Australian Government
Department of Resources, Energy and Tourism

Energy Efficiency Opportunities

CASE STUDY

INCITEC PIVOT - GIBSON ISLAND

THIS CASE STUDY LOOKS AT THE ASSESSMENT APPROACH ADOPTED BY A MAJOR CHEMICAL MANUFACTURER PARTICIPATING IN THE ENERGY EFFICIENCY OPPORTUNITIES (EEO) PROGRAM.

Incitec Pivot plant at Gibson Island, Qld

Incitec Pivot Limited (IPL) manufactures nitrogen-based fertilisers at its Gibson Island and Phosphate Hill facilities in Queensland. The process is very energy-intensive, with natural gas contributing up to 50% of the cost of producing ammonia. Approximately half the natural gas is feedstock and half is used as fuel for production.

The company has had a long-term focus on energy efficiency, improving energy use at Gibson Island by approximately 20% since 1980. This case study looks at how the Energy Efficiency Opportunities (EEO) program has provided a stimulus for IPL to implement *further* energy efficiency improvements by encouraging new assessment methods and more formal energy management processes.

The assessment approach at the Gibson Island facility has been pragmatic and incremental, building on existing site knowledge and using the EEO *Industry Guidelines* extensively. This enabled the company to undertake a fast and effective assessment process identifying significant opportunities using internal resources. Parts of the EEO *Assessment Handbook* and *Energy Savings Measurement Guide* were used as resource material. The simple four-year payback method also proved to be an efficient tool for screening potential opportunities and to quickly identify projects that warranted more detailed investigation. Learnings from Gibson Island are being incorporated into the company's next assessment at Phosphate Hill.

ABOUT THE COMPANY

IPL is the largest supplier of fertilisers and the second largest supplier of explosives in Australia. Based in Melbourne, the company has more than 20 manufacturing facilities and around 4,500 employees globally. It is one of the largest 100 companies on the Australian Securities Exchange.

Nitrogen-based fertilisers are manufactured at Gibson Island in Brisbane and Phosphate Hill in north Queensland, and two sites in the United States.

THE ASSESSMENT PROCESS

LEADERSHIP AND RESOURCES

Safety and responsible environmental management are well-established organisational priorities at IPL. Corporate policies and objectives for environmental management are communicated to staff via the intranet, staff performance reviews and site meetings. Because energy is the biggest single cost at Gibson Island and Phosphate Hill, both sites have energy-specific KPIs and corporate targets. A corporate standard and guidelines for resource efficiency have been drafted. This policy will be the framework for IPL's energy use improvement objectives.

After reviewing the EEO requirements IPL decided at the start of the process to treat the program as a technology issue not just a compliance issue, and to allocate more internal resources to energy management. The company recruited a full-time Energy Engineer to assume responsibility, under supervision of the Development and Energy Manager, for data collection and analysis and coordination of the assessment process. Through establishing this new role, IPL can now meet EEO requirements and significantly improve energy efficiency practices.

OUTCOMES ACHIEVED SO FAR

The opportunities workshops originally identified 130 potential opportunities to improve efficiency at the Gibson Island facility. This list was reduced to 33 following an initial screening based on payback period (less than four years) and technical feasibility. The estimated benefits of these projects, if implemented, would deliver the following energy, greenhouse and productivity benefits:

Energy savings of 0.86 PJ per year (approximately 13% of non-feedstock energy use), primarily from natural gas. This saving represents an equivalent in energy consumption to that of 15,300 vehicles or 17,200 households.

Greenhouse gas emissions (GHG) reduction of around 50,000 t CO_2-e (approximately 9% of total GHG emissions). This equates to the CO_2 uptake by approximately 230 hectares of mature temperate forest.

Productivity improvements include Advanced Process Control (APC) which has resulted in production gains of approximately 5 tonnes per day of extra ammonia by maximising plant operation close to process constraints.

Eight opportunities have already been implemented, saving 0.14PJ per year.

DATA COLLECTION AND ANALYSIS

Opportunities workshops were held with IPL staff from each of the three major plants at Gibson Island – ammonia, urea and granulation. Following the advice in EEO's *Assessment Handbook* (p. 67), the Energy Engineer prepared a background paper on energy use for participants at each workshop. The company already had a good understanding of energy and material flows and was able to use this knowledge to inform its initial data analysis. The information collected for the background paper enabled participants to focus on key areas of energy use within the plant, the financial implications of energy use and its relationship to production. It led to many of the ideas that were raised at the workshop.

