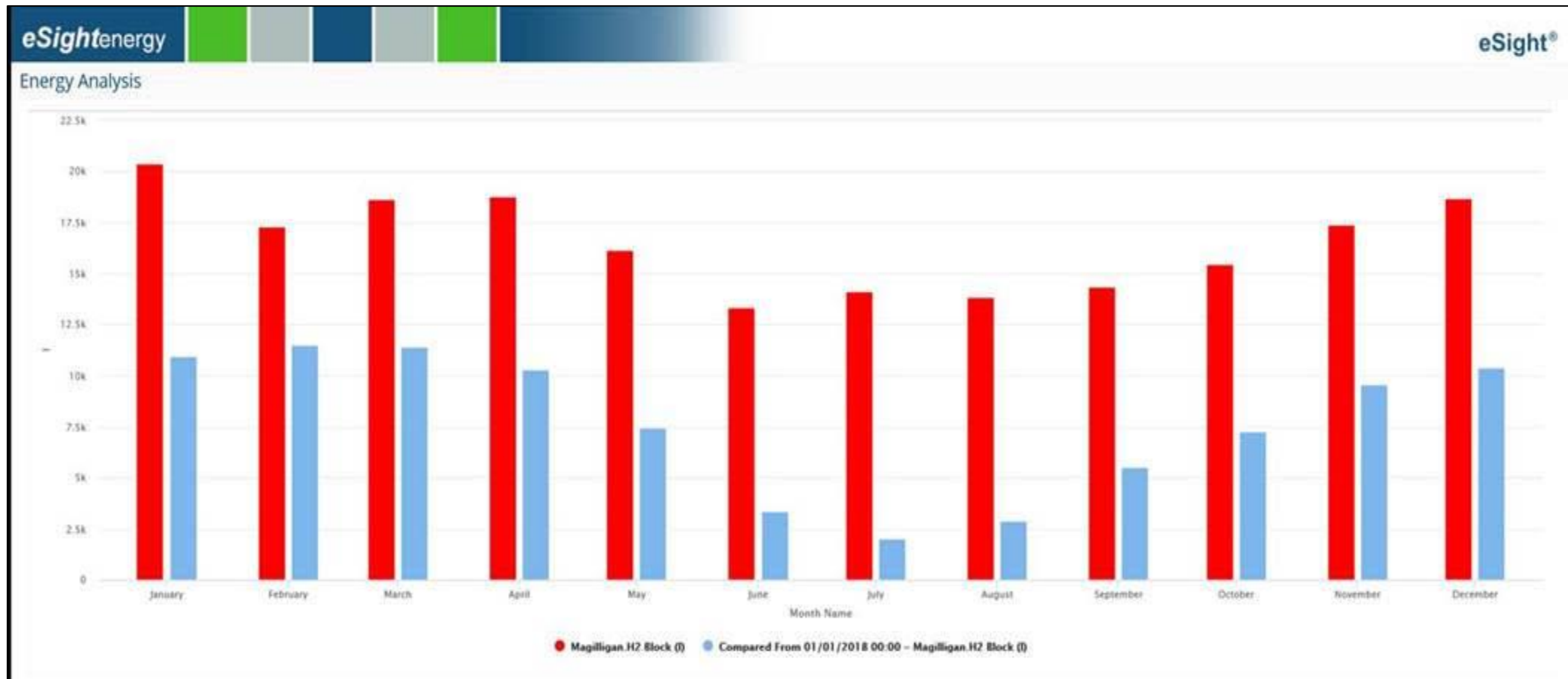
Post Project Evidence - Reduction in Oil Consumption after Boilerhouse Upgrade

	Oil (litres)	
	2016	2018
January	7,520	7,504
February	6,450	7,327
March	9,832	7,847
April	11,438	6,579
May	8,071	5,090
June	5,848	2,418
July	5,742	1,596
August	3,343	1,615
September	4,914	2,785
October	5,785	5,321
November	7,252	6,981
December	8,180	7,032

