CADDET energy efficiency
IEA / OECD

Mining company implements energy management system

Energy management in a mining company

Summary

An innovative energy management program has been successfully implemented at Mount Isa Mines, Mount Isa. Situated in Australia's north-western Queensland, remote from any electrical grids, Mount Isa Mines, owned by M.I.M. Holding Ltd, relies on electricity generated through its own two power stations. In 1988-1990 the company was faced with a pressing requirement to reduce both operating costs and carbon dioxide emissions. As a result, Mount Isa Mines adopted a comprehensive energy-efficiency policy, which has resulted in annual savings of over AUD 3 million and more than AUD 26 million in deferred capital expenditure with total investment costs of AUD 2.86 million.

Highlights

- **Annual energy consumption reduced by approx. 36%**
- **Annual savings of over AUD 3 million**
- **CO_2-emission reduction of 150,000 tonnes**

The Mount Isa Mines complex at Mount Isa, Queensland.

Aim of the Project

In 1988-1990 the Mount Isa Mines operations of M.I.M. Holdings Ltd was forced to re-examine its operational procedures to optimise performance and reduce operating costs, due to increased market competition in a period of low metal prices. Moreover, Mount Isa Mines was faced with energy constraints because of a continuing increase in power use. At the time Mount Isa Mines provided power for two mines at Mount Isa with an additional mine being developed 20 kilometres away and also supplied power for the local electricity distribution system. Maximum power demand had almost reached the total generating capacity. With overall power demand still increasing new generating capacity would soon be required. However, the company did not want to spend millions of dollars on extra generating capacity. Moreover, load shedding was not seen as a viable option since this would result in reduced production capacity and increased unit costs in a tightening market. Instead, the situation was approached with a company-wide focus on energy management.

The Principle

In the assessment of energy management strategies, considerable efforts had already been made to improve efficiency in the smelting section of the mines by waste-heat recovery for power generation. The main focus was therefore not on surface activities but on underground operations, since this section was mainly responsible for the growing load demand of the mines.

In 1991 Mount Isa Mines adopted an energy-efficiency policy with the initial focus on reducing the energy consumption of various appliances, such as the mines' ventilation fans, de-watering pumps, subterranean cooling system, and skip hoisting. Subsequently, a computerised energy management system was installed to monitor and control most of the energy-related functions of the operational system.

The Situation

A number of ventilation fans are operated in the mines to provide the necessary ventilation. Twelve large fans on the surface provide the main ventilation at all times. Prior to the improvements the fans' power consumption totalled 14 MW. Air flow is now reduced during periods when miners were in crib rooms, during shift change or prior to blasting, typically up to 8 hours each day. Air-flow reduction was achieved by changing the fan-blade pitch angle from 32° to 7°. The energy use for each fan was consequently reduced from 1.56 to 0.5 MW. Moreover, approx. 1,000 small fans with an electrical load of 11 MW are used to circulate the underground air. Ripple-frequency receivers were fitted to the local starter of each fan to control its operation. Ripple-control pulses stop the fans automatically at the end of each 12-hour shift. The fans are manually restarted when required by the miners using local start buttons.

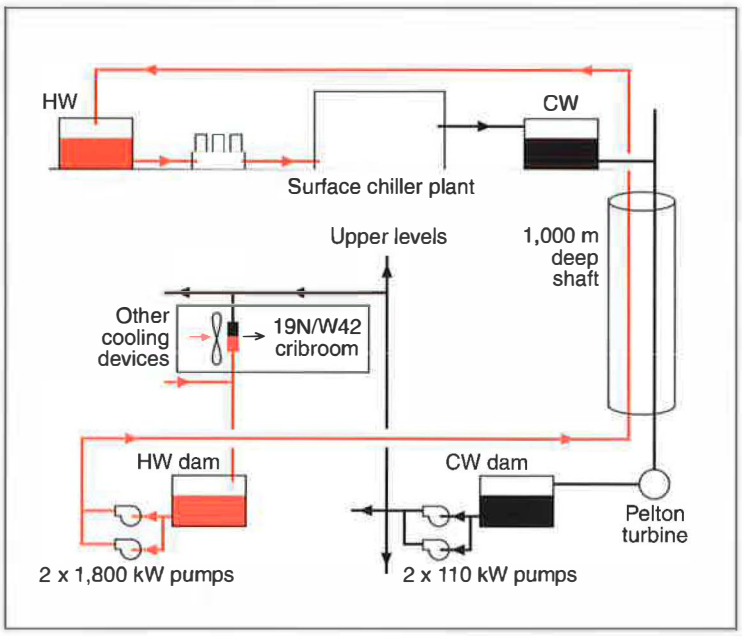


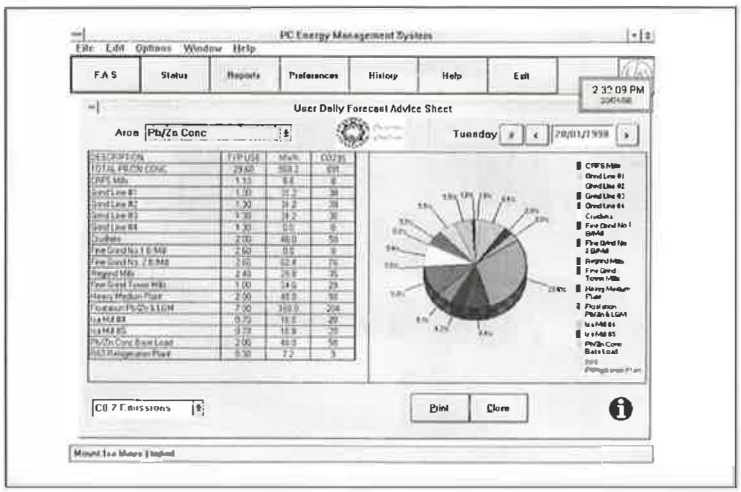
Figure 1: Schematic of the chilled-water installation.

