NIWE

NEW INDUCTION WIRELESS MANUFACTURING EFFICIENT PROCESS FOR ENERGY INTENSIVE INDUSTRIES

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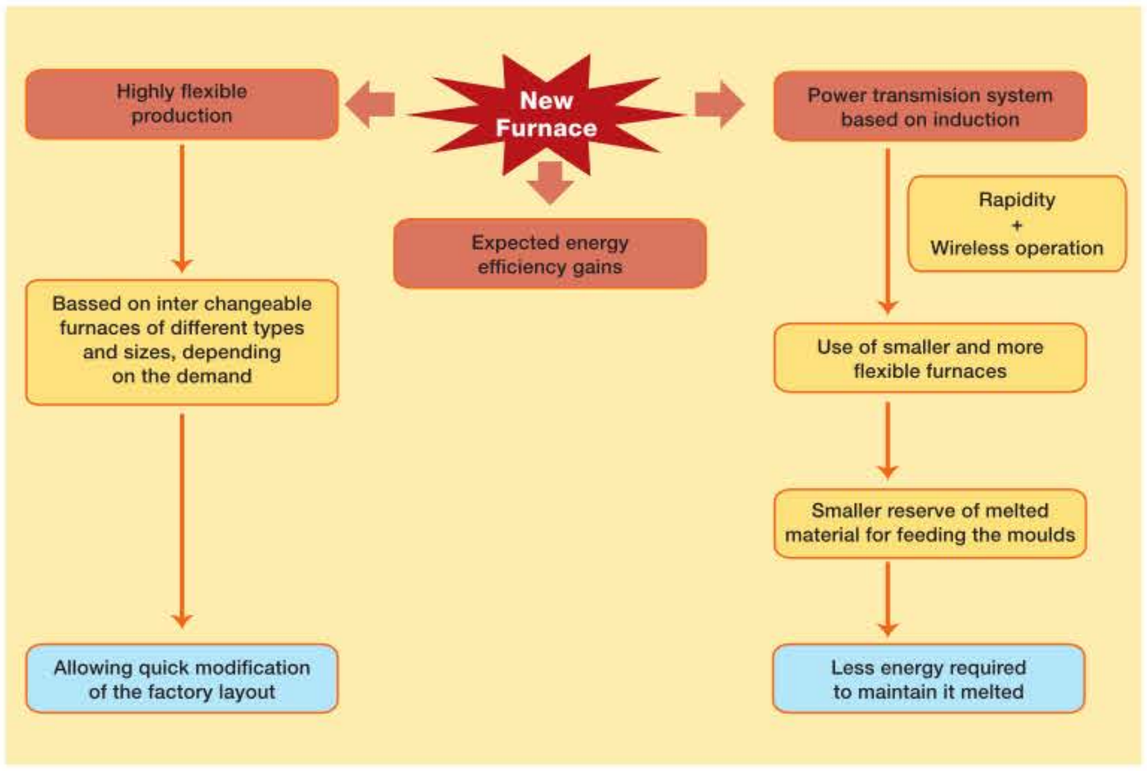
Project Budget: 11,09 M€
European Union funding: 6,69 M€

OBJECTIVES

Demonstration of a new production process able to decrease the embodied energy of the foundry products by over 25%, reducing drastically its carbon footprint

