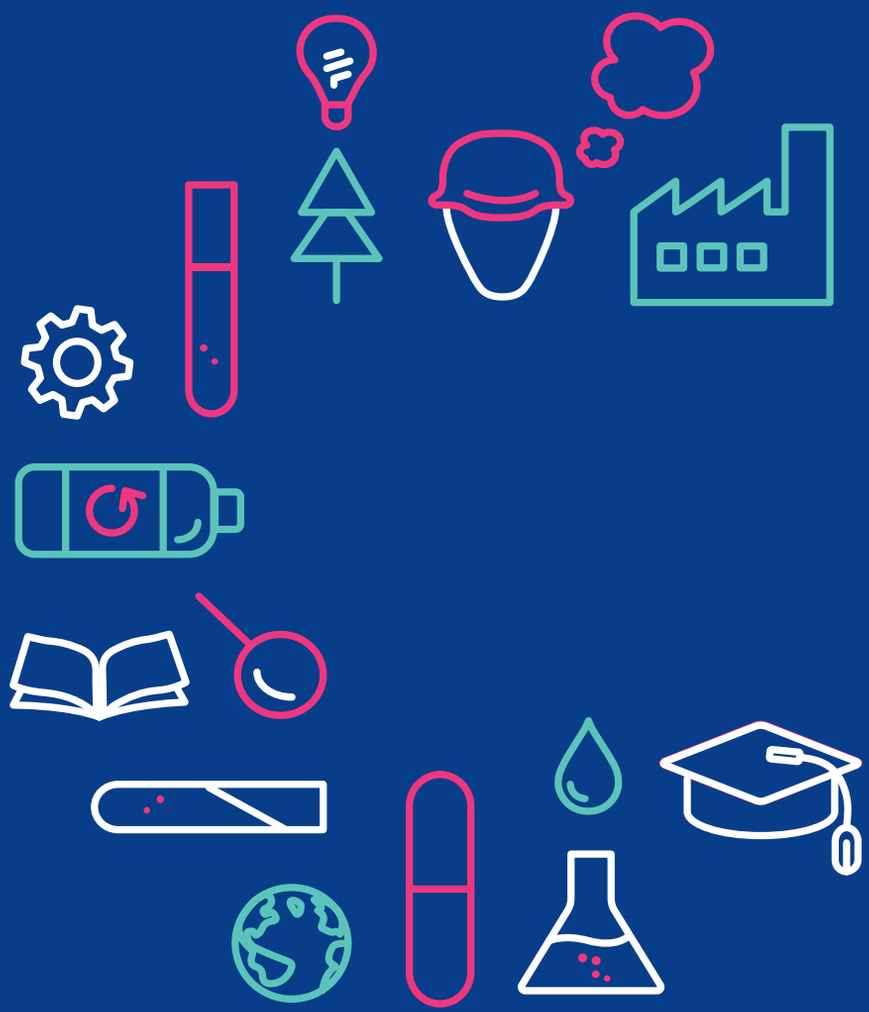


We have more than just a plan!

In support of the Dutch climate agreement,
Chemelot is striving to become carbon neutral by 2050

May 2018

chemelot
for today's future

We have a plan

We have a plan! – a plan to entirely eliminate CO_2 emissions by 2050, which will strengthen the economic position of the Netherlands and allow us to make the products that the world needs now and in the future. We like to be one step ahead, which is why we are now presenting a concrete plan to become **carbon neutral** by 2050. But we have more than just a plan. We have determined the conditions that will actually allow us to achieve our goal. Our Chemelot site is well-integrated and has a history of transition, transformation, and innovation. Our **Brightlands Chemelot Campus** provides us with the golden opportunity to develop and implement innovations both on and off the Chemelot site. Chemelot's partners are professionals who possess the quality and capacity to help us achieve our ambitions.

