glass WORLDWIDE

Cost benefits of efficient electrical boosting power supply design

In recent years, Eurotherm by Schneider Electric has published several technical articles on the subject of next generation furnace boosting power supply systems, aimed at engineers and technical personnel. For financial decision makers, purchasing personnel and those responsible for energy saving, however, it was recognised that the design benefits needed a less technical explanation. With this in mind, Amber Watkin and René Meuleman have reworked what has been published so far, to explain the benefits in terms of cost savings and sustainability.

When choosing a boosting solution for a glass furnace, customers need to look ahead 15 to 20 years to get the best return on investment (ROI) in terms of capital expenditure (CAPEX) and operating expenditure (OPEX). Think about the changes that might be needed if business grows. Will it be necessary to increase throughput, what will the most efficient methods be and which new energy regulations might affect costs and carbon footprint? In other words, how will furnace electrical boosting affect business revenue?

To cope with potential issues, Eurotherm specifically designed its next generation boosting power supply solution with the future in mind, giving customers the flexibility to 'buy what is needed now', 'expand later' and 're-use elsewhere'.

WHY IS ELECTRICAL BOOSTING NEEDED?

Electrical furnace boosting is needed to apply additional clean energy in areas of the furnace that are difficult to heat using gas or fuel firing, particularly when factories need to melt coloured glass, run a high throughput furnace or produce high quality glass. The method improves and enforces convection currents in the melt, enabling increased pull rates, better fining and glass quality improvements. In most cases, electrical furnace boosting is 'super-efficient', having a much higher impact on the energy household of a furnace than would be calculated.

The technology is well established and considered to be safe and efficient. In most cases, a well designed combination of gas/fuel firing melting with electrical boosting is still the most sensible choice. Looking forward, however, even though the world is still far away from running out of fossil fuels, eventually glass melting will need to become 'all-electric' and in that respect, glass manufacturers and system designers have an obligation to keep improving electrical power concepts to meet future needs. All-electric furnaces are not only suitable for special glasses but should also be considered for commodity glass melting.

EFFICIENT POWER SUPPLY METHODS

Stricter energy saving regulations may be introduced during the 15-20 year lifetime of the furnace, leading to higher energy costs, extra taxes and fines and the need to publish results for carbon footprint reduction. The latest traditional energy saving boosting designs do not address the whole power system, typically giving an energy reduction of around 1%-2% and a poor ROI (within 18-24 months). In a typical thyristor-controlled power system, electrical noise is present due to the physical properties of the components and >

Specialist firing modes and control strategies in EPower controllers help save energy by reducing electrical noise in the system.

Stepping down to a standard voltage in global plants simplifies the supply chain and reduces inventory costs through standardisation of components.

design. This causes energy to be lost in the system itself, rather than being utilised to melt the glass, affects the energy measurements taken by the electricity supply company and adds extra costs to the bill.

Eurotherm's electrical boosting power supply design and method substantially reduces electrical noise in the system. How does this help? Compared to a traditional design, most of the electrical power drawn now contributes to the melting process and is not wasted. Importantly, the energy used is correctly charged by the supplier. Electricity charges are minimised and the carbon footprint is reduced. Compared to a typical boosting system, the Eurotherm solution can reduce electricity bills by approximately 10%.

REDUCED RISK OF UNPLANNED DOWNTIME

Glass furnaces need to run 24/7 for many years, otherwise the glass melt will start to cool. This slows down production and affects glass quality until the melt has returned to the correct temperature and consistency. In a traditional electrical boosting design, a single transformer and power controller are used to supply power to the heating electrodes. In the event of a device failure, the boost power is lost, causing the melt to cool and production to slow down. The repair is costly, with excessive downtime.

The Eurotherm design strategy utilises a network of multiple small transformers and power controllers. If one device fails, the others continue working, enabling the furnace to continue at full capacity. The remaining devices have enough bandwidth to supply the extra energy needed to make up for the loss. Multiple small transformers and power controllers often cost no more than using one large transformer, so there are no downsides to moving to this redundant design, which reduces the risk and cost of lost production due to unplanned downtime.