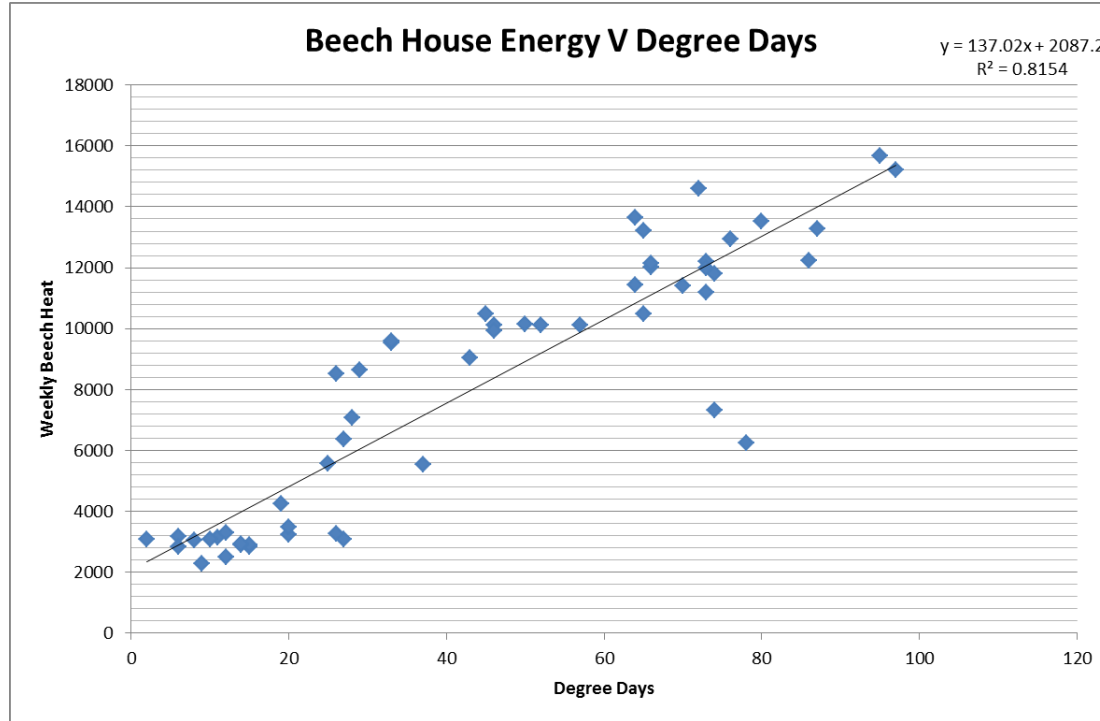
Annual consumption	58,244	39,976
Consumption Saving (litres)		18,268
Percentage Saving		31.4%
Estimated Cost Saving £ (55p/litre)		£10,047



Post Project Evidence - Reduction in Oil consumption following installation of zone control valves on heating system.



Analysis - Regression analysis on Beech House at Hydebank (2015)– original pipework design.



Linear Regression Analysis

Correlating energy consumption with degree day data (i.e. how cold or hot the weather is)

