The hoop Tales

Discover the biocircular journey of our lighthouse cities and regions

The HOOP project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°101000836.

Albano Laziale: Golden Biowaste for Local Benefit

The municipality of Albano Laziale (Italy), represented in HOOP by the association of municipalities ANCI Lazio, is part of the Region of Lazio and has broad experience in the participation in EU projects, notably in the SCALIBUR project. The HOOP urban metabolism analysis and baseline studies showed that Albano has very high rates of biowaste collection (93.8%) with very high quality (98.5%). The biowaste quality is better from households than from the HoReCa sector. Despite its high quality, the biowaste was not valorised within the Albano municipality or the surrounding area, which meant that Albano could not benefit from this great separate collection performance. Therefore, as a first action, Albano constructed a composting facility to valorise 13% of its biowaste with an investment of €600,000. In parellel, Albano continued with pilot actions to improve the biowaste quality from the HoReCa sector with the use of the HOOP citizen science app, and invested €300,000 for the purchase of the land dedicated to a 'reuse island' and €200,000 for the creation of a system of computerised islands (for paper, glass, oil, plastic collections).

The baseline study showed a low diversity of locally available bioproducts. This meant that innovative technologies could open new opportunities for Albano's high-quality biowaste. From the HOOP State-of-the-Art portfolio of technologies, Albano discovered the valorisation of used cooking oils (UCO) into bio-plastic poly-3-hydroxybutyrate (P3HB), patented by Nafigate Corporation. The technology was deemed of high interest and potential key stakeholders were engaged through the Biowaste Clubs promoted by ANCI Lazio with the help of HOOP. These discussions and meetings helped to build a tailored business model, which identified the waste oil management companies as key stakeholders. The strong cosmetic sector in Lazio region was identified as a potential circular buyer of the P3HB produced from UCO. Demand could be driven by the need to replace microplastics and TiO2, in line with the future ban on micro-plastics, the potential of the biodegradable P3HB in cosmetic formulations, as well as future limitations for biodiesel, which currently absorbs almost all UCOs available on the market. In parallel, pilot actions to increase the acceptance of bioproducts and dissemination of the HOOP portfolio of technologies for valorisation of biowaste were performed.

The UCO from Albano were tested and found to comply with the requirements for its application in the technology. The techno-economic feasibility study provided by the HOOP PDA showed that a significant production capacity is required to achieve profitability. The increased size of the potential plant entailed the expansion of the scope of the project to a broader area in the region of Lazio, and brought the required investment up to €17 million. Although this ticket was too high for the initial promoter, thanks to the intense communication activities by ANCI Lazio through HOOP, the project raised the interest of the National Consortium of Waste Oils in Italy. Local Biowaste Club and other meetings at national level, promoted by ANCI Lazio and HOOP, took place in the process of discussions for promoters to step in. Furthermore, HOOP organised a study visit to Prague for the potential promoters to gain more detailed information on the technology, to better assess the creation of this novel value chain in the Lazio Region and at national level. Although the project is currently in standby, the awareness and interest created about this technology mean that it might launch at any moment. Furthermore, UCO separate collection has been extended in Albano and started in neighbouring Ciampino, with a total investment of €162,000.

Albano has used all the elements of the HOOP PDA to build a project proposal from scratch, with special focus on the stakeholder engagement as tool to build a business model, investing €81,000 so far. Moreover, Albano has stepped up their circular valorisation with €900,000 additional investment. The momentum created about the valorisation of UCOs at the national level has been extremely high.

