European Commission

Just Transition Platform Case study:

Chemelot Circular Hub

Key information

Member State:
Netherlands

Region(s):
Zuid-Limburg

Sector(s):
Chemistry

Duration:
Since 2020

Type of activities:
Multi-stakeholder engagement, knowledge creation and sharing, investment planning and support

Background

Regional policy strategies relevant for the Just Transition Mechanism

In June 2022, the European Commission approved the Just Transition Fund (JTF) subsidy programme for the Netherlands, effectively allocating up to EUR 623 million to be used for the facilitation of a just transition in the regions most affected by the shift towards sustainable productive activities. Within this budget, EUR 60 million are devoted exclusively to the Chemelot Campus and industrial park, a heavy industry cluster focused on bulk chemical production, which is located in the region of Zuid-Limburg. Since early 2023, eligible SMEs, knowledge institutes and organisations have been able to submit project proposals to receive EU subsidies under this scheme. The focus of the JTF for the region lies in the development of green technologies for the chemical industry, specifically the use of bio-based feedstocks for plastics production, circular design of the supply chains, electrification of industrial processes and the production of renewable hydrogen.

At a national level, Netherlands' course towards a net-zero economy will also be aided by the European Regional Development Fund (ERDF) and the European Social Fund Plus (ESF+). The former allocates up to EUR 550 million that will be used for public investments and subsidies in the fields of renewable energies, smart specialisation and sustainable urban development; the latter will instead make available up to EUR 413 million to support people in dire situations by sponsoring training and re-training for future-proof sectors.

Within the region of Zuid-Limburg specifically, the policy strategies relevant for JTM include: (i) financing and investment support through the leveraging of public-private partnerships; (ii) promoting knowledge transfer and innovation by forming fora for private companies and knowledge institutions to interact; and (iii) promoting skill development and training, for example via the setting up of four campuses for education and research; as well as the creation of innovative higher education curricula at the University of Maastricht.

Characteristics of the region

The region, situated at the southern-most part of the Netherlands, shares most of its borders with neighbouring Germany and Belgium, which makes it economically deeply intertwined with these Member States. The region's productive activities are mostly geared to bulk chemical production. Chemelot's industrial

park, one of the largest chemicals production clusters in the Netherlands and in Europe, is situated in the heart of the ARRRA region (Antwerp, Rotterdam, Rhine-Ruhr Area), which employs around 340 000 and generates up to 40 % of the overall European chemical sales. The site itself employs directly around 8 000 workers, with an additional 20 000 indirect jobs orbiting around the site in the fields of supply and service provision. While most activities on site are concentrated in plastics production (especially for packaging and car components), there exists some scope for related diversification. Indeed, the site gathers almost 150 companies – both large multinationals (e.g. SABIC) and SMEs – and it incorporates the Brightlands Chemelot Campus, a centre for excellence in research in sustainable chemistry which creates the pre-conditions for future innovative projects to be spawned *in loco*. The other three Brightlands Campuses in the region offer a degree of diversification potential also outside the chemical sector. Specifically, the Campus in Heerlen focuses on digital technologies, the one in Maastricht on health and life sciences, and the one in Venlo on agriculture and food production. It should also be noted that the area used to feature a large car manufacturing plant and paper milling activities, although these latter two sectors were always marginal to the region's economic gearing and are now in decline.

Despite the promising initiatives mentioned above, however, the region suffers from a net outflow of people (in the order of -7% in the last 20 years, and more marked amongst young cohorts), and the companies on site face staffing difficulties especially with respect to technical profiles. The persistent mismatch between demand and supply of labour has led regional authorities to consider opening facilitated avenues to source workers from outside Europe, although this initiative is still at a conceptual stage.

In terms of the level of technological innovation, Chemelot is at the forefront of improving the sustainability of chemicals' production processes, with a focus on circular design driven by feedstock and energy transition. The former concern the study and adoption of biomass and recycled materials as inputs to produce chemicals, as opposed to fossil fuels and petrochemicals; whereas the latter focus mostly on the electrification of processes, which could allow companies to opt for a more sustainable energy mix, possibly entirely from renewable resources.

