RE4Industry Industrial FORA

a vision for the decarbonisation

RE4INDUSTRY
Renewable energies for industries

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INTRODUCTION

The energy intensive industries are at the centre of Europe's economy, which they have helped to develop and shaped it into what it is today. However, in the current climatic, energetic and economic crisis, the industry sector is often singled out and requires huge investments, both financial and human, to succeed in the sustainability transition. In order for the world to have a 50% chance of keeping global warming to 1,5°C over pre-industrial levels by 2050, industrial emissions must decline by more than 90%, according to the International Energy Agency's (IEA) "Net-Zero by 2050" scenario. Decarbonization of industrial process heat generation will be a crucial step in eradicating industrial greenhouse gas emissions since a significant portion of industrial emissions is caused by fossil fuels for process heat generation.

To understand the importance and magnitude of the challenge that industries are facing today, it is worth giving some figures, particularly in terms of energy consumption and GHG emissions. When looking at the final energy consumption, the industrial sector represents about 26% of this value (Eurostat). In comparison, the transport sector accounts for about 28,5% of final energy consumption and energy consumption in European households for about 28%. If we focus on the evolution of this value over the last 20 years, we can see that it fluctuates around an average of 26,7%, but the trend is slightly downwards overall.

The industrial sector accounts for about a quarter of the EU's energy consumption, but what about GHG emissions? According to the European Environmental Agency, the sector is responsible for 719,574 ktCO2-eq in 2020, or 22,16% of the EU's total emissions. This emission value is composed of two factors added together, namely the combustion of fuels for heat/electricity generation and - on top of that - the emissions from industrial processes and product use. It's however important to note that GHG emissions associated with the energy used in industry but not produced on site are not counted in the industry sector directly, but in the "Energy Supply" sector, which represents the highest emitting sector in terms of CO2-eq. The industry is also responsible for a share of those emissions.

These figures demonstrate the importance of the industrial sector and underline the intensity of the efforts needed to achieve the complete decarbonisation of heavy industries by 2050. However, several factors are at stake which complicates and slow down industrial decarbonisation.

The first problem is the variety of activities included under the "industry" category. Indeed, when talking about Energy Intensive Industries (EIIs), a multitude of sectors are involved such as cement, iron and steel, chemicals and petrochemicals, fertilizers, glass, lime, paper, pulp and printing, non-ferrous metals, etc. All these different industries have the same goal to decarbonise gradually, but each sector will achieve this objective according to its own strategy. Indeed, the energy needs of all these segments are different, along with the means each of them has at its disposal to reduce their GHG emissions.

On top of the technical challenges, it is required to stay competitive on a global level while at the same time complying with the EU's ambition in terms of decarbonisation. The investments required for the energy transition of European industries are colossal, and it is crucial to have the proper support mechanisms in place to encourage more sustainable practices while maintaining a competitive economic model for European stakeholders. This is to avoid the risk that "decarbonisation" turns into "de-industrialisation" at the European level, where industries will simply relocate to places where ecological standards are less strict.

In order to identify common interests, barriers and opportunities associated with the decarbonisation of energy-intensive industries, a consultation with three different types of stakeholders was conducted. These are policymakers, industry representatives and industry association representatives. Together, these stakeholders have a good overview of the ongoing key policy issues while being aware of and defending the interests of key market players in their sectors.

This consultation made it possible, among other things, to highlight the convergences and divergences of opinion on several key topics listed on the following pages, such as:

- Carbon removals, storage, and usage
- The position of Hydrogen
- Bioenergy and solid biomass
- Electrification
- Finance and investments

Each page of the document, therefore, presents one of the topics mentioned above, as well as the opinion of each stakeholder interviewed. This approach allows highlighting some differences in perception on certain topics depending on the type of stakeholder.