Trend data and key metrics for individual plants and the site as a whole (such as GJ/t of production) that were originally collected for the EEO workshops are now regularly updated and provided to management at their weekly meetings. Prior to this, energy use was closely monitored for the ammonia process, but not other parts of the plant. Formal reports were only provided to managers on a monthly basis. The new system requires managers to monitor energy use more closely and to quickly respond to issues as they arise.

ENERGY OVERVIEW

Natural gas makes up around 50% of the cost of a tonne of ammonia so there is a business imperative to manage energy efficiently. Gibson Island consumed around 13 PJ of energy in 2007-08, which was approximately 55% of the total energy used by IPL in Australia. Most of this was natural gas for the manufacture of ammonia (approximately half as feedstock and half as fuel for production).

INVESTIGATION OF OPPORTUNITIES

With a June 2008 deadline for evaluation of all potential opportunities, the team quickly realised that they needed a more streamlined process to prioritise projects and evaluate opportunities to meet EEO requirements. EEO guidance materials provided them with some of the ideas and tools to help them do this.

IPL staff identified 130 ideas at the workshops for the three plants, and these were recorded in a simple spreadsheet. To avoid 'reinventing the wheel', the template for the spreadsheet was taken from the projects register in EEO's *Energy Savings Measurement Guide* (Appendix 12.3). The spreadsheet, which included project status, estimated energy savings, financial benefits and payback period, provided a more formal process than had previously existed for documenting and tracking potential opportunities. Prior to this the only system for tracking projects was the capital budgeting process, which did not include opportunities still in the early stages of investigation. The new tracking system allows all identified opportunities to be documented and investigated over time, and supports internal and external reporting requirements.

Reports required by the EEO legislation focus on opportunities with a four-year payback or better. This proved to be a very useful tool for the initial prioritisation of opportunities because it is easier and faster to calculate than more conventional financial measures (net present value and internal rate of return). Combined with a preliminary assessment of feasibility and whole-of-business benefits, the screening process resulted in a list of 33 opportunities that appeared to be technically feasible and financially viable. Three of these are presented below.

OPPORTUNITIES IDENTIFIED AND INVESTIGATED

ADVANCED PROCESS CONTROL (APC)

APC is computer software that automatically adjusts the operation of the ammonia plant, replacing minute to minute control by the operators. The installation of APC software was already under consideration at IPL, but the EEO process gave it more impetus. APC increases production because it identifies capacity constraints and enables the plant to be run as close as possible to capacity. It also saves energy because maximising production typically reduces energy use per tonne produced. The installation of APC is saving 30,000 GJ of energy and reducing GHG emissions by around 1,500 t CO_2e per year. It had a very short financial payback of less than 6 months. Another benefit is the fact that it collects more accurate and real-time data, which over time will provide further insights into the way that energy is used at the site.

Control Room - Advanced Process Control

"IPL has certainly seen benefits from the additional focus provided by the Energy Efficiency Opportunities program. Energy contributes a high percentage of operating costs for fertiliser manufacture so the company has always placed a high priority on energy savings. Even so, the EEO program has provided an added impetus and enabled us to find further energy and cost savings in an era of tight margins and rising energy costs." – Bernard Walsh, President Global Manufacturing, Incitec Pivot Ltd

The glowing furnace refractory seen through an inspection hatch

REFRACTORY COATING

The first stage in the ammonia process mixes natural gas with steam over a catalyst in a refractory-lined (heat resistant) gas fired furnace. One of the ideas presented by the Ammonia Technologist at the opportunities workshop was a new refractory coating, recommended by an external supplier, that could be used to improve the efficiency of the furnace. The proposed new coating could decrease fuel consumption in the furnace while still maintaining the same production rate by altering the radiation wavelength and thus reducing the amount of energy that is carried away in the flue gas stream. The coating could also reduce thermal nitrogen oxide (NOx) emissions and increase refractory lining life.

The EEO assessment requirements provided the Technologist with a structured process whereby this idea could be properly discussed, considered and evaluated. Because the project appears to offer potential for significant financial benefits, it is now undergoing more detailed investigation. A preliminary analysis suggests that it will have a financial payback of just over a year and the potential to save 60,000 GJ of energy and reduce GHG emissions by around 3,000 t CO2e per year.

