On the road to decarbonisation

With 16 factories on-site, Terneuzen is a hub for Dow services in Europe, the Middle East, Africa and India, including R&D and the development of sustainable solutions. In part one of a two-part feature, **Dominique Huret** visited the site for a tour

Just a year ago, Dow announced that its Benelux operations had drawn a roadmap to reduce current carbon emissions from its Terneuzen operations in the Netherlands by more than 40 per cent by 2030 on its path to achieve net carbon neutrality by 2050.

Earlier this year, *Eco-plastics in Packaging* highlighted the challenge of quantifying Scope 3 emissions (October 2022 issue, p40-41). It cited Dow, which estimated 2021 Scope 1 emissions of 28.3 million tonnes of carbon dioxide equivalent, Scope 2 emissions of 5.7m/t and Scope 3 emissions of 77.6m/t. The latter was 70 per cent of the total. More than half of those are from purchased goods and services, so how do you reduce them?

"We started engaging with our suppliers, which also encompass the raw materials used to make plastics, so it is a broad spectrum of very different impacts or contributions for Scope 3," explains Peter Sandkuehler, director for sustainability EMEA at Dow Packaging and Specialty Plastics.

"We have worked over the years to have a good understanding of the different composition and the structure of our Scope 3 emissions from the upstream purchases and raw materials that we are using.

"We know well the very big items that are contributing to our Scope 3 and the potentially smaller ones. One of the big ones is the raw material that we are using: naphtha as a key feedstock in Europe and the natural gas-derived ethane that we are using in North America."

These, he admits, have significant contributions and Dow needs to work with the refineries, naphtha producers and ethane producers. A component of natural gas, ethane is a raw material that is transformed into ethylene as a building block for PE.

"So, of course, we are interested to see how we can work with our suppliers so that they provide us products and materials with reduced emissions. We are looking at selecting the refineries that will be reducing their carbon emissions and at how natural gas can be produced with low carbon emissions," says Sandkuehler. "That is one part of the equation. We are also looking at suppliers' engagement with the value chain, to see how we can hold each other accountable. That will allow us to source preferably from companies that offer the lowest carbon footprint. All these steps will ultimately play into the final product that we are offering. As you can imagine from the scale, this is a massive effort to undertake."

Sourcing emissions data from suppliers comes via discussion, but data collection will be key for traceability and accountability,

Turning the tide at Terneuzen

- Employees: Total 3,700 with 1,000 in services, 2,500 in operations, and 200 in R&D
- Capacity of 3 million tonnes of high-value chemicals and 1m/t of processed polymers
- Exports 85 per cent
- Energy requirements: On average, Dow consumes 65 petajoules of energy, which is the equivalent of 80 per cent of all the renewable energy currently produced in the Netherlands from wind and solar
- Electricity and steam are supplied by the ELSTA cogeneration facility, owned by Dow since 2018
- Total site emissions are 4m/t of carbon dioxide annually
- Annual transport of production: 2,400 cargo boats, 70,000 trucks, and 85 trains/wagons/carriages
- Terneuzen Path2Zero Project investments include a new hydrogen plant on site, and carbon capture and storage
- Joint projects at Terneuzen include an e-cracking project with Shell, and the Steel2Chemicals project with ArcelorMittal, Tata Steel and several research bodies and universities
- In the latter, the chemical conversion of steel mill off-gasses allows for the production of chemicals instead of greenhouse gas emissions

Above left: *Dow's Peter Sandkuehler admits that the company must work with refineries, naphtha producers and ethane producers to reduce emissions*

Left: *Dow has plans to reduce carbon emissions at the Terneuzen plant by more than 40 per cent by 2030*

which Sandkuehler acknowledges is a very important ongoing discussion right now.

"We have colleagues in purchasing who are engaging with our suppliers on these topics. They are looking for the short-, medium- and long-term sustainability plans on carbon emissions reduction that our suppliers have."