CARBON MANAGEMENT

The interest in carbon removal solutions has been growing steadily for the past years, and significant progress is being made on the technological side of carbon capture and utilisation. Certain industries, like the cement or lime sector, have a lot of GHG emissions embedded in their production processes. These process emissions are unfortunately extremely difficult to get rid of, because, unlike combustion-based GHG emissions, switching from fossil fuels to renewables does not impact process emissions. Therefore, the only available solution to reduce process emissions is through carbon capture and storage.

However, implementing carbon capture and storage technologies tends to increase energy consumption quite significantly. To address this issue, investments in renewable technologies to produce this much-needed energy are a must in order to keep costs low and allow for the industry to remain competitive. On top of this, if there is not enough CO_2 produced, it is hard to find a place to store it since moving it around is a costly process and might not be worth it if the quantities are too low. In that regard, it's a possibility that bigger players (with very high CO_2 production) will develop long-term contracts, but there is currently no authority for centralizing CO_2 storage and developing a better network to transport it. A significant role will be played by carbon removal technologies, essential to enable effective climate action, avoid greenwashing and strengthen public confidence.

Carbon Dioxide Removal (CDR) refers to “anthropogenic activities removing CO_2 from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products” (IPCC). Removals can 1) accelerate the reduction of net emissions (immediately), 2) counterbalance ‘hard-to-abate’ emissions (near-term), and 3) deliver net negative emissions (long-term). Carbon removals lead to the generation of “negative emissions”, which are crucial in achieving our climate goals. CDR’s deployment is currently facing many obstacles and legitimate questions around how it can be developed and maintained as an effective, ethical, and scalable means of addressing climate change.

TRADE ASSOCIATIONS

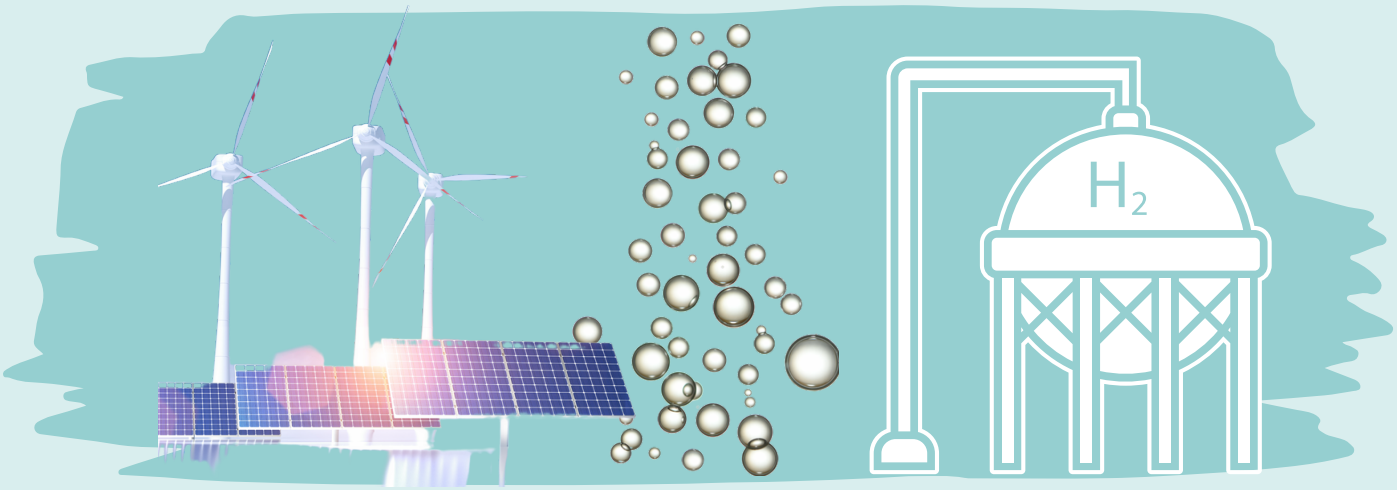
Even if, as of today, carbon capture is technologically feasible, there is no real carbon transport network to make use of. There is a clear need from the industrial side to have a better carbon framework, that would speed up the uptake of carbon capture technologies and the pace of decarbonisation.

