

5 Ways to save energy when melting and transferring metal

Aluminium foundry efficiency: a practical guide to addressing your energy hot spots

Aluminium die-casting operations are notoriously energy intensive. In fact, approximately 25% of the total cost of die cast parts is associated with energy consumption. Identifying and tackling energy 'hot spots' can therefore make a huge difference to overall cost-efficiency and profitability.

Which is exactly why this guide takes a closer look at melting and transferring liquid aluminium. Energy intensive processes are by no means limited to this specific area, but a substantial amount of energy is required to melt scrap and ingots and keep the molten metal at the right temperature. So much so that evidence suggests the melt-shop alone can account for as much as 77% of the overall energy consumption in a die casting foundry.

To help you make savings that could make a big difference to your business - here are 5 things to consider when it comes to cutting energy consumption and carbon emissions in your aluminium foundry.



1) Use data to pinpoint the saving potential

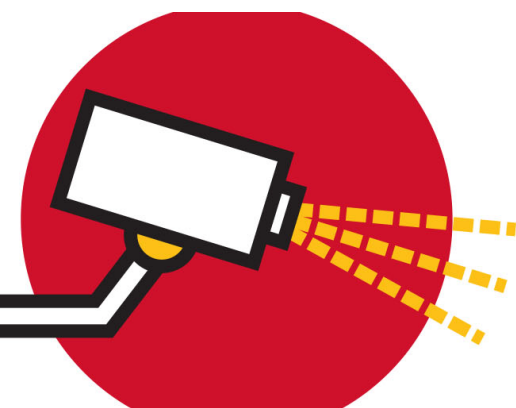
The nature of the processes involved means the melt shop is a logical first stop when looking for ways to reduce energy consumption. But one of the best strategies for pinpointing exactly where the biggest opportunities for improvement are, is to leverage what is arguably becoming a die casting foundry's greatest resource – data.

Most foundry equipment, including melting and dosing furnaces, now leaves the production line Industry 4.0 ready meaning machines are pre-equipped to collect and provide informative data on performance. For legacy equipment that doesn't fall into the '4.0 ready' category, so-called gateway technology exists - Norican's NoriGate solution being one example - which can be retrofitted to any machine in order to leverage the same information. A data-driven view of the entire die casting line is now possible and practical to achieve.

Crucially data ready to be unlocked in this way – and, with tools like Monitizer, displayed and analysed in real time - includes production KPIs which can be matched against energy consumed in order to identify potential issues and/or technology not performing to its full efficiency potential.

Watching your weight: One particular data set which can prove very revealing is to use furnace load cells to track the weight of charged material going into the furnace or the weight of liquid aluminium coming out and overlay this with energy used during the same time frame. The resulting information will help quickly identify sub-optimal performance which may well be caused by inefficient filling and material distribution (see point 2).

Digital solutions is an area we are going to cover more extensively as this content series progresses, specifically looking at implications for improving uptime, quality and productivity. Keep an eye on our dedicated 'foundry efficiency formula' page for updates.



2) Check your shaft fill is optimized

Shaft melting furnaces, particularly with regards aluminium, are widely regarded as the most energy efficient furnace on the market. This is because they combine preheating, heating and liquefaction in one unit and function to a favorable counter flow principle: exhaust gas from melted charge material at the bottom of the shaft gradually heating up cold raw material as it travels down from being loaded at the top, minimizing the time it needs to spend at (energy-intensive) high temperature to complete the melting process.

Quick fact: With an energy consumption level of 540kWh/t, a StrikoMelter shaft melting furnaces with an annual melting capacity of about 14,000 t creates 860 t less CO₂ emissions every year than the melting furnace technology otherwise available on the European market.

But even shaft furnaces can be made more efficient. Particularly by looking at shaft fill and material distribution in the shaft. Wasted space is wasted energy. Here are 3 things you might want to look at to make sure your fill is as efficient as possible:

- **Consider automation.** Using a shaft scanner and weighing system to continuously monitor charging material levels and automatically manage the filling process can result in energy savings of up to **4%**. When this type of level monitoring with laser technology was retrofitted as part of a comprehensive modernization project at Skoda Auto at its Mladá Boleslav site in the Czech Republic it helped reduce energy consumption by as much as **10%**.

Tip: Make sure a full charging cart is always ready to go in the charging unit, so the furnace can be loaded at any time, as determined by the system.

- **Look at charge material mix.** A ratio of 50% returns and 50% ingots ensures the best filling condition for optimal energy use and metal yield. Where possible, using smaller ingots for charging makes better use of space and maximizes the surface area available for heat transfer compared to larger ingots.

Tip: Do not load an empty shaft with heavy materials to avoid damage to the refractory lining.

