



Energy Efficiency Opportunities

CASE STUDY

THIESS' AUSTRALIAN MINING BUSINESS UNIT

THIS CASE STUDY CONSIDERS SOME OF THE KEY CHALLENGES FACED BY A MINING CONTRACTOR IN DEVELOPING A REPRESENTATIVE ASSESSMENT APPROACH FOR EARTHMOVING VEHICLES AND EQUIPMENT ACROSS MULTIPLE SITES.



EEO ASSESSMENT – THIESS' AUSTRALIAN MINING BUSINESS UNIT

Despite having a lean and efficient operating culture, Thies's Australian Mining business unit¹ has, through effective use of the EEO Assessment Framework, found new efficiencies and dollar savings. The assessment also provided a valuable contribution to the company's preparation to meet its future liabilities under the Carbon Pollution Reduction Scheme (CPRS).

As a mining contractor, Thies faced a number of challenges in designing an assessment process that would be both effective and efficient to deliver. For example, unlike most other companies involved in the Energy Efficiency Opportunities program, energy use is not fixed to any single geographic location in Australia. Equipment moved from mine-site to mine-site to meet specific mine-operators' requirements creates

¹ Throughout this case study Thies's Australian Mining business unit will be referred to as Thies's.

unique considerations for the company, in that, operational procedures, terrain, climatic conditions, and timing associated with the commencement and completion of contracts are variable. At the same time there are sufficient similarities in the type of mobile equipment used and the tasks performed to warrant a representative approach² to assessments.

The approach involved a thorough investigation of the use of mobile equipment at various mine sites and decisions and factors influencing energy use.

To ensure that this approach and the subsequent assessment would be rigorous and comprehensive, Thies established a core assessment team to manage the work. Personnel from mine sites were involved at critical points in the assessment process to incorporate their insights and to build support for the implementation of energy efficiency initiatives across all mine sites.

² A representative assessment is an assessment of sample sites, fleets, technologies or processes (that use less than 0.5 PJ) which can be replicated.



BUSINESS BENEFITS ACHIEVED SO FAR

In the financial year 2007/08 Thies used 7.63 PJ of energy, mainly in the form of purchased diesel in mobile equipment.

Thies identified 206 ideas from workshops run at site and management level.

A consolidated list of 46 potential projects was developed based on impact, cost, risk and effort criteria. Of these projects, four were selected to proceed immediately and the remaining 42 remain the subject of ongoing investigation.

The projects being implemented are:

- payload management,
- automating mobile lighting equipment,
- plant idle-time management, and
- turbo idle-down time.

Thies estimates that these projects will deliver energy savings of 150,800 GJ/annum, 3.9 million liters of diesel fuel equivalent to 10,600t CO₂-e/annum and \$3.7 million³. This represents a 1.7% reduction of total energy use with a simple payback period of less than two years.

These projects will yield other business benefits, including:

- improved operational efficiency,
- reduced maintenance costs, and
- a reduction in the number of vehicles required.

In addition, the energy efficiency assessment process has raised the profile of energy efficiency within the business, encouraged sharing of new ideas and improved business practice across all mine sites where the company operates.

³ Price based on terminal gate price for bulk diesel from BP (Brisbane terminal) (www.bp.com) on 11 December 2008 (119.59 c/L less FTC of 38.14).



ABOUT THE COMPANY

Thiess Pty Ltd is a leading mining, construction and services contractor with diverse operations throughout Australia and selected international markets. It is part of Leighton Holdings Limited, Australia's largest project development and contracting group. Thiess' Australian Mining business unit (Thiess) accounts for more than 85% of the group's total energy use.

Thiess contract large-scale earth moving operations to open-cut mining companies. Diesel is used in mobile mining equipment including dump trucks and excavators. The size and scale of the mining operations prompted Thiess to focus its first energy efficiency assessment efforts on its mining business.

The assessment focused on the 12 mine sites where Thiess had operations during the assessment period March to December 2008.

THE ASSESSMENT PROCESS

As a mining services provider Thiess faced two unique considerations in designing an efficient and effective representative energy efficiency assessment process.

