

IRENA INNOVATION WEEK 2020

SUMMARY OF KEY INSIGHTS FROM THE SESSION 5:

RENEWABLE SOLUTIONS FOR INDUSTRY SECTOR TRANSFORMATION

ORGANISED IN PARTNERSHIP WITH THE MISSION POSSIBLE PLATFORM

SESSION OVERVIEW

The 3rd IRENA Innovation Week took place online between 5-8 October 2020 under the theme 'Renewable solutions for transport and industry'. *Session 5: Renewable solutions for industry sector transformation* took place on the 7th October 2020. It was organised in partnership with the World Economic Forum's Mission Possible Platform. This session explored the most promising technology-driven systemic innovations for four industrial sub-sectors which together produce over 85% of energy and process-related emissions and account for over two-thirds of all industrial energy use. Focusing on the **iron and steel (panel I)**, **cement and lime (panel II)**, as well as the **chemical and petrochemical (panel III)** sectors, experts showed what is possible now and explored how to accelerate the development and dissemination of innovative solutions based on key technological options: 1) *electrification with renewable energy*, 2) *the use of green hydrogen* and 3) *the use of biomass*.

3 Panels

16 Expert speakers

382 Participants

SUMMARY OF KEY INSIGHTS

- **Materialising a renewable-based strategy to decarbonise industrial sectors is possible by mid-century.** Technologies and financial resources are available and the key stakeholders in the field, including private sector are increasingly aware of the need to act and increasingly are collaborating to make the energy transition in the industry sector happen by mid-century.
- **Several technological pathways need to be pursued in parallel to decarbonise the industrial sectors, combining conventional and innovative approaches.** For each sector there is not only one low-emission technology available, but several ones and only a combination of these options, chosen and applied according to local specificities, can enable the scale-up and the energy transition in the industry sector. By accounting for about half of the economic emission abatement potential in the "hard-to-abate" industry sectors, renewables could play a more important role than previously estimated.
- **The development of ambitious and long-term joint industry & government plans, the alignment of policies across countries and new regulatory frameworks are critical to support the energy transition in the industry sector.** Current policies and regulations are not incentivizing new low-emissions processes and are often biased towards existent technologies, preventing competition and innovation. Industry experts identified a global level-playing field, with a global and transparent CO₂ accounting and pricing mechanism as a key objective.
- **The costs of new low- or zero emissions technologies are higher than those they seek to replace, which makes investments difficult to justify from a pure economic point of view.** However, support to RD&D and early deployment projects and measures to incentivise early demand for green products could help the scaling-up of these technologies, making them consequently cheaper than and more competitive with conventional ones.

- **New low-emissions technologies require new infrastructure to support the industry from production to distribution.** Investments needs to begin now to make sure that infrastructure is ready at the right time and that confidence is built ahead to drive the demand for low- or no-carbon products. **Industry experts highlighted that the COVID-19 pandemic creates additional challenges but also an opportunity to *build back better*.**

Scene-setting

In his welcoming remarks, **Dolf Gielen**, Director, IRENA Innovation and Technology Centre highlighted that, while the need to accelerate the energy transition five-fold is clear, the path to get there for the industry and transport is not.

Via video, **H.E. Andreas Feicht**, State Secretary for Energy, at the Federal Ministry for Economic Affairs and Energy, Germany provided an overview of Germany's ambitious green hydrogen strategy, which is key to decarbonize hard to electrify sectors and reach carbon neutrality in Germany by 2050. Making hydrogen cost-competitive by ramping up production and intensifying international cooperation to develop international supply chains lie at the heart of this strategy.

In his scene-setting presentation, **Anthony Holey**, Executive Director of the Mission Possible Platform, World Economic Forum highlighted that the COVID-19 pandemic is a unique opportunity for a great reset towards resilient and sustainable societies achievable through *ambition* from the private sector, *action* to implement it and *alignment* across global initiatives, including governments, banks and institutional investors, as well as the industry and the end consumers.