“y” = kWhs of energy consumption

“x” = corresponds to number of degree days

The figure that multiplies the x represents the gradient of the trend line

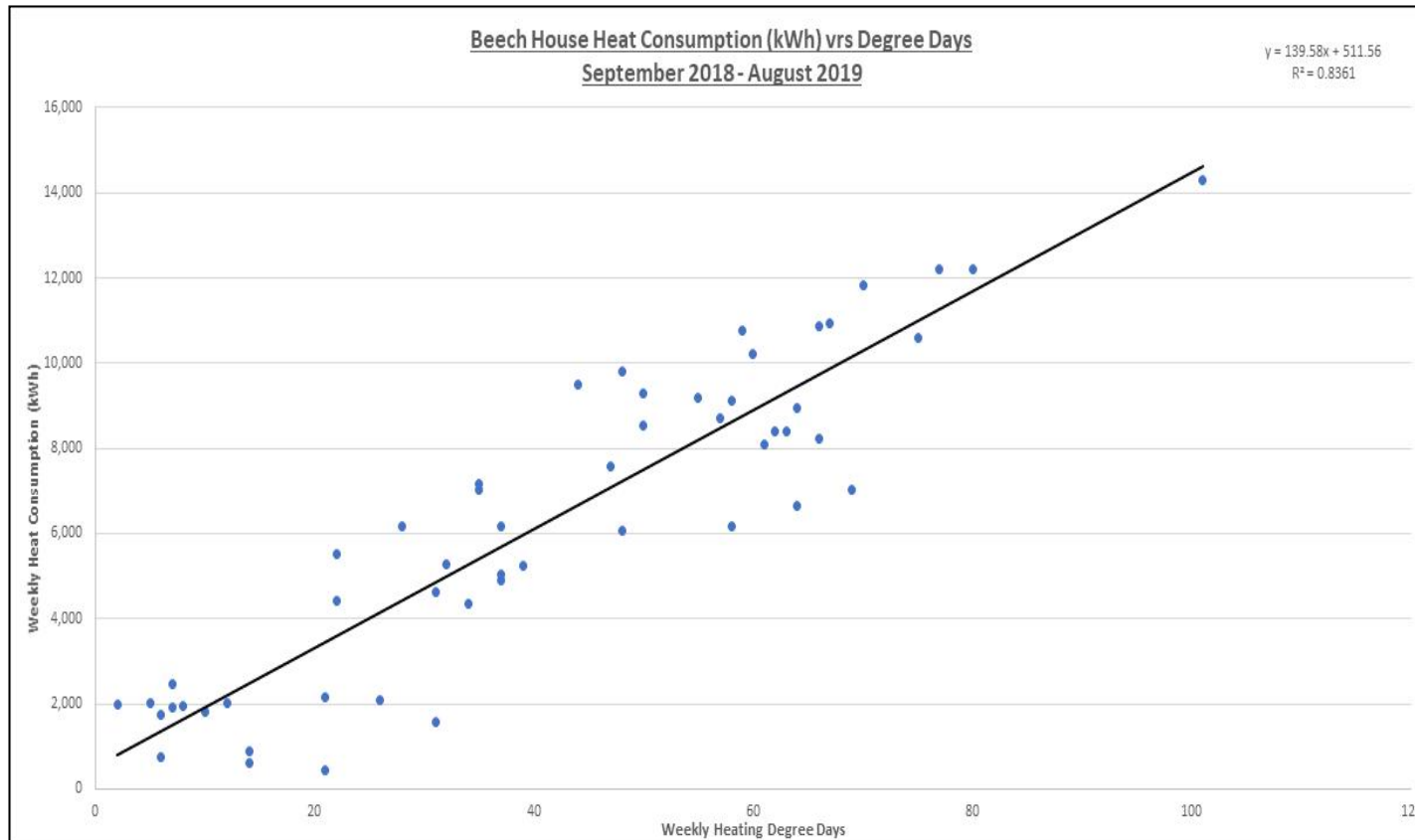
The constant at the end is the intercept (baseload for the time period assessed)

R^2 = is a measure of how good the correlation is. The closer to 1 the better.

The slide shows a “y” intercept of 2,087 kWh. This means that during the summer months when the heating should be off we were consuming 2,087 kWhs of heat. Obviously heat is required for hot water but this figure looked excessive. Upon investigation we discovered that a pipe work connection had been taken off the MTHW before the step down calorifiers to serve a circuit of fan convectors.

This meant in previous years ‘they’ had been running all summer !!!! Modification were made to the pipe work and a much improved “y” intercept can be seen in the next slide.

Analysis - Regression analysis on Beech House at Hydebank (2019) – following heating modifications and plantroom upgrade.