- Mining vehicles are moved from site to site according to the specific requirements of clients and timing associated with the commencement and completion of contracts. This means that since Thiess' energy use is not fixed to any single geographic location, site-based assessments on their own would be impractical.
- The central operational task on all mine sites is to transfer overburden and coal or ore from one location to another within the site. This means that potential energy savings opportunities identified at one site are very similar to the opportunities available at all other sites.

This is the core reasoning behind the adoption of a representative assessment.

Thiess designed an approach that involved key stakeholders from all mine sites engaged in identifying opportunities. The approach needed to be rigorous and comprehensive to address key requirements of the EEO *Assessment Framework*. Elements of the approach related to the EEO program requirements are explained below.



CORPORATE LEADERSHIP

In August 2009, Thies released its Core Business Imperatives in which energy efficiency and the implementation of initiatives identified from the EEO assessment process were highlighted as priority areas.

This important strategic planning document highlighted that the EEO assessment was directly aligned with other business priorities, including operational efficiency, utilisation of vehicles, payload management and productivity.

The value of the assessment was clearly communicated by the General Manager through the Thies employee newsletter.

He said:

"If we are able to demonstrate a 1% improvement in our operations as part of the EEO program, that will represent a saving of close to three million litres of diesel and prevent over 7000 tonnes of CO₂ equivalent greenhouse gases being emitted."

Michael Rosengren, General Manger, Thies' Australian Mining business unit

Leadership commitment to saving energy was demonstrated in practice through establishment of the core project team tasked to steer the assessment and deliver recommendations.

THE PROJECT TEAM

Thies established a combined corporate and business team to facilitate and drive the energy efficiency assessment. The team met on a regular basis and contributed to the design and key decisions made throughout the assessment.

The team members and their key responsibilities were:

- *Energy and Greenhouse Manager (Thies Corporate)* – accountable to the Board for ensuring that all legislative requirements were met in a way that was efficient to deliver and optimised business outcomes. The key tasks were to develop the Assessment and Reporting Schedule, design the representative assessment approach and manage EEO assessment workshops for staff.
 - *Sustainability Manager (Thies' Australian Mining business unit)* – responsible for facilitating implementation of the process. The key tasks were to provide input to all aspects of the assessment, drive the implementation of the identified initiatives and develop the plan to communicate assessment outcomes.
 - *Energy Efficiency and Greenhouse Specialist (Thies' Australian Mining business unit)* – this new role was established in July 2008 with key tasks to provide overall support for the assessment and the implementation of initiatives at site level.
 - *Senior Business Analyst (Thies' Australian Mining business unit)* – gathers and analyses energy and production data for the assessment. This role includes ensuring that data analysis is communicated in ways that are easily understood at site level by a wide range of personnel including supervisors and operators.
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DATA COLLECTION AND ANALYSIS

The starting point for the energy efficiency assessment was to develop a background paper for distribution to all participants. Developed by the project team, the paper provided critical data related to energy use.

The background paper included:

- high level production and energy data including graphs showing diesel consumption relative to production output,
- specific data associated with mobile equipment transporting coal and overburden, showing both actual and relative performance across all site operations,

- open questions about the data to encourage consideration of potential energy efficiency projects by staff prior to workshop attendance, and
- an update on new technology options such as alternative fuels and hybrid trucks.

The background paper was a crucial preparatory document as it ensured that representatives from all mine sites were able to review current operational data and suggest energy efficiency improvement projects. It was also central to facilitating a representative assessment approach.

OPPORTUNITIES IDENTIFICATION WORKSHOPS

Thiess held two one-day workshops as part of the assessment. The primary objective of the workshops was to identify viable energy efficiency improvement projects.

The first workshop was held at a Queensland mine site considered 'representative' of all other mine sites because mobile equipment, and the way it is used, is similar to that of all other Thiess mine sites. Participants included site-based operators from across functional areas, including planners, operators, maintenance personnel and site management. The senior business analyst from head office was closely involved and presented site-level data.

The major output from the site workshop was a list of potential opportunities generated by small groups prior to a plenary session in which the top ten opportunities from each group were presented and discussed.

The second workshop, held in Thiess' head office in Brisbane, involved all key head office technical staff together with operational managers from six of the largest mine sites. The workshop was opened by the General Manager who clearly stated the importance of energy

efficiency to the business and its alignment with core business objectives.

Participants were split into two groups and asked to list all potential opportunities. Following this brainstorming process, the opportunities identified by the groups were consolidated and cross-checked against the list developed at the site workshop.