ENERGY INTENSIVE INDUSTRIES

Carbon removals are the only available solution that would allow certain European industries (with high process emissions) to become fully carbon neutral.

HYDROGEN USE

Hydrogen is a hot topic at the centre of the political debate, spreading the most divergent opinions. First of all, it is interesting to review why hydrogen is generating so much discussion, and what it actually represents. Hydrogen is not an energy source as such but rather an energy carrier and possible energy storage opportunity. The production of green electricity by means of solar or wind energy has one major flaw: its intermittency. It is unfortunately entirely conditioned by the presence of sun or wind, and the periods of high demand for electricity do not generally coincide with periods of high production of green electricity. For this, hydrogen is particularly interesting, as it allows the electricity produced to be "stored" in another form through the electrolysis of water.



According to the “REPowerEU” plan developed by the European Commission as a response to the energy crisis and containing solutions to make Europe more energy independent, renewable hydrogen will play a fundamental role in replacing fossil fuels like gas, coal or oil in some “hard to decarbonise” industries. The current REPowerEU plan sets the ambitious target of 10 million tonnes of European green hydrogen production, coupled with another 10 million tonnes of imported green hydrogen.

However, tremendous efforts need to be undertaken in order to have renewable hydrogen commercially available, and some industrial stakeholders shared their doubts regarding that specific availability in the short term (2030). Those efforts include, among others, speeding up the deployment of hydrogen infrastructure for the production, import and transport of hydrogen, accelerating the work on missing hydrogen standards, accelerating investments, etc.

TRADE ASSOCIATIONS

Hydrogen seems to be a completely valid solution on paper, but there's a risk that the much-needed increase in renewable electricity generation will be entirely consumed for green hydrogen production.

POLICY MAKERS

In the longer term, there is likely to be a greater role for hydrogen. It could help with decarbonised energy storage. Hydrogen is hugely valuable, as it can be used to meet the flexibility and reliability challenges of heat and electricity systems.

BIOENERGY AND SOLID BIOMASS

Energy generated from all forms of biomass represents around 60% of the European renewable energy mix. This figure illustrates the importance of this energy source in the production of zero-carbon heat and electricity and highlights the key contribution of biomass to the decarbonisation of the European energy system.

At the industrial level, biomass is currently used by some sectors which have high thermal energy demands, as it is often a cheaper alternative to fossil fuels. Due in large part to how certain industries such as the forest-based sector (pulp and paper, sawmills, etc.), use internally generated residues and byproducts, forest biomass is, as of today, the main source of renewable industrial process heat. However, it is crucial to recognize the significant amount of variability that falls under the term “biomass” when it comes to larger prospects for its role in industrial process heat. Indeed, bio-based materials may take on a variety of forms, and there are several ways to turn those materials into process heat, such as torrefaction, gasification, or liquefaction, on top of direct combustion.

Therefore, biomass can in theory satisfy the majority of industrial process heat requirements since it can be transformed to create biomass-based fuels that are relatively comparable to the fossil fuels now in use. Nevertheless, it is challenging to make “feedstock independent” statements about the cost competitiveness of biomass, since some of those pre-processing technologies are not yet commercially available and the price of the feedstock might vary significantly.

Moreover, when it comes to solid biomass, there is a whole range of diverging opinions between the different stakeholders involved in the decarbonization of energy intensive industries. Industrial players see solid biomass as one of the best assets to decarbonize their activities due to its low cost, versatility, abundance in Europe, the local development it enables, its well-developed value chains, etc. The other major advantage of biomass is that it contains carbon, which is a crucial element in some industrial processes (steel production, lime production, chemical processes, etc.). Therefore, some sectors have already invested heavily in adapting their processes, such as the cement industry, which is one of the biggest GHG emitters. The sector has set an ambitious target of 60% alternative fuels by 2030, and 90% by 2050, more than half of which will be biomass waste.

