T-Man Lighting Tower – Shinning a Light on Safety

Thiess

The Problem

Thiess projects operate 24 hours per day, 7 days per week. This requires 240-volt industrial lighting towers be installed at an active mine site to illuminate excavation pits, dumps, go-lines, maintenance pads, haul roads and other working areas.

At any given time, more than 60 separate lighting towers are in operation across a radius of up to 50km. Each lighting tower requires continuous field monitoring and maintenance, resulting in high-levels of interaction with towers by maintenance and operational staff.

Thiess' Plant and Asset Operations Manager, Brian Edwards, identified a number of risks and opportunities for improvement, including:

- Reducing electrician's exposure to potentially harmful gases when replacing blown globes
- Minimising maintenance personnel exposure to high-voltage circuits when monitoring daily oil and fuel levels
- Decreasing the interaction between light and heavy vehicles with high-voltage towers during tower switch-on, and off, during shifts
- Increasing energy efficiency and extending the life of lighting plants
- Reducing maintenance travel times across a site.

Figure 1T-Man Lighting Tower Conversion

The Solution

To address each problem, Brian first analysed and monitored maintenance data, including:

- The number of trips maintenance personnel made to towers daily
- The regularity in which lighting towers were returned to the Mackay warehouse for repair
- The lighting maintenance schedules
- The safety risks associated with in-situ maintenance.

Brian's research identified the existing 3-head, 240V Allight metal halide lighting tower could be improved by replacing the 240V AC metal halide lights with his T-MAN 24V DC LED light system.

The T-MAN LED Lighting Tower is an innovation design that:

- Eliminates bulb replacement
- Reduces high voltage levels
- Increases lighting output
- Reduces fuel usage and carbon emissions
- Minimises servicing and refuelling frequency.

Figure 2 240V Lighting Output

Figure 3 T-Man 24V Lighting Output

The T-Man lighting tower was designed and developed in-house by Thiess staff using existing lighting plant components including frames, axles, wheels, and hydraulics, providing a cost-effective solution. The team partnered with HAYNES Group and Auxilium Systems to provide additional workshop facilities, source components and materials, and to provide satellite tracking software with remote capabilities via phone and PC application to enhance the conversion.

A trial of the T-MAN lighting tower was conducted at the Lake Vermont project. Testing was focused on successfully converting the existing Allight tower to a 24V LED lighting tower. The test also needed to prove the T-MAN solution was a safe and, cost effective alternative.

The team then tested the implementation of Remote Satellite Tracking software, which enabled maintenance crews to remotely monitor the lighting plants. The software significantly reduced staff interaction with the towers, including minimising light and heavy machinery interaction, while increasing operational efficiency. It provided:

- Remote start/stop function - eliminating travel to and from lighting plants
- Remote monitoring - eliminating travel to and from lighting plants
- Reduced servicing and refuelling frequency – minimising in-pit interaction between service trucks and mining fleet
- Satellite tracking software identifying the exact location of every lighting tower onsite – minimising frequent and un-warranted relocation of lighting towers by staff.

Following the successful testing and implementation of the T-MAN lighting tower at Lake Vermont, work began on converting 160 lighting towers to the T-MAN tower across Australia and Pacific operations. Only 10 of the former 240V format remain in use across Thiess' operations. The team are now exploring opportunities to apply the technology at our Botswana, Canada, Chile, Mongolia and Indonesia projects.

The hierarchy of control was applied in the following manner:

Elimination

- Satellite remote start/stop function and satellite remote engine/system monitoring. Operators and fitters no longer had to drive to each lighting tower during their shift. This eliminated in-pit light vehicle and heavy vehicle interaction.
- Mechanically operated stabiliser legs and mast towers were replaced by electric over hydraulic cylinders. This eliminated physical effort to raise or lower components while providing an additional level of protection for manual handling.

Substitution

- High voltage 240V electrical components and systems were substituted by low voltage 24V components and systems.

Engineering

- Engineered a compact 24V power and lighting system that uses minimal fuel and only requires refuelling and servicing once per month. This minimised the exposure of service personnel to hydrocarbons and reduced light vehicle and heavy vehicle interaction.
- The T-Man lighting plant is more compact reducing the load weight on a trailer allowing the lighting tower to be safely towed using a light vehicle.
- Strategically mounted electric controls activate electric over hydraulic stabiliser legs and masts, negating exposure of personnel to high pressure hydraulic components.

The Benefits/Effects

A range of benefits were able to be realised from implementing the T-MAN lighting towers, including:

- Removing maintenance staff and operator exposure to high-voltage circuits by introducing low voltage circuits and components
- Increasing lighting efficiency to 20,000 hours by introducing LED lights
- Minimising exposure to glass globes and harmful gasses when changing blown lamps
- Reducing the interaction between light and heavy vehicles and towers by installing remote satellite tracking for a range of tasks:
    - Starting-up and shutting-down machines
    - Maintaining units

    - Detecting mechanical problems
    - Monitoring oil and fuel levels monthly
    - Monitoring service schedules.

- Improving visibility and working conditions by allowing mine supervisors to safely activate and de-activate lighting towers across their mine site

- Reducing manual-handling incidents by providing hydraulically operated legs and masts instead of manual levers and winches

- Separating hand controls from hydraulic valves and hydraulic hoses, reducing exposure to high-pressure hydraulic fluids

- Improving visibility in dusty environments, particularly around stockpiles

- Increasing operational efficiency by using more efficient LED lighting and smaller engines in the T-MAN lighting tower

- 75% reduction in fuel consumption and CO_2 emissions

- Refueling frequency reduced from every 3 days to 12 times per annum

- Increasing mobility of lighting towers via light vehicles, by installing smaller and lighter engines and alternator components in the T-MAN

- Reducing manufacturing costs with conversions taking place on lighting plants close to the end of their service life

- Increasing long-term financial benefits from reduced fuel consumption, part replacements and maintenance.