Central framework conditions

The province of Zuid-Limburg, in the south of the Netherlands, has a repeated history of industrial transitions. The latter part of the 20th century was characterised by a tug and pull relationship between the region and the coal mining sector. A first de-carbonisation phase started in the late 1960s, when the then Social Democratic Minister of Economic Affairs Den Uyl launched an agenda for the closure of mines, to steer a gradual phase-out of coal directed by the government in collaboration with the parties involved. The phase-out was sped up by the discovery of bountiful natural gas reserves in the country, which largely rearranged the energy mix powering the country, but left the workers formerly employed in the coal sector in disarray. The 1970s saw a resurgence in the use of coal in the transformation sector, namely for the generation of electricity. The oil crisis that hit global markets in that decade highlighted the vulnerability of the Netherland's' energy system and led to renewed interest in coal. However, domestic production ended officially in 1976, with the closure of the Oranje-Nassau I coal mine, in the town of Heerlen. This opened three decades of economic and social disarray, with the province of Limburg recording unemployment rates persistently higher than the national average and faring poorly on key indicators such as health of the population and quality of life. This occurred despite high levels of public spending for social schemes in support of the displaced workers (e.g. early retirement schemes, re-training, sheltered employment programmes, etc.) and to re-attract business activity back in the area; the benefits of these measures were later to be seen. The objective of re-attracting economic activity in the area was pursued through the relocation of governmental agencies and, notably, the setting up of the LIOF development bank, the regional development agency for Limburg, which is still active today. The ingenious use of public funds to catalyse private investment is a theme that still echoes into the just transition efforts of the region. Indeed, recognising the need to move beyond a declining industry, Limburg embarked on a path of economic diversification and transition. Efforts were made to attract new industries, promote innovation, and capitalise on the region's strengths. One of the key strategies was the establishment of the Chemelot industrial site, which transformed the former coal mining site into a hub for chemical and materials research and production. This initiative leveraged the region's existing infrastructure and expertise, creating new employment opportunities and attracting investments. Limburg embraced the concept of sustainable development, focusing on environmental preservation, energy transition, and circular economy principles. This commitment to sustainability principles is best exemplified by the vision of the Chemelot Circular Hub (CCH), the initiative subject of this case study. Importantly, Chemelot industrial park emits around 1/3 of Limburg's total greenhouse gas emissions, and around 3 % of the total national ones. Accordingly, the successful implementation of the CCH Action Plan will be fundamental for the Dutch government's objective to achieve carbon neutrality by 2050, the legally binding goal set out via the Dutch Climate Act (2019).

Description of Project

CCH is an alliance involving three different types of organisations, namely organisations from private industry, the public sector, and from Research and Technology Organisations (RTOs), for a total of 27 partners (see overview below). It is an 'archipelago' of entities that interact, collaborate and exchange on sustainability topics that are vital for the chemical industry, and whose commitment is embedded in the Circular Economy Action Plan, a document that synthesises the vision and the milestones needed to lead the Chemelot industrial park to reach circular and climate-neutral objectives by 2050.

Participating organisations
AMI Biobased Materials
AnQore
Arlanxeo
Brightlands
Brightlands Materials Center
Brightsite
Chemelot
Chemelot Innovation and Learning Labs
Driven by values
DSM
Fibrant
Jeugdtheater
Leo
Limburg federate
Maastricht University
Municiplaity of Sittard-Geleen
Province of Limburg
SABIC
Sitech Services
Smurfit Kappa
TNO
USG
UWV
VISTA College
Zowonen
Zuyd Hogeschool

Source: Chemelot Circular Hub's Circular Economy Action Plan

The activities of the Hub revolve mostly around the formation of knowledge and investment partnerships, as well as technical and administrative assistance for securing EU and national public funds, where possible. Indeed, only last year the province of Limburg has spent around EUR 150 000 on the development of project proposals and tendering, outside of the initially allocated budget. A sense of direction and purpose underlying every initiative is guaranteed by the Hub's strategic four pillars, each of which inspires several flagship projects. The **first pillar** concerns circular innovations and applications. This pillar is mostly focused with the elaboration and adoption of circular designs,[1] namely designing products so that they can be efficiently and cheaply recycled for further use, avoiding landfilling/incineration. Another topic that stimulated the engagement of the Hub is that of developing ways and workflows to exploit waste as raw material for the generation of carbon and hydrogen. The FUREC project that is reviewed in the box below is a key example of how this flagship is to be implemented. Under this pillar, considerable attention has been devoted to the electrification of processes. At the moment, most industrial practices in the chemical sector are powered via natural gas or other fossil fuels. Indeed, electrification raises a series of considerable hindrances, such as the suitability of power capacity and of the grid infrastructure, or the difficulty of achieving the required heat and temperature to set off the needed chemical reactions. However, replacing fossil fuels with electricity is a key abatement lever and offers great potential, especially given the growing share of renewables in the energy mix of the Netherlands.