However, the important role of biomass seems to be under-recognized by some political groups and non-governmental organizations. Indeed, recent reforms to the review of the Renewable Energy Directive (REDIII) call into question the 'renewable energy' status of primary woody biomass, defined as any type of feedstock from the forest regardless of its quality. Such changes would have dramatic effects on the decarbonization potential of certain industries, would reduce biomass feedstock availability and would greatly penalize front-runners who have already invested heavily in the use of woody biomass for energy.

TRADE
ASSOCIATIONS

Bioenergy applications in industries such as pulp and paper are common, as they use biomass to produce steam. Bioenergy is a great solution for industrial heat processes.

ENERGY INTENSIVE
INDUSTRIES

Biomass is already playing and will play a huge role in decarbonising industrial heat production.

POLICY
MAKERS

Biomass might sometimes have a negative public image, but this seems to be less the case when it is processed and not burned as is.

ELECTRIFICATION

System electrification is the decarbonisation option that seems to have the most consensus among and within the many types of stakeholders. It appears to be a simple, quick and efficient way to completely reduce the emissions associated with certain processes, as long as the electricity used comes from renewable sources. An example of heavy industries' processes that are decarbonized through electrification is electric arc furnaces for steel production. These furnaces are usually filled with scrap steel and use powerful electric arcs to melt the material or can be fed direct reduced iron that will be converted to liquid steel.

However, there are some concerns from market stakeholders when it comes to full electrification. First of all, there is the issue of competition for electricity. Whether one is a private, commercial, or industrial user, the electricity used is the same and the electrification of certain uses, such as individual transport, reduces the amount of electricity available to industrial users. Secondly, and still linked to the competition for green electricity, comes the issue of green hydrogen production. As explained above, the REPowerEU plan envisages a European production of 10 billion cubic meters of green hydrogen by 2050.

To achieve this, the same plan announces an increase in the installed capacity of solar photovoltaics (PV) to reach 320 GW newly installed in 2025 (more than double the current capacity) and reach 600 GW in 2030. As the production of green hydrogen by electrolysis is an electricity-intensive process, there is a risk that the increase in green electricity production will be totally consumed by the production of hydrogen, thus penalizing sectors opting for electrification.

Another problem hindering the development of green electricity is the slow and complex permitting process. It can take up to 9 years to obtain a permit for wind projects and up to 4,5 years for ground-mounted solar projects. Given the speed at which the political context changes, these times can be frightening to investors, and it is, therefore, essential that these processes are simplified and shortened in time if industrial decarbonisation is to take place through electrification.

Finally, there is the intermittency of the main renewables used to produce green electricity. Whether it is solar or wind power, the production of green electricity is dependent on weather conditions. This intermittent nature is problematic for many industries whose workload does not coincide with the peak period of electricity production.

TRADE ASSOCIATIONS

When discussing the electrification of industries, it is important to have a level playing field among different players. Indeed, renewable electricity production capacity is not equivalent in every country, and it is important to have a regulatory framework dealing with inequality issues.

POLICY MAKERS

The priority is the electrification of industrial processes fed by green and renewable electricity, whose production is supported by REDII.

FINANCING AND INVESTMENTS

One of the main obstacles to the energy transition is the financing associated with the establishment and development of renewable projects. Indeed, if the EU wishes to reach its objective of becoming climate neutral by 2050, substantial investments must be made from both the EU and the national/public sector, as well as the private sector. According to the European Commission's prediction, additional investments of €260 billion per year by 2030 would be needed to meet the present climate and energy commitments.

Various tools have been developed to support sustainable investments. These include the European Green Deal Investment Plan, which aims to raise at least €1 trillion over the next ten years while providing the practical support needed to carry out sustainable projects. Although all Member States, regions, and industries must contribute to the transition, the challenge's extent varies. Some areas will be significantly impacted and witness a substantial economic and social transformation. To overcome this issue, the Commission developed the Just Transition Mechanism, which will offer tailored monetary and practical assistance to help with the required investments to achieve a fair transition. This scheme consists of three different sources of financing: the Just Transition Fund, a dedicated transition scheme under InvestEU, and the facilitation of loans with the European Investment Bank. There are also other types of financing more closely linked to the industrial sector or to specific innovative projects, such as the Innovation Fund or Horizon Europe. As for the Innovation Fund, it promotes carbon neutrality by providing around €10 billion during the 2020–2030 period for the commercial demonstration of new low–carbon technology, whereas Horizon Europe has a wider spectrum and budget (around €95,5 billion).