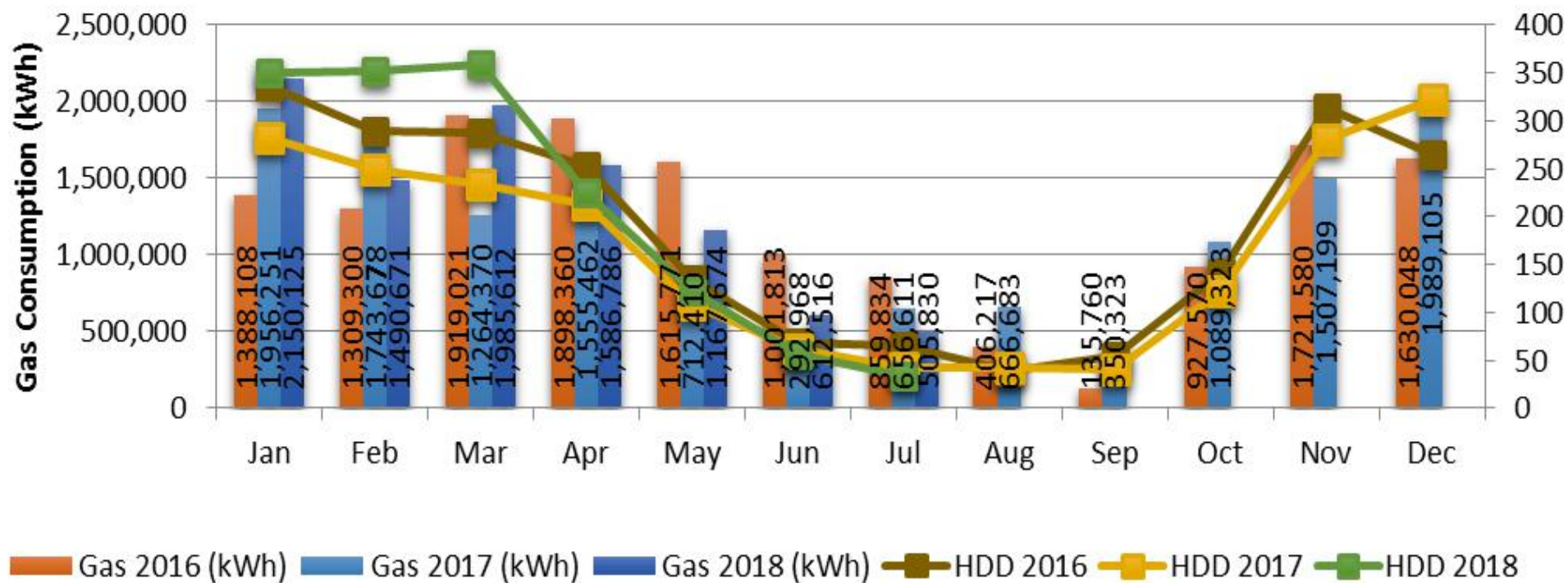


This slide shows a much improved “y” intercept i.e. 511 kWh compared to 2,087 kWh prior to modifications to the heating system.

The heat consumed by Beech House in the previous slide was reduced from 494,259 kWhs and 332,110 kWhs on this slide (data has been normalised using HDD data). This represents a **33% reduction in consumption** and a financial saving of **£8,100 / annum** based on current fuel prices.

