### GAS TO ELECTRIC



### DILIP CHANDRASEKARAN, R&D KANTHAL SHTE-KONFERENS 2019



### OUTLINE

- Introduction
- Why go Electric?
- Some examples
- Enablers for Gas to Electric
- Summary and Challenges ahead





Figures refer to Group total 2016 excl. Mining Systems \*Intellectual property

### KANTHAL

THE SANDVIK BRAND FOR HEATING TECHNOLOGY

- Heating Materials resistance heating and high temperature alloys for temperatures up to 2 000°C (3 632°F)
- Heating Systems products, components, systems and services for thermal processing
- Broadest range of products and systems for industrial heating. From raw material to finished products
- Global R&D with in-depth competence in high temperature matertals and products





## WHY GO ELECTRIC?



FINANCIAL INCENTIVE



- Financial incentive
- Pay-back
- Productivity

### PROCESS IMPROVEMENTS



- Quality
- Process control
- Maintenance

### PLANET ENVIRONMENTAL



- Carbon footprint
- Waste / Emissions
- Work environment



# THE DECISION THAT SLASHED ENERGY COSTS BY 40% AND REDUCED EMISSIONS TO ZERO

FROM GAS TO ELECTRIC Although the switch itself from gas to electricity entailed a substantial cost saving, Glassit wanted a powerful heating system that it could rely on for its process. In addition, the plan called for the upgrade of furnace zones as well as service and maintenance to keep the system working effectively and efficiently far into the future.

### GAS TO ELECTRIC - EXAMPLE















# FUEL: LNG CO<sub>2</sub>: 4,000 TONNES PER YEAR EFFICIENCY: 30%



### **KANTHAL EXPERTISE**



#### TARGETS

- Replace gas burner system with electrical heating
- Reduce CO2 emissions
- Reduce energy consumtion by 30%
- Maintain quality and productivity
- Turn key solution



### FUEL: 100% RENEWABLE ELECTRICITY

# CO<sub>2</sub>: 0 TONS PER YEAR AVAVAVI WWW

### **ENERGY EFFICIENCY: +59%**

ANNUAL SAVINGS: 253,000 EUR



### **ENERGY COST SAVINGS EUROPE 2018**



KEY :

Gas / Electric energy cost comparison

- Dark green Always a cost saving.
- Light Green Mostly a cost saving.
- Brown Sometimes a cost saving.
- Orange Rarely a cost saving.

\*Does not include other savings outside energy costs.





## WHY IS THE FUTURE ELECTRIC?

### HEALTH AND SAFETY

- No toxic or harmful emissions:
  - Electric furnaces and ladle heaters do not introduce NO<sub>x</sub>, SO<sub>x</sub> (long term respiratory problems and death) or Carbon monoxide (possibly fatal) into the workspace.
- Improved working environment:
  - Electric heating elements are virtually silent in operation, vastly improving working environment. (Gas burners and furnaces can be 100dB+)
  - Cooler working environment, due to higher efficiencies electric furnaces introduce up to 5 times less heat into the working environment.

- Reduced explosion / fire risk:
  - Removal of gas/fuel/oxygen lines reduces the risk of explosion and fire.
  - Uniform drying / heating reduces risk from water vapour explosions.
  - All Fossil fuel heaters produce water vapour as part of the combustion process. This can condense in cold ladles and moulds increasing the risk of explosion.





## WHY IS THE FUTURE ELECTRIC?

#### PROCESS

- Maintenance and operation:
  - Remote and automated operation.
  - No requirement to recalibrate burners to maintain efficiencies or combustions safety.
  - Easier to move process equipment, no gas, air or oxygen lines to move.
  - Uniform heating leads to longer lining lifetime of up to 20%. Less time relining, fewer stops.
- Future proof:
  - To reach environmental commitments most countries will have to phase out new and existing fossil fuel systems.

#### QUALITY

- Product Quality and Yield:
  - Repeatable, consistent and uniform heating processes increases product quality and yield.
  - Reduction of slag buildup in primary metals.
  - No contamination from combustion products.