The purpose of this document is to voice our ambitions for 2050 and to make clear which conditions have to be fulfilled in order to accomplish them. To achieve our ambitions, we need the assistance of government and policy makers, because some solutions **don't yet exist**, some are still **impossible**, and some are **not allowed**. In view of a carbon-neutral chemical site in 2050, we can achieve a significant reduction of CO_2 by 2030 by initiating a series of projects. These projects and their results are likewise suitable for use in other companies and clusters.

Chemelot's **location** is unique but faces a multitude of limitations, for instance because of the great distance from the sustainable energy that is generated at sea. However, this geographical location also offers opportunities to **cross borders** and collaborate with partners in Germany and Belgium.

Chemelot's secret

Not everyone knows what happens at the Chemelot site and it's much easier to explain when you know a bit about our history. Ours is a history of transitions. In 1974, we made the switch from coal to chemistry. At the turn of the millennium, DSM underwent a reassessment of its activities and new professionals were brought into Chemelot. A few years later, a modern knowledge and innovation campus was built. The current refocus on sustainability, energy, and climate is the third major transition for us.

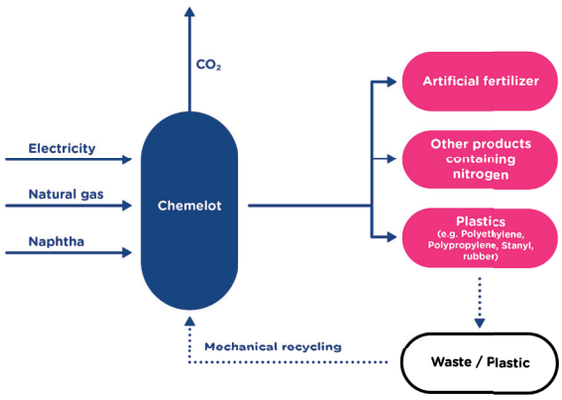
Chemistry stands for connection

In essence, the commitment to an environmentally-responsible company is a teamwork challenge. Because of its unique history, Chemelot is used to collaboration. The 150 companies and institutions on the site all share a common vision. Their organizations and technologies are likewise linked in many ways, from shared pipelines to shared permits and licences. Chemelot is constantly working towards finding better solutions and improving its factories to make them safer, more environmentally friendly, and more competitive. This is how we have reduced our carbon footprint by 40% per tonne of a produced product since 1990. But now the time has come to achieve more – much more.

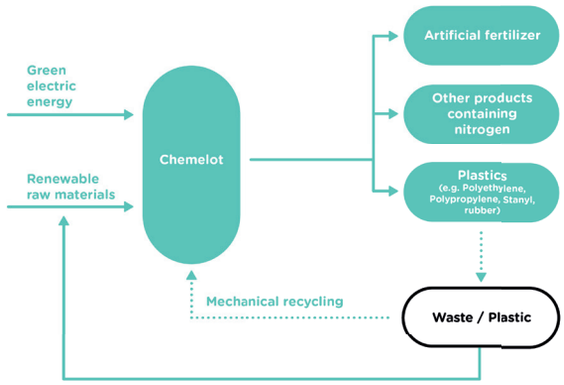
A carbon-neutral chemical site in 2050

Chemelot has the clear goal to become an entirely carbon-neutral organization by 2050. In the future, Chemelot will continue to produce all the products it produces today, but they will be environmentally friendly. In order to achieve this, Chemelot invests in both green raw materials and green energy. This change isn't just about energy, but also about industry.

The diagram below shows Chemelot's development towards carbon neutrality:



Chemelot's current situation



Picture of Chemelot's future

The sustainable greening plan will be carried out based on these five programme points:

1. Electrification based on green energy
2. Sustainable greening of raw materials
3. Circularity
4. Process improvement and optimization
5. Carbon Capture and Storage (CCS) and Carbon Capture and Utilization (CCU)

Chemelot is currently supplied with two large-scale streams of fossil fuels via pipelines, namely natural gas and naphtha. These are used as raw materials and energy carriers. The factories on the Chemelot site can all be made sustainable by greening the raw materials and switching to sustainable electricity as the energy supply. The high degree of connection between the factories offers unique opportunities, but also requires precise coordination.

