On the Way to Climate Neutrality

European Chemical Producers Invest in a Greener Future

The EU Commission's ambitious plan for a European Green Deal, launched shortly before the pandemic struck in early 2020, aims to make the continent the world's first climate-neutral region by 2050. The goals spelled out in January last year call for reduction of greenhouse gas emissions by at least 50% up to 2030, compared with 1990 levels. While green groups have pushed for even bigger cuts, others have expressed fears that this could cripple industry.

Europe's chemicals and energy industries are taking a pragmatic approach. Large companies as well as a plethora of smaller specialized firms believe Brussels' goals are indeed achievable, even in an age of uncertainty. This high-tech sector also has an ace up its sleeve, the necessary financial and technology resources to bring it off.

The industry can move swiftly forward and demonstrate leadership in innovating and deploying competitive new technologies for products such as solar panels, wind turbines, batteries, building insulation, medicines or chemical recycling technologies, Marco Mensink, director general of the European Chemical Industry Council (CEFIC) says. But to stem the "massive investment" the Green Deal will require, "it will need the right framework conditions to remain competitive during the transition."

Toward the greening of Europe, the EU Commission is prioritizing energy efficiency, focusing on fuels such as renewable hydrogen and sustainably produced bio-methane, as well as seeking to promote innovation in chemical processes, to reduce the overall environmental footprint of industry. To encourage innovation, Brussels is offering a carrot and a stick: financial incentives, along with a more ambitious regulatory framework that will require only minor adjustments to REACh.

Mensink notes that industry "will need massive amounts of renewable energy in future." To test the potential, CEFIC has signed a Memorandum of Understanding to collaborate on the RE-Source Platform founded by SolarPower Europe, WindEurope, The Climate Group and CDP (RE100) and the World Business Council for Sustainable Development (WBCSD), a European alliance of stakeholders representing clean energy buyers and suppliers. The platform pools resources and coordinates activities to promote a better policy framework for corporate renewable energy sourcing, at EU and national level, while raising awareness and facilitating business opportunities.

Producers Lead the Way with Examples

Before chemical producers can make truly sustainable products, the energy and feedstock balance has to be right. Two important focal points in the transition away from fossil fuels are electrification of crackers and use of more renewable feedstock. At BASF's recent Capital Markets Day, CEO Martin Brudermüller, who is currently president of CEFIC, gave a glimpse into how the world's largest chemical producer intends to "go green," building on the vast integrated network it calls Verbund.

For 2050, BASF has set itself the ambitious goal of achieving "net zero emissions." An interim step will be to reduce absolute CO_2 emissions by 25% by 2030, compared with 2018. While it's already technically feasible for integrated chemical producers to eliminate CO_2 emissions almost entirely, it's not yet economically feasible, Brudermüller stresses. This will be "an ambitious journey over decades," he says, "but we need to act now to get there."

Upstream, hydrogen will be an important driver. In a first move, BASF plans to make its own "green" hydrogen, starting with building a large water electrolysis plant at Ludwigshafen, due on stream in 2024. To harness other renewable energy sources, it is eyeing offshore wind parks and large-scale redeployment of waste heat from its chemical plants, the latter a project being pursued with Siemens Energy.

As part of The Cracker of the Future consortium, BASF, Borealis, BP, LyondellBasell, SABIC and Total are working on electric cracking as a means of reducing CO_2 emissions from ethylene production. Steam crackers, which break down hydrocarbons into olefins and aromatics, require enormous amounts of energy. Typically, the reaction is carried out at about 850°C, which requires burning large volumes of fossil fuels. But as the energy grid becomes increasingly supplied by renewable sources, the consortium members believe an innovative approach could be using renewable electricity to heat the furnaces, which also would help to decarbonize emissions.

The collaboration between the six petrochemical majors in the Northwest Europe "cracking corridor" is bound up with the region's Trilateral Strategy for the Chemical Indus-

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try being developed in cooperation with the Dutch national government, Belgium's Flanders region, the German state of North Rhine-Westphalia and the German, Dutch and Belgian chemical industry associations.