The validity of the representative assessment approach was demonstrated by the similarity between opportunities identified at the site and those identified in the management level workshops. In total the two workshops generated 206 ideas some of which were the same.

A final and critical component of the second workshop was a planning session to identify how best to approach implementation at a site level. Considerations included:

- the resources required at site level to support project implementation,
- the role and support to be provided by corporate staff, and
- ways to more effectively share learning about the implementation process across all sites.

DETAILED INVESTIGATION

Following the site and Brisbane workshops, an internal focus group was formed to review and rationalise potential projects. The group consisted of the Plant Manager Infrastructure (Queensland), Manager Operations Support, Manager Technical Systems, Energy and Greenhouse Specialist, Sustainability Manager and an Area Manager.

The 206 ideas were filtered to remove duplicates and those that would not produce a significant improvement in energy efficiency. This yielded a consolidated list of 46 potential energy efficiency improvement opportunities ranked and scored according to the following criteria.

Impact: Higher score for greater energy and cost saving

Cost: Higher score where implementation costs are low

Risk: Higher score where implementation risk is low

Effort: Higher score where required implementation effort is low

The outcome was a list of ten initiatives that achieved a score of 75% or greater. These were further investigated to determine the feasibility of implementation and to identify where implementation might already have commenced.

The ten were then reviewed in more detail with a focus on identifying alignment with business objectives and the ability to quantify the potential savings to within the required $\pm 30\%$ accuracy. These opportunities were further scoped and business cases developed before presentation to the Leadership Team for approval to proceed. Out of this detailed investigation four initiatives were selected.

This ranking process ensured that implementation of some key projects would commence quickly. It demonstrated practical benefits to all those involved in the assessment. The projects not selected for implementation will undergo further detailed investigation throughout 2009. The status of the opportunities is shown in the table below.

Thiess implemented a number of projects because they were clearly good business practice. However it was not easy to accurately estimate the resulting energy savings. This was because of the many variables impacting on energy use at different sites over time. The effort to quantify those savings was deemed to be greater than the value of the savings. These opportunities have been implemented but not reported.

In the future, when both energy use and factors impacting on energy use are better understood, opportunities implemented may be able to be measured and reported on as a total saving.

Status of opportunities	Number of opportunities	Estimated energy savings GJ p.a.
Outcome of assessment	46	150,800
Business response		
under investigation	38	-
to be implemented	3	145,900
implementation commenced	1	4,900
implemented	0	-
not to be implemented	4	-

OPPORTUNITIES IDENTIFIED AND INVESTIGATED

1. PAYLOAD MANAGEMENT

Payload management will ensure that each dump truck carries the optimum tonnage of material to increase fuel efficiency and, in some cases, reduce the number of trucks required to complete tasks.