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Albano Laziale: Golden Biowaste

Partner in HOOP

Population

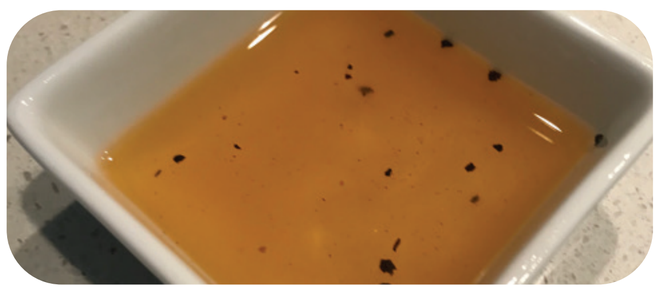
41,000

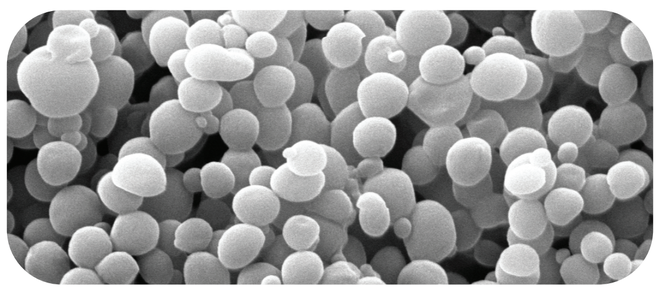
Starting point

- Biowaste collection 93,8%
- Biowaste quality: 98,5%

Urban Circular Bioeconomy Project

Used Cooking Oils ➔ Bioplastic poly-3-hydroxybutyrate (P3HB) ➔ Use in the local cosmetic sector





Actions

- Tailored business model developed within the HOOP Biowaste Clubs
- Techno-economic study showed the feasibility of the project
- Study visit to Prague to meet with technology developers Nafigate Corporation

Challenges

- A significant production capacity is needed to achieve profitability, too large for Albano Laziale to develop alone
- Investment required also increases due to this finding

Status

- Project currently in stand-by mode, but could launch at any time.

Investments

- €600,000 on a composting facility to valorise 13% of local biowaste €€€€€€
- €500,000 on a 'reuse island' to increase reuse and recycling €€€€€
- €162,000 extending Used Cooking Oil collection €€
- €81,000 developing the P3HB project from scratch €
- €900,000 stepping up circular valorisation in the territory €€€€€€€€€

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Almere: Cluster the Innovation to build up

The City of Almere (The Netherlands) has broad experience in circular economy and the promotion of entrepreneurial initiatives. An especially remarkable initiative is the Raw Materials Collective, which focuses on the development of raw materials from waste and coordinates circular projects. Their main focus is the valorisation of green waste from many sources, such as invasive plants, aquatic plants, wood waste from agriculture. The HOOP urban metabolism analysis and baseline study found that a high amount of bioproducts are being producted, suggesting very high levels of innovation, but at small scale and far from the market.

Almere is the fastest growing city in the Netherlands and has a very active construction sector. Therefore, the city aims to build upon all this innovation to foster solutions able to respond to the demand for construction materials. This criterion influenced the selection of urban circular bioeconomy projects such as i) the production of biocomposites for traffic signs and urban furniture with fibres from invasive plants, ii) the use of fibres from wood waste as additive to circular concrete and iii) torrefaction of green waste. Despite their interest, the atomisation and small scale of the projects has been a challenge both from the supply chain and from the market demand side, compromising their feasibility. HOOP has tried to increase the marketability of the bioproducts by characterising the properties of biocomposites and evaluating their applicability to packaging in a process of product development.

After realising that most of the projects did not have enough entity or maturity by their own to be upscaled, a completely different business model was proposed in the framework of HOOP PDA. This new model is a multipurpose fibrebank, which provides a business-to-business approach and buffers the fluctuations both from the supply (seasonality of feedstock) and the demand side (marketability of products). Biowaste Clubs have been instrumental to develop this new concept where the products are fibres as intermediates. The project is currently in search of a promoter to further develop this concept. The multi-purpose fibrebank has clustered with other projects in Almere to be part of a potential circular systemic solution where part of the green waste is sent to anaerobic digestion, another part to torrefaction and a third part to the isolation of fibres. Several actions have been taken in terms of acceptance of bioproducts in order to increase the marketability of circular fibres. However, regulatory issues have been detected by HOOP PDA, which is in the process of providing evidence of the higher sustainability of Almere's approach for the treatment of invasive species. Moreover, the torrefaction part has faced regulatory barriers, which means that the project is currently in stand-by.

