The customer challenge – Terex Trucks

Based in Motherwell, Scotland, Terex Trucks has been building robust articulated and rigid dump trucks for extreme hauling applications since it was established in 1950. The company manufactures a range of products in both categories at this site, of which 95% are exported.

Following the company’s acquisition by Volvo Construction Equipment in 2014, Terex Trucks was faced with a challenge to meet the corporate standards of their new owner. For Volvo CE, three key values underpin their work: safety, quality, and the environment.

This renewed focus on the environment created a strategic imperative for Terex Trucks to drive towards becoming a carbon neutral facility.

The first objective for the Terex Trucks management team was to be able to accurately map the energy consumption across the site and implement plans to meet stringent corporate metrics, for example idle energy consumption, kW/h per unit manufactured, and kW/h per man hour.

This prompted a number of projects to investigate how to measure and reduce current energy usage. One priority area was to look at the efficiency of the lighting across the Terex Truck’s facility.

Terex Trucks evaluated a number of lighting options and were particularly impressed with the rigorous and professional assessment of their requirements by lighting designer and manufacturer Carbon Reduction Technology (CRT).

The operational environment at Terex Trucks meant existing lighting control technologies were either unreliable, problematic or simply impractical to implement. The vast steel frame structures created problems for wireless technologies and installing a wired control system was simply unrealistic.

CRT therefore concluded a powerline communication (PLC) system was the only viable alternative for this environment. CRT decided to write their own PLC market requirement and if necessary invest in developing their own solution. Fortunately the Carbon Trust introduced CRT to enModus and the technology and market fit was ideal. A joint proposal submitted by CRT and enModus was accepted by Terex Trucks and the lighting project was launched.

The combination of the new CRT HBX LED luminaires combined with the enModus Smart Lighting Control system has resulted in total energy savings between 92–97% (depending on work area) with significantly improved lighting quality and accurate ongoing monitoring of the energy consumed by each light. These results dramatically exceeded Terex Trucks’s expectations and they have now placed orders to retrofit further CRT LEDs with enModus Smart Lighting controls to other parts of their facility.

“Our ultimate goal is to become a carbon neutral facility. We believe we can utilise enModus technology to monitor every energy consuming asset throughout our facility and create a complete energy map of our operations. This will enable us to make better decisions on how these assets are used in the production process and control them to minimise the energy usage and carbon footprint in the future.”

Paul Hudson, Operations Director, Terex Trucks
The approach - enModus and CRT

The Carbon Trust has been supporting enModus with business incubation services over the past two years through the Department of Energy and Climate Change’s Energy Entrepreneurs Fund. In 2010, the Carbon Trust had also incubated CRT. The Carbon Trust introduced enModus to CRT in 2015 to explore collaboration opportunities.

enModus provides innovative smart building solutions, based on a patented new PLC technology called WattWave.

Simply put, Wattwave is a way of connecting and controlling lighting and other building assets using the existing power cables. The simplicity of using the existing building power infrastructure to communicate, coupled with a powerful cloud based service platform and distributed intelligent hardware design, allow organisations to monitor and manage their entire estate through one simple App.

PLC is not new and for good reason. Using the existing power distribution cabling as the physical transport layer to connect, control, and monitor assets connected via the mains is an obvious and highly advantageous solution.

However history has shown that developing robust PLC solutions over noisy mains environments is very difficult to achieve in anything other than simple point to point applications.

enModus has combined some well proven communications techniques along with highly innovative and patented developments that enable extremely reliable, long distance, two way, multi-point communications over existing power lines.

This unique capability is ideally suited to low bandwidth control and monitoring applications.

Terex Trucks can now connect distributed assets throughout their manufacturing facility, communicate energy use across the powerline to a cloud-based application platform and optimise the energy used by these assets through a simple web based interface.

This innovative monitoring and control solution is now a key component in Terex Truck’s plans to address Volvo CE’s environmental standards and realise their ambition to become a carbon neutral facility.
enModus has solved the complex physics of driving control signals very long distances, reliably over mains cabling. The ability to do this opens up huge opportunities for existing building owners to implement Smart control systems where other technologies would not be practical. We can help make existing building stock become smart buildings of the future. This project at Terex Trucks is a great example and we are very excited to be working with CRT to help Terex Trucks reduce their carbon footprint and of course energy bills.

