

Energy Event 2010

National Motorcycle Museum - Birmingham

9th September 2010

Analysis Techniques to Identify Energy Waste using AMR Data

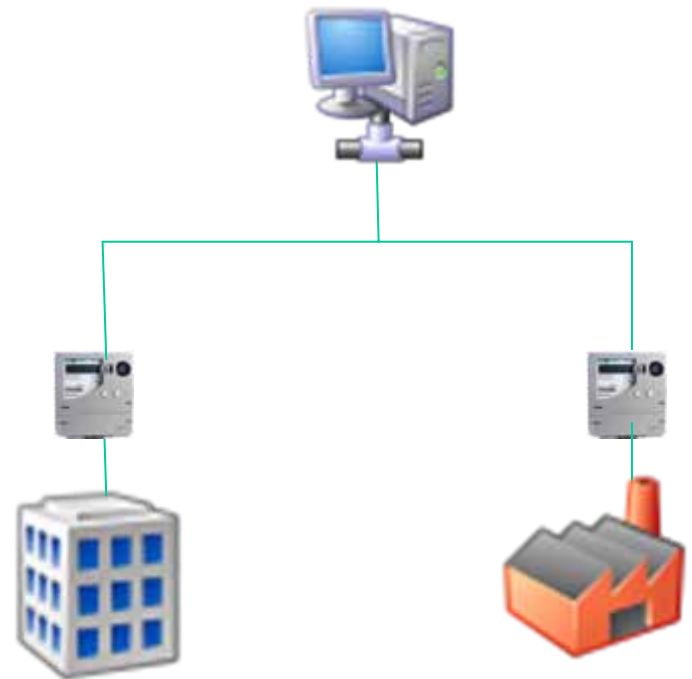
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Optima Energy Management

Sub-Metering

- AMR meters are installed
- Half-Hourly (HH) data collected for all key areas of a building or site
- Automatically collected at a central location and delivered D+1
- What happens next?



Data Volumes

- Consider a system of 25 sub-meters
- Manually read once per week
- 25 meters x 52 weeks
- 1,300 data points
- aM&T system, 30 min intervals
- 25 meters x 48 HH x 365 days
- 438,000 data points



Data Management

- Key issue:
 how to use the data effectively
- Spreadsheets?
- Often a starting point
- Good for viewing 'raw' data
- Not scalable
- Difficult to maintain
- Spreadsheet Soup!



