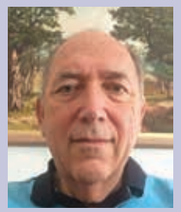
Mission Possible: Net-zero carbon emissions

Following engagement with The Clean Energy Wire (CLEW) which, in cooperation with the Wuppertal Institute for Climate, Environment and Energy, recently hosted a research tour of the decarbonisation pathways being developed by Europe's top-emitting industries, Louis Mielke introduces the Energy Transition Commission's (ETC's) 'Mission Possible' initiative and summarises one of the associated Mission Possible sectoral reports: *Reaching net-zero carbon emissions from plastics*.

Mission Possible is an ETC initiative to identify ways of reaching net-zero carbon emissions from harder-to-abate industry sectors. It is underpinned by the objective of limiting global warming, ideally to 1.5 °C and, at the very least, to well below 2.0 °C by the middle of the 20th century.



A chemical process engineer, Louis Mielke is a past Vice President and convenor of the Small Tonnage Interest Group of SAIChE. He is a member and director of the Virtual Local Section of the American Institute of Chemical Engineers (AIChE). His career covers production, safety, design and commissioning in the mining, food, chemicals and oil and gas industries. Louis Mielke is currently active in the environmental and energy fields.

Several reports have been produced that outline possible routes to fully decarbonise cement, steel, plastics, trucking, shipping and aviation – which together represent 30% of today's energy emissions, a figure that could increase to 60% by mid-century as other sectors lower their emissions.

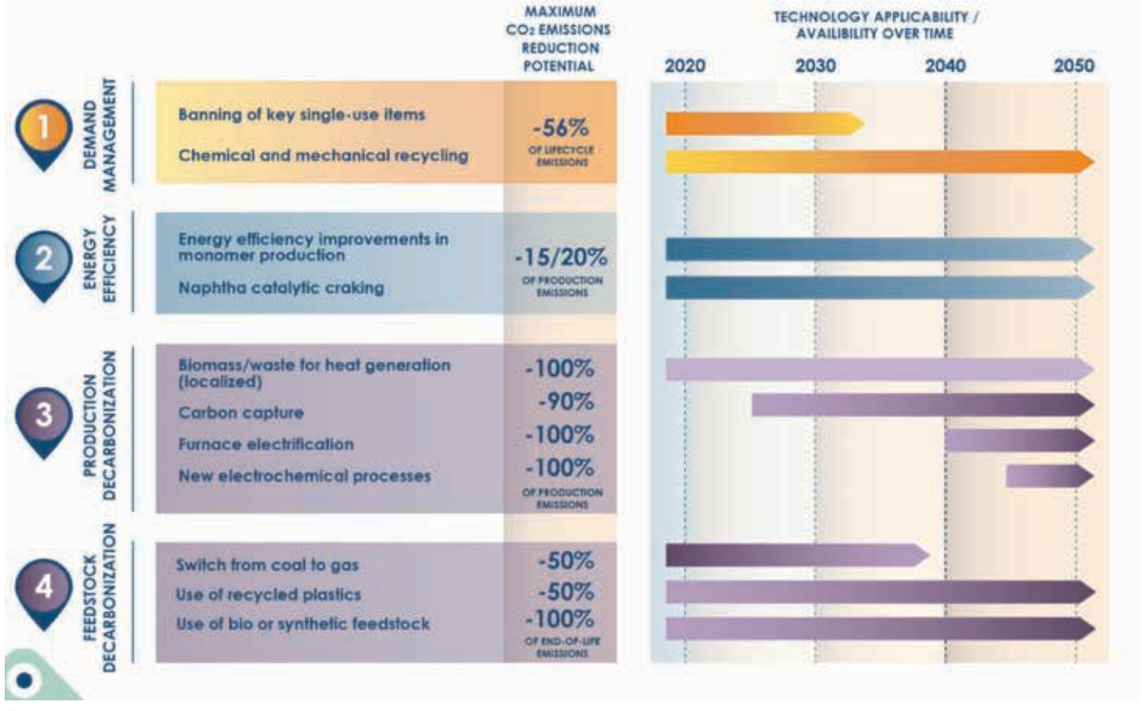
ETC's Mission Possible initiative finds that reaching net-zero carbon emissions from heavy industry and heavy-duty transport sectors is technically and financially possible – by 2050 in developed countries and 2060 in developing countries – with technologies that already exist, although several still need further investment to reach commercial readiness.

The total cost to the global economy of this achievement would be less than 0.5% of GDP by mid-century and could be reduced further by improving energy efficiency, making better use of carbon-intensive materials (through greater materials efficiency and recycling) and by limiting demand growth for carbon-intensive transport (through greater logistics efficiency and modal shifts). Also, this could be achieved with a minor impact on the cost of end consumer products.