BASF and SABIC have also linked with Linde to develop and demonstrate solutions for electrically heated steam cracker furnaces and are evaluating construction of a multi-megawatt demonstration plant at BASF's Ludwigshafen site, to start up in 2023. They estimate the technology could potentially cut CO_2 emissions by as much as 90% compared with burning fossil fuels. The companies, which have already worked together on concepts to use renewable electricity, have applied for funding under the EU Innovation Fund and Germany's Decarbonization in Industry program.

"Cracking furnaces are one of the largest CO_2 emission sources in the whole petrochemical value chain," says Jürgen Nowicki, CEO of Linde Engineering. "This is a time-tested, optimized technology that we are now putting on a completely new footing, not in the laboratory, but on a large industrial scale."

In the Netherlands in addition to the US, Dow and Shell are working together to design and scale e-cracker technologies. Over the coming years, the companies plan to first try to prove any technological innovations in laboratory and pilot operations before scaling up to commercial crackers.

Driving the Renewables Revolution

Many European chemical companies have been pursuing plans to develop circular plastics, for the most part reprocessing soiled waste from municipal collection systems. Ineos Styrolution, to give one example, has developed styrenics recycling processes with satisfying results, but integrating these seamlessly into the production chain will take some time.

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For its ChemCycling program, BASF is working with a number of companies processing waste into pyrolysis oil, which can be used to make near-virgin polymer. SABIC is partnered with chemical recycling specialist Plastic Energy, which has developed and patented a feedstock called Tacoil, derived from plastics waste classified as non-recyclable, and Austria's OMV has been working on a similar process to produce "ReOil".

Finnish refiner Neste is one of the principal architects of the European feedstock revolution, cooperating with chemicals and plastics producers, and in at least one case retail, to relieve the burden on the environment by removing and reusing non-recyclable plastic waste. According to estimates, only about a third of plastic waste is currently recycled, so there is considerable ground to be made up in order to meet the EU's ambitious targets for creating a circular economy. Rules implemented by the European Council in 2018, e.g., call for plastic packaging recycling rates of 50% by 2025 and 55% by 2030.

In autumn 2020, Neste reached an important milestone toward its goal, processing liquefied plastics waste for the first time at industrial scale, together with Belgian plastics distributor and compounder Ravago, which helped source the waste. The next processing run in the race to produce renewable feedstock is in preparation at Neste's fossil-fuel-fired refinery in Porvoo, Finland.

Big names are on the refiner's growing list of partners. Clariant is cooperating with Neste to use its renewable hydrocarbons to make sustainable solutions more accessible to a variety of industries, including plastics, hot-melt adhesives and coatings. DSM's engineering plastics arm is striving to replacing fossil fuels with recycled plastics waste, 100% bio-based hydrocarbons or a combination of the two. The Finnish company is also working with plastics producers and the Dutch holding of Swedish retailer Ikea to use its refinery residues in plastic home furnishings as well as production of renewable PP.

In a project not involving Neste, the UK's ReNew is preparing to build a chemical recycling plant at Teesside that would process end-of-life plastics into petrochemicals. With a throughput capability of 80,000 t/y, this would be the first plan to employ the Cat-HTR process, part of the catalytic hydrothermal liquefaction platform developed by technology supplier Licella, at commercial scale.

No Signs of Italy's Proposed Bioeconomy

Beyond petrochemicals, the European transition to renewable futures has been slower, though using agricultural resources to feed new production processes is seen as an opportunity. One major disappointment has been the hoped-for greening of Italy's plastics sector following the collapse of its petrochemicals industry. With its industry-leading biopolymer Mater-Bi, Novamont has swung from success to success, but Eni's plans to turn its plastics arm Versalis into a pillar of the green economy have mostly fizzled.

Even the acquisition of the remaining "green" businesses of insolvent plastics producer M&G has not helped Versalis. Eni CEO, Claudio Descalzi informed the workforce in March that decommissioning of the Porto Marghera petrochemical cracker will take place in spring 2022. No signs of the bio-cracker once being talked have materialized but Eni management has dangled a promise to create a new biotech corporate segment, which would see capital spending of more than €1.5 billion.

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Dede Williams and Elaine Burridge, CHEManager