Monitoring and Targeting

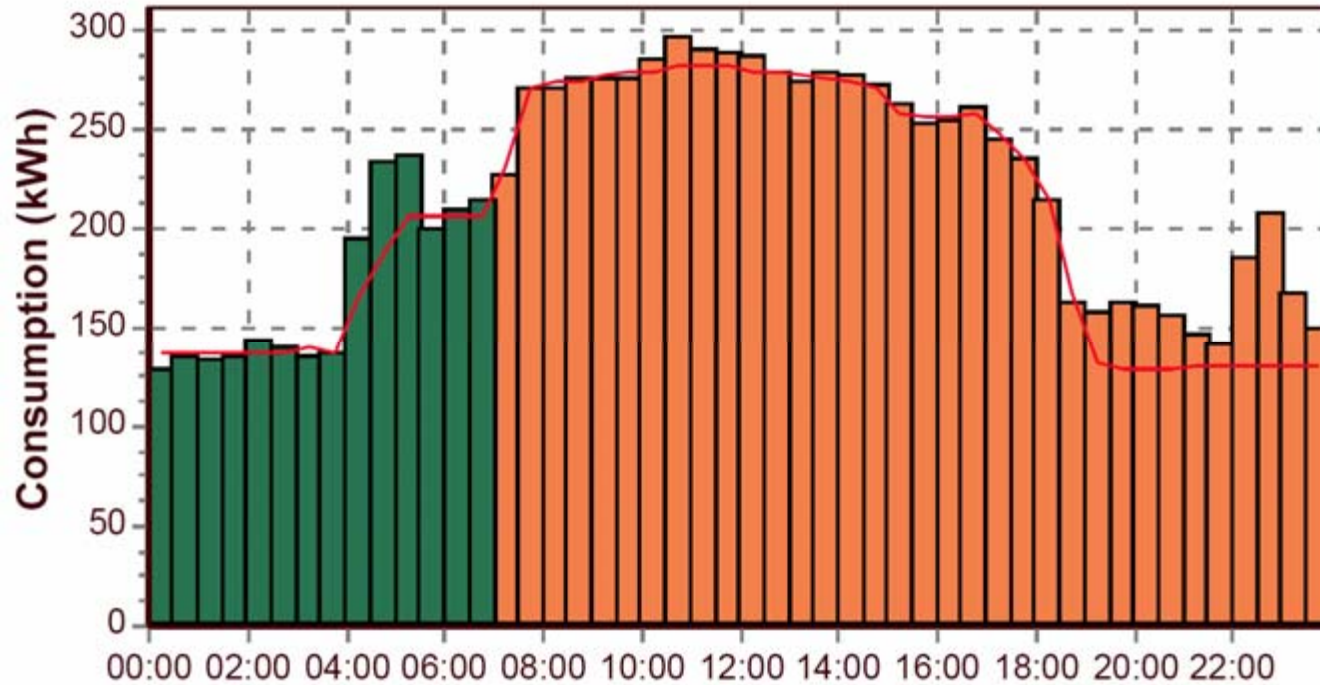
- Understand where and how your energy is used
- Detect waste quickly



Data Analysis & Targets



Data Analysis & Targets



Data Analysis & Targets

Consumption & Target CUSUM Report [SR120]