John Wanklyn, VP Sales & Marketing enModus

Pilot overview and results

The existing mercury vapour lights at the Terex Trucks site were inefficient and were no longer meeting Terex Truck’s needs. CRT and enModus inspected the facility, assessed the requirements, specified, designed and installed a solution to meet Terex Truck’s needs.

Two high bay areas were selected for the pilot; a storage racking area where 8 of CRT’s HBX LED lights plus one emergency light were installed alongside a DANLERS Passive Infrared Sensor (PIR), which detects motion. A further 12 lights were installed in a separate workshop area, which is fitted with skylights, so a DANLERS ambient light sensor was installed alongside the PIRs to allow for daylight harvesting (where the lights are dimmed as daylight levels increase).

In both pilot areas, new lights and controls were introduced and the lighting layouts were altered compared to the original installation in order to meet Terex Truck’s needs for greater light output and improved light quality. Installation of the enModus solution was simple. A Node was installed at each light and these Nodes connected via existing powerlines to a Hub. This Hub connects to an easy-to-use web-based interface with monitoring and control capabilities. Energy use is reported every second enabling real time energy management.

Key results from the trial include:
• Energy savings of 92-97% (depending on work area)
• Lighting control savings factor of 63-87% (depending on work area)
• Three-fold increase in light output
• Improved lighting quality (including better colour rendition and daylight balancing)
• Payback period on the capital cost of the CRT and enModus solution, using Enhanced Capital Allowances, of 12 months

enModus NODER POWERLINE CONNECTED TO HUB

enMODUS NODES PASSIVE SENSORS INPUT POWERLINE CONNECTED TO HUB

enMODUS NODES PASSIVE SENSORS INPUT POWERLINE CONNECTED TO HUB

HBX LED HIGH-BAY LIGHTS CONTROLLED BY NODES VIA DALI PASSIVE SENSORS

3-PH POWER CIRCUIT

3-PH ENERGY METER

3-PH POWER CIRCUIT

3-PH POWER CIRCUIT

3-PH ENERGY METER

3-PH POWER CIRCUIT

3-PH POWER CIRCUIT

THERMAL FUSE

USER DATA ENERGYSIS REPORTS LIGHTING CONTROL SET UP SCHEDULE SET UP

USER DATA ENERGYSIS REPORTS LIGHTING CONTROL SETTINGS SCHEDULE SETTINGS

enMODUS NODER CIRCUIT TO NODE

enMODUS NODES CIRCUIT TO HUB

enMODUS NODER CIRCUIT TO NODE

enMODUS NODER CIRCUIT TO NODE

INTERNET

INTERNET

enMODUS CONTROL PLATFORM (ECP)
MICROSOFT CLOUD-BASED SERVERS

WATTWAVE POWERLINE COMM BETWEEN HUBS & NODES

WATTWAVE POWERLINE COMM BETWEEN HUBS & NODES

WATTWAVE POWERLINE COMM BETWEEN HUBS & NODES

WATTWAVE POWERLINE COMM BETWEEN HUBS & NODES

FACTORY LIGHTING CONTROL SYSTEM

WATTWAVE POWERLINE COMM BETWEEN HUBS & NODES

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WATTWAVE POWERLINE COMM BETWEEN HUBS & NODES

WATTWAVE POWERLINE COMM BETWEEN HUBS & NODES

enMODUS NODER CIRCUIT TO NODE

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INTERNET

INTERNET

enMODUS CONTROL PLATFORM (ECP)
MICROSOFT CLOUD-BASED SERVERS
An example of the energy savings achieved in the racking area from this improved lighting design layout, more efficient CRT HBX LEDs, and enModus’s monitoring and control solution is shown in Figure 1.

- In this racking area, the lighting control savings factor, or additional energy savings achieved once LEDs are installed, was an average of 87%.

Operational savings (relating to emergency lighting and reduced lamp failure) could add a further 17% to the overall cost savings. Further savings and a faster return on investment could be achieved by:

- Changing the ratio of new CRT HBX lights to the existing mercury vapour lamps
- Further optimising the daylight harvesting settings in the Workspace Area.

To ensure that the results were robust, the Carbon Trust has independently reviewed and verified the results achieved on this pilot project with Terex Trucks. Further review and verification details are contained in a separate technical verification report available at www.enmodus.com.