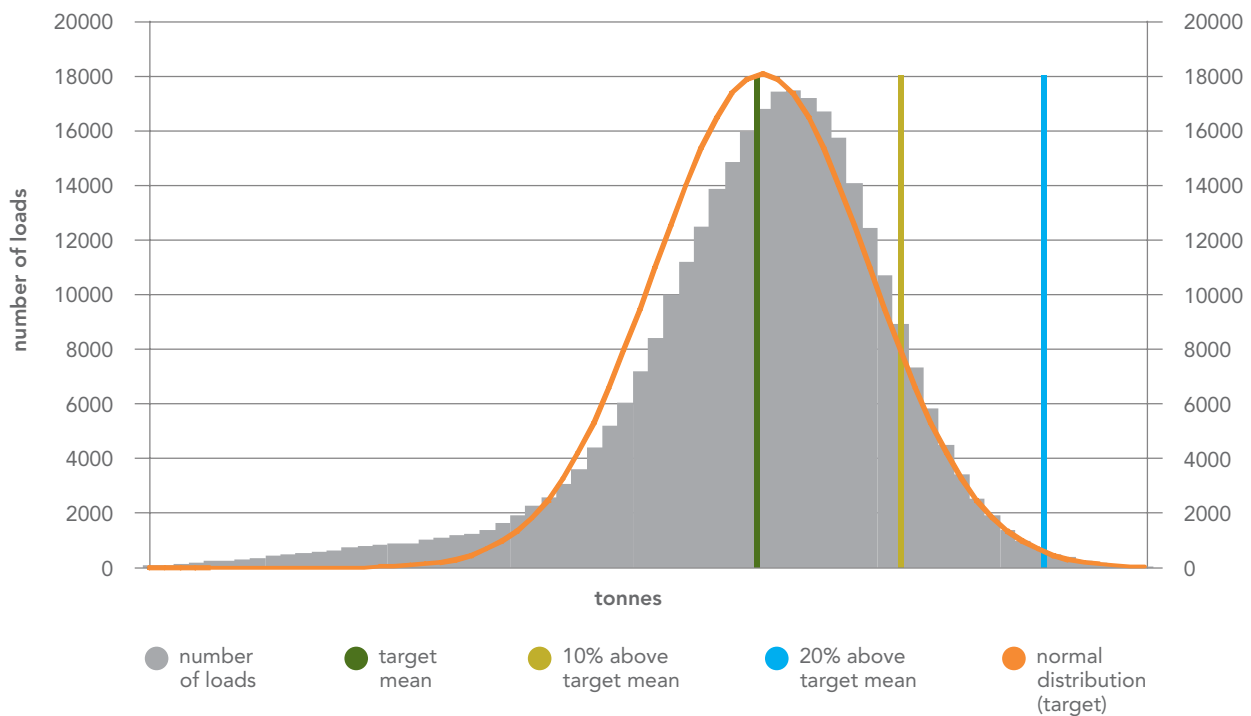
The assessment highlighted that the biggest impediment to improving payload management was that accurate data was not being consistently reported to operational personnel in a timely manner to enable frequent and timely payload adjustments.

By way of example, the graph below shows the payload distribution for a particular class

of dump truck. The payload is measured as the weight (in tonnes) of material carried by the truck. If the truck is under-loaded then more diesel is required to transport the material being carried. If the truck is overloaded then truck warranties may become void and maintenance costs increase due to additional wear and tear on the vehicle.

The graph demonstrates the potential to reduce diesel use by having trucks more frequently loaded to the set target level. This type of analysis was used in the assessment process to compare performance across sites. It provided the basis to identify specific actions required to be taken on each site to improve energy efficiency performance.

PAYLOAD DISTRIBUTION





The following key initiatives were identified and will be implemented across all Thies' mining operations:

- daily payload data will be more frequently downloaded and reviewed,
- the actual versus the targeted payload will be communicated to operators more frequently,
- supervisors will ask truck operators for payload data more frequently, and
- senior management will review payload performance regularly.

The availability of timely and accurate data, clearly articulated targets and ongoing feedback are central to achieving the potential energy savings identified.

The estimated energy saving from the implementation of this project across all Thies sites is 117,300 GJ/annum with an investment return of less than two years. Additional project benefits include reduced fleet size and maintenance costs.

2. AUTOMATING MOBILE LIGHTING EQUIPMENT

Thies runs 24-hour operations and good lighting is essential to support safe and efficient work practices. Due to the geographic spread and changing location of operations, diesel powered mobile lighting units are used. This project was identified by personnel in both workshops. It involves fitting automated systems to the lighting plants to ensure that they only operate in low light conditions. The estimated diesel saving is 165,000 litres/annum (6,400 GJ/annum) with an investment return of less than two years.

Other benefits from this project include:

- a reduction in operator labour time and light vehicle diesel use since personnel no longer need to travel on the site in order to manually turn the lighting units on and off,
- improved safety due to a reduction in the potential for light vehicle accidents with heavy vehicles, and
- reduced maintenance and longer operational life of the lighting units.

3. PLANT IDLE-TIME MANAGEMENT

The assessment identified that there are several situations in which vehicles idle unnecessarily due to the influence of driver behaviour and logistical planning. For example, when drivers change over between shifts or if delayed in loading up due to bottlenecks in the mining process, they tend to idle the vehicle during the wait. To reduce unnecessary idle-time, Thiess collected idle-time data from the Timemaster system for each piece of equipment during pre start meetings, and provided direct feedback and reinforcement to crews, including a comparison of performance across shifts.

The estimated energy saving from the implementation of this project across all Thiess' sites is 22,200 GJ/annum with an investment return of much less than two years. Many of the savings will come through improved production planning which will minimise fuel use and ensure skilled operators spend more time working to meet production objectives. It means too that less equipment is required to meet production targets.

