VORTEX ENERGY SAVER

Revolutionising Energy Consumption

DSA DRIVING STANDARDS AGENCY SAFE DRIVING FOR LIFE

1. Introduction

DSA installed Vortex Energy Saver devices at four test centres during the month of January 2012 to investigate the impact that they have on gas consumption. The DSA business case for installing Vortex Energy Saver devices at the four sites expected to see reductions of between 8-29%.

The four sites chosen cover a range of profiles from small low consuming test centres to larger high consuming sites. The table below shows the test centres and the date that Vortex Energy Saver devices were installed:

Test centre name	Annual gas consumption	Date of installation
Canterbury DTC	35,000kWhs	23 January 2012
Colchester DTC	27,500kWhs	23 January 2012
Kings Lynn MPTC	23,000kWhs	23 January 2012
Llanelli DTC	18,000kWhs	09 January 2012

Each of the selected sites has gas AMR (automatic meter reader) installed and a reliable provision of half hourly gas consumption data. This data will be used to ensure that the performance of the Vortex Energy Saver devices can be accurately assessed.

2. Analysis technique

The performance of the Vortex Energy Saver devices at each site was analysed using the gas consumption data taken from the AMRs, 4 weeks pre-installation and 4 weeks post-installation. Weather correction techniques were there used to determine the actual effect of the Vortex Energy Saver devices without the influence that colder and warmer days have on the heating temperature on the buildings.

Daily degree days were used and taken from **www.degreedaysforfree.co.uk** and sourced from stations within a 5-10 mile proximity of the test centres, except for Llanelli where degree day data for Swansea was used. A standard heating degree day of 15.5°C was used for all sites. Using degree day data of such frequent intervals can cause issues when analysing data, but this had little impact on the results, so there was no need to remove any data. However, any anomalies have been highlighted in the analysis of each site.

3. Highlights

The main highlights from the report are as follows:

- The results show a 19% reduction in gas consumption on average, with Colchester seeing the least improvement (5-7%) and Llanelli benefitting the most (30%).
- All sites saw an apparent decrease in energy performance in early February, this has been attributed to the colder weather and other factors including occupation activities and boiler controls.
- Due to the frequency of the data collected, and the reliability issues this causes, the correlation between temperature was not strong at each site.
- A second analysis using a monthly data set would be beneficial later in 2012.

4. Canterbury

Canterbury DTC is one of the highest consuming test centres, using approximately 35,000kWhs per annum; this high consumption is a result of constant gas usage.

The data taken from gas AMR and degree day data was for the period 26 December 2011 to 20 February 2012. When the daily kWhs (kilowatt hours) and degree days were plotted into the linear regression chart, a strong correlation between the data sets, with a moderate scatter, was revealed. This allows the analysis to progress as a relationship between the two data sets exists.

The linear regression chart and control chart revealed the data points below, which are considered to be anomalies in the data:

Date	Degree days	kWhs	Predicted consumption (kWh)	Avg. kWh per degree day
18/01/12	**4**	**363**	**260**	**91**
31/01/12	**14**	**283**	**385**	**20**
05/02/12	**14**	**525**	**388**	**37**
06/02/12	**15**	**136**	**402**	**9**

The data was analysed with and without the data points above, and the variance was minimal with the overall result the same.

The two charts used to analyse the impact that installation of the Vortex Energy Saver device had at Canterbury DTC showed differing results. The chart revealing the cumulative sum of the difference evidenced that gas consumption had been improving and worsened prior to the installation of the Vortex Energy Saver device. It then shows a minor improvement on installation of the device, before continuing to increase energy consumption. This apparent decrease in energy performance could be a result of many changes including the colder weather through late January and early February or human influence (i.e. doors and windows being left open, increase in activity, increasing the temperature on the thermostat).

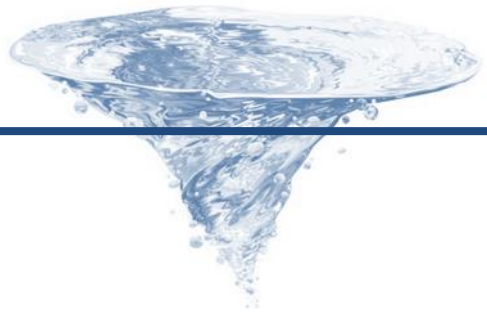
The second chart produced showed contrasting evidence that the energy efficiency of the building had in fact improved since the installation of the Vortex Energy Saver device. This chart compares the number of kilowatt hours consumed per degree day. Prior to installation the site consumed on average 41kWhs per degree day and after installation the site consumed 33kWhs per degree day.

As the energy consumption begins to worsen before the Vortex Energy Saver device is installed, it can be assumed that exterior influences were the result. Taking this into consideration the latter result can be considered accurate, presenting a 20% reduction in gas consumption.

