

Time to sober up!

The elephant is still in the room, says **Rutger Gyllenram***, and this time it is grey.



The author sobering up.
Photo: Pelle Berglund, Znapshot.
Makeup: Thérèse Gyllenram

IT is now four years since *Steel Times International* published my debate article "Between a pony and a pink unicorn" which was written as a reaction to what could be described as hydrogen euphoria. The message was simple: decarbonisation is about management of scarce resources, tedious work and avoiding wishful thinking. Since then, we have seen several projects based on hydrogen reduction emerge, some are now on the way to materialise, possibly facing extreme production costs, some are waiting for capital and others are halted.

Again, other companies close their blast furnaces and invest in mainly scrap-based production which changes scrap availability drastically without positive effects on global decarbonisation since it is just moving the ore reduction, often in blast furnaces, elsewhere. This was not what we hoped for in 2021 - what went wrong and what should we do now?

Climate hangover

The greenhouse effect where the temperature on Mother Earth gradually

rises with the increasing atmospheric concentration of higher order molecules, Green House Gases, GHGs, is indeed a global problem that spans all sectors in society. Meeting the Paris agreement while maintaining our standard of living is a challenge and from my outlook it does not look good. I believe we have in Europe made a number of fatal mistakes followed by financial interventions hard to understand and in my mind counter-productive attitudes towards coal and natural gas:

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- The concept “decarbonisation” as the necessary way to mitigate climate change, is misleading since it indicates that solutions should exclude coal. Instead, the focus should be on GHG emission abatement.

- The European Union spent vast amounts of taxpayers’ money on the ULCOS project developing the oxygen blast furnace with top gas recycling and CCS only to scrap the project after the Lehman Brothers crash. Had we continued to create a new normal for blast furnaces the world would have been in a much better state now.

- Another ULCOS project was ULCORED based on blue hydrogen but was never implemented.

- During the ULCOS project, CCS was considered a feasible way to deal with carbon dioxide but that changed and it disappeared for a period until it was suddenly recognised again as necessary. We lost a decade.

- Germany and Sweden have had similar problematic relations with nuclear energy. We have both closed fully functional plants. Sweden is now planning new capacity but again we have lost some decades.

- The timing and implementation of some of the hydrogen projects in Germany are difficult to analyse for an external observer.

- In the end, the elephant in the room is the use of fossil energy in blast furnaces and DR shafts. It does not matter how much we close our eyes and hope it will disappear. It is there and we have to

learn to live with it. At least for the next decades or so. Responsible use of coal and natural gas includes stopping the leakage of methane from mines, wells and pipes. But promoting this is difficult if we do not accept the use.

It is easy to blame politicians for this destructive industrial policy and poor environmental development, but we all share responsibility for not communicating industrial insights and standing up for what we believe is the truth. Time for a pain killer, a cold shower and back to work.

What playbook – global – regional - sectoral or corporate?

All sectors in society need to decrease GHG emissions, not only the part that constitutes the mining and metals industries, and that transition to a low-emission society consumes vast resources for low-emission energy production. Storage capacity for captured carbon dioxide must be created, new low emission electricity generation installed and structures for sustainable biomass harvesting secured. In providing this capacity, other environmental factors than Global Warming Potential (GWP) must be considered like Land Use - Land Use Change (LULUC) and biodiversity, not to forget the water issues. Resources and additional strains that can be put on nature are limited and the balance between decreasing the GWP and effects on other factors will control the pace at which the transition can go forward.

For these concerns, the perspective given

by an environmental declaration based on the bookkeeping LCA used today doesn’t provide a full picture since it does not tell if resources are used to abate emissions in an optimal way. How is available electricity best used? Is it to produce hydrogen to reduce iron ore or produce E-fuels? Is biomass best used for district heating or for producing chemicals? The answers may depend on the scope applied but we need to be able to handle this expanded system view to make the necessary prioritisations.

Other factors...

There are finally other factors affecting the transition pace: available capital, available human resources, mature technology and perhaps the most critical: support among the electorate for allocating the necessary resources and accepting a possibly increased price for goods.