Site Sample ██████████

Analysis Period ██████████

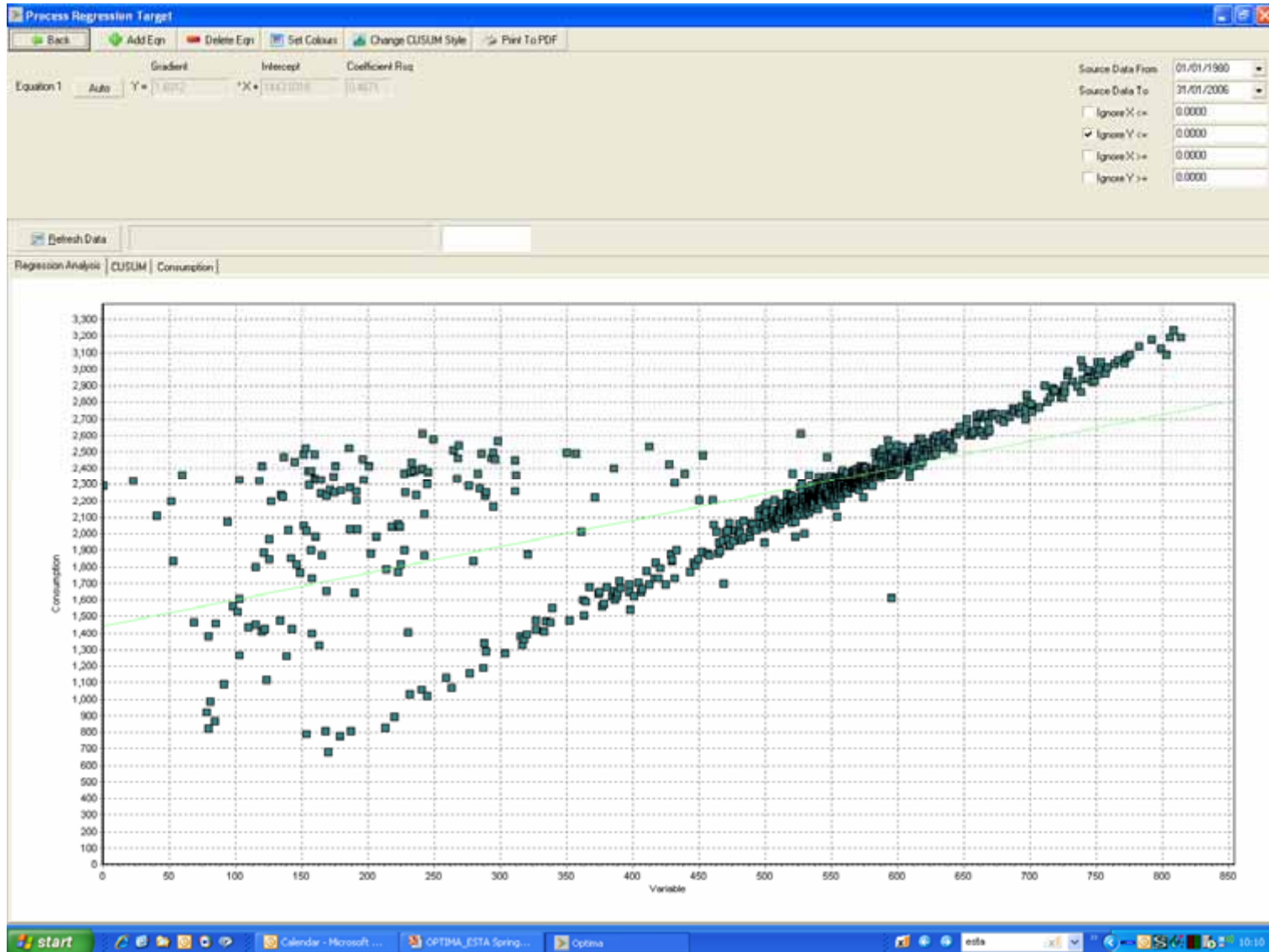
Report Type Half Hourly

Historic Period Historical Only

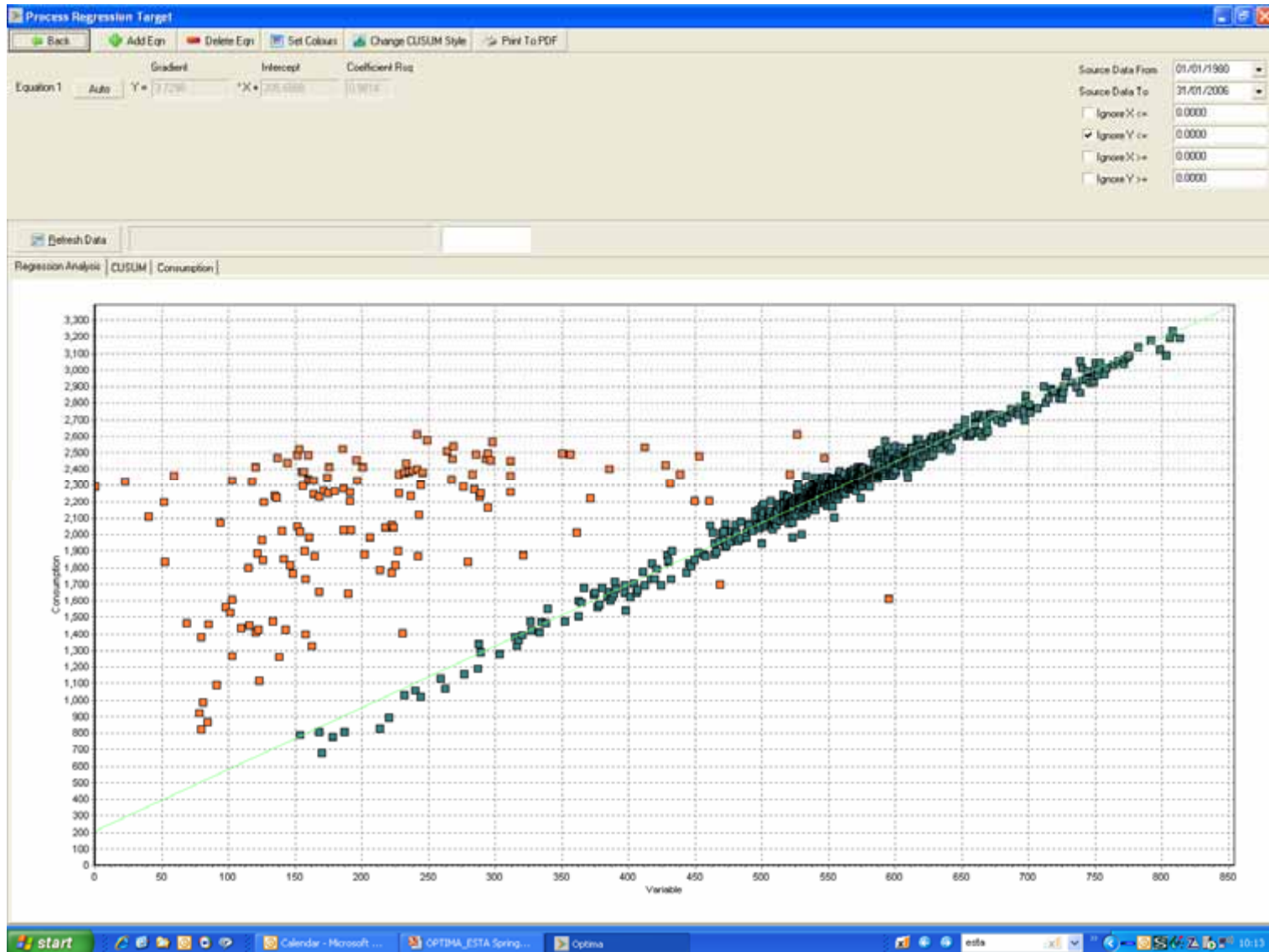
* = Incomplete; 'X' = Prov; † = In vs; 'X' = Both