- **Take cover.** Another way to keep energy consumption down is to maximize heat retention by covering the shaft to prevent energy from escaping unused. A hot gas baffle (shaft cover) is mainly used to retain heat during periods of free-melting for melting chamber cleaning. It has been shown to reduce energy consumption during free-melting operations by up to **15%**.

Solution spotlight: The StrikoMelter BigStruc is an example where a hot gas baffle is also used during the melting process – to help reduce heat loss during the remelting of large structural parts.



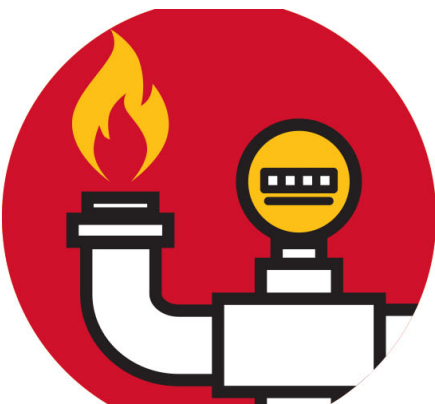
3) Make sure short melting periods don't drain your energy

Aluminium die casting is most energy efficient at high utilization. The trouble is, it is also quite common for aluminium foundries to melt at below 100% capacity for a number of reasons, from line maintenance to new project development.

This often translates to shorter, interrupted melting periods that are very inefficient – energy is lost during the intervening gaps, and must be spent again to re-heat. In addition to seeing energy consumption go up, the process can also see metal quality go down due to oxidation and dross formation. A lose/lose situation.

Crucially though, low utilization does not have to mean shorter melting periods. Switching instead to longer melting periods during low utilization, where melting and holding are automatically applied in the most energy efficient way, can reduce energy consumption by up to **20%**.

Solution spotlight: StrikoWestofen's Part Load Efficiency Control - a dedicated burner control system – has been developed to prevent this kind of stop/start wastage and is particularly beneficial when melting furnaces are operating below 75% capacity.



4) Maintain your way to less waste – it all adds up

Keeping on top of maintenance can have a dramatic impact on energy consumption. It's another reason why digital management solutions that utilize and visualize equipment data can be so invaluable, as they can help flag when and where maintenance might be needed to prevent performance loss...or worse, downtime (again a topic we will be looking at more closely later in this content series).

And often, it's not necessarily one big thing but rather an accumulation of small things that can add up to significant energy savings. For example:

- **Maintaining the rope seal on furnace doors** may seem a very small detail but even this can generate an energy saving of **1%**. Together with the self-sealing cleaning door, the rope seal achieves perfect tightness. Having a tight seal in place saves energy by reducing heat loss during melting and holding, while also preventing air ingress which could result in oxidation and corundum formation.
- **Burner efficiency means better efficiency.** A well-adjusted burner with a stoichiometric air fuel ratio can save up to **2%** of energy compared to a burner with too much air-surplus. This is because excess air i.e. air not necessary for the combustion process, will actually lower flame temperature and make heat transfer less efficient.

Did you know: Near-stoichiometric burner adjustment is now included as standard on StrikoWestofen's StrikoMelter PurEfficiency and BigStruc furnaces – helping foundries use approximately seven kilowatt hours less energy per tonne of metal.



5) Keep the heat – cover up with metal transfer and dosing

We've already mentioned the energy efficiency benefits of keeping heat in the shaft to avoid wasteful thermal loss, but what about when hot molten aluminium is ready to be transferred to the dosing or holding furnace?

While they are pre-heated, most transfer ladles typically used to complete this task are uncovered resulting in heat loss and energy waste – melt often has to be *over-heated* to compensate, a solution which has the potential negative side effect of metal quality degradation.

Hot tip: In addition to being considerably safer, a closed metal transfer system like the Schnorkle mitigates this efficiency issue by keeping the molten aluminium at a constant temperature. Hermetically sealed transfer solutions also minimise contact with the atmosphere for optimal metal quality which in turn has implications for productivity - better quality metal in, better quality cast parts out, more efficient and effective use of energy.

Another cover up: As with transferring metal from the primary melting furnace, holding and dosing systems for liquid aluminium are also far more energy efficient as they eliminate the potential for wasteful temperature loss. Energy consumption for this process can be cut by around **2/3** as a result. Closed dosing systems can also have a dramatic impact on metal loss and quality.

Did you know: StrikoWestofen's Westomat crucible-free dosing furnace uses just one-third of the energy required by a classic ladle system, limits metal loss to just 0.06%, eliminates temperature fluctuations and has a 98% availability rate due to minimal maintenance requirements and durability.

For more information like this, keep an eye on our Foundry Efficiency hub:
www.strikowestofen.com/foundry-efficiency