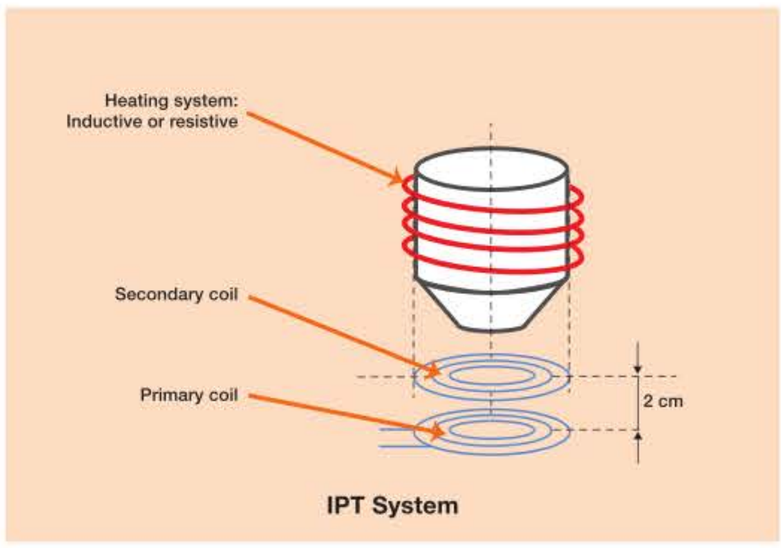


TECHNICAL CHARACTERISTICS: INDUCTIVE POWER TRANSFER (IPT)

System formed by two coils, electrically isolated from each other, but magnetically coupled either through the air or through a magnetic material. This system is able to transfer electrical power with a high efficiency Wireless.

The inductive coupling system presented will be used to transfer energy from the source to the final consumption point without wires or physical connections.

This new concept of induction changes the traditional one of fixed furnaces and moduls in the factory, providing a flexible layout and production for the metallurgy industry, improving the adjustment of the equipment and processes in the casting chain according to the current demand.



IPT System

1. The objective is to feed the resistance or the induction heating coil using an IPT system.
2. It allows a highly flexible production. This increase on the production flexibility attends to the current variability of the foundry products demand.

SECTORS TACKLED: ENERGY INTENSIVE INDUSTRIES FROM THE ALUMINIUM, IRON, STEEL SECTORS

The processes involved in these Energy Intensive Indus- tries (EII) share a common step where raw materials are heated in industrial furnaces to obtain a subsequently treated product.

Traditional furnaces were initially designed and manufactured to be heated by coal or coke and the concept evolution has driven the newest furnaces to mostly be heated by gas or electricity resources such as: electrical arc, induction, reverberatory and crucible furnaces. However, these furnaces are still very high resources and energy demanding, as it is shown in Table 1.

Most of the energy consumed by these furnaces is used to heat the raw materials up to the corresponding melting points (from ~700°C for an aluminium furnace to ~1450°C for Iron furnace and 1650ºC for Steel furnace).

From this energy used during the heating process, up to 50% is lost via heat transfers and gas waste.

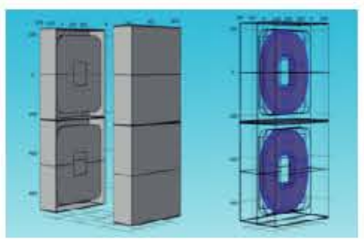
NIWE targeted sectors (EU)	Aluminium	Steel casting	Iron
Production (Mio ton/ year)	2,85	0,91	9,9
Turnover (billion €)	23,83	1,25	13,6
Energy intensity for melting (KWh/ton)	1.100	722	700
CO2 intensity (tco2/t)*	2,3	1,5	1,1
Total energy (GWh/year)	3.135	657	6.915
NIWE estimated energy SAVINGS up to 25% in the whole foundry process			
Embodied energy saving per tone of product kWh per tone	275	180,5	175
Estimated CO_2 reduction (Mio ton of CO_2 per year)	1,64	0,34	2,7

(*) CO_2 Abatement in the iron adn steel industry 2012; IEA Clean coal centre

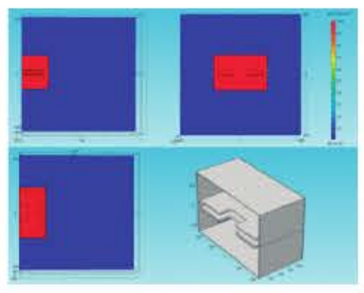
Table 1: *Targeted sectors and long-term expected impacts;* Data from the he European Foundry Industry 2012. CAEF (The European Foundry Association).