Although there are several funding opportunities at the European level which represent an asset for political stakeholders, the number and diversity of funding mechanisms can be more of an obstacle for market stakeholders, especially for smaller structures. Indeed, it sometimes becomes difficult for some to find their way through all these mechanisms, to know which ones they can benefit from, the amounts available, what they need to provide, etc. A simplification of the administrative procedures related to obtaining European funding would be favourable in order to encourage the uptake of renewables and the industrial transition.

In addition to public funding, private contributions will be needed to achieve the short- and long-term objectives. However, in order to attract private funding, it is necessary to minimise the investment risks, of which the most relevant one is the stability of the political framework. It is indeed essential to keep a stable regulatory context to make long-term investments feasible and less risky, while keep pushing for higher ambition.

ENERGY INTENSIVE INDUSTRIES

Financing is a key issue when considering such an important transition as the decarbonisation of industries. However, it is complicated to navigate all the funding schemes in Europe, especially for smaller structures.

POLICY MAKERS

Access to finance and investment is facilitated by a stable political environment, as this reduces risk. To maximise the financing opportunities, you need a clear understanding and stable environment in the regulation.

BARRIERS TO OVERCOME AND POSSIBLE SOLUTIONS

- One of the main barriers to industrial decarbonisation is the lack of understanding of some industrial needs by the political world, resulting in unsuitable legislation.
- Policy files supposed to help with decarbonisation, such as the EU ETS, had mixed success. There is a dire need to elaborate, together with industrial stakeholders, a framework that will allow European industries to become carbon neutral without hindering their competitiveness at a global level.
- Fossil fuels are still heavily subsidised and are slowing down the development of renewables by consuming funding that could be allocated to them.
- Transitioning to zero-carbon technologies can be expensive, and industries may not have the financial resources to make the switch. They need to be supported by financing schemes.
- Fear of losing competitiveness with other regions that do not have similar decarbonisation targets.

- Ensure that high volumes of renewable fuels are available for industrial players that are committed and investing to decarbonise.
- Difficulties linked to biomass logistics can hinder the sustainable transition. There is a need to ensure and facilitate access to biomass feedstock in the upcoming regulations.
- Storing green electricity that is produced through intermittent sources or during hours of low demand is still a challenge, for which new innovative solutions (e.g. new batteries) should be developed.
- The absence of a level playing field and lack of incentives can make it difficult for certain industries to adopt renewable technologies.
- Products should be better designed from the start. This will allow recycling at the end of life to recover the precious material they contain and re-purpose them to reduce material consumption.

MAIN TAKEAWAYS

- There is no silver bullet, the preferred option will always be a mix of solutions providing versatility to the energy system.
- Solutions that are available here and now, and that can be commercially scaled up for industrial use should be prioritised.
- The cost of energy is as important as decarbonisation. In the current energy crisis context, many businesses are forced to close, decarbonisation shouldn't happen through deindustrialisation.
- Energy is not just electricity! Heating represents around half of the energy consumed in Europe, and renewables such as bioenergy are particularly well adapted to decarbonise heat production.
- To cover electricity consumption, the EU needs to develop internal production chains for renewable technologies such as PV. As of today, most of those technologies are imported from outside of the EU, mainly from China.
- Hydrogen will most likely play a much bigger role in 2050 and will be valuable to enable the flexibility to address the reliability challenges of heat and electricity production.
- Importance of Eco-design for new industrial installations. The best way to save energy is by not consuming it or using smarter appliances.
- There is an urgent need to stop fossil fuel subsidies and redirect these resources to renewable projects.