5. Colchester

Colchester DTC is the second highest consuming test centre taking part in the trial of the Vortex Energy Saver devices. It consumes approximately 27,500kWhs per annum and, whilst it does have boiler controls (assumed 24hr control), it is often left on constant for periods of time resulting in this high consumption.

The data taken from gas AMR and degree day data was for the period 26 December 2011 to 20 February 2012. When the daily kWhs (kilowatt hours) and degree days were plotted into the linear regression chart, a strong correlation between the data sets prior to installation of the Vortex Energy Saver was revealed. Post-installation data provided a wide and varied scatter, showing little correlation; however, it is possible that the much colder weather contributed to this.



THE LINEAR REGRESSION CHART AND CONTROL CHART REVEALED THE DATA POINTS BELOW, WHICH ARE CONSIDERED TO BE ANOMALIES IN THE DATA:

DATE	DEGREE DAYS	KWHS	PREDICTED CONSUMPTION (KWH)	AVG. KWH PER DEGREE DAY
01/02/12	**16**	**287**	**196**	**18**
02/02/12	**16**	**281**	**204**	**17**
04/02/12	**17**	**263**	**207**	**15**
08/02/12	**16**	**284**	**199**	**18**
09/02/12	**16**	**275**	**196**	**18**
10/02/12	**20**	**133**	**242**	**7**

THE DATA WAS ANALYSED WITH AND WITHOUT THE DATA POINTS ABOVE, AND THE VARIANCE WAS MINIMAL WITH THE OVERALL RESULT THE SAME. ALSO, EXCLUDING THE DATA ABOVE WOULD HAVE REMOVED 25% OF THE DATA POINTS FOR POST-INSTALLATION ANALYSIS.

THE TWO CHARTS USED TO ANALYSE THE IMPACT THAT INSTALLATION OF THE VORTEX ENERGY SAVER DEVICE HAD AT COLCHESTER DTC PROVIDED SIMILAR RESULTS. THE CUMULATIVE SUM OF THE DIFFERENCE CHART EVIDENCED THAT GAS CONSUMPTION BEGAN TO IMPROVE BEFORE THE INSTALLATION OF THE VORTEX ENERGY SAVER DEVICE, BUT WITH FURTHER IMPROVEMENT AFTER, BEFORE AN INCREASE IN ENERGY CONSUMPTION. THIS DECREASE IN ENERGY PERFORMANCE IS LIKELY THE RESULT OF COLDER WEATHER THROUGH EARLY FEBRUARY.

THE SECOND CHART PRODUCED SHOWED THAT THE ENERGY EFFICIENCY OF THE BUILDING HAD NARROWLY IMPROVED WITH THE INSTALLATION OF THE VORTEX ENERGY SAVER DEVICE. THIS CHART COMPARED THE NUMBER OF KILOWATT HOURS CONSUMED PER DEGREE DAY. PRIOR TO INSTALLATION THE SITE CONSUMED ON AVERAGE 15KWHS PER DEGREE DAY AND AFTER INSTALLATION THE SITE CONSUMED 14KWHS PER DEGREE DAY; THIS REPRESENTS SAVINGS OF APPROXIMATELY 7%.

6. Kings Lynn MPTC

Kings Lynn MPTC consume approximately 23,000kWhs of gas per annum. This is a result of constant low gas consumption. As an MPTC the site should have a condensing boiler with timer controls installed, but this is not apparent from the consumption pattern. This constant usage should enable any benefit derived from the Vortex Energy Saver device easily identifiable.

The data taken from gas AMR and degree day data was for the period 26 December 2011 to 20 February 2012. When the daily kWhs (kilowatt hours) and degree days were plotted into the linear regression chart, a strong correlation between the data sets, with minimal scatter, was revealed.

The linear regression chart and control chart revealed the data points below, which are considered to be anomalies in the data:

Date	Degree days	kWhs	Predicted consumption (kWh)	Avg. kWh per degree day
30/12/11	**7**	**138**	**119**	**19**
04/01/12	**8**	**141**	**119**	**19**
12/01/12	**11**	**102**	**128**	**9**
05/02/12	**15**	**157**	**135**	**11**
12/02/12	**13**	**151**	**132**	**12**

The data was analysed with and without the data points above, and the variance was minimal with the overall result the same.

The two charts used to analyse the impact that installation of the Vortex Energy Saver device had at Colchester DTC provided similar results. The cumulative sum of the difference chart evidenced that gas consumption began to improve before the installation of the Vortex Energy Saver device, but with further improvement after installation and before an increase in energy consumption. This later decrease in energy performance is likely the result of colder weather through early February.

The second chart produced showed that the energy efficiency of the building had improved with the installation of the Vortex Energy Saver device. This chart compared the number of kilowatt hours consumed per degree day. Prior to installation the site consumed on average 14kWhs per degree day and after installation the site consumed 11kWhs per degree day; this represents savings of approximately 20%.