Besides the highly innovative entrepreneurship environment, the HOOP urban metabolism analysis and baseline showed that the levels of separate collection (52%) were not the best in the Netherlands and the quality neither (85%). Therefore, actions had to be taken to improve these values. The first was a total change in the separate collection system, followed by activities to raise awareness and educate citizens on how to properly sort the biowaste. Some of these actions were inspired by the experiences of Murcia and Münster. The total investment for this change is €4.46 million.

Almere has taken advantage of the sharing of good practices within HOOP to bring about a change in the biowaste separate collection system. Moreover, the atomised projects from the Raw Materials Collective have clustered and got a new business model thanks to the PDA.

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Almere: Cluster the Innovation to build up

Partner in HOOP

Gemeente Almere

Population

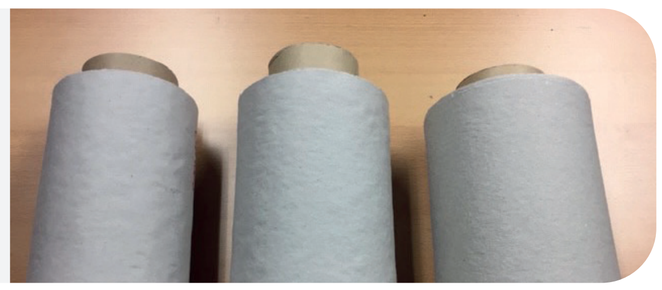
200,000

Starting point

- High levels of innovation and entrepreneurship
- Quantity and quality of biowaste collection can be improved

Urban Circular Bioeconomy Project

Local biomass → Multipurpose ‘Fibrebank’ → Innovative bioproducts



Aim

The idea behind the Fibrebank is to cluster the many smaller projects present in Almere to mitigate risks related to fluctuations in supply of biomass and market demand

Challenges

Regulatory issues have been detected related to the treatment of invasive species and the application of torrefaction

Status

The atomised projects from the Raw Materials Collective have clustered and got a new business model thanks to the HOOP PDA

Investments

- €4.46 million to improve biowaste collection and increase citizen awareness
  €€€€€€€€€

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Bergen: Start up the Symbiosis

The region of Bergen (Norway) is represented by the waste management company BIR AS, which was awarded as the Circular Company of Year in Norway in 2021. Despite having run biowaste separate collection in HoReCa for more than 40 years, separate collection in households was not implemented. This separate collection has been implemented during the HOOP project, with an investment of €3.76 million. Education and awareness raising campaigns were launched to show citizens how to properly sort biowaste. Acceptance of bioproducts has been promoted through actions such as showing mealworm in schools.

Considering the limited market for compost at the beginning of the project, the target of BIR AS for the use of biowaste was not compost production, but rather its use for circular applications in symbiosis with the local economy. BIR AS participates directly as shareholder in two circular start-ups in the Bergen region, both using food waste as feedstock. One of them is Invertapro, producing yellow mealworm, and the other is Greentech Innovators, producing microalgae. In both cases the target was to produce feed for the local aquaculture sector, following an industrial symbiosis approach and increasing the use of local resources. However, regulatory assistance from HOOP PDA in the framework of the ROOTS initiative showed the limitations for the use of food waste depending on the final application of the bioproduct.

The projects for the expansion of the capacity of both start-ups have been self-promoted. Knowledge about EU Taxonomy from the PDA inspired the development of life cycle assessments (LCA) for both processes so that both the mealworm- and microalgae-derived products could demonstrate their substantial positive effects on the environment, especially in terms of climate change. The maturity shown by the projects and confirmed by the HOOP tools made them suitable for pitches to attract investors in several events, including the HOOP Circular Investors Board meetings and the HOOP Circular Investor Day held in Brussels in May 2023. The application of the HOOP financial model proved the profitability of both projects in order to further increase their appeal to investors.HOOP LCA results were used by Invertapro in a crowdfunding campaign, which succeeded to get the targeted €1.3 million. In the case of Greentech Innovators, HOOP PDA provided a proof-of-concept test, confirming the technical feasibility of the project and opening the possibility of a new business model based on hydrolysate as growth media for biotechnology. The start-up has obtained €1.75 million up to now.