Site Name	HH Meter Ref	Units	Period	Consumption		Variance			CUSUM	
				Target	Actual	(Units)	(%)	(£)	(Units)	(£)
██████████	██████████	kWh	01/10/2005 00:30	38	57	19	50.13	£0.64	19	0.64
		kWh	01/10/2005 01:00	37	57	20	52.55	£0.66	39	1.29
		kWh	01/10/2005 01:30	37	57	20	52.14	£0.65	58	1.94
		kWh	01/10/2005 02:00	38	56	19	49.60	£0.62	77	2.57
		kWh	01/10/2005 02:30	38	55	17	46.13	£0.58	94	3.15
		kWh	01/10/2005 03:00	38	47	9	25.00	£0.31	103	3.46
		kWh	01/10/2005 03:30	38	37	-1	-2.10	-£0.03	103	3.43
		kWh	01/10/2005 04:00	38	37	-1	-2.36	-£0.03	102	3.40
		kWh	01/10/2005 04:30	39	37	-2	-5.85	-£0.08	99	3.33
		kWh	01/10/2005 05:00	48	37	-11	-23.03	-£0.37	88	2.96
		kWh	01/10/2005 05:30	58	37	-21	-35.88	-£0.69	68	2.26
		kWh	01/10/2005 06:00	55	37	-18	-33.03	-£0.72	49	1.54
		kWh	01/10/2005 06:30	55	37	-18	-33.03	-£0.72	31	0.82
		kWh	01/10/2005 07:00	44	37	-7	-15.84	-£0.28	24	0.54
		kWh	01/10/2005 07:30	38	38	0	0.53	£0.01	24	0.55
		kWh	01/10/2005 08:00	38	39	2	4.24	£0.07	26	0.62
		kWh	01/10/2005 08:30	37	51	14	37.43	£0.63	40	1.26
		kWh	01/10/2005 09:00	38	59	21	57.07	£0.97	61	2.22
		kWh	01/10/2005 09:30	39	60	21	54.64	£0.96	82	3.18
		kWh	01/10/2005 10:00	47	61	14	29.03	£0.62	96	3.80
		kWh	01/10/2005 10:30	60	62	2	3.01	£0.08	98	3.88
		kWh	01/10/2005 11:00	62	62	1	0.97	£0.03	99	3.91
		kWh	01/10/2005 11:30	63	63	0	-0.32	-£0.01	98	3.90