A motorised boiler feedwater pump

FEEDWATER PUMPS

Prior to the assessment there were two pumps delivering water to the boilers in the utilities plant, one driven by an electric motor and the other by a steam turbine. The plant operators knew that both pumps needed to be refurbished – this would improve their performance and allow one pump to go off-line – but they were unaware of the full cost implications. The data analysis for the EEO workshop highlighted the financial benefit of running motor driven pumps instead of their turbine driven alternatives. An initial evaluation found that running the steam turbine is often 6 to 10 times more expensive than the motorised pump.

Running both pumps obviously uses more energy than necessary, and also risks production loss if one pump fails (normal practice is to have one pump in reserve for this situation). As a result of the EEO assessment, a better understanding of the financial impact allowed the maintenance schedule to place more priority on the overhaul of these pumps. Both pumps have now been refurbished and the turbine pump is no longer running continuously. The project has a payback of about a year and is expected to save around 60,000 GJ of energy and reduce GHG emissions by approximately 5,000 t CO_2e per year. Another benefit is the improved reliability of the pumping system.

LESSONS LEARNED

TAKE A STAGED APPROACH

IPL have taken a pragmatic and incremental approach to the assessment that has enabled them to 'learn by doing'. They started with relatively simple processes for the identification and evaluation of opportunities, utilising existing knowledge and tools wherever possible, which allowed the company to focus their time on detailed analysis of a relatively small number of projects.

A long list of potential energy efficiency opportunities can appear quite daunting. IPL learned that an efficient and effective solution is to start with an initial screening of ideas to eliminate any that obviously have a payback of more than four years based on first-pass estimates, or appear to be impractical or inconsistent with current business plans. This produces a shorter list of ideas that can then be evaluated in more detail to determine their feasibility.

A similar approach can be applied when quantifying the energy flows within a site i.e. undertaking an Energy Mass Balance (EMB). This can appear to be a time consuming task if it has never been done before. However, IPL suggest that companies start by focusing data collection on their largest energy-using processes. This is likely to deliver sizable, early benefits and help build a case for management's endorsement. It also contributes to better understanding and buy-in amongst shop floor personnel.

ALLOCATE INTERNAL RESOURCES TO HELP BUILD CAPACITY

IPL chose to employ an Energy Engineer, rather than an external specialist consultant, to collect and analyse data and coordinate the EEO process. This has built internal capacity in energy efficiency and allowed for the timely evaluation of opportunities. Consultants are sometimes used for specialised projects, but an internal champion with sufficient time to devote to the EEO process has enabled IPL to access the considerable site knowledge and expertise of existing staff at Gibson Island. Internal expertise has been particularly important because site specific knowledge is crucial to identify opportunities in a complex chemical plant. A full-time project champion is also able to maintain momentum and motivation within the company.

THE BENEFITS OF FORMAL ENERGY MANAGEMENT SYSTEMS

IPL believes that they have benefited from the more formal energy management systems that have been established to meet EEO requirements. Data collection is undertaken at regular intervals and the results reported to management on a weekly basis. This enables them to more closely monitor performance. The formal tracking system, which includes a record of all opportunities, supports more effective project management. Effective tracking means that projects can be revisited when and as circumstances change. It also ensures that good ideas are not lost as a consequence of staff changes, budget constraints or business priorities.

NEXT STEPS

The global financial crisis and continuing drought in much of Australia are expected to contribute to a difficult trading environment for many companies throughout 2009. Within this context IPL will continue to place a high priority on energy efficiency as a business improvement tool to reduce costs and improve plant performance particularly where there are low capital investment costs and early paybacks.

Using the lessons learned at Gibson Island, IPL will complete the initial identification and preliminary assessment of opportunities for Phosphate Hill in 2009. Gibson Island opportunities will also be further investigated to confirm their financial viability and to prioritise implementation.

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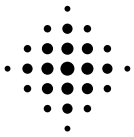

National Framework for Energy Efficiency

ENHANCING AUSTRALIA'S ECONOMIC PROSPERITY

The Department of Resources, Energy and Tourism thanks Incitec Pivot for sharing the information in this case study.
Readers should be aware that this case study outlines key learnings and does not necessarily represent a complete assessment as required by legislation.

Energy Efficiency Opportunities
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The aim of the Energy Efficiency Opportunities program is to increase the uptake of cost effective energy efficiency opportunities by Australian industry through improving the identification, evaluation and public reporting of energy efficiency opportunities by large energy using corporations.