The outcomes from the ROOTS regulatory assessment clearly showed that the production of feed is not the only solution for Bergen's biowaste from households. Therefore, BIR AS established collaboration with nearby municipalities in the Indre Hordaland region and expanded there the area of operation. This has resulted in the creation of a Biopark for bioeconomy in Voss, where an anaerobic digestion plant for the treatment of both the biowaste from Bergen region and the manure from the farms in the surrounding area will be installed in 2025, with an investment of €30 million. The outcoming liquid digestate will be employed in nearby lands. However, the use of the solid fraction is not determined yet, and BIR AS, following HOOP PDA guidelines, has launched an open market consultation to find alternatives for the valorisation of the solid fraction of the future digestate, promoting the circular bioeconomy in the area. The full-scale Invertapro plant is planned to be built at the same location, is which will mean an investment of €10 million. The concept of the Biopark has been worked through the Biowaste Clubs and awareness about the idea has been extended to other areas of Norway through the National Replication Workshop.

Bergen has experienced a large evolution during the HOOP project, starting with no separate collection to the creation of an industrial symbiosis park, with an investment of €43.76 million, including innovative technologies and using open market consultation. Start-ups have succeeded to get €3.05 Mmillion up to now, taking advantage of HOOP PDA.

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Bergen: Start up the Symbiosis

Partner in HOOP

BIR

Population

356,000

Starting point

- No separate collection from households
- Partnership with two start-ups to develop products for local aquaculture sector

Urban Circular Bioeconomy Projects

- Biowaste → Insect rearing → Feed and food products / Plant nutrition products
- Biowaste → Nutrient release → Growth medium for micro algae

Actions

- LCA studies were conducted and used for marketing
- Proof of concept testing carried out
- Presentations made to HOOP Circular Investors Board

Challenges

Regulatory assessment showed limitations for the use of food waste as a raw material within the selected projects

Status

Partner start-ups have received funding and raised private capital to upscale their activities. Creation of a regional 'Biopark' for bioeconomy, including an anaerobic digestion plant and new pilot facilities, planned for 2025.

Investments

- €30 million invested in the 'Biopark' €€€€€€€€€€ €€€€€€€€€€ €€€€€€€€€€
- €3.76 million invested to launch separate collection at household level €€€€€€€€€€
- €3.05 million raised by two partnering start-ups €€€€

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Kuopio: Do not waste, learn

Kuopio (Finland), represented in HOOP by Savonia University of Applied Sciences, has separately collected biowaste from households since 2003, treating it together with urban wastewater sludge in a private anaerobic digestion facility providing heat and electricity to the city. Results from the HOOP urban metabolism analysis showed that the levels of production of urban biowaste are very low (96 kg per person yearly), which can be explained by the high degree of implementation of home composting (48% of households). However, the separate collection rate for the remaining half of biowaste was still medium (50.6%), one of the causes being the fact that those sectors that cannot take advantage of the home composting, like HoReCa, become large producers. Therefore, education actions and awareness raising campaigns have targeted these groups, including through the use of the citizen science app.

At the beginning of the project, the main project in Kuopio was the upscaling of the nutrient recovery pilot from digestate at Kuopio's anaerobic digestion facility, but this plan was unfortunately affected by international tensions leading to rising component and energy prices. Besides that project, HOOP proposed to Kuopio the possibility to explore other technologies for the valorisation of biowaste from the HOOP state-of-the-art portfolio as Best Available Technologies. Among these technologies, pyrolysis was one of the most promising ones, with the possibility to establish a symbiosis with the forestry sector identified in the baseline studies. Savonia University of Applied Sciences started the plans for the construction of a pyrolysis pilot to provide assistance to different local industries to treat their by-products, with the aim of obtaining biochar for agriculture or other diverse applications, such us feed additives or replacement of coke from coal in steel production. The pilot obtained funding for €830,000. The tests were supported by HOOP PDA to evaluate the actual use of biochar in field tests and their potential for certification. The business model is not based on the sales of biochar, but on providing services to local and regional industries using the pilot in the university in order to promote the development of larger scale solutions. From this perspective, the future impact is expected to be high. The pilot started operation in late 2023 and it is ready to expand the knowledge about pyrolysis.