4. TURBO IDLE-DOWN TIME

Original Equipment Manufacturers (OEM) supply vehicles with a pre-determined idle setting. Idling vehicles prior to shutting them down protects the turbo diesel engines by preventing overheating. Thiess contacted OEM to determine whether a shorter idle time would be acceptable for the conditions in which their vehicles operate. This led to an agreement with OEM that idle-down time could be reduced from five to three minutes.

Turbo idle-down time was first identified under the Greenhouse Challenge Plus program and trialed at a few sites in Queensland. Under the EEO program the results were reviewed and a decision taken to implement this initiative across all operating sites.

The potential saving, which involves no capital outlay, is estimated to be 127,000 litres of diesel/annum (5,000 GJ/annum) worth approximately \$97,800⁴ based on 250 pieces of equipment.

⁴ Price based on terminal gate price for bulk diesel from BP (Brisbane terminal) (www.bp.com) on 11 December 2008 (119.59 c/L less FTC of 38.14)



LESSONS LEARNED AND REMAINING CHALLENGES

CAREFUL ASSESSMENT PLANNING CAN LEAD TO SIGNIFICANT BENEFITS

Thiess carefully planned its assessment to meet key requirements of the EEO program's *Assessment Framework* and optimise business outcomes. The representative assessment approach was successful because it:

- accounted for the nature of the operations,
- involved relevant people at the right time,
- had the support of senior management,
- was adequately resourced - engaging corporate and business unit personnel in the assessment team, and
- had the buy-in of key personnel at site level.

EFFECTIVE PEOPLE ENGAGEMENT IS KEY

Since the Thiess assessment used a representative approach it was important to ensure the right people were involved at the right time. For example, senior management were engaged early to ensure adequate resources were allocated to achieve the outcomes required. Site-based staff were involved in the site workshop to ensure their perspectives were identified prior to the head office workshop with site managers and corporate staff. Now that the opportunities are being implemented, shift supervisors and drivers on all sites are directly involved in reviewing operational and energy data on a daily basis.

COMMUNICATING DATA CLEARLY IS CRITICAL

The ongoing monitoring and reporting on energy and production data within Thiess is a priority. Having the right data is important, but it is equally important to communicate that data in forms that employees at different levels can understand and directly relate to their work. The opportunities identified for implementation provide a focus for reporting energy efficiency performance which is now communicated on a regular basis across the entire organisation from operational staff through to senior management.



NEXT STEPS

To better track energy use and greenhouse gas emissions across all sites, Thiess established a software tool called GEEMIS - Greenhouse Emissions Energy Management Information System. In addition, a greenhouse and energy specialist was appointed to oversee the implementation of the four opportunities across all mine sites. Opportunities generated by the EEO assessment will form the start of an emission abatement cost-curve which Thiess will undertake over the next three to four months as preparation for the introduction of the Carbon Pollution Reduction Scheme.

A major benefit of the representative assessment approach is that identified opportunities are 'transferable'. That is, as well as incorporating the opportunities into existing operating procedures and through their 'back-to-basics' operator training program, whenever Thiess commences work on a new mine, those initiatives will be implemented from the outset.

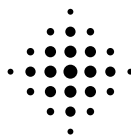
"We see the energy efficiency assessment that we have undertaken as a catalyst for improving our culture of energy and emissions management across the mining business unit. It has provided a renewed focus on our business improvement process, and provided additional strength by turning the focus on measuring the effort and the monetary result of energy savings. The assessment was embraced by staff with openness and enthusiasm and perceived as an important measure to reduce the company's resource use and minimise our carbon footprint. It represents a valuable contribution to our preparation for when the Carbon Pollution Reduction Scheme commences in 2010."

Gabriele Sartori, Energy and Greenhouse Manager, Thiess' Australian Mining business unit





Australian Government
**Department of Resources,
Energy and Tourism**



National Framework
for Energy Efficiency

ENHANCING AUSTRALIA'S ECONOMIC PROSPERITY

The Department of Resources, Energy and Tourism thanks Thiess' Australian Mining business unit for sharing the information in this case study. Readers should be aware that this case study outlines key learnings and does not necessarily mean that the Department has verified that the assessment has met all legal requirements.

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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.