Claire O'Neill, Managing Director, Climate & Energy, World Business Council for Sustainable Development underlined three key requirements: 1) *clear policy support*; 2) *innovation in financial and contractual arrangements* (e.g. auctions); and 3) *integration of value chains and infrastructure* (pipelines, transmission lines, etc.).

Paul Durrant, Head of End use sectors and bioenergy at the IRENA Innovation and Technology Centre provided an overview of IRENA's recent [Reaching Zero with Renewables](#) report indicating that to reach a deeper decarbonization by 2060, particularly in industry and transport requires change of mind-set to focus on those few options that are consistent with reaching zero emissions. Achieving deep decarbonization in the seven "hard-to-abate" sectors can be achieved through a combination of:

1. Reduced demand and improved efficiency (circular economy)
2. Direct use of clean, predominantly renewable electricity
3. Direct use of renewable heat and biomass
4. Indirect use of clean electricity via synthetic fuels and feedstocks
5. Use of CO₂ removal measures (with lower potential than other estimates)

Panel I: Solutions to decarbonise the iron & steel sector

This panel focused on the cutting-edge technologies which address the decarbonisation of iron and steel-making processes. Two key innovative technologies are promising to be game changers for this sub-sector, when paired with renewables: 1) *hydrogen-based direct reduced iron (DRI)* and 2) *smelting reduction for iron-and steel-making*. The panel was moderated by **Faustine Delasalle**, Director, Energy Transitions Commission (ETC) and the following panellists joined the discussion: **Yoon-Gih Ahn**, Senior Vice President, Management Consulting Center, POSRI (POSCO Research Institute) who provided the insights after the session due to an unstable connection, **Åsa Ekdahl**, Head of Environment and Climate Change, World Steel Association and **Andreas Regnell**, Chairman of the Board of Hybrit, Vatenfall.

Highlights from the discussion:

- » **There a small number of options to decarbonise the steel and iron sector.** Hydrogen-based DRI and electric arc furnace-based steel production has been identified as amongst the most promising technological pathways. However, other technologies such as use of biomass and hydrogen, CCUS as well as direct use of electricity through electrolyzers could play a role perhaps in combination. The appropriateness of specific technologies will depend on the region and sites.
- » **Carbon capture, utilisation and storage (CCUS) will play a role for the iron and steel sector, but likely only a limited one as blast furnaces are gradually replaced with DRI and electric arc furnaces:** Capturing and storing process CO₂ emissions is a pathway being considered, which can be combined with renewables for energy supply. However, in the long-term most of the blast furnaces will be phased out, so CCUS is an intermediary solution. A CCS project in Norway that ships captured CO₂ can serve as an example that innovation on infrastructure goes beyond the physical infrastructure and it can shape the overall energy system.
- » **Outside China, half of primary steel capacity will reach the end of its investment cycle in the next 10-15 years,** which creates a window of opportunity that requires fast and concise actions. Hybrit project in Sweden provides an example of actions that can be replicated elsewhere (innovative background, access to reliable and low-cost renewable electricity and government support).
- » **A global level-playing field is required for low-carbon steel to take off:** Currently steel is traded on a global market with high competition and low margins. Low carbon steel costs 20-100% more than conventional steel. For low carbon steel production to become competitive and to be further commercialized, it is necessary to create a market for these technologies. Policy instruments like a fundamental to increase in the CO₂ price in Europe, or government support in the early days to decrease investment risks (e.g. through public procurement), as well as global and transparent tools to quantify and price CO₂ footprints would help. A transparent and international agreement would be needed and a clear policy signal is lacking today.
- » **Long-term plans and infrastructure investments are key enablers.** A concrete and long-term national climate policy is crucial as the changes implemented today take decades to have effects. The complexity of this sector requires partnerships and involvement of different stakeholders. Required infrastructure include supply of reliable renewable electricity, storage capacity and pipelines. As the market by itself does not have sufficient incentives to decarbonize today, it is imperative for governments to have a clear and consensual plan, both at national and international level.