The most challenging industrial sectors to decarbonise are identified as plastics, mostly due to end-of-life emissions; cement, due to process emissions; and shipping, because of the high cost of decarbonisation and the fragmented structure of the industry.

Key policy levers were also identified to accelerate the decarbonisation of harder-to-abate sectors. These include:

- Tightening carbon-intensity mandates on industrial processes, heavy-duty transport and the carbon content of consumer products.
- Introducing adequate carbon pricing, strongly pursuing the ideal objective of internationally agreed and comprehensive pricing systems, but recognising the potential to use prices that are differentiated by sector, applied to downstream consumer products and defined in advance.
- Encouraging the shift from a linear to a circular economy through appropriate regulation on materials' efficiency and recycling.
- Investing in green industry, through R&D support, deployment support and the use of public procurement to create initial demand for green products and services.
- Accelerating public-private collaboration to build necessary energy and transport infrastructure.



Reaching net-zero emissions from plastics is possible by combining four major decarbonisation routes.

Growth in demand will result in a surge in carbon emissions from plastics, which by 2050 could reach as much as 4.2 Gt if both production and end-of-life emissions are accounted for.

This body of work provides a rational response to one of the most important questions in today's world: How can we sustainably maintain and develop our high level of private and public prosperity under the conditions of increasing globalisation; hugely accelerated innovation; and the expansive and protectionist industrial policies of some countries?

In Germany, 'prosperity for all' is a political pledge established years ago by Ludwig Erhard. In spite of our problems in South Africa, it is a promise entrenched in current South Africa politics, too.

South Africa, as a signatory of the Paris Agreement, is also committed to reducing CO_2 emissions so as to limit the global temperature rise to below 2.0 °C by 2050. The programmatic approach encapsulated in these ETC reports suggests that this mission is possible without abandoning the 'prosperity for all' approach.

Net-zero carbon emissions from plastics

Demand for plastics is likely to grow rapidly over the next decades, especially in developing countries as a growing share of the population gains access to higher standards of living and a broader set of consumer goods. Without profound changes in the plastics value chain, this growth in demand will result in a surge in carbon emissions from plastics, which could represent 2.0 Gt per annum by mid-century, just accounting for emissions from the production process, and as much as 4.2 Gt if accounting for end-of-life emissions.

Plastics entail two streams of CO_2 emissions: the production process produces on average 2.5 t of CO_2 per tonne of plastics, while the decomposition of plastics at end-of-life (particularly if incinerated) produces approximately 2.7 t of additional CO_2 per tonne of plastic waste.

The Energy Transitions Commission has developed a vision of a feasible path to decarbonise plastics throughout their lifecycle based on four major routes:

- A shift to a circular plastics economy.
- The improvement of energy efficiency in the production process.
- The decarbonisation of the production process.
- A partial switch to renewable feedstock.

"We believe that it is possible to achieve a 56% carbon emissions reduction from plastics by mid-century, and even more in developed economies, thanks to greater materials efficiency and circularity (via mechanical or chemical recycling). Our analysis shows that this can be realised at a low cost if greater coordination throughout the value chain enables the development of new business models in the sector," reads the ETC's Plastics sectoral focus report.

It goes on to point out that the fundamental barriers to recycling are not primarily technical, but arise from a combination of adverse policy, market and industry features throughout the plastics value chain – and all of these could be overturned.

In parallel to the plastic production side, continued growth in virgin plastics production will demand a decarbonisation of the associated production process. Energy efficiency improvements could deliver useful, but only moderate emissions reductions.

The route to full decarbonisation could involve carbon capture, along with a switch to zero-carbon energy sources for the high heat/energy needs of production processes (biomass, hydrogen or direct electrification). The optimal choice between these different technologies will depend on the price at which renewable electricity is available and on the technical and political feasibility of carbon capture and storage (CCS) in particular locations.

Finally, even with a significant increase in plastics recycling (from 9% of end-of-life plastics today to a minimum of 50% by mid-century), a significant share of plastics will still have to be dealt with at end-of-life, either through incineration (potentially combined with carbon capture) or secure landfilling that pays particular attention to avoiding plastic leakage into the environment.

Using a proportion of zero-carbon feedstock such as bio- or synthetic feedstock in primary plastics production would help compensate for the carbon emissions from the remaining incineration (or decomposition) of non-recyclable plastics waste.

End note: The plastic sectoral focus summarised here is presented in detail in a full report that can be accessed via the link below. This report is the underlying analysis on plastics decarbonisation that fed into the ETC's integrated 'Mission Possible' report.

www.energy-transitions.org/sites/default/files/ETC%20sectoral%20focus%20-%20Plastics_final.pdf

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