7. Llanelli

Llanelli DTC is the lowest gas consuming site of the four trial sites for the Vortex Energy Saver devices, using approximately 18,000kWhs per annum. The site appears to have 24hr (possibly 7day timer as Mondays have a unique pattern) timer controls as it has three distinctive peaks in gas consumption that occur daily.

Llanelli was the first site to have a Vortex Energy Saver fitted, so the data taken from gas AMR and degree day data was for an earlier period of 12 December 2011 to 06 February 2012. When the daily kWhs (kilowatt hours) and degree days were plotted into the linear regression chart, there was a weak correlation between the data sets, with a wide scatter. This could be the result of several things including the activities of the buildings occupants, other sources of heat, issues with the heating system or the frequency of the data. In spite of the weak correlation, the analysis was conducted.

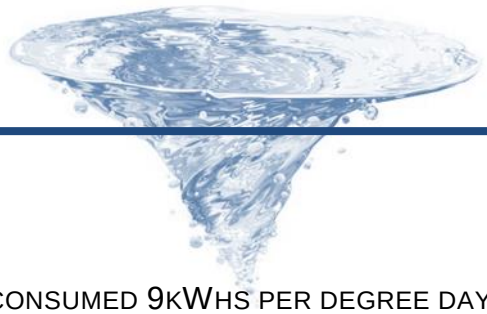
The linear regression chart and control chart revealed the data points below, which are considered to be anomalies in the data:

Date	Degree days	kWhs	Predicted consumption (kWh)	Avg. kWh per degree day
24/12/11	**6**	**113**	**85**	**20**
31/12/11	**5**	**111**	**83**	**24**
16/01/12	**13**	**69**	**95**	**5**
04/02/12	**12**	**150**	**93**	**13**

The data was analysed with and without the data points above, and no variance was evident as the overall result was the same.

The two charts used to analyse the impact that installation of the Vortex Energy Saver device had at Colchester DTC provided similar results. The cumulative sum of the difference chart evidenced a clear improvement in gas consumption with the installation of the Vortex Energy Saver device. This did see a decrease in early February and is likely attributed to the colder weather.

The second chart produced also showed that the energy efficiency of the building had improved with the installation of the Vortex Energy Saver device. This chart compared the number of kilowatt hours consumed per degree day. Prior to installation the site consumed on average 13kWhs per



DEGREE DAY AND AFTER INSTALLATION THE SITE CONSUMED 9KWHS PER DEGREE DAY; THIS REPRESENTS SAVINGS OF APPROXIMATELY 30%. IT SHOULD BE NOTED THAT WITH THE WEAK CORRELATION BETWEEN DEGREE DAYS AND CONSUMPTION, THIS REDUCTION MAY IN FACT BE SLIGHTLY LOWER, BUT THERE HAS DEFINITELY BEEN AN IMPROVEMENT.

8. SUMMARY

THE INSTALLATION OF THE VORTEX ENERGY SAVER DEVICES AT EACH OF THE NOMINATED SITES HAS SHOWN A REDUCTION IN GAS CONSUMPTION FROM JUST BELOW THE MINIMUM EXPECTED (8%) TO JUST ABOVE THE HIGHEST EXPECTED (29%).

ALL SITES HAD VARIOUS ISSUES DURING ANALYSIS, MUCH CAN BE ATTRIBUTED TO THE FREQUENCY OF THE COLLECTED DATA. DAILY DEGREE DAYS AND ENERGY CONSUMPTION ARE LESS RELIABLE THAN VIEWING A MONTHLY DATA SET, DUE TO THE VARIATIONS THAT CAN OCCUR IN SHORTER PERIODS OF TIME. HOWEVER, ON VIEWING MORE RECENT AMR DATA CANTERBURY DTC SWITCHED FROM CONSTANT GAS CONSUMPTION TO USING 24HR BOILER CONTROLS; THIS HAS RESULTED IN A 50% REDUCTION IN GAS CONSUMPTION AT THIS SITE. HAD THE ANALYSIS TAKEN PLACE WITH A MONTHLY DATA SET THIS COULD HAVE PROVIDED MISLEADING EVIDENCE THAT THE VORTEX ENERGY SAVER DEVICE HAD WORKED TO A GREATER EFFECT THAN IT HAD, ALTHOUGH IT WILL HAVE CONTRIBUTED TO THE 50% REDUCTION.

ALTHOUGH, AS MENTIONED ABOVE, THERE ARE POTENTIAL ISSUES WITH USING MONTHLY DATA, IT WOULD BE BENEFICIAL TO CONDUCT A SECOND ANALYSIS IN JUNE/JULY 2012 USING WEATHER CORRECTION TECHNIQUES. THIS SHOULD ALLOW A CLEARER PICTURE OF ANY BENEFIT DERIVED FROM THE INSTALLATION OF THE VORTEX ENERGY SAVER DEVICES, ALTHOUGH THIS INITIAL ASSESSMENT EVIDENCES THAT THEY COULD POTENTIALLY PROVIDE SIGNIFICANT SAVINGS.