



Industry Case Study

ORICA

Orica has a history of setting and achieving challenging energy efficiency targets. It has a worldwide corporate target to reduce energy use per tonne of product by 15 per cent between 2004 and 2010 and was one of the first signatories to the Australian Government's *Greenhouse Challenge* Program in 1996.

With this background, and as a large user of energy – with an expected 16 petajoules (PJ) to be used globally in 2007 – it was only natural that Orica volunteered in 2005 to be one of 25 trial companies for the Energy Efficiency Opportunities program. At a corporate level, Orica saw the program as an opportunity to assist the company to achieve its 2010 energy reduction target, and to support a 'beyond compliance' approach to energy efficiency legislation.

Orica conducted a trial assessment over a period of six months at the Mining Services site at Kooragang Island in Newcastle NSW, as the site accounts for 80 per cent of Orica's total energy use in Australia. With a diverse range of energy using processes and a fully supportive management team, this site was ideal.

At the same time, the company was required to submit an Energy Savings Action Plan to the NSW Department of Energy, Utilities and Sustainability (DEUS). Conducting an energy efficiency opportunities assessment at Kooragang Island presented the opportunity to meet State and Australian Government requirements and to maximise business benefits at one time.



BUSINESS BENEFITS ACHIEVED SO FAR

The assessment identified over 70 potential energy efficiency opportunities. The implementation of just one of these projects has already achieved:

- energy savings of 140,000 GJ/yr, which is a 6 per cent reduction in non-feedstock energy use across the site; and
- greenhouse gas reductions of 9,520 tonnes of CO₂ equivalent per year.

In addition, 12 other projects have been quantified and are expected to achieve:

- further energy savings of 266,000 GJ/yr; and
- further greenhouse gas reductions of 19,600 tonnes of CO₂ equivalent per year.

The direct financial savings of these 13 projects is likely to be well in excess of \$1,000,000 per year.

With the current increase in production, the company confidently expects the site to reduce energy use per tonne by 5-10 per cent over the next three years.



About the company

Orica is a publicly-listed company based in Melbourne, with operations in 50 countries.

It employs around 14,000 people in four businesses:

Orica Mining Services, Orica Consumer Products, Chemnet and Chemical Services.

The largest energy using sites are Kooragang Island (NSW), Yarwun (Qld), Botany (NSW) and Carseland (Canada).

Energy use at Kooragang Island

The Kooragang Island site consists of an Ammonia Plant, three Nitric Acid Plants and two Ammonium Nitrate Plants. The highly energy intensive Ammonia Plant, which commenced operations in 1969, uses approximately 12 PJ per year, or over 90 per cent of the site's total energy. The plant is currently the most energy efficient of its type and age in the world. Total energy costs for electricity, gas and transport fuel are around \$55 million per year.

Designing the assessment

The assessment was designed to meet the requirements of Energy Efficiency Opportunities and the NSW DEUS Energy Savings Action Plan in a way that used site resources efficiently.

To assist the site, an energy consultant familiar with the company and the site's processes was engaged to work with the assessment team to identify and analyse opportunities.

The aim of the assessment was to develop a series of projects to improve the site's energy efficiency. To achieve this, the company:

- conducted a familiarisation tour;
- engaged staff;
- collected data;
- held an opportunities workshop; and
- conducted preliminary investigations.

The company is continuing to investigate, in detail, energy efficiency opportunities identified during the assessment.

Familiarisation tour

The Site Manager organised a tour for the consultant and representatives of the Energy Efficiency Opportunities program to familiarise them with the site, its processes and people.

Staff engagement

In preparation for the opportunities workshop the Site Manager and Environment Manager built support for the assessment by informing operators and production managers about the assessment. They also identified people with the skills needed for the workshop.

Data collection

Energy use data and production data going back to 1996 was provided to the energy consultant. The consultant then undertook detailed analyses of energy use against production, both for the Ammonia Plant and the site as a whole. X-Y scatter graphs were found to be the most appropriate method for measuring and analysing performance. The consultant also reviewed performance against internal and external benchmarks, including an international benchmarking study on Ammonia Plants.

This data was used to prepare a background paper, which was provided to participants before the opportunities workshop.

Opportunities workshop

A one-day facilitated workshop was held with eight site personnel, two external experts, the consultant, and representatives from Orica's corporate office and the Department of Industry, Tourism and Resources.