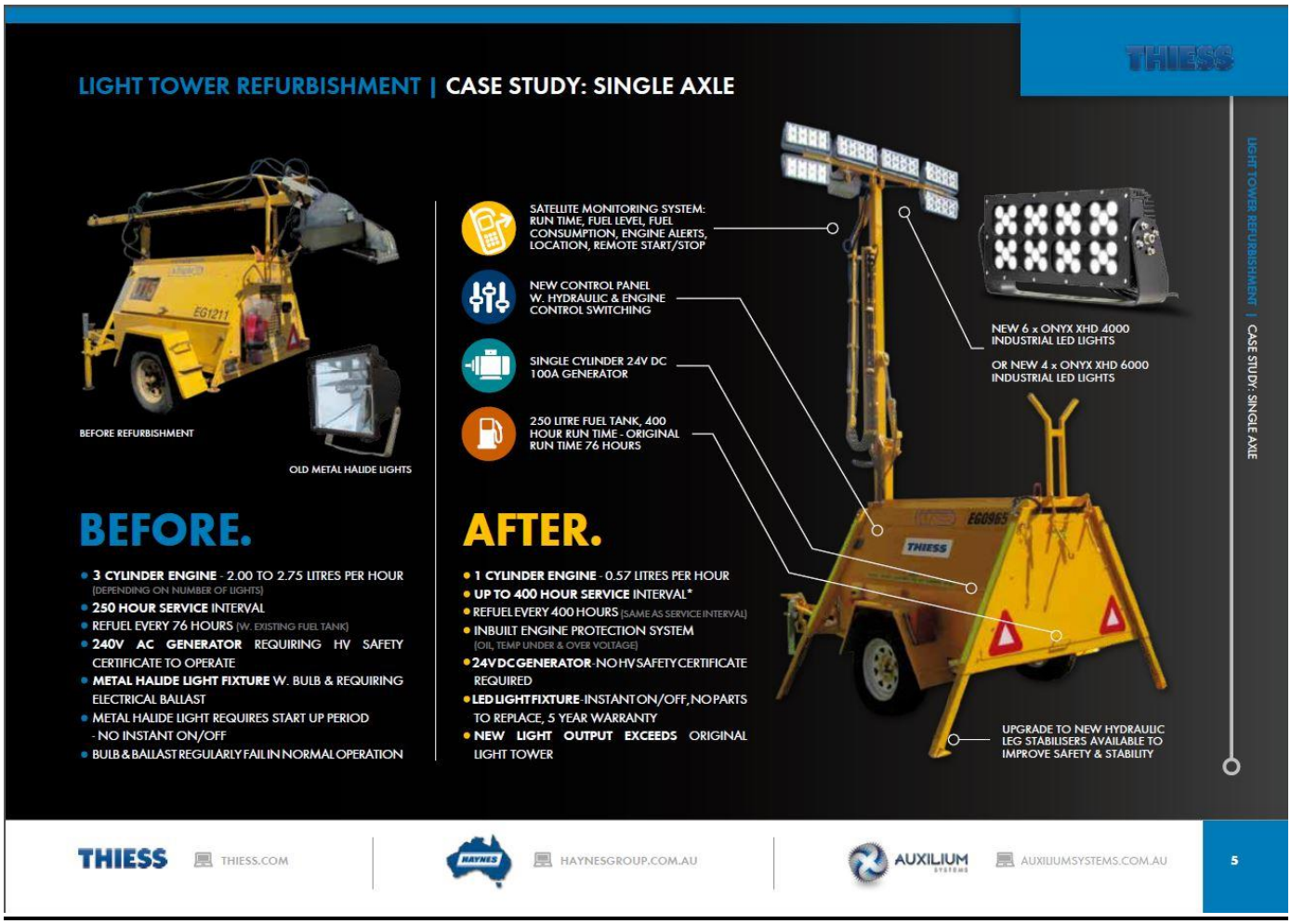

Figure 4 T-Man Lighting Tower Case Study Single Axle Conversion

Transferability

The T-MAN lighting tower can be used across the mining industry where similar lighting systems exist. Converting lighting plants at the end of their service life brings long-term financial benefits, including:

- Improving fuel consumption
- Reducing parts and maintenance costs
- Minimising personnel exposure to high voltage levels.

Innovation

Although LED lighting towers are in use across the mining industry, this is a design first as there was no equivalent product available on the market when Brian first developed this idea in-house. By using existing components and repurposing lighting towers at the end of their useful

life, the team has delivered a cost-effective innovation not seen in the industry before. The T-Man lighting tower improves safety conditions, reduces Thiess' environmental footprint and inspires personnel to challenge business-as-usual activities. By minimising maintenance personnel exposure to high-voltage circuits and decreasing interaction between light and heavy vehicles, the T-Man lighting tower has already achieved strong safety results. This innovation can be universally adapted for other equipment including both fixed and mobile plant machinery. The team is currently investigating using this technology in the future for remote monitoring of in-pit dewatering pumps. This initiative is an excellent example of an innovation that has made our mining operations safer and smarter and will continue to deliver future benefits.

Approximate Cost

Initially $294,900 was invested to convert 20 lighting plants to the T-Man lighting plant design. Total fleet refurbishment for the 160 lighting plants required an additional investment of $2,424,000. Overall total savings per annum are anticipated to be $5,399,040, recovering the additional investment costs within six months.

Converting the lighting towers has also saved approximately 3.2 million litres of diesel and 8.5 million kilograms of CO_2 emissions annually. The team is currently producing a monthly carbon footprint report to monitor the lighting tower's ongoing environmental performance.