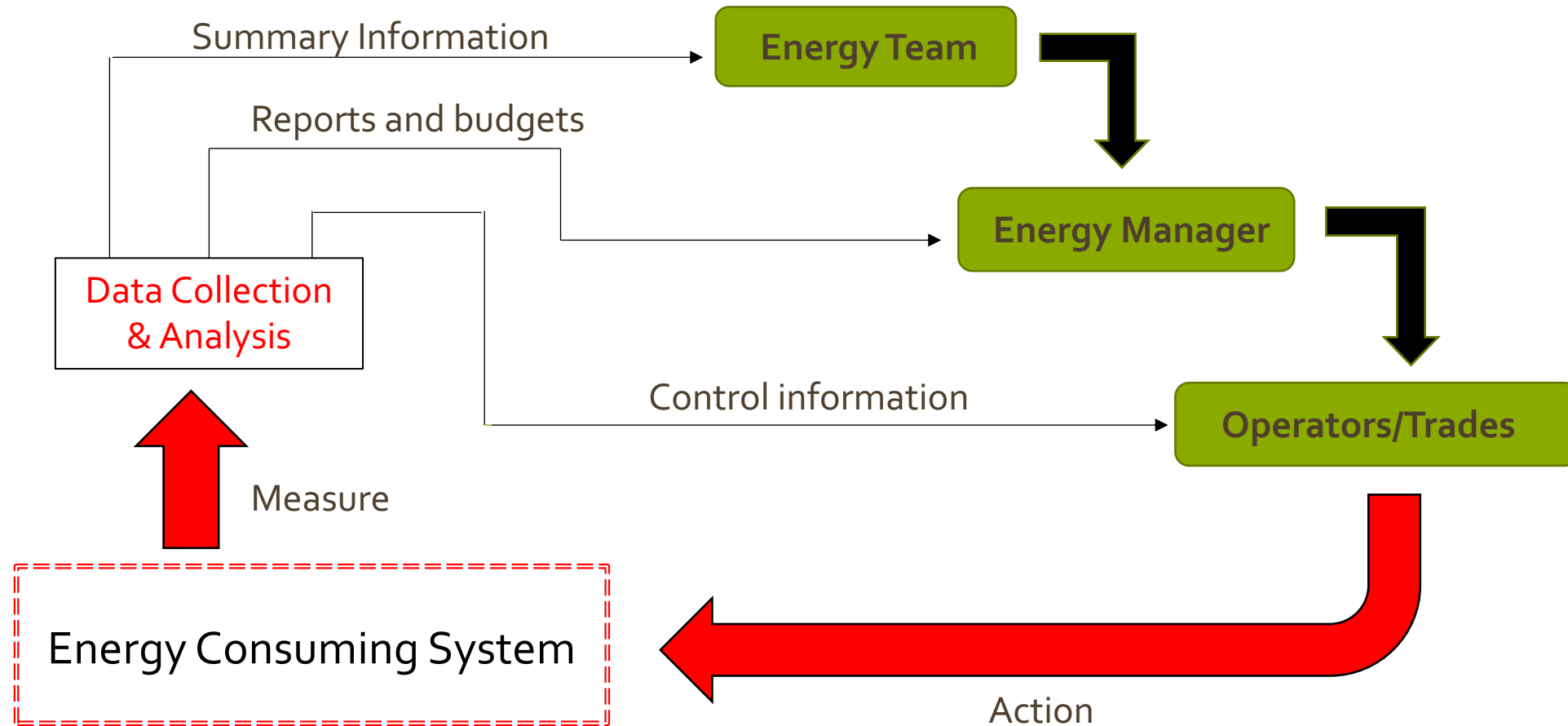
Performance Report for Governors

Maghaberry Total Gas



Monthly Gas consumption report prepared for the Governor and his staff. Data allows them to compare previous months/years to the current period and also indicates how weather can increase or reduce consumption (HDD is Heating Degree Days).

M&T – Closing the Loop



Key Benefits of M & T

- Provides Good Visibility of what is happening – how you consume energy and the impact of making changes
- Making Energy Efficiency Relevant / Easily Understood
- Reducing energy consumption / CO₂ emissions
- Generating Financial savings
- Establish accurate energy budgets/ KPI's
- Opportunity to extend the Lifespan of Plant & Equipment

Lessons Learned - M&T Installation

- Have a site plan and consider the merits of installing M&T in key buildings (it may not be needed in every building)
- Only meter essential information (don't make it impossible to operate/analyse by overloading yourself with too many meters)
- Bureau service – select a reputable specialist M&T provider with a proven track record (not someone who has added a package to their existing BMS system)
- Source an experienced operative to analyse, validate and prepare reports – factor in the associated cost for this
- Data from previous years (prior to installing M&T) needs to be available when required – back up servers

Lessons Learned - M&T Installation

- When purchasing Data Loggers ensure the batteries can be replaced – otherwise costs can be high
- Use pillars for below ground water meters – as it can sometimes be difficult to get a signal back to a concentrator
- Ensure M&T provider has bill validation software
- Check that bandwidth frequencies do not effect any other security systems in the prison
- Remember to check meters to ensure they are working. If a critical meter fails have it repaired.
- Use your analysis in conjunction with a BMS to make corrective changes

Conclusion

- Monitoring & Targeting energy use is a critical component of an effective energy management regime.
- The M&T system provides NIPS Energy Manager with feedback on operating practices, results of energy management projects and guidance on the level of energy use during a certain time period.
- M&T is a useful tool to not only track energy use but also to control it. It turns data on energy use into useful information that can lead to significant energy and cost savings.

Questions



Tony McDonnell, BSc (Hon) MRICS

Head of Infrastructure and Asset Management

Estate Division | Northern Ireland Prison Service | NI Department of Justice

Tony.McDonnell@justice-ni.x.gsi.gov.uk

The foundation of energy management

- Increases the visibility and oversight of energy use (Electricity, Gas, Oil, Water) at each utility meter - helpful when you have a large estate/ number of buildings
- Allows you to actively monitor and track energy use and target resources to make improvements and to control what is happening
- The M&T Reporting functionality makes it relatively easy to interrogate energy data – allowing you to analyse the energy consumed within individual buildings, identifying and prioritising where improvements can be made, helping to improve efficiency and reduce waste.
- Capability to create KPI and reporting metrics – taking actionable steps to become more efficient and improve environmental outcomes