Kuopio has set the basis to become a regional reference for pyrolysis, providing assistance to the regional stakeholders in order to open new business models.

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Kuopio: Do not waste, learn

Partner in HOOP

SAVONIA

University of Applied Sciences

Population

120,000

Starting point

Low biowaste production due to prevalence of home composting

Urban Circular Bioeconomy Project

- Local by-products → Pyrolysis → Biochar

Actions

- Creation of a pyrolysis pilot plant
- Tests to evaluate the use of biochar and potential for certification

Challenges

Original project (upscaling of a nutrient recovery plant) had to be dropped due to rising component and energy prices

Status

The pyrolysis pilot plant has been operational since 2023, providing testing services to local industries. Kuopio has quickly become a reference for pyrolysis

Investments

- €830,000 for the creation of the pyrolysis pilot plant €€€€€€€€€€

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Münster: Bioexcellence and Circular Carbon

Münster (Germany), represented in HOOP by the waste management company AWM, is one of the reference cities in Europe in terms of separate collection of urban biowaste and its treatment by anaerobic digestion, which is being performed since the mid-1990s. Besides this, AWM established a trans-border symbiotic model with the region of Twente (Netherlands), so that sorting residues from the residual waste treatment plant from Münster goes to energy recovery in Twente and Twente's biowaste is utilised for composting in Münster. This extensive experience and the work accumulated during decades has led AWM to biowaste separation rates as high as 87% with excellent quality (96.5%). The years of experience have allowed the learning on the good practices such as the door-to-door collection, the avoidance in use of bags for biowaste and the specific campaigns for raising awareness. AWM identified blocks of buildings as the most challenging spots for ensuring high collection rate and high quality. For these spots, good practices were promoted, while initiatives from the citizens were disseminated by HOOP Local Champions.

The HOOP baseline analysis showed that the actual material recovery of biowaste was 75.8%, being the unrecovered 11.2% the important amount of sieving overflow, constituting the refuse from the composting of green waste and digestate (mainly lignocellulosic material). This sieving overflow is sent to energy recovery outside Münster boundaries. Therefore, the focus of HOOP for Münster is to increase the circular processing of this overflow within the municipality and promoting innovative solutions. Two different approaches were followed: i) the increase of the yield of biogas by hydrolysis of the wooden parts of garden waste and ii) the production of biochar from refuse together with digestate (that is being produced in very high quantities and can't all be composted with garden waste) by pyrolysis. Moreover, thanks to the awareness gained through HOOP PDA on quality, AWM plans to invest in pilot AI technologies to upgrade the purity of incoming biowaste flows, to pave the way for future higher added-value valorisation routes.

The characteristics of the sieving overflow are a challenge and the technical feasibility both of the hydrolysis and the pyrolysis had to be proven. In the case of pyrolysis, proof-of-concept tests were required, showing the high potential of overflow as a source of good quality biochar. During this process, the Biowaste Clubs have been the platforms for the engagement of potential customers, spreading the knowledge about pyrolysis, especially to potential customers in agriculture. The initiative and commitment of AWM with pyrolysis has even promoted replicability actions and clustering with other cities and regions from the HOOP Network with interest in biochar. Biochar acceptance actions were organised, creating a high awareness around Münster. However, regulatory barriers have been found in the pyrolysis project, especially connected with the national regulatory framework in Germany, which might be satisfied by a redesign avoiding digestate. Moreover, HOOP PDA is promoting actions on policy to overcome some of these barriers. In any case, the project will need a tender due to the public nature of AWM.