IPT ALUMINIUM

Design and construction

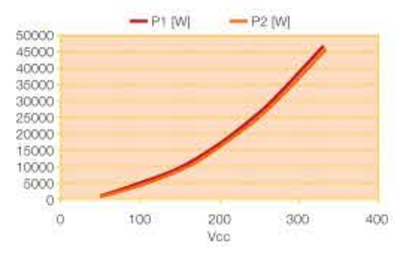


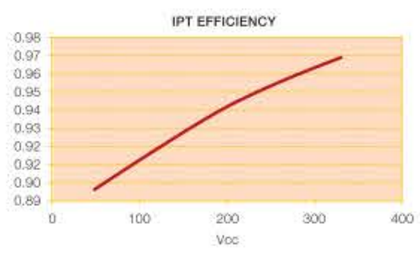
Distribution of magnetic field in each module (Symetrical cut)



IPT Performance

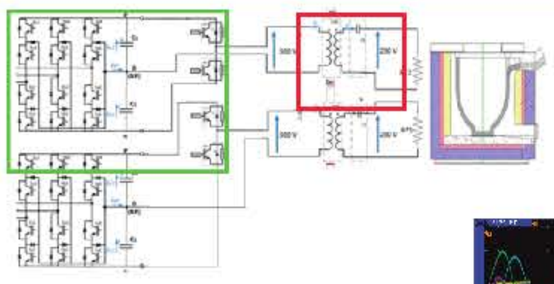
Vcc V	Freq. Hz	V1 V	I1 A	Vload V	Iload A	P1 W	P2 W	Effic. %
50	23000	45	25	33	29	1035	957	92
150	23000	135	71	101	89	9585	8989	93.7
250	23000	225	118	170	148	26550	25160	94.7
330	23000	297	157	228	198	46629	45144	96.8





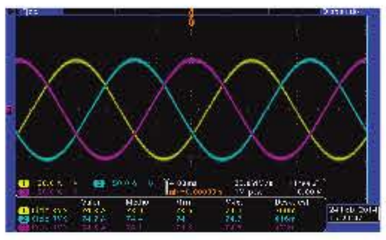
So far the prototype worked according to the expectations and maintained 400 kg of aluminium. In recent tests, the IPT system has been able to melt 300 kg of aluminium within 3 hours, showing the suitability and potential for industrial applications.

Design: 2x50 kW Power Electronics Converter



50 kW High frequency inverter:

- A three legs interleaved half-bridge
- The three legs are activated by turns
- Ultrasonic switching

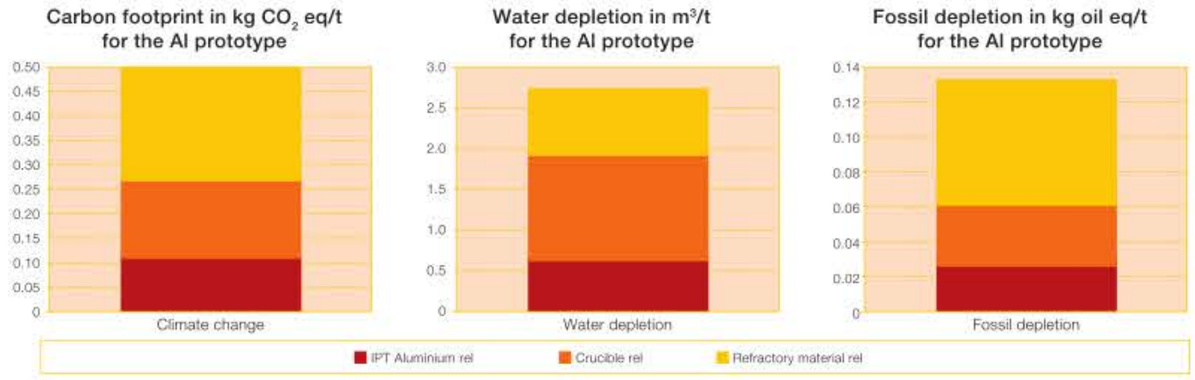


50 kW Three level inverter (NPC) topology:

- High power transfer capability
- Improved power quality
- High efficiency
- Fewer EMC certification problems because of reduced noise and dV/dt values
- Cost and size reduction
- Smaller filters

LCA Results. Impact per Al t.

1. IPT: Expected life 10 - 20 years. Main contributors PCBs, capacitors and primary cooling system (10 years)
2. Crucible: Expected life 10 years. Main contributors cast iron and steel for crucible, lid, support, shell and electronic rack.
3. Refractories: Expected life 3 years. Main contributor SiC from 30% Promalight, and refractory fireclay from Promacret



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