Similarly, Dow is held accountable by its own customers for reduction plans, as carbon footprints are becoming part of private and public tenders.

"This is a positive evolution and we expect this is going to become more and more part of the purchasing decision," he admits.

Dow's own emissions are calculated as a mass balance, by measuring what goes in and out of its processes without any losses or gains of materials. This, he explains, is reasonably straightforward. Dow is also part of the Carbon Disclosure Project, the international organisation where major companies report their carbon emissions per site on a yearly basis.

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Peter Sandkuehler

"Essentially, the Scope 1 emissions are measured and we know these numbers, so they are feeding into our annual emissions data," he says. "What requires more calculation is the product's footprint or how the overall emissions are broken down to the products that we sell. Making an average of the different products of the company remains a calculation, but it is getting better and more accurate with time and with more actors involved.

"These numbers keep evolving, and as the measurements get better, the number can sometimes even increase due to improved methods and data becoming available. Some of the downstream measurements are now correctly assessed, but weren't in the past."

But back to Dow's greatest challenge – Scope 3 – which is also an area where Dow ▸▸

Dow's ambitions recap

Accelerating carbon neutrality and plastics circularity are Dow's core targets.

By 2030, Dow aims to reduce its net annual carbon emissions by 5 million tonnes. This represents a 15 per cent reduction from Dow's 2020 baseline, and a 30 per cent reduction from the 2005 baseline. By 2050, Dow intends to be carbon neutral.

Another target is transforming waste. By 2030, Dow will enable 1m/t of plastics to be collected, reused or recycled through its direct actions and partnerships.

Closing the loop is the third ambition. By 2035, Dow will enable 100 per cent of its products sold into packaging applications to be reusable or recyclable.

Above images: *Dow used the event in Terneuzen to illustrate its latest solutions for sustainable flexible packaging*

Right: *Packaging EMEA marketing director Romain Cazenave highlights a recyclable barrier pouch consisting of PE and ethylene-vinyl alcohol, digitally printed on an HP Indigo*

could contribute the most. "One of the Scope 3 initiatives is really to find alternatives to fossil feedstocks," Sandkuehler points out.

This is a very large-scale project for Dow given that it is currently using a sizeable amount of naphtha. The company is committed to accelerating the circular ecosystem by transforming waste and alternative feedstock to deliver 3m/t per year of circular and renewable solutions by 2030. Dow is also engaging with its suppliers to work on reducing the emissions associated with the extraction and transformation of fossil feedstocks.

"That will lead to a more effective fossil-based feedstock system but, ultimately, a large part of that needs to be shifted to alternative feedstocks to then become circular," adds Sandkuehler. "We need to make sure that our projects are executed well, like our multigenerational plan for Terneuzen to reduce carbon emissions or the Steel2Chemicals project to develop synthetic naphtha from industry waste gases. We will measure the reduction on our own processes."

By 2050, Dow has the target of carbon neutrality. The first-generation Terneuzen project will already bring some results from 2025 and will help to achieve the 5m/t reduction by 2030.

"But we are working on other projects in different sites and areas to contribute and hopefully exceed these objectives," he states.

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Dow is working first on its emissions in its North American and European sites, not least because operations in areas such as the Middle East are joint ventures. "There, we are not the sole owner, so we need to see what can be done in these areas. This is not an excuse, we have found a partner but what Dow owns there is limited, so we have less latitude to work on these reductions.

"Circularity is the first step of decarbonisation, but circularity alone will not help decarbonise the whole industry. It will eventually help to de-fossilise, so that we are extracting less feedstock from the ground for polymer production in the future.

"But there are still emissions in the chemical and plastics industries from processes, and those emissions need to be reduced. As such, circularity we can all contribute now to is the first point," says Sandkuehler. "The second one is to reduce what at Dow we can do on our Scope 1. These two areas are complementary. Circularity is a key enabler for decarbonisation because it keeps the carbon in the system."

• *Next month, Dow's Carolina Gregorio discusses the European Green Deal and circular carbon chains* EP