In the case of hydrolysis, the technical PDA tests have confirmed the feasibility of enzymatic hydrolysis as pretreatment to increase biogas yield, but requiring some intermediate conditioning steps which are now under economic evaluation. Moreover, the good results of the pilot tests have led to the search of alternatives in the production of bacterial biostimulants, with very promising results on laboratory scale.

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Münster: Bioexcellence and Circular Carbon

Partner in HOOP

awm
alle wirken mit!

Population

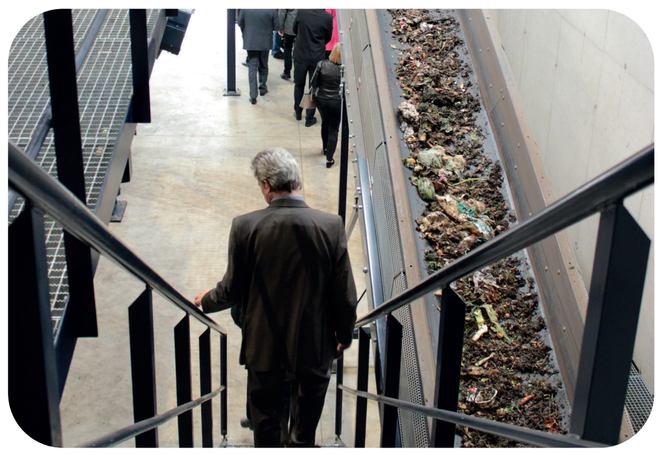
315,000

Starting point

Long experience in separate collection of biowaste with high quality

Urban Circular Bioeconomy Projects

- Wooden parts of garden waste → Pyrolysis → Biochar
- Wooden parts of garden waste → Hydrolysis pretreatment → More efficient biogas production



Actions

- Proof of concept tests for both technologies
- Engagement of potential customers in agriculture

Challenges

Regulatory barriers have been found in the pyrolysis project, especially connected with the national regulatory framework in Germany

Status

Both projects were launched from scratch within the project and can be further developed now the feasibility has been proven. Munster is now a reference for Biochar.

Investments

AI technologies to upgrade the purity of incoming biowaste flows

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Murcia: Prepare the Land

Murcia (Spain) has an important background in circular bioeconomy due to the experience in EU projects such as VALUEWASTE, where several innovative technologies were developed on a pilot scale based on urban biowaste. The main focus of Murcia in HOOP has been the urban wastewater value chain, having as key stakeholder EMUASA in some of the projects. The HOOP urban metabolism analysis and baseline studies showcased the best water circularity indicators of all the Lighthouses, with a complete circular management of the sludge (which is mainly land applied), but with low level of innovation. Therefore, projects related with water were selected, namely the valorisation of sludge into volatile fatty acids (VFA) following a biorefinery approach. Having a clear objective from the outset made this project advance very fast in providing the technical PDA. The techno-economic feasibility study showed promising turnover results, but exposing the negative profit due to the low capacity of a plant processing available sludges.

Moreover, HOOP PDA identified as Best Available Technology the production of black soldier fly larvae, foreseeing the possibility to upscale the VALUEWASTE pilot. However, the regulatory assessment performed in the framework of the ROOTS initiative revealed important barriers for the use of insects for the treatment of biowaste, shifting the business model to the treatment of agri-food by-products from the surrounding area. The promotor was a technology provider, who finally found an investor, but relocated the project to another area of Spain. In any case, the need to provide a circular treatment for the future full-scale urban biowaste has led HOOP to provide technical assessments of possible scenarios for urban biowaste management.

After the cancellation of the first two projects, a new project for the wastewater sludge value-chain was selected, recovering nutrients (ammonia) from effluent in digestate of sludge in the municipal wastewater treatment plant. The bioproducts are strategic for their application in the strong agriculture sector in Murcia. The PDA proved its technical feasibility and now the project is expanding to increase the amount of streams valorised, with special focus on water recovery. The water management company will launch an open market consultation to define better the conditions for the future precommercial procurement, which has raised high interest in Murcia thanks to HOOP PDA, with a National Replication Workshop dedicated to innovation public procurement.