REDUCED CAPITAL SPEND + INCREASED PRODUCTIVITY

A furnace campaign needs to last 15-20 years but during that time, the demand for a successful glass product may rise. What if production needs to be increased by melting more glass in the same furnace footprint, or productivity levels need to be maintained as the output decreases towards the end of a campaign due to worn out components? In a traditional 'fixed' furnace boosting design, upgrading to gain extra power means replacing the whole system at a high cost, with excessive downtime.

Eurotherm's design scheme is modular and easily scalable. Extra boosting power can be added to the furnace in steps during the campaign. Additional boosting can easily be added at any time, in order to melt glass faster during the furnace start-up sequence, run the furnace at a higher capacity, or extend the life of the furnace by a few years. It is the most cost-effective design if customers want to buy what is needed now and expand later.

STANDARDISED COMPONENTS

Global glass plants typically run on a variety of different voltages, so supply chain personnel need to specify and purchase different size transformers and power controllers for each region. Inventory costs are high due to multiple component sizes being kept for spares and expensive components cannot be reused by different regions at the end of a furnace campaign.

Eurotherm's electrical boosting method uses a stepdown transformer, which transforms the incoming supply voltage down to the customer's chosen plant voltage. This feature means all plants can run at the same intermediary voltage. The transformers and power controllers can all be the same size (standardised parts) for use in any global region, simplifying the ordering and reuse of parts and reducing inventory costs.

REDUCED REAL ESTATE COSTS AND CARBON FOOTPRINT

Land is expensive and available space for system upgrades can be a problem in older facilities. A traditional boosting solution needs a large electrical transformer, which is either oil filled, or air cooled by air conditioning units. Both types need to be situated in an external room, away from the furnace for safety and take up a lot of factory floor space.

The Eurotherm boosting solution is designed using multiple relatively small, tightly sealed transformers, which can be positioned much closer to the furnace. The smaller, modular components make up a flexible network of sub-systems that can be fully integrated into the furnace steelwork. The system is completely adaptable to available space and to specific furnace electrical power demands. The traditional transformer room along with its non-environmentally-friendly air conditioning units or oil are no longer needed, saving space and reducing the carbon footprint.

SUSTAINABLE FUTURE

Traditional boosting system design often uses components with mechanical parts that wear out over time. It is also common for damaging vibration to occur in the whole system, due to poorly applied power. Most system components are high value because they contain large amounts of copper and the resulting maintenance in replacement parts is costly, not only in financial terms but also in unnecessary environmental waste.

The components used in the Eurotherm design have minimal mechanical parts and are chosen or specifically designed for their high durability in the glass manufacturing environment. Also, the design in combination with Eurotherm's expertly applied power control minimises vibration in the system. Less mechanical parts and less vibration reduce the risk of damage to expensive copper busbars and transformers. Unlike a traditional boosting system, most of the parts used in the Eurotherm design will last longer than the furnace lifetime and can be used in further furnace campaigns, making it more sustainable through extended life and reuse of these high value components.

FUTURE-PROOF SOLUTION

With over 50 years' experience in the glass industry, Eurotherm has put a lot of effort into designing a future-proof boosting solution in terms of CAPEX and OPEX that is also efficient, reliable, sustainable and safe. Interested parties can also contact their global glass projects team, who are available to carry out energy surveys and calculate possible savings in the plant. ■

A network of small, space saving water-cooled transformers continues to apply boosting power in the event of a device failure, reducing the risk of unplanned downtime.