The investors need profitable business cases free from dreams about green premiums and wishful thinking. That can be fixed with carbon taxes and border protection provided the companies do not just close down and move. Human resources may in some parts of the world require migration combined with training, and technology matures best when implemented in manageable steps. All a piece of cake compared to voter acceptance that requires an informed and open debate where different opinions are heard and respected. I do not know about the USA or Asia but in Europe this issue needs attention.

To summarise, our plans to drastically change the industrial landscape, including the metals and mining industries, may not lead to the desired results due to oversimplification given by the LCA methods applied and only taking into account the needs of the steel sector. We need research in this field together with an open, unbiased discussion on how to move forward.

Resilience – laying the ground for resource conservation and new processes?

The twilight period we are experiencing now offers additional challenges. After decades of supply chain globalisation, some countries now dominate production of critical metals which cause problems from a resilience perspective. For iron and steel, it is problematic since it is used to cast doubt on plans for decoupling the

iron supply chain by producing DRI with CCS in countries with natural gas. It would otherwise probably have been the most efficient way to produce low emission iron. We must find a way around this problem. For critical metals, which all have a higher carbon footprint than iron, the need to improve recycling becomes obvious. Today the economic value of these elements does not cover the extra cost for necessary deconstruction of used products, shredding and automatic sorting but with regulations stipulating recovery, who knows? Another issue that springs to mind is that we lose large amounts of iron and alloys including carbon in the steelmaking process when we remove unwanted elements. With better scrap processing that might not be necessary. Decarbonisation and resilience in one strike – bingo!

Recycling is not enough

Recycling is, however, not enough to create a resilient supply of critical metals and we need primary production from ores, tailings, slag, dust etc containing trace elements of these elements. Also here, I see a possible symbiosis between the efforts put into the climate work and resilience ambitions. It is painful to see how hopeful inventors of new low emission processes describe how they want batteries of many small units on the scale of a few tons to compete with shaft furnaces to produce pig iron or DRI. I am sometimes asked to give an opinion and I always say the same thing: "Try to produce something with a higher added value that can cover the extra cost for a small plant." Without going into detail, some of the new ideas have the potential to become commercial much faster if they focus on metals other than iron, and perhaps having iron as a co-product.

The conclusion is that resilience and emission abatement are both of strategic interest and may be mutually supportive for metals. If fossil coal becomes a part of the necessary mix to secure the supply of reductants, then carbon storage capacity will become a strategic asset. This might be hard to digest for policy makers.

Try again and do it right this time

Awareness of the climate crisis has made most of us willing to join the troops and fight climate change based on a mix of sincere concern and opportunism. The extensive number of new decarbonization professionals with no previous knowledge

of the industry that has joined the force need precise roles and guardrails in their respective organisations. It is my opinion that this has not worked for the last 10 years and that many of the problems we see today are caused by a lack of professionalism. Here are my thoughts on how we must all adapt to avoid a total failure in the future.

- Governments and governmental organisations: Focus on setting goals on reduction levels that are possible to achieve with mature technology. Provide funding for research, test benches, demonstrator plants and whatever that makes the technology front move forward, but do not expect major technology shifts before 2050. Furthermore, refrain from limiting the research scope based on sentiments. We need solutions on both short- and long-term and might have to kill our babies to achieve some real emission abatement. Financial instruments like ETS and CBAM for Europe and similar systems in other parts of the world, still must prove their relevance to promote the transition and not just cause deindustrialisation. Well, we will see about that, but a low hanging fruit is to promote abatement where it can be done at the lowest possible cost instead of trying to improve already super-optimised production facilities. How to do that? I do not know, but I guess it is soon time for politicians and industry to start again with a clean slate and discuss how to promote real sustainable change.

- Scientific community: Stick to scientific methods and refrain from politics! Base your claims solely on published research and your own results and avoid repeating opinions from the public discourse even if it helps the funding. Too often we hear statements like "the blast furnace process has reached the limit of possible development" which is false and if it occurs in peer reviewed papers it is deceptive. In the same way, in the hypothetical case of future problems with financing and implementing large-scale hydrogen reduction projects, saying that 'hydrogen reduction is no longer an alternative' to

promote some other line of processing would be equally wrong. Process development is complex, takes decades and must be analysed with deep understanding of the intrinsic mechanisms and the nature of process development. This is what science does best and where it is a key to progress.