NIPS Energy Benchmark Performance

		Measured Energy Consumption			Measured Energy Consumption			Measured Carbon Dioxide Emissions		Measured Water Consumption	
		Fossil Fuels	Electricity	Overall	Fossil Fuels	Electricity	Overall				
		kWh/m2	kWh/m2	kWh/m2	kWh/prisoner	kWh/prisoner	kWh/prisoner	kg CO2/prisoner	kg CO2/m2	m3/prisoner	m3/m2
Maghaberry	2010/11	391	138	529	25,954	9,195	35,149	9,934	150	308	4.64
	2011/12	457	131	588	25,535	7,326	32,861	8,729	156	160	2.88
	2012/13	398	128	526	23,102	7,426	30,528	8,288	143	153	2.64
	2013/14	378	129	540	22,761	7,129	29,890	7,799	141	149	2.69
	2014/15	388	119	507	21,668	6,632	28,300	7,330	131	151	2.70
	2015/16	345	116	461	22,771	7,651	30,422	9,722	147	178	2.70
	2016/17	327	122	449	23,125	8,625	31,750	8,750	128	237	3.36
	2017/18	292	117	409	21,004	8,453	29,457	6,630	92	162	2.26
	2018/19	291	112	403	21,339	8,224	29,563	6,453	88	168	2.29
Magilligan	2010/11	391	117	508	27,777	8,269	36,046	12,095	170	196	2.77
	2011/12	444	115	552	28,163	7,292	35,455	11,717	182	141	2.20
	2012/13	393	122	515	23,713	7,334	31,047	10,508	174	165	2.75
	2013/14	414	114	528	24,387	6,698	31,085	10,311	175	164	2.79
	2014/15	374	105	479	22,644	6,322	28,966	9,172	151	181	3.00
	2015/16	319	102	421	21,207	6,756	27,963	10,226	154	191	2.89
	2016/17	367	96	463	27,180	7,166	34,346	11,367	153	185	2.50
	2017/18	269	98	367	21,230	7,735	28,965	8,227	104	220	2.80
	2018/19	256	95	351	19,278	7,173	26,451	7,062	94	179	2.38
Hybebank	2010/11	284	82	366	35,937	10,343	46,280	12,480	99	713	5.64
	2011/12	336	83	419	38,604	10,586	49,190	12,386	108	161	1.40
	2012/13	297	80	377	38,083	10,234	48,317	12,762	100	150	1.18
	2013/14	280	76	356	35,754	9,688	45,442	12,026	94	153	1.19
	2014/15	207	71	278	29,562	10,107	39,669	10,680	75	149	1.04
	2015/16	208	69	277	40,620	13,506	54,126	15,158	80	198	1.01
	2016/17	214	64	278	42,886	13,014	55,900	15,801	78	171	0.80
	2017/18	218	69	287	41,283	13,772	55,055	12,414	62	216	1.08
	2018/19	210	65	275	39,243	12,288	51,531	11,185	59	227	1.21

This slide shows our energy performance since 2010. NIPS installed M&T in 2015 and this has been a contributing factor in the reduction of consumption against each metric.

Key questions

Will M&T save money?

Yes – If you do not meter, then you can't measure and therefore you cannot manage energy effectively.

Does M&T require trained or specialist staff input?

Generally not, although some knowledge of energy management and spreadsheets would be beneficial.

Is there significant associated investment cost?

Not necessarily. M&T can be implemented with relatively little cost. There are however costs associated with management of the system, Bureau services and maintenance. These costs can be relatively low compared to the prospective savings potential.

Key questions

What is Energy Monitoring and Targeting (M&T)?

M&T is a term used to describe a range of management techniques employed to improve understanding of how energy is consumed and how costs evolve. It is a system for measuring and analysing energy consumption and costs. It allows performance measurement with a greater degree of accuracy that can be used to improve accountability, quality and profitability.

Is M&T complex?

An M&T system can be as complex or as simple as you want it to be. It is really not about how complex the system is, it is about how appropriate the system is.

Is M&T easy to implement?

Yes it is a simple management procedure requiring the collection and analysis of energy consumption data against another metric, i.e. outside weather conditions, site footprint or number of staff/those in our care.