The **second pillar** addresses the human capital requirements to achieve the stated goals. These will be pursued through targeted projects to build the skill sets that are essential for the industrial complex to attain its goals (for example, the University of Maastricht, in a world first, has launched a bachelor's degree in circular engineering), through the development of state-of-the-art facilities for applied research, and through the attraction and update of talent via bespoke life-long training.

1 The European Commission Circular Economy Action Plan states that up to 80 % of a product's environmental impact is determined at the design stage.

The **third pillar** concerns the creation of a circular fundament for the activities that take place on the Chemelot site. This implies projects to ensure the viability of the activities that orbit around the cluster, for example, projects to foster the security of supply of circular and biogenic raw materials and of renewable energies, as well as the creation of adequate logistics infrastructure.

The **final pillar** invokes the creation of a circular society. The Hub seeks to improve the quality of life in the cities and dwellings surrounding the plant and calls for effective collaboration between the industry representatives and local communities. Below, one can find the full list of flagships, arranged according to the respective pillar. Also note that one of the strengths of the Hub lies in its integrated approach, so it should be expected that each of these initiatives generate synergies with the others.

Since its inception, the Hub has collected a portfolio of 101 projects organised around the pillars explained above and reported in Table 1. For the period 2022–2025, 22 of them have been prioritised and are now at a stage for which either the project proposal is complete, or it is in the pipeline. Note that any proposal requires a scouting of the available funding opportunities at the EU and national level, and stringent regulations have somewhat slowed down investments.

Table 1: Chemelot Circular Hub's pillars and related flagships

Pillars	Flagships
Pillar 1: *Circular innovations and applications*	1. Circular design 2. Waste as a raw material source for carbon and hydrogen 3. Biogenic raw materials 4. Reduction of non-CO_2 emissions 5. Electrification 6. Integration
Pillar 2: *Circular human capital agenda*	7. Strengthening the education chain 8. Employability and involvement of people 9. Real estate for education and research 10. Setting up labs and professional premises
Pillar 3: *Circular fundament*	11. New investments and the establishment of new circular activities 12. Security of supply of circular and biogenic raw materials 13. Security of renewable energy supply 14. Adequate capacity for logistics and infrastructure 15. Urban-industrial symbiosis
Pillar 4: *Circular society*	16. Test neighbourhoods and centres, such as City Labs 17. Youth health 18. Acceleration of sustainable energy and consumption 19. Intelligent handling of waste in society 20. Strengthening Euregional links and connection 21. Social support and regional pride

Source: Chemelot Circular Hub's Circular Economy Action Plan

The following section highlights the **goals and approach** of the initiative. As argued in the CCH's Action Plan, the instauration of a circular economy model implies more conscious consumption and design of products, as well as the arrangement of production processes into 'loops' and their optimisation to reduce material, energy, and water exploitation. A hub for circularity – a concept that has been introduced in the Processes4Planet's (former SPIRE) vision and supported by the European Commission – is then a physical or virtual platform that facilitates the transition towards a circular economy. Chemelot Hub acts precisely as one such platform, serving as a focus point for collaboration on these themes and accelerating the adoption of circular practices. One of the milestones that can be annumerated among the Hub's achievements is the formalisation of a shared understanding of what this new paradigm entails for Chemelot's industrial park, and the definition of a set of strategic goals that inform the Hub's initiatives.

Table 2: CCH's goals

Goals	
Goal 1	Accelerate the transition towards a circular and climate-neutral economy and generate environmental returns. By increasing 25 % of hydrogen production without CO_2 and reducing by 25 % the water usage as well as the harmful substances emitted to the surface water.
Goal 2	Generate economic returns by strengthening the foundations of the regional economy, creating new competitive circular revenue models and synergies, expanding from the chemical- and materials cluster to amongst others the manufacturing industries. Finally, offer opportunities for entrepreneurs, regional small- and medium-sized enterprises (SMEs), multinationals, suppliers, and customers.
Goal 3	Generate societal returns. Through attracting employment perspectives and places to live and work, the creation of a cleaner, safer, and healthier living environment and promote the region as Circular Hub to include local stakeholders and citizens to participate.
Goal 4	Increase the labour participation. This is done by providing competent people with new future-proof and attractive jobs, re-training the existing workforce to acquire circular knowledge and skills, attracting younger generation talents to the region and, lastly, reducing brain drain of the regions, especially in the younger generation.
Goal 5	Strengthen the region's knowledge position. This is to be implemented through the attraction of talent, education institutes, innovation centres, the process industry and manufacturing industry, cultivating cooperation among these.
Goal 6	Establish Chemelot Circular Hub in the Euregion as a showcase of European cooperation, by increasing (EU) regional and national earning capacity and accelerating sustainability and the climate transition.