- Non-Governmental Organisations, NGOs: Focus on being a part of the solution and not a big chunk of the problem! Being passionate about the climate is not enough. A general roadmap for decarbonization where some solutions are included and others excluded is questionable and may make the situation even worse. A recent example was a transition project where reduction with natural gas and melting in an EAF was supposed to replace a blast furnace plant, something that would have halved the emissions. It was, however, scrapped due to the opposition against fossil gas and instead, the blast furnace

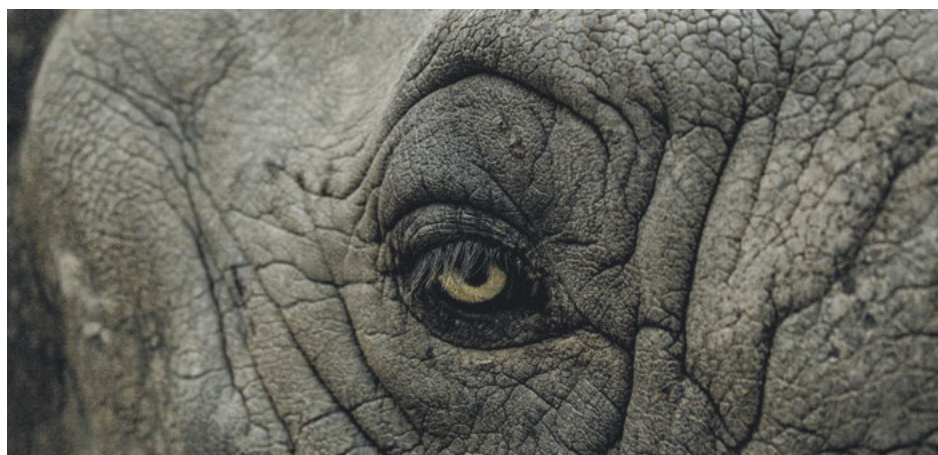




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“In the end, successful abatement of climate gas emissions on a global scale relies first of all on continuous improvement and wise reinvestment programmes enhancing existing plants.”

is still operating. Furthermore, all the alternatives to standardised LCA that NGOs offer the industry for certification, consume large amounts of engineering resources. Engineers are crucial for improving production but wasted on administrative work. However, watchdogs are needed. There is a lot that can be done in industry and there are a lot of difficult questions to be asked. Companies should explain what they do to abate emissions. All companies have a list of possible improvements and following up on them is a journalistic task worthy of any climate bull terrier.

- Steel customers: Base your selection of low emission steel suppliers on facts and figures and a profound knowledge of the supply chain you are becoming a part of. Buying only from scrap-based producers may sound like you have a decarbonisation strategy but is elusive. The global steel supply comes from multiple process lines and sources and what matters is that they are operated optimally from an emission perspective according to their preconditions. In addition, it is essential to understand that steel is a circular material and that its circularity depends on how well your factory scrap is sorted and how well your product is suited for deconstruction and recycling, preserving the material value.
- Steel companies with blast furnaces: Consider stepwise transition to top gas recycling if the goal is to continue

production. Even if the blast furnace is scheduled for closure in the coming years there are ways to increase the energy efficiency until that time, which has a positive effect on GHG emissions. Charging scrap has no such effect unless all electricity is from coal combustion, but charging DRI/HBI is effective even when produced with natural gas without CCS.

- Steel companies with direct reduction furnaces: Consider selling part of the DRI produced as HBI and offer carbon storage as an additional service.
- Steel companies with electric arc furnaces: Focus on scrap management to facilitate lower losses of iron and alloys.

In the end, successful abatement of climate gas emissions on a global scale relies first of all on continuous improvement and wise reinvestment programmes enhancing existing plants. I could have added bullets for financial institutions, mining companies, technology providers and other parts of the iron and steel eco system, but I end it here with just one addition.

- Shop floor managers, researchers and personnel throughout the circular supply chain: Keep up the good work. You are the ones that must make the industry survive and climate gas emission abatement come true. To quote my friend Joachim von Schéele: “Perseverance Eats Passion for Breakfast”. ■