Participants in the workshop used a brainstorming process to identify 74 potential energy efficiency opportunities. A quick screening process was then developed and used to rate each of the opportunities against a series of criteria, including financial payback, potential energy savings and resources required for the evaluation.

Preliminary investigation

The consultant then spent a week investigating the opportunities, with the support of site personnel as required. The project team met again to review the results of the preliminary investigation and determine which projects to investigate in more detail.



Orica uses sophisticated plant process control systems to monitor energy use at Kooragang Island



Orica staff identified 74 opportunities, many of which are likely to have a four-year payback or better

Opportunities classification

The project team sorted the 74 initial opportunities into the following four categories:

- **13 opportunities likely to have a four year payback or better.** These projects range in energy savings from tens of GJ per year to over 100,000 GJ, and cost from a few hundred dollars to several million dollars. One of these opportunities has already been implemented, with two others approved for implementation. Detailed investigations, expected to be completed by the end of 2007, will be undertaken on the remaining projects to determine their feasibility.
- **17 opportunities possibly having a four year payback or better.** These are projects that could meet the four year payback criterion for Energy Efficiency Opportunities. Further investigation will be undertaken to confirm the payback threshold of these opportunities and their strategic importance to the business. The investigation of these projects is expected to be completed by December 2008.
- **12 management actions to improve energy management systems on site.** These actions will be progressively implemented over the next two years.
- **32 opportunities considered to be unsuitable for implementation.** The reasons included obvious process, safety or environmental risks; payback periods clearly greater than four years; or projects too similar to those already identified.

Example – Nitrates low fire burner use

The assessment identified that the use of low fire burners in the Nitrates Boilers was a potential opportunity to reduce energy consumption at the site. As a large steam user (145t/hr), the Ammonia Plant has always maintained a steam balance to ensure the optimisation of steam usage. The nitrates area, which is a combination of steam users and steam producers, uses two stand-by boilers to balance the steam demands within the plant operations. The natural gas fired boilers were typically producing just over 10t/hr of steam. As the scale of steam production was low, this area had received relatively little attention. However, a steam balance showed that at least 5t/hr of steam from the boilers was usually being vented straight to the atmosphere.

In 2002, low-fire burners were installed on each of the boilers to reduce the steam produced and then vented. In the event of low steam pressures within the system, the boilers would automatically fire up. The system initially worked well but over time the Operations Team began to run the boilers on their normal settings due to lingering concerns about the reliability of the low fire system.

Reliability concerns were addressed and a steam balance was developed which confirmed the potential benefits of changing one of the Nitrates Boilers to run on the low fire burner. This was implemented in June 2006 and is expected to save approximately 140,000 GJ of energy and 9,520 tonnes of greenhouse gases per year.

As the steam balance was developed other opportunities were identified. As a result, work has commenced on finalising the details of the steam balance to enable further investigation into the feasibility of these opportunities.

Cost Effective Energy Efficiency Opportunities

Description of opportunity	Potential Annual Energy Savings (GJ)	Simple Payback Period (years)
1. Reduce waste steam venting from Nitrates Boilers by fully commissioning the low fire burners (Implemented).	140,000	instant
2. Replacement of steam turbine driven lube oil pumps with electric pumps, as the steam pump generates steam at a pressure that is currently not able to be used.	106,000	0.4
3. Upgrading of Nitrates Boilers control system to enable low fire operation or replacement of Nitrates Boilers	114,000	1.7
4. Insulate exposed piping in the Nitrates Area to reduce heat loss.	21,000	1.4
5. Repair or replace leaking steam traps or piping in the Nitrates Plant.	9,500	1.5
6. Insulate exposed piping on steam systems in the Ammonia Plant.	14,000	1.2
7. Reduced operation of Ammonia Plant Cooling Tower Fans during cooler months.	60	1.2
8. Link Compressed Air Systems to maximise utilisation of efficient instrument air compressor.	160	3.9
9. No. 1 Ammonium Nitrate Plant Scrubber Fan speed control	1,000	1.9
10. No. 2 Ammonium Nitrate Plant Wash Tower Exhaust Fan speed control.	280	3.5
11. Lighting improvement - Ammonia Plant.	100	3.8
12. Removal of lighting on redundant equipment in the Ammonia Plant	3	3.1
13. Lighting improvements - Nitrates Workshop.	4	2.9

Project tracking

Existing project approval and site management systems are being used to monitor progress in the implementation of energy efficiency projects.