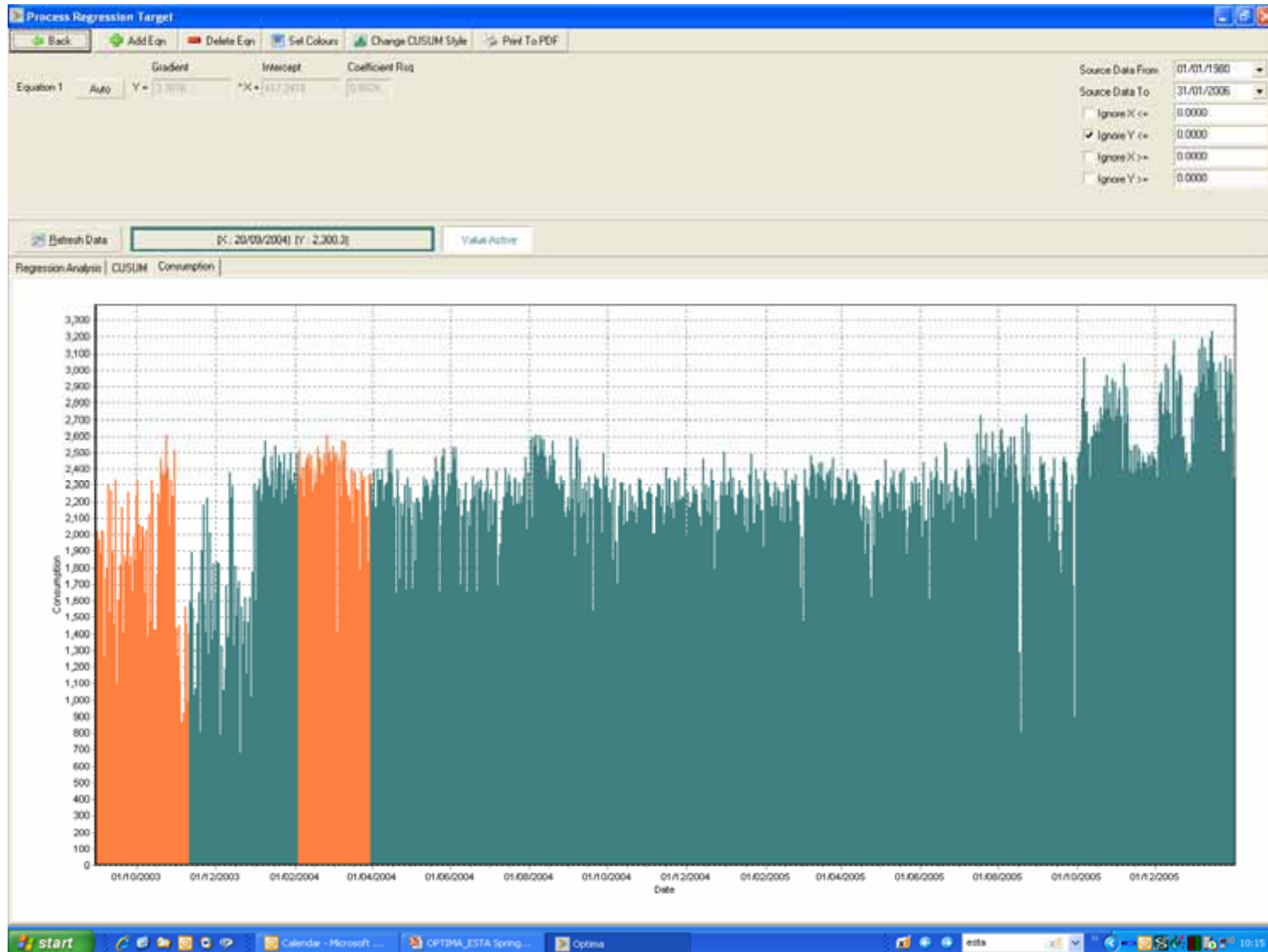
Data Analysis & Targets



Data Analysis & Targets



Data Analysis & Targets



Coping with Large Data Volumes

- Large Scale roll-out of AMR
- Many '000s of Meters
- Large Amount of Data to Analyse
- New techniques
 1. Automatically Identify Suspect Values
 2. Profile Analysis using Load Factor

Data Analysis & Targets

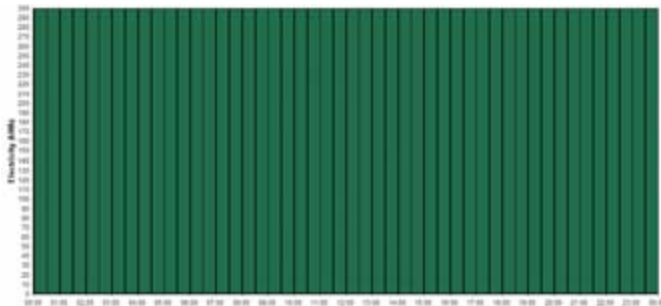
Site Name	Meter ref	Channel Type	Max	Min	Target Load Factor
SWINDON	1600000153560	Electricity (kWh)	271.0	61.7	63.67%
BRADFORD	2316513653013	Electricity (kWh)	126.1	2.6	62.41%
LEEDS	2316541158010	Electricity (kWh)	286.1	6.3	65.53%
HEADINGLEY	2346542747016	Electricity (kWh)	108.9	1.4	62.86%
HUNSLET	2346551995019	Electricity (kWh)	359.8	68.1	66.05%
WIDNES	1300035358615	Electricity (kWh)	329.5	27.5	69.10%
WOLVERHAMPTON	1423819000009	Electricity (kWh)	370.1	111.7	64.13%
CHESTERFIELD	1100039628251	Electricity (kWh)	312.5	81.9	67.23%
ROTHERHAM	2380000130758	Electricity (kWh)	326.0	64.0	59.78%
GAINSBOROUGH HEAPHAM ROAD	2376570618115	Electricity (kWh)	267.9	3.0	59.40%

Data Analysis: Suspect Values

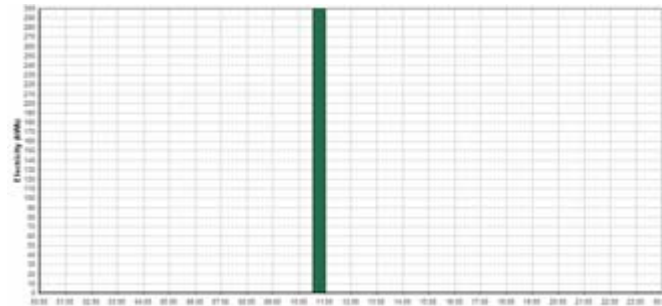
Reading Date		1843 Days Data	(Daily Total 12844.8000)	30 Minute Resolution												
