2020 SUMMIT
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Best of the Betters: 2020 Better Project and Better Practice Presentations

Wednesday, June 10
11:00 am-12:30 pm ET
Marco Gonzalez
Waupaca Foundry

Submit Questions
www.slido.com event code #bbsummit
then go to room “Best of the Betters”
Cupola Blast Air Dehumidification System

Marco Gonzalez, CEM
Waupaca Foundry, Inc.
Corporate Energy Manager
Who we are

Waupaca Foundry, a Hitachi Metals Group company, produces best-in-class gray iron, ductile iron, austempered ductile iron and compacted graphite iron castings at seven, strategically located state-of-the-art foundries in North America.
Waupaca Foundry, Inc. – Sustainability Goals 2020

- Reduce energy intensity by **25%**
- Reduce spent foundry sand generation by **30%**
- Reduce Water use consumption by **80%**
- Maintain cutting edge air pollution control technologies
Tell City, IN – Plant 5

- Footprint: 560,000 square feet
- Employees: 956
- Melting Capacity: 160 tons per hour
  (at two cupolas 80 tons/hr each)
- Casting capacity: 450,000 tons annually

Portfolio, Gray & Ductile Iron:
Brake rotors and drums, brake calipers, crankshafts, differential carriers, differential cases, and flywheel housings

DH Project implemented in Cupola 5.1 Gray Iron
Waupaca Foundry, Inc. – Melting Facts

• Waupaca Foundry, Inc. melts over **10,000 tons per day** at seven locations. 80% is melted using Cupolas.

• A **Cupola Furnace** consists of a vertical steel shell, lined with a refractory brick. The charge consists of alternate layers of scrap metal, coke as an **additive and fuel**, and limestone flux.

• The **coke** is consumed in air which is introduced by the blast air blowers and oxygen injection through the tuyeres.

• The hot gases generated in the melt zone ascend and preheat the descending charge. A recuperative design allows waste heat recovery from the cupola for other applications.

• At Cupola plants, **melt equipment represents ~70% of the total energy consumption of the plant.**

• Coke supplies 50% of the energy consumed at Waupaca Foundry, Inc.

• Waupaca Foundry, Inc. is continuously implementing actions to improve the melting efficiency at its plants.
Humidity Impact on Cupola Blast Air

High humidity in cupola blast air has **detrimental effects** on cupola efficiency,

- Increased coke rate per unit of iron melted.
- Reduced combustion temperatures.
- Reduced carbon pickup (coke also provides C to the iron)
- Elevated thermal oil heat loads increasing exhaust volume to the emission control system.

When water vapor is “burned” in the cupola combustion zone at 4,000°F, the water is dissociated into elemental Hydrogen and Oxygen. The strong reducing effect of the hydrogen causes the oxygen to react with Coke in a reduction process, consuming coke and generating carbon monoxide.

CO and H levels in the cupola gas become elevated causing a highly endothermic reaction that consumes heat and decreases the efficiency of the coke combustion.

This drop in efficiency increases the overall coke demand while reducing the cupola melt rate.
SOLUTION: Installing a Cupola Blast Air Dehumidification System

WF ENERGY STRATEGY # 2: IMPROVING PRODUCTION PROCESSES

Project developed in partnership with cupola manufacturer and dehumidifier manufacturer.
Project Timeline: 14 months. Payback 3.8 years

1. **The Dehumidifier Unit**: A rotating desiccant wheel divided into two sections with a seal between these two sections. On one side, the ambient process blast air to be dehumidified is drawn through the desiccant wheel, and the moisture in the air is absorbed by the desiccant wheel. On the other side, the absorbed moisture in the wheel is removed with heated regenerative air section.

2. **Thermal Oil Heating System**, from the cupola waste heat recovery system, provides the heat required to reactivate the desiccant wheel.

3. **Water Cooling System**, using cupola process cooling water, reduces the blast air temp before the blower.
Benefits

+3% CUPOLA MELTING EFFICIENCY

16,728 MMBTU ENERGY SAVINGS
1% PLANT’S ENERGY USAGE

$ 335,000 ENERGY COST SAVINGS
Project Timeline: 14 months
Payback 3.8 years

-2.5% COKE REDUCTION
656 Tons

1,804 t-CO₂ AVOIDED – 1% PLANT’S GHG

The water vapor removed is equivalent to

126,757 gallons of Water removed from blast air

= 8,178 Kegs of Beer

= 21x

1 Keg = 15.5 Gallons

1 Water Truck 6,000 Gallons
thank you

Marco Gonzalez
Corporate Energy Manager
Waupaca Foundry, Inc.
Marco.Gonzalez@waupacafoundry.com