## WHY IS THE FUTURE ELECTRIC

#### ENVIRONMENTAL

- Electric Furnaces and ladle heaters have an efficiency of 90-98% compared to open flame Gas/Fossil fuelled of 15-25%.
- Electrical ladle heaters, furnaces and ovens do not produce CO<sub>2</sub> which leads to global warming.
- Do not produce toxic gases, NO<sub>x</sub>, SO<sub>x</sub> or Carbon monoxide.
- Automatic regulation and control, only provides heat when temperature calls for it.
- Can be powered by 100% renewable power





# LADLE HEATER INSTALLATION ELKEM, NORWAY

23

KANTHAL

### EXISTING HEATER AT CUSTOMER SITE

### LOCATION ELKEM NORWAY

Heater: Diesel oil fired Power: 600 kW

#### Efficiency comparison

- Oil burner system: 15%
- Electrical system: 95%





## INSTALLATION ON SITE

FEATURES – LOCATION NORWAY

- Two weeks work for installation and commissioning at customer site by Field Service Engineers
- Joint cooperation between customer and Field Engineers
- Electrical installation by Norwegian partner company







### RESULTS

- Much faster heat up cycle
- Cost per cycle, oil: 330 EUR per cycle.
- Cost per cycle, electric: 60 EUR per cycle.
- Annual Savings: 160 KEUR



Part of Sandvik Group



### EU CLIMATE & ENERGY

The 2020 & 2030 climate and energy package/framework is a set of binding legislation to ensure the EU meets its climate and energy targets

#### 2020 PACKAGE

- 20% cut in greenhouse gas emissions (from 1990 levels)
- 20% of EU energy from renewables
- 20% improvement in energy efficiency



#### 2030 FRAMEWORK

- At least 40% cuts in greenhouse gas emissions (from 1990 levels)
- At least 32% share for renewable energy
- At least 32.5% improvement in energy efficiency
   KANTHA

Part of Sandvik Group

### PARIS AGREEMENT

AS OF FEBRUARY 2019, 194 STATES AND THE EUROPEAN UNION HAVE SIGNED THE AGREEMENT REPRESENTING MORE THAN 87 % OF GLOBAL GREENHOUSE GAS EMISSIONS

#### Targets

- Reduce greenhouse gas emissions by 20%
- Increase the renewables share to 20% and
- Increase energy efficiency by 20%



COP21.CMP11



# ENABLERS FOR GAS TO ELECTRIC



### MATERIALS EVOLUTION

Mechanical strength at high temperature
Corrosion and oxidation resistance
BUT ALSO
Weldability
Formability
Ductility in service
Cost



Part of Sandvik Group

### **HEATING SOLUTIONS**



#### **ELEMENTS & CASSETTES**

Forced convection furnaces

Element T ≤ 800°C

Compact element design for optimized heat transfer and maximized power outputs.



#### KANTHAL<sup>®</sup> FLOW HEATERS

Air and gas heating

Outlet T ≤ 1100°C

300°C higher outlet temperature

Compact design

Replaces gas burners





#### KANTHAL APM™ & KANTHAL APMT™ TUBES

Radiant tubes, thermocouple tubes, muffle tubes etc.

Tube T  $\leq$  1250°C

150°C higher operating temperature

Increased productivity



#### FURNACE ROLLERS

Furnace  $T \le 1250^{\circ}C$  without need for water cooling.

Large energy savings

Reduced maintenance costs



### **HEATING SOLUTIONS**



#### KANTHAL® SUPER

Electric heating elements (MoSi2)

Element T ≤ 1850°C

Available in a wide variety of shapes and sizes

Seven grades for optimized performance



SUPERTHAL<sup>™</sup> Heating panels and modules Furnace T ≤ 1750°C Glass industry

Electronics Ceramics Laboratory



#### **GLOBAR®**

Electronic heating elements (SiC)

Element T ≤ 1625°C

Available in a wide variety of shapes and sizes

Two grades SD and HD

### **NEW PRODUCT**



Improve work environment

Carburizing, Carbo-nitriding



### **ELECTRIFICATION - SUMMARY**

#### CHALLENGES AND OPPURTUNITIES

- Need for large-scale (MW-type) heating solutions to replace existing heating with gas-burner technology (Steel industry)
  - Robust, low-maintenance, high productivity
- Development of hybrid solutions, combinine different heating solutions (Resistance / Radiation, Induction)
  - Crucial to adress challenges /advantages with current technology
- Potential to include more "intelligence" in the heating solution
  - Automisation, Control and Predictability
- New products and technology development vital
- Vital with collaborations and partnerships across businesses and organisations