To provide an ongoing and visible commitment to energy management, the site established an Energy Steering Committee which is chaired by the Site Manager and includes senior managers from the production, site services, engineering and environment areas. The committee meets quarterly to oversee progress on the implementation of energy efficiency activities and projects across the site. The group will also implement periodic reviews to identify additional projects and evaluate the effectiveness of implemented projects.

Costs and Benefits of the assessment

Direct costs

The direct costs included the consultant's costs for time spent on the assessment and preparing the report, and travel costs for Orica corporate personnel. The total was approximately \$20,000.

The assessment costs were small because the site already had systems in place to monitor energy consumption and production data, as well as a detailed knowledge of the production process and potential energy opportunities.

Indirect costs

The major indirect costs related to the amount of time Orica personnel spent on the process, with an estimated 500 hours spent undertaking the feasibility assessments.

Detailed investigations of the remaining projects identified as suitable for implementation is estimated to require a further 400 hours. The total time involved in the assessment, including the consultant's time, is estimated to be equivalent to around eight months work.

It should also be noted that assessments require ongoing resourcing to ensure that new opportunities are identified, assessed and, if appropriate, implemented.

Direct benefits

The direct financial savings for the 13 projects identified as likely to have a four year payback or better is well in excess of \$1,000,000 per year. With a continued focus on energy efficiency, the site expects to reduce energy use per tonne of product by 5 to 10 per cent over the next three years.

Indirect benefits

The main indirect benefit is that Orica has tested a new approach to assessing energy opportunities and energy management systems that can be replicated across any site within the organisation, regardless of its size. In addition, the learnings can be applied to new capital investments to ensure that optimum energy efficiency is built into these projects at the start, rather than requiring costly upgrade projects in the future.

Lessons learned

Brainstorming to identify opportunities

Participants in the opportunities workshop found the brainstorming process to be an excellent way of identifying a wide range of potential opportunities.

Involving staff

The workshop was attended by the corporate electrical and utilities specialist, site manager, senior plant managers, senior electrical engineer, operations engineers, environmental manager, safety, health and environment advisor, and services manager.

Orica plans to involve production supervisors and shop floor personnel in future workshops to offer different and valuable perspectives on potential opportunities, and to build site-wide support for future assessment activities.

Ranking energy efficiency opportunities

During the workshop, many energy efficiency opportunities were identified but it was difficult to sort these into useful categories that could inform future decisions. A set of criteria, including financial payback, potential energy savings and resources required for the evaluation, were quickly developed and applied, but the ranking did not clearly identify projects that should proceed to detailed investigation.



Orica puts a high priority on the monitoring of machinery to ensure optimum operating efficiency



The preliminary evaluation of projects can be used to recommend which projects to implement, further investigate or not implement

Experience has since shown that applying the following five categories might have been more effective:

1. Small projects that are easy to implement and likely to cost almost nothing.
2. Middle-cost projects (e.g. up to \$500,000).
3. Large scale projects to undergo a feasibility assessment.
4. Projects requiring further process engineering to determine whether they could then proceed to feasibility assessment.
5. Projects which will definitely not proceed due to process, safety or environmental issues.

Once the projects are categorised, whole of business criteria and weighting factors can then be developed during the workshop and used to evaluate the projects during their preliminary investigation. The preliminary evaluation of projects can be used to recommend which projects to implement, further investigate or not implement.

Next steps

The site's Energy Steering Committee meets quarterly to review energy performance, monitor progress on energy projects and prioritise future activities. This committee will continue to investigate opportunities identified during the trial. The projects identified will be reviewed periodically, particularly as business needs and process changes may result in shifting priorities on projects.

To help achieve Orica's *Challenge 2010* targets, a corporate sustainability training package has recently been developed. With over 50 major sites around the world and more than 100 smaller sites, an effective and consistent approach to identifying, prioritising and implementing opportunities is essential. The learnings from this trial have been consolidated into the training package, and the Energy Efficiency Opportunities assessment methodology has been transferred seamlessly into other areas of environmental management such as water efficiency and waste minimisation.

The training is currently being delivered across Orica sites. Feedback from over 50 attendees at recent training courses, ranging from site managers to process operators and tradespeople, has been very positive, with the workshop approach particularly well received.

The Department of Industry, Tourism and Resources thanks Orica for its involvement in the trial to test and develop aspects of the Energy Efficiency Opportunities program, and for sharing its results and the lessons learned. Readers should be aware that this case study is based on a trial assessment and may not represent a complete assessment as required by legislation.

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