00:30	175.00000	06:30	243.00000	12:30	290.80000	18:30	324.00000	<table border="1"> <tr><td>Normal</td></tr> <tr><td>Edited in Optima</td></tr> <tr><td>Missing</td></tr> <tr><td>Estimated</td></tr> <tr><td>Suspect</td></tr> <tr><td>Suspect and Edited in Optima</td></tr> <tr><td>Suspect and Missing</td></tr> <tr><td>Suspect and Estimated</td></tr> </table>	Normal	Edited in Optima	Missing	Estimated	Suspect	Suspect and Edited in Optima	Suspect and Missing	Suspect and Estimated
Normal																
Edited in Optima																
Missing																
Estimated																
Suspect																
Suspect and Edited in Optima																
Suspect and Missing																
Suspect and Estimated																
01:00	173.00000	07:00	271.80000	13:00	350.40000	19:00	319.20000									
01:30	179.80000	07:30	283.60000	13:30	363.20000	19:30	311.00000									
02:00	182.40000	08:00	252.00000	14:00	410.00000	20:00	301.60000									
02:30	181.00000	08:30	257.80000	14:30	412.00000	20:30	293.00000									
03:00	179.40000	09:00	303.80000	15:00	403.00000	21:00	293.80000									
03:30	177.80000	09:30	274.20000	15:30	351.20000	21:30	234.40000									
04:00	177.20000	10:00	288.40000	16:00	343.40000	22:00	183.20000									
04:30	173.60000	10:30	333.60000	16:30	329.80000	22:30	173.60000									
05:00	180.80000	11:00	284.60000	17:00	330.60000	23:00	173.20000									
05:30	211.40000	11:30	333.80000	17:30	333.40000	23:30	179.60000									
06:00	223.80000	12:00	285.00000	18:00	333.40000	24:00	180.20000									

