*Figure 1 / 'Climate transition of the world' Painting 2014*

**Ecology and economy in secondary steel production** – or to meet the goals of the energy and climate transition with profit.

At the end of June 2022, I had a lecture on the topic ' How can companies strive for net-zero targets and at the same time reduce costs? '. This was to initiate a discussion at the MMSteelClub conference in Barcelona.

The 'net-zero' target, which is technically feasible in primary steel production with the conversion of blast furnaces to DRI reduction plants, special electric arc furnaces ("smelters") and the existing converter plants, does not seem to be so clearly feasible in secondary steel production.

The electric arc furnace has been massively improved technically since the 60s of the last century, the efficiency of the heat transfer of the arc to the steel bath has been significantly increased, the production has been increased by continuous scrap conveying, but the use of waste heat, which is usually over 40% of the energy introduced, is not or only poorly used. When used, the subsequent exhaust gas neutralization destroys the energy gain achieved. The use of the bound energy (post-combustion of CO in $CO_2$) used in some 'preheating projects' is a sham, since in these applications continuous combustion no peaks are reached as in the shaft furnace and therefore the environmental impact is not correctly reproduced.

Although the electric arc furnace is flexible, efficient, and production-optimized, produces much less climate-damaging exhaust gases than the blast furnace, it is still far from net zero, especially because the exhaust gas is not used enough in terms of energy.

The problem, that most leaders and politicians have is not that they don't know what saving the entire world looks like, but how to take the 'small' steps in the right direction. It does not always take a major investment and new buildings to create the energy transition.

My thoughts and suggestions on the energy and climate transition of secondary and partly also for primary steel production:

1. Produce and use as much renewable energy (solar, wind and hydro) as possible
2. Improve the thermal benefits of the electric arc furnace with a simple change in exhaust gas flow that can be realizable in short-term. ROI < 1year
3. Use the exhaust energy of the electric arc furnace in an optimized scrap preheating. ROI < 2 years
4. Use the constant residual heat in the off gas after the preheating process for other applications such as furnace air preheating, electricity generation (steam, ORC, etc.), district heating, etc.

A **paradigm change** is needed on point 2. The existing furnace, optimized in the energy transmission 'arc-metal bath' is not optimal in scrap melting.

The spherical high-temperature range around the individual electrodes produces cold areas where additional natural gas burners must support the melting (Figure 2).

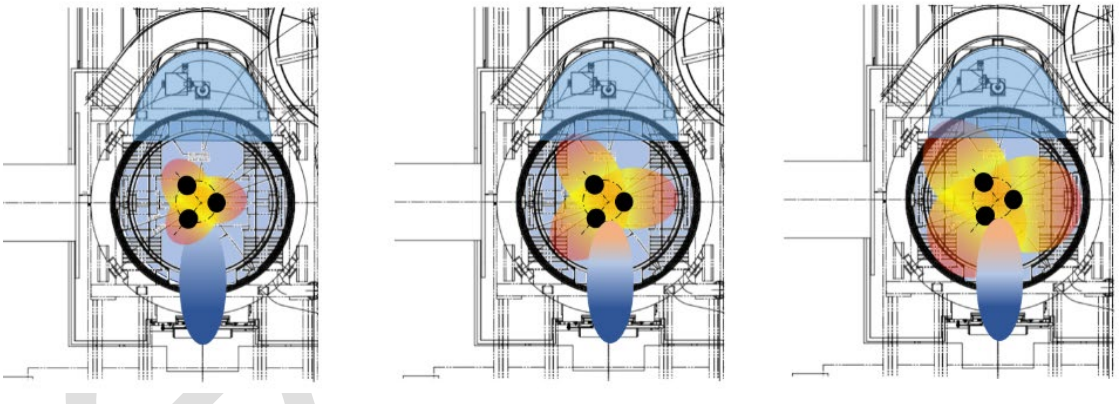

*Figure 2 / Melting of the scrap (cold areas)*

The additional energy required to heat the cold areas can be replaced with a change in gas flow in the furnace (Figure 3).

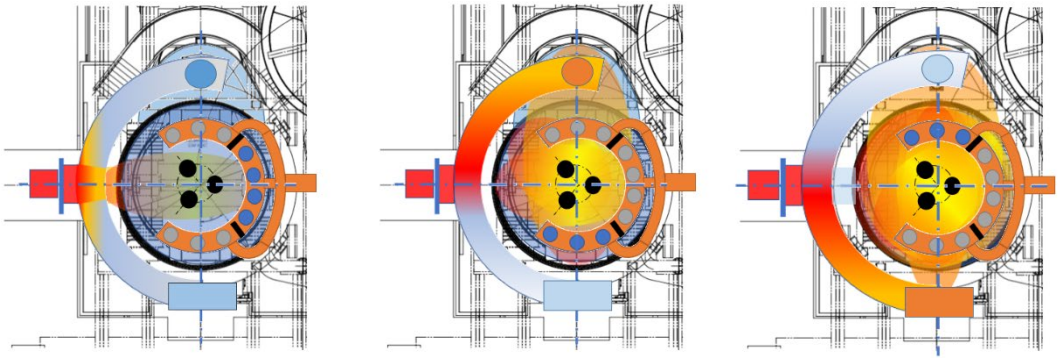

*Figure 3 / Melting the Scrap (Core)*

This not only makes the burner energy, usually natural gas, or LPG, unnecessary, but also results in a smaller wear of the refractory material and a more uniform and smaller load on the cooling panels in the top furnace and on the furnace lid.

Another advantage is the thermal relief of the electrodes, since the 'cooling air supply' separates the hot area of the scrap along the borehole from the electrodes (Figure 4).

This change in off-gas flow provokes an active scrap or DRI preheating in the furnace and can be used in any electric arc furnace including the smelters.

This significant change in the gas flow in the furnace can be realized with a minimal investment and disturbance; the savings potential roughly corresponds to the cost potential of the burners used minus 1 burner.

The return on investment (ROI) is in less than one year. This change also frees from any dependance of natural gas in the furnace. The realization of this step is possible at short notice.

More about the individual proposals will follow in further contributions.

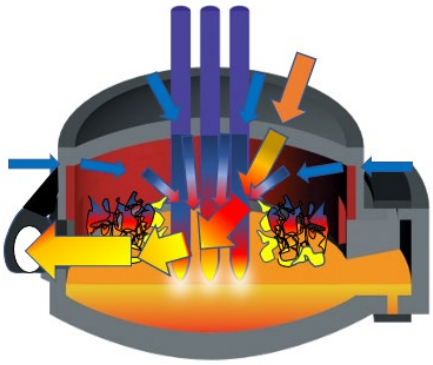

*Figure 4 / 'Cooling' of the electrodes*

The perfect moment for avoiding the climate change has gone – let's take the second best. And this is NOW!

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