Panel II: Solutions to decarbonise the cement and lime sector

This panel, which focused on the cutting-edge technologies available to reduce carbon emissions in cement and lime manufacturing, was moderated by **Jim Rushworth**, Industrial Policy Director, CEMBUREAU. The following panellists joined the discussion: **Kiran Ananth**, Principal Counsellor, Confederation of Indian Industry - Godrej Green Business Centre, **Rob van der Meer**, Director EU Public Affairs, Heidelberg Cement, and **Davide Zampini**, Head of Global R&D, Cemex.

Highlights from the discussion:

- » **Several technological pathways need to be pursued in parallel to decarbonize the cement and lime sector, combining conventional and innovative approaches.** In addition to bottom-up company strategies, CEMBUREAU's "2050 Roadmap" sets out the European pathway to climate neutrality by 2050 down the cement and concrete value chain, thanks to *alternative raw materials* (use of decarbonated waste materials to replace limestone, *fuel switching to renewables* (a combination of electrification of calcination, use of solar energy, plasma burners, hydrogen and the use of biomass and waste) *energy efficiency* improvements in kilns and ancillary processes, *partial substitution of clinker* in cement and cement in concrete, *capturing and storing CO₂ emissions* (apply CCUS to abate remaining fuel and process emissions; use biomass with CCS (BECCS) to

produce negative emissions that can offset some uncaptured clinker emissions), and *recarbonation* in the built environment and through recycled concrete, among others.

- » **Incumbents are investing in research, development and demonstration (RD&D) projects, in addition to collaborating with start-ups to find innovative solutions.** Among the pilot projects mentioned were Cemex' cooperation with Energy Vault (gravity and kinetic energy-based storage) and HeidelbergCement's LEILAC, Oxyfuel, Amine, micro-algae, hydrogen and kiln electrification projects, which are at different RD&D stages. Other projects in Austria, Denmark, India, Norway also featured prominently.
- » **Valorisation of CO₂ is needed for further deployment of CCS and CCU technologies and will enable to establish a broader carbon circular economy.** While the European industry targets climate neutrality by 2050, India, the world's second largest cement producer aims to reduce GHG emission by 45% by 2050, compared to 2010. A regulatory or market driver such as an emissions trading scheme would be needed in India to achieve the national target to reduce 45% of GHG emission by 2050. In Europe, a key challenge is the lack of incentives to use the captured CO₂ (CCU), as only storing it is encouraged (CCS). Noting that utilising captured CO₂ in ways that eventually mean it is released is not consistent with a zero emission goal.
- » **While decarbonization is technically feasible, policy, regulation, infrastructure investment and the demand-side of the market will be the key driving forces.** Although the available conventional and innovative technological pathways face challenges, these can be managed, experts expressed with confidence. However, the key decarbonization challenge is the absence of (or in the presence of low) CO₂ prices, low returns on investments, lack of infrastructure as well as lack of financial and regulatory measures. Creating a level-playing field and providing infrastructure for production, supply and transport of waste materials, recycled concrete and access to renewable electricity will be therefore key.

Panel III: Solutions to decarbonise the chemical and petrochemical sector

This panel focused on the cutting-edge technologies available to reduce fossil carbon intensity in the chemical and petrochemical sector. The panel was moderated by **Değer Saygın**, Director, SHURA Energy and the following **panellists** joined the discussion: **Florian Ausfelder**, Head of Energy and Climate, Dechema, **Eelco Dekker**, Chief EU Representative, Methanol Institute and **Babette Pettersen**, Vice-President Europe, Lanzatech.

Highlights from the discussion:

- » **The chemical industry has a vital role to play in the climate discussion.** Besides being one of the largest CO₂ emitting sectors, it also has a large portion of hydrocarbon feedstock and options for its decarbonization are limited. Indeed, the decarbonisation of the chemicals sector is complex and could follow different pathways. However, the focus should not be solely on the production side, but a life-cycle approach is needed to capture all CO₂ emissions and offer a full portfolio of mitigation opportunities. The term 'decarbonisation' risks being misleading in the chemical sector context because 'carbon' is an essential element for chemicals. Decarbonisation needs to be understood to refer to the avoidance of CO₂ emissions into the atmosphere.
- » **A range of solutions are needed to move away from fossil based chemicals.** For both energy and feedstock, a switch to green hydrogen and biomass would be required, however the circular carbon economy also plays a key role, especially in the context of plastics recycling. All solutions should be considered rather than focusing on a few technologies. It would also need a mix of conventional and alternative pathways in the transition.