Another issue involves the accumulation of water in the mines' sumps. Prior to the energy management program an average of 11 pumps operated simultaneously in five pump stations to remove this accumulated water. The system operated poorly and was unstable. To remedy this situation pump controls were connected to the mines' control system. One pump in each pump station is now operated continuously, to keep the water level low and reduce the need to start up other pumps when a sudden inflow of water occurs. An average of six pumps now operate at any given moment. This measure has reduced energy needs by at least 5.8 TJ annually and maximum demand by at least 3.6 MW.

Underground rock temperatures at Mount Isa reach 60°C. Cooling of the subterranean areas was achieved by the reticulation of chilled water. However, approx. 11% of the cooling effect of the water was lost in the vertical pipe connecting the surface with the underground cold-water storage dam. To correct this situation, a Pelton turbine generator was installed between the pipe discharge and the cold-water storage dam (Figure 1). The water's kinetic energy is used to drive the turbine generator, simultaneously reducing the water temperature. The output of the turbine generator is 1 MW, a useful addition to the electricity supply.

In Mount Isa Mines' copper and lead mines two skips per mine are used to lift ore to the surface. Changes were made to the hoisting sequence so that both cages do not accelerate simultaneously. Introduction of this measure led to peak-load reduction and has deferred the need for additional generating capacity.

Figure 2: The PC Energy Management System displays emission data.



A PC-based energy management system (EMS) was installed to improve energy management and reduce carbon dioxide emissions. The system allows controllers of the main electrical loads to forecast plant operation at half hour intervals for a period of 7 days. In addition, controllers at both power stations enter forecasts of generating capacities into the energy management system. An extensive local area network, covering a surface area of over 25 km^2, collects the data for processing in a central database. Energy-consumption, energy-cost, power-use, and emission forecasts are calculated from the data and transmitted to plant operators, power station staff, and the energy management section. Comparison of generation and load forecasts minimises the need for load shedding and the use of Mount Isa Mines' 33 MW diesel-fired gas turbine set. Figure 2 shows a typical display of the PC Energy Management System, in this case CO_2 emission. Similar displays are continuously available for all areas and for different parameters. Particular plant items can be selected, highlighting the corresponding representation on the display chart.

The Company

M.I.M. Holdings Ltd is an Australian-based international mining and mineral processing company whose core products comprise copper, gold, zinc, lead, silver, and coal. The Mount Isa mining and smelting complex, on which the company has been built, produces copper, which is refined at the company's refinery in Townsville, lead and silver, smelted and refined by the company in the United Kingdom, and zinc, which is sold as concentrate.

Economics

The investments in plant for the described energy-efficiency measures amounted to AUD 2.56 million with an additional AUD 300,000 for the PC-based energy management system. Returning annual savings of over AUD 3 million, the program has saved more than AUD 26 million in deferred capital expenditure since its implementation. The total investment costs were paid back in less than a year. The main energy sources will be changed to natural gas during the last two years of the century. It is estimated that 1999/2000 emission levels will be at least 40% lower than those emitted during 1990-1991 and that accumulated greenhouse gas emissions for the period from 1990-1991 to 1999-2000 will be reduced by over 2 million tonnes.

Host Organisation

M.I.M. Holdings Ltd
Energy Management Dept
Mount Isa QLD 4825
Australia
Tel.: +61-7-47443512
Fax: +61-7-47443991
Contact: Mr B. Budd,
Principal Engineer

Information Organisation

CADDET Australia
PO Box 131
Deakin West ACT 2600
Australia
Tel.: +61-2-62604102
Fax: +61-2-62853583
Contact: Mr Hugh Saddler

Please write to the address below if you require more information.

CADDET energy efficiency IEA * OECD

Swentiboldstraat 21,
6137 AE Sittard,
PO Box 17, 6130 AA Sittard,
The Netherlands,
Telephone: +31-46-4202224,
Telefax: +31-46-4510389,
E-mail: caddet@caddet-ee.org
Internet: http://www.caddet ee.org

* IEA: International Energy Agency
OECD: Organisation for Economic Co-operation and Development

IEA

The IEA was established in 1974 within the framework of the OECD to implement an International Energy Programme. A basic aim of the IEA is to foster co-operation among the 24 IEA Participating Countries to increase energy security through energy conservation, development of alternative energy sources, new energy technology, and research and development (R&D).

This is achieved, in part, through a programme of energy technology and R&D collaboration currently within the framework of 40 Implementing Agreements, containing a total of over 70 separate collaboration projects.

The Scheme

CADDET functions as the IEA Centre for Analysis and Dissemination of Demonstrated Energy Technologies. Currently, the Energy Efficiency programme is active in 15 member countries.

This project can now be repeated in CADDET Energy Efficiency member countries. Parties interested in adopting this process can contact their National Team or CADDET Energy Efficiency.

Demonstrations are a vital link between R&D or pilot studies and the end-use market. Projects are published as a CADDET Energy Efficiency 'Demo' or 'Result' respectively, for ongoing and finalised projects.

This brochure is printed on 100% chlorine-free bleached paper *March 1998*