Source: Chemelot Circular Hub's Investment Agenda 2020–2030

Key success factors and lessons learnt

Fundamentally three **key success factors** can be extrapolated from the experience of the CCH, and from that of the wider Chemelot site. First, the size of the industrial park itself. Chemelot represents the fifth biggest economic centre of gravity in the Netherlands, generating 20 % of the direct value added generated by the chemistry sector nationally. The high concentration of companies implies at the same time a high concentration of technological know-how, which acts as a driving force in attracting investments. Second, the history of the region and of the plant itself should be given the proper credit: Limburg is familiar with industrial transitions, having moved away from coal mining and towards bulk chemical production, and now shifting yet again to sustainable chemical production. For what concerns the site, it should be noted that it was initially endogenously developed by Dutch State Mining (DSM). Many of the current CEOs of the firms based on the site have ties back to this initial phase, which ensures a strong informal network aiding knowledge sharing and investment synergies. Finally, a key success factor that helps the operation of the Hub lies in the fact that Limburg's regional government has extensive financial resources. These largely come from the sale of shares of formerly publicly owned companies. Deep pockets, together with a strong commitment to regional development mediated by private-public ventures, ensured the financing of many individual projects in the chemical sector; not to mention the overarching presence of the Brightlands Campuses, expected to be key producers of innovations and start-ups in the near future (note that the construction and development of the four campuses has costed the regional authority around EUR 600 million).

Concerning **scalability and transferability**, other regions should learn from the Hub's experience of how a strong programme is very important to stimulate collaboration. But it should also be noted that the situation of Chemelot is highly peculiar. Given its position, history, and size, it featured as a very promising location where to set up a Circular Hub. This could be an indication that regions hosting industrial clusters may have more to learn from this experience. At the same time, focusing on the chemical industry, one should know that private organisations are already cooperating to a large extent on knowledge sharing to devise sustainable solutions.

The **key challenges** that the Chemelot cluster is facing concern the operationalisation of circularity and sustainability principles. Specifically, putting in place and securing supply chains for the provision of bio-based feedstocks is considerably harder than simply relying on NAFTA to produce plastics. Solving this issue will require new infrastructure and new resources management. The same is true for what concerns energy supply. As mentioned, electrification of chemical industrial processes is a considerable technical challenge in itself. Furthermore, to ensure sustainability, the electricity used in production should come from renewable sources, and at the moment the plants relying on these (especially wind) are concentrated in the north of the country, far away from Chemelot. Overcoming this obstacle will require both the adaptation of power grids and innovations in industrial processes. Fourth, the fact that Chemelot is an inland site creates some difficulties concerning logistics, as most cargo is now forced to travel by road (note that this issue intensifies the problem of setting up supply chains). Indeed, negotiations are ongoing for the construction of pipelines to connect Chemelot to Rotterdam and to Antwerp. Finally, stakeholders have lamented labour supply shortages, and the difficulty of filling vacancies for technical profiles. This situation is compounded by the ageing population, as many of the workers currently employed at the plant are approaching retirement.

Three fundamental **strengths** transpire with respect to the Hub's experience. They all relate to the Hub's mode of governance. First, and most notably, this case highlights the value of a triple helix alliance that involves parties from industry, the public sector and knowledge institutes. Second, having a vision in place which not only enumerates principles but also attaches key outcome indicators and precise, measurable milestones to them is crucial to catalyse investment and collaboration. Third, having an entity gathering many members and promoting a diverse portfolio can be useful in the management of projects, as a birds-view perspective of the ongoing initiatives is always available and can inform new, synergetic investments.

For what concerns **weaknesses**, stakeholders have highlighted two main ones. First, the fact the Hub lacks a legal personality. This proved to be an impediment on many occasions. For example, multinationals situated on site were precluded from receiving public funds due to their status as large companies; in this situation, had the Hub been able to submit project proposals on its own, it could've facilitated access to these funds, fostering in turn innovation and private contributions. Second, the looseness of the alliance also revealed to be a problem at times. Cooperation has not been as strong as some would've hoped for, and some of the partners have exhibited low levels of engagement. The latter situation may be due to the foreign ownership of these companies. Indeed, when the high-level decision-making units of some partners reside abroad, they may exhibit lesser interest in the future of the local area.