For starters, the naphtha crackers could switch to renewable naphtha and a sustainable electricity supply. Subsequently, sustainable electricity could be used for the production of hydrogen. In the long run, this will make Chemelot carbon neutral and Carbon Capture and Storage will no longer be necessary.

Projects

In order to achieve this vision, it's necessary to develop technology by means of pilot projects and, in the long run, demo projects. The combination of Campus and Industrial Park makes Chemelot especially suitable to work on this technological development; not only for its own use, but for other clusters too. Below is a list of pilots and demo projects currently envisaged at Chemelot.

Pilot projects

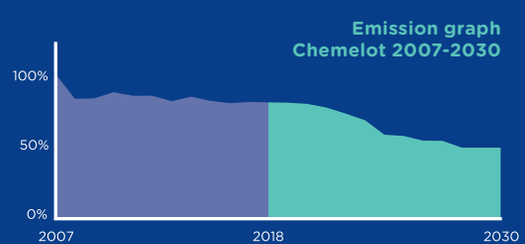
- **Power-to-Hydrogen pilot**
  Pilot plant to use green electricity for the production of hydrogen and carbon from light hydrocarbon.
- **CO_2-utilization pilot**
  Pilot plant to follow up on interesting leads for CO_2 utilization, both for energy carriers and as a raw material.
- **Expansion of energy management initiatives Asset Health Center**
  Minimization of electricity and energy use by factory machinery by means of digital monitoring and adjustment of the production processes.
- **Pilot waste-plastic pyrolysis and hydrogenation**
  Pilot plant for converting pyrolysis oil from waste plastic into a suitable raw material for Chemelot.
- **Pilot electrolyser**
  Pilot plant for production of hydrogen from water by means of an electrolysis process fuelled by green electricity. The hydrogen from this electrolyser is used for ammonia production.
- **Projects for innovative energy efficiency technologies**
  Pilot and demo projects for technologies that increase Chemelot's energy efficiency by providing practical use for waste heat.

Demo projects

- **Power-to-Hydrogen Demo**
  Demo plant to use green electricity for the production of hydrogen and carbon from light hydrocarbons (after the pilot, probably after 2030).
- **Biomass burner**
  Burning biomass, such as sludge from Chemelot's waste-water treatment, used in the production of hydrogen and light hydrocarbons.
- **Demo hybrid boiler feedwater deaerator**
  The deaeration of feedwater using green electricity in a hybrid deaeration installation at the best possible moment (Demand Side Response, DSR).

Projects CO_2-reduction 2030

With an eye to 2050, we can already start making steps in the right direction by halving our CO_2 emissions by 2030. We can achieve this by making our raw materials and electricity greener, by making efficient use of energy, and by using CO_2 storage as a temporary solution. The following projects address these issues:



The CO_2 emission in 2007 is comparable to the emissions in 1990

- **Extra measures to boost energy efficiency**
- **Reduction of N_2O / nitrous oxide**
- **Purchase of green energy**
- **Carbon Capture and Storage (CCS) in collaboration with PORTHOS project Rotterdam**
- **The first steps in electrification in combination with Demand Side Response (DSR)**
- **Heat supply to direct surroundings (i.e. companies and houses)**
- **First steps towards the sustainable greening of naphtha**
- **Projects surrounding Carbon Capture and Utilization (CCU)**
- **ZITTA Biogas project – pig manure as raw material for biogas**
- **CO_2 pipeline to greenhouse areas**
- **Asset Health Center – digitalization and dedication**

What we ask from the government

At Chemelot we can do a lot, but we can't do everything. A number of conditions have to be fulfilled in order to achieve the industrial and technical development necessary. The enormous task we all have at hand also demands effort on behalf of the government. This effort involves taking the lead, adjusting laws and regulations, and providing financial arrangements with the right financial incentives. In order to achieve carbon neutrality by 2050, we are asking for the following:

1. A level playing field

The Netherlands is not an island. It's important that our ambitions preserve and preferably strengthen the competitiveness of the Netherlands. A level playing field is a necessity. The chemical sector is the perfect sector to operate on a global scale and competes with companies in Europe and the world. The Dutch ambition to be sustainable is commendable, but must not mean that production in the Netherlands is made impossible. CO_2 and chemical products have a common denominator: they know no boundaries. This could be solved, for instance, by a global tax on CO_2. However, first we have to make sure that we allow the companies on the Chemelot site to make our economy sustainable while maintaining our competitiveness.

2. Taking the lead in infrastructure development

Chemelot is the only large chemical cluster not located near the sea. This location is challenging for several reasons. For instance, Chemelot has to be connected to the new energy infrastructure in order to profit from energy supply based on wind energy from the sea. The same is true for CO_2 storage under the North Sea, which is necessary for Chemelot as a temporary solution to achieve the 2030 goals. We expect the government to take the lead in infrastructure development by planning, financing, and placing pipelines. We also expect this leading role with regard to the corresponding operational models and financing structures. For instance, expanding the reach of the national Infrastructuurfonds (Infrastructure Fund) would also help to finance pipeline infrastructure. Current legislation can also unwittingly block the use of existing non-operational pipelines. We have to make maximum use of existing infrastructure and make an assessment as to which parts can be made operational again.

3. Regulations

Laws and regulations may hamper Chemelot's ambition to become sustainable. This is currently the case in many areas. For instance, plastic is still seen as waste, rather than a raw material, which limits the ways in which it can be recycled. Obtaining used plastic from Germany and Belgium is extra difficult due to these restrictions. Legislation surrounding CO_2 can also hamper CO_2 storage solutions. Shipments of CO_2 to Rotterdam currently fall within the

emission category. We're also asking for a new framework of CO_2 usage (CCU), for instance to develop the use of CO_2 in building materials.

4. The right incentives

In order to stimulate companies to actively reduce their CO_2 emission and to facilitate the process, it's important to create the right incentives, financial or otherwise. Innovation needs to be rewarded. The chemical industry can also contribute much to the reduction of CO_2 in other sectors. These advantages should be used and the chemical industry should be rewarded for its contribution to CO_2 reduction in its direct surroundings, as well as in the electricity and agrarian sectors, even when they cross national borders.

5. Using the location

In order to achieve the required CO_2 reduction, we have to make sure that companies work together to a maximum degree. One company's residual waste is another company's raw material; heat can no longer be wasted. This type of circular economy requires strong ties between the parties involved. This is why we are asking the government to actively promote this collaboration between companies that can use each other's energy or material waste. Chemelot is also asking the government to look beyond the national borders, in which respect it is crucial to make maximum use of Chemelot's unique location. The climate agreement may end at the Dutch border, but climate change does not. The borders represent both a bottleneck and an opportunity. We are urgently asking the government to support us in our collaboration with, for instance, North Rhine-Westphalia and Flanders in terms of infrastructure, sustainable energy, and residual waste.

6. Magnet for talent

In order to achieve our ambitions, we need talent. By supporting pilot projects and by stimulating collaboration between knowledge institutes, companies, and governments, we not only support a healthy climate, but also create a robust knowledge economy. Our innovative Brightlands Chemelot Campus allows us to develop the solutions of the future and attract talented employees to the sector in general and to Chemelot specifically.

Conclusion

Aside from the above-mentioned points, we are asking the government to provide a reliable business climate with responsible industrial politics. The above-mentioned ambitions also require substantial investments. These investments can't come from the business community alone; they require intelligent and robust financial instruments.

Facts and figures

8000 employees

research & development

more than 60 nationalities

800 hectares of land

central position

1 common licence

50 kilometres of road

60 kilometres of railroad

education

inland harbour

150 companies

60 factories

chemelot
for today's future

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