- » **Price is a decisive factor determining whether new chemical processes can compete with CO₂-rich processes.** CO₂-free chemical production is possible with existing technologies. However, the potential of low-emission technologies can be realised only if the necessary infrastructure exists and pioneering work is incentivised. Currently, costs are not well distributed across the entire value chain and transferring them would help increasing the competitiveness of new and cleaner alternatives.
- » **A collaborative effort is needed across the sector.** Individual companies cannot transform the chemical industry on their own and partnerships among actors across the value chain are key to overcome obstacles and challenges from production to final consumption. These can be through alliances, in the form of public-private partnerships, bilateral projects, as well through the involvement of private sector financing earlier in the value chain.
- » **Governments should create an enabling regulatory and legislative framework for new low-carbon solutions in the chemical sector.** A general lack of regulatory and supporting schemes is found in the chemical sector unlike the transport and fuel sector. Lessons from other sectors can serve as a good basis.
- » **A proper carbon accounting mechanism would enable synergies between chemical sector and other industry sectors.** Most of the alternative pathways need CO₂ as a raw material. And it could be sourced from other carbon intensive industries such as steel and iron, cement and lime sector. Balanced carbon credit allocation would encourage the recycle of CO₂ in the broader industry ecosystem. Measures to avoiding product use or end-of life emission would still be needed to be consistent with a zero emission goal.

Closing remarks

The closing remarks were delivered by **Dolf Gielen**, Director of IRENA Innovation and Technology Centre. He welcomed the three sessions' discussions and all speakers' interventions. He summarised the discussions as follows:

- ⇒ **Learn from the power sector and considering deep decarbonization** or even zero carbon by mid-century, which is different than emission halving strategies. Currently, the industry does not have incentive to shift towards low-carbon products, and those companies who do, make it on a voluntary basis.
- ⇒ **Consider the combination of various emission abatement strategies in an integrated manner:** the falling cost of renewable power is changing the paradigm. So far, renewable solutions in the industry sector have been underestimated, so it is critical to consider the system coupling implications for green hydrogen and renewable electricity supply, which have emerged as key solutions in recent years. Energy efficiency and circular economy concepts, direct and indirect electrification and biomass energy and feedstock use all have a role to play. CCUS will have a role too, but less than anticipated previously (with a few exceptions, it will be mainly an intermediate solution to be used in existing plants until the change in infrastructure is made).
- ⇒ **Provide a long-term plan for the development of a global market for low-carbon products:** Low carbon solutions exist but they often increase production cost, and therefore the cost for end consumers, which is why a global market is needed for especially when the product prices are set globally as it is the case for the steel products. Governments can create demand for low carbon products via foresighted policies and public procurement as a tool (e.g. innovation in contractual arrangements). Setting global and transparent CO₂ accounting and pricing methods would allow the creation of a level-playing field. A carbon tax adjustment would require further international debate since it impacts current trade arrangements under the WTO.

- ⇒ **Learn from lighthouse projects:** the pilot projects like Hybrit illustrate the key ingredients for success: innovative climate with supporting government, assets that are already approaching the end of their life cycle and reliable access to clean electricity at low price.
- ⇒ **Invest in infrastructure is fundamental:** we need to produce, supply and transport CO₂, waste materials, recycled concrete and reliable renewable supply.
- ⇒ **Adopt systemic thinking** by integrating the real economy with climate change action, for example distributing the high costs of replacing existing plants across the entire value chain of the iron and steel or the chemical industry and by shifting perceptions of value from cost to environment and social values.