Box 1: FUREC project – Producing hydrogen from household waste

FUREC – which stands for Fuse Reuse Recycle – is a venture of the energy company RWE and represents one of the most exciting projects taking place at the Chemelot site. The initiative builds on patented technologies to convert non-recyclable municipal waste into sustainable hydrogen. In doing so, it will compete directly with the unsustainable practice of waste incineration and add to the recycling opportunities available to the province of Limburg (and beyond). It should be noted that RWE, the company sponsoring this project, is not formally affiliated with CCH. However, part of the motivation to situate the initiative at the Chemelot industrial park lied precisely in the cluster's commitment to carbon-neutrality and circularity principles. Indeed, the substantial reductions in CO_2 that will be afforded by FUREC will help the site in attaining its objectives for 2050.

The chemical industry has often expressed its desire for a sustainable source of hydrogen, as cost considerations push most firms into relying on so-called grey hydrogen in their operations, namely the type produced from fossil fuels – primarily natural gas. Electrolysis, the process currently employed to produce green hydrogen, is expensive and hard to scale, which has largely slow downed adoption. Thus, the importance of this innovative process lies in the fact that it will provide the industry with a source of green circular hydrogen which can compete, pricewise, with the current sources of 'grey' hydrogen.

The project started in 2016 and matured at pace, developing into an investment in the order of EUR 700 000 million (co-founded by the European Union Innovation Fund for an amount of EUR 108 000 million), which makes it the biggest investment in the Netherlands that is underpinned by circular economy principles. A final investment decision is to be reached by 2024, with operations set to start in 2027 if its outcome is positive. FUREC will involve two plants: a pre-treatment plant situated in Zevenellen (Limburg) to convert non-recyclable municipal solid waste into fuel pellets which will then be transported and used as input at the Chemelot plant to produce hydrogen. At regime, the Chemelot plant is expected to convert 700 000 tonnes of solid, non-recyclable waste into 50 000 tonnes of hydrogen per year. If neighbouring companies at the Chemelot site will adopt this new source, as they likely will, this could result in a reduction of 280 million cubic metres in the consumption of natural gas, saving up to 400 000 tonnes of CO_2 per year. It should also be noted that contracts and infrastructure are also being studied to enable the sale of hydrogen to firms in Rotterdam and in the general Ruhr area, further enlarging these projections. Besides the obvious benefits for the environment, the project will also create around 200 high-skilled, well-paid jobs in the region.

At the moment, RWE is in the process of securing permits for the construction and operations of the plants, but this process has proved difficult and untimely. The strict requirements on nitrogen emissions and the almost *de facto* veto power granted by law to contesters of the project have proved particularly thorny. It would appear that a blind enforcement of the law, in this case, may prevent FUREC from expeditiously delivering the benefits it promises. In terms of the outlook of the project, one key takeaway is that FUREC is understood by its creators as a platform. This implies that replication will be welcomed and swift as soon as the business model proves its viability. Within the countries where RWE's core business activities reside (e.g. Germany, United Kingdom, Netherlands, and Belgium) and within budgetary limits, this replication effort will be spear-headed by RWE itself; but the company remains open to the possibility of strategic partnerships. This could very well signify a paradigm shift in waste management at the EU-level and afford great strides towards the meeting of the EU Circular Economy Action Plan's objectives with respect to the reduction of non-recycled municipal waste.

Sources: Interview with representatives from RWE, 11 May 2023; FUREC website; Innovation Fund: FUREC

Outlook

For the time being, the CCH initiative is set to go on until 2030. Indeed, the investing agenda plans projects for a period of 10 years (2020–2030). However, many goals within the Circular Economy Action Plan identify the year 2050 as the ultimate target. Additionally, CCH is collaborating with the ministries across borders of Economic Affairs and chemical branches of the Netherlands, Flanders and North-Rhine-Westphalia in the trilateral strategy which is planned to last until 2050. An extension of the initiative's lifetime could be possible. At a more operational level, stakeholders have highlighted some possible future avenues of development for the Hub. First and foremost, more effort will be devoted to the development of funding strategies. This may include the institution of the Hub as a legal entity, or the creation of a devoted fund to meet public subsidies' matching requirements and kickstart promising initiatives. Finally, the Hub seeks to take on a more prominent lobbying role, trying to shape regulations and inform policy makers – both at the EU and national level – about the realistic needs of a just transition. For example, it has been argued how the outflow of the JTF is guaranteed only to projects that are fully carbon neutral. In the chemical industry, this is hardly possible, but it shouldn't preclude innovative enterprises from accessing vital funds that could deliver only a gradual, yet highly needed transition.

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