Data Analysis: Load Factor

- Definition: ratio of average demand to the maximum demand during a period.
- A good indication of profile shape



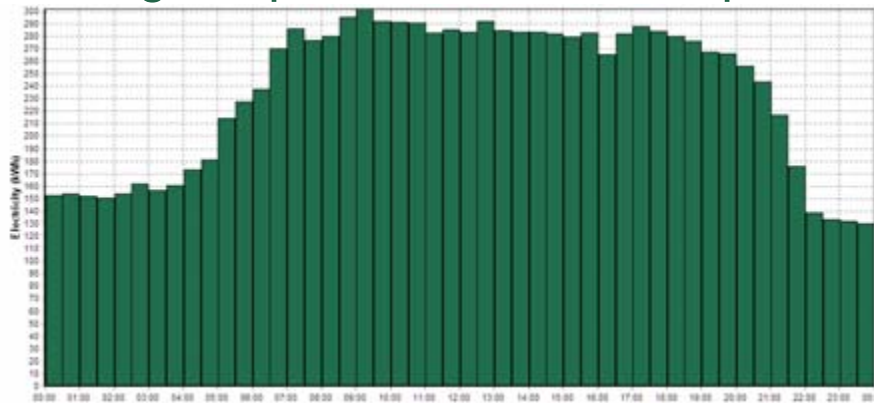
Load Factor = 100%



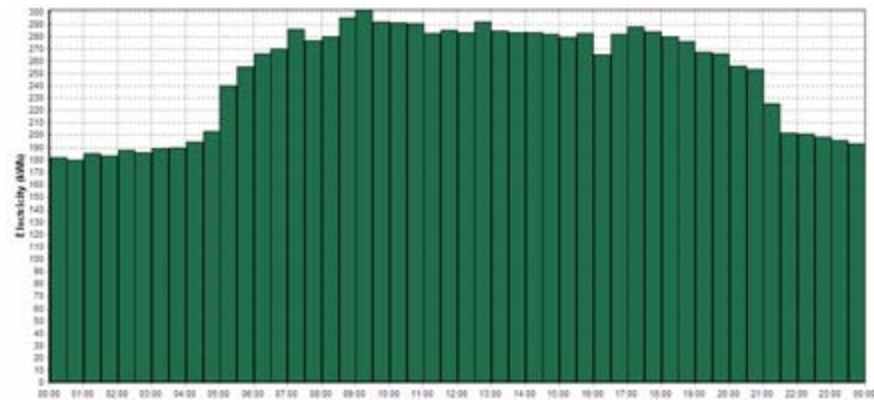
Load Factor = 2%

Data Analysis: Load Factor

- Can be used to find subtle differences in patterns of consumption.
- Any change in patterns of consumption – change in load factor.



Load Factor = 78%



Load Factor = 83%

- Easy to set targets and then analyse in bulk.



Thank You

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