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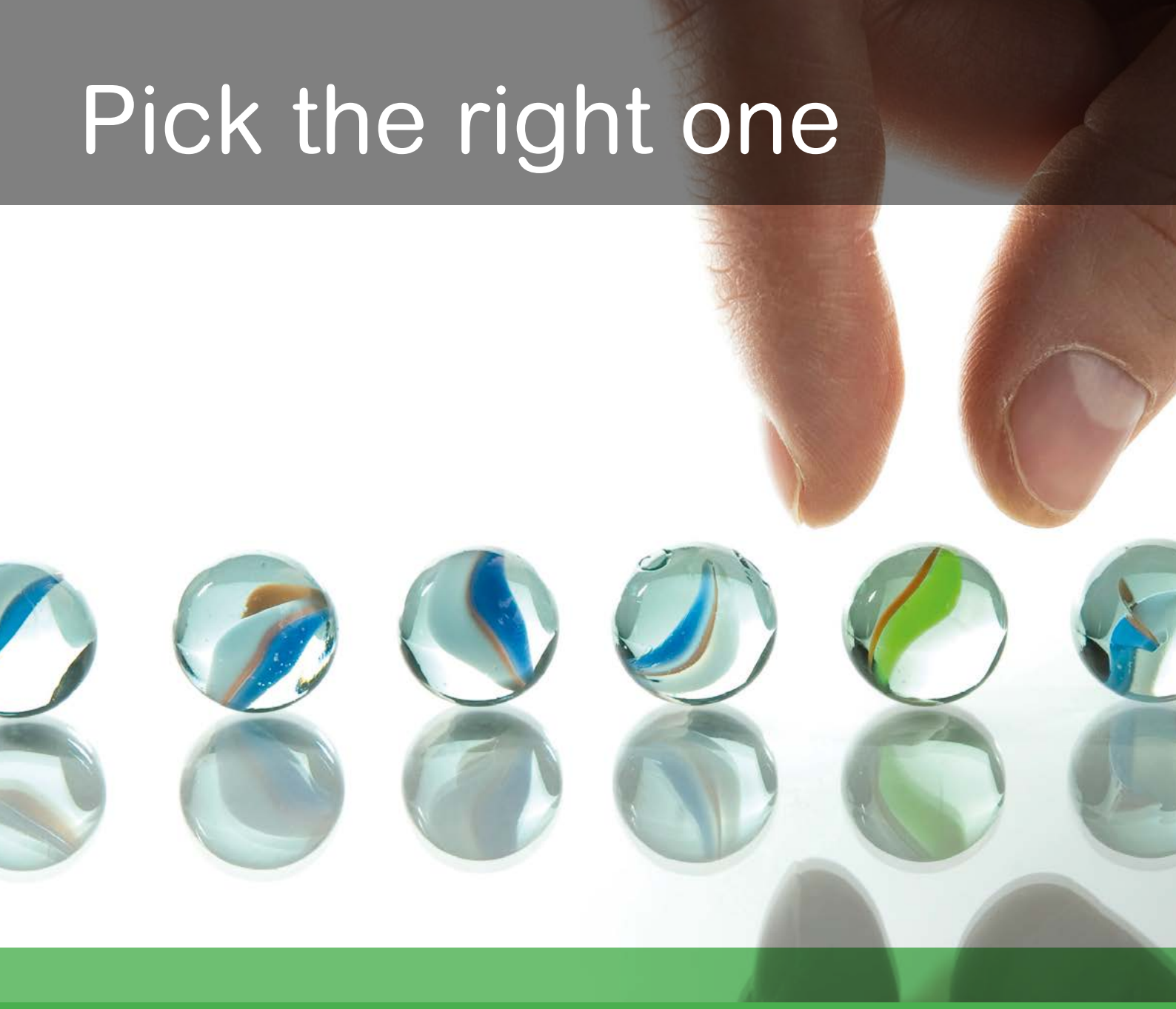

Our Glass Boosting Solutions are efficient, cost reducing, reliable, safe and sustainable

www.eurotherm.com/glasspowersolutions

Find us at DGG meeting, Goslar, Germany, 6th to 8th June, where we will present "Understanding the value of precision process control".

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