Saving and Sharing at Pfizer Loughbeg

THE Pfizer Active Pharmaceuticals Ingredients (API) facility in Loughbeg, Cork employs over 300 people. The facility prides itself on a long-standing commitment to reduce energy and improve energy efficiency, and on its participation in the Large Industry Energy Network (LIEN). Pfizer Loughbeg signed up to the Energy Agreements Programme in May 2006 and achieved certification to IS393 in May 2007.

The Syltherm System

The plant's main energy project involved optimising a syltherm (thermal fluid) refrigeration and distribution system. The special investigation was important to the energy team as it was the first energy project adopting six-sigma principles of analysis and the first to be guided by the IS393 system. The generation and distribution of cold syltherm is one of the site's biggest energy users, as was found during the Energy Aspects Review.

The cold syltherm system essentially consists of:

- two refrigeration skids, each housing two compressors
- a dedicated constant-speed primary thermal fluid transfer pump for each skid
- a variable-speed secondary thermal fluid transfer station compromising three pumps, one of which is a stand-by
- one storage tank comprising a cold and hot reservoir

The system also supplies a hot syltherm loop which maintains the hot syltherm via a steam-heated exchanger and the system balance via a roof-mounted expansion tank.

The Six-sigma Approach

Recent process changes meant that the refrigeration skids were approaching full capacity. Both skids were running at 75%-100%, depending on manufacturing intensity. With no redundancy on the system, there were concerns about continuity of supply of the thermal fluid for manufacturing. In the past, extra refrigeration capacity would typically have been installed – in this case at an estimated cost of €1M. However, during the Energy Aspects Review, the energy team found that the system had good potential for saving energy. Thus, before any consideration of increasing refrigeration capacity, the energy team looked into increasing the efficiency and freeing up stand-by capacity.

Since the 'Right First Time' initiative was introduced at Pfizer, six-sigma has been the preferred problem-solving/process-optimisation approach within Pfizer Global Manufacturing. A six-sigma team was established in March 2006 to optimise the energy performance of the syltherm system. Led by a six-sigma black belt and involving personnel from manufacturing, utilities, maintenance, technical services and the energy champion, it set about 'analysing the requirement for refrigeration and heating loads' rather than the generating processes themselves. This phase involved analysing key data gathered from the system so that all aspects of the process could be questioned, including the systems settings, process requirements, etc. A combination of existing and temporary instrumentation was used for this analysis.

Generating a fishbone diagram, the team brainstormed all technical and engineering issues that might affect the energy efficiency of the system. Key questions were:

- Is the cold storage tank too small?
- Is there too much interference between the hot and cold sides of the system, perhaps through leakage?
- Is the system pump pressure too high?
- Is the refrigeration temperature too low?
- Is the hot side temperature of the system too high?

The interconnecting nature of the system issues became apparent as the team delved deeper into the design of the system and gained a clearer understanding of the processes. What became evident was that the core energy service requirement of the processes was excessive and damaging the operational capability and system efficiency. By focusing on the core energy service requirement, it was felt, the refrigeration process could be optimised.

Using measurements taken from the entire system and analysing them thoroughly, as per the six-sigma approach, highlighted opportunities to increase efficiency:

- The pump-control software was upgraded so that pumping reflected the actual system load
- The reactor heating temperature settings were lowered and refrigeration temperature settings increased
- At the cold syltherm generation system, significantly higher refrigeration COPs (Coefficient of Performance) were achieved

Expected savings

So far, an increase of 50% in refrigeration system efficiency has been secured. Similar savings have been gained in the heating system and there are further savings in the reduced pumping costs associated with the maintenance, control and rebalancing improvements carried out. One year ago, there were three to four compressors running. Today, there are two part-loaded compressors servicing the same processes. Once the programme is complete, it is anticipated that one compressor may be able to meet the entire demand of the refrigeration system.

When the project is concluded, the team expects:

- a 20% to 30% reduction in cold syltherm distribution loop pressure
- a 50% reduction in cold syltherm loop flow
- a 10°C rise in the cold syltherm settings
- a 45°C degree reduction in hot syltherm settings

Attribute	March 2006	July 2007	Anticipated (Q4 2007)
Delivered flow of thermal fluid	300 tonnes/hour	150 tonnes/hour	120 tonnes/hour
Cold system load	650 kW	350 kW	350 kW
Hot system load	450 kW	250 kW	250 kW
Hot fluid circulating temperature	145ºC	100ºC	100ºC
Refrigerated fluid circulating temperature	-15ºC	-5ºC	-5ºC
Refrigerated fluid hydraulic pressure	3 bar(g)	2.5 bar(g)	2 – 2.5 bar(g)

Savings	
Natural gas	1.47 GWh
Electricity	3.07 GWh
CO_2 emissions	2254 tonnes

Maintaining the improvements

The IS393 energy management system plays a vital role in ensuring that the improved performance of the refrigeration system is maintained. Temperatures, pressures and other key parameters are now monitored and EPIs have been selected to ensure that energy performance indicators do not drift beyond the defined limits. These measures should ensure that the energy performance is maintained into the future.

What has been learnt has been shared with some sister facilities abroad through the global energy network.

Replicating the project

The project is readily transferable and easily replicated. The IS393 energy-management system has accelerated the implementation of energy projects in which the same data-driven approach through analysis of energy service requirement has been adopted. It is anticipated that the refrigeration temperature for another separate system can also be increased in the coming months.

Other system energy improvements have been achieved. Twelve months ago for example, in the steam system, the four boilers at Pfizer Loughbeg were always available to generate steam at 10 bar. Today, the same steam system is running two boilers at 6 bar. Looking beyond the plant, the energy team have begun aiding other facilities in the organisation to replicate these advances.

Optimisation of a system by assessing and managing the core energy services can best be carried out within the framework of six-sigma, supported by a multifunctional and cross-departmental team. In this project, maintenance, technical services, the quality function, manufacturing and utilities all had key responsibilities according to their function.

Informing R&D

One of the main benefits of this project is that the findings relating to product set-points have been shared with our Research and Development colleagues. Their work leads to many new processes being introduced to manufacturing sites throughout the world and they are involved in setting the processing set-points for these processes. They now understand the implications that this can have on energy consumption in the manufacturing plants and will be able to optimise these set-points, ensuring major energy efficiencies into the future.

Glasnevin, Dublin 9, Ireland
Glas Naíon, Baile Átha Cliath 9, Eireann
T. +353 1 836 9080
F. +353 1 837 2848
info@sei.ie
www.sei.ie

NDP National Development Plan 2007 - 2013
SEI is funded by the Irish Government under the National Development Plan 2007-2013 with programmes part financed by the European Union.