Regarding the biowaste value-chain, the HOOP urban metabolism analysis showed a low separate collection rate (9.4%) as it was only implemented on pilot scale. The full implementation of the separate collection in Murcia, involving an investment of €6.79 million up to now, sets challenges in different areas, with citizen awareness being one of the most important. In this sense, several campaigns have been run in order to promote separate collection and circular bioeconomy. The Biowaste Club conducted in the Circular Economy Fair LOOP (organised by the municipality) was a perfect example of the attempt to create consciousness and co-create to prepare and engage the citizenship for the full-scale separate collection. These actions involve also the promotion of bioproducts and the education actions in schools using as support material the citizen science app. Moreover, the entrepreneurial ecosystem in Murcia was involved in Biowaste Clubs meetings, especially through the association AEMARM, with the aim to scan innovative solutions already available and promote actions to develop new circular ideas and bioproducts. In this sense, separate collection of used cooking oils has been implemented, with an investment of €550,000.

Murcia is preparing the ground for upcoming feedstock valorisation (urban biowaste from households) and improving the value from the sludge through innovative solutions using the valuable HOOP PDA. Investments need to be taken for implementation, accounting for €7.34 million to this point. HOOP promoted awareness about the use of innovation public procurement, expecting to be a tool for circular bioeconomy development for the future.

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Murcia: Prepare the Land

Partner in HOOP

Ayuntamiento de Murcia

Population

450,000

Starting point

- Established circular water management but with low levels of innovation
- Recently launched separate collection of biowaste
- low quantity of collected biowaste with low quality

Urban Circular Bioeconomy Project

Wastewater sludge → Nutrient recovery → Fertilisers

Actions

- Technical feasibility studies for the selected project
- Preparation of an Open Market Consultation
- Intensive citizen awareness actions to support roll out of separate collection

Challenges

First two identified projects were not followed up on due to regulatory and profitability issues identified during the PDA

Status

Open market consultation will define better the conditions for the future precommercial procurement of the nutrient recovery technology.

Investments

- €6.79 million roll out separate collection of biowaste from households €€€€€€€€€€€€€
- €550,000 to introduce separate collection of used cooking oils €€€€€€

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Greater Porto: Circular Agriculture

LIPOR is the public waste management company in the region of Greater Porto (Portugal), formed by Porto and 7 other municipalities, and has been the pioneer in composting in the Iberian Peninsula. They hold a broad experience with composting, with special attention to Nutrimais®, made from separately collected biowaste and providing highly satisfactory results for the vineyard crops in the surroundings. LIPOR is highly engaged and has run many campaigns of awareness and promotion of the community composting. Moreover, a Waste Data Observatory has been developed to check the waste generation per municipality.

The HOOP baseline analysis showed a significant level in biowaste production (207 kg/cap year), which explains the campaigns and actions for food waste prevention, especially from the HoReCa sector, promoted by LIPOR. The analysis also showed a rate of biowaste separate collection of 29.5%, because separate collection of food waste from households has not yet been fully implemented. These data are line with those accessible through the Waste Data Observatory.

The expansion in biowaste collection to households also requires an increase in the treatment capacity. This will be done through an anaerobic digestion facility. However, both due to the requirements in wastewater discharge and due to LIPOR's commitment with circularity, the construction of a nutrient recovery facility is planned. HOOP's technical PDA has evaluated the possibilities of recovery of the high amount of ammonia expected in the effluent of digestate, as well as the recovery of phosphorus by struvite precipitation, trying to provide a circular solution to the excess of nutrients and the needs of regional agriculture. The PDA has served as guide for the intense work of design, preparation and launch of the open market consultation to assess the possibilities that the market offers to solve this challenge in a circular way, with an event in April 2024 gathering relevant technology providers. The results from the consultation will serve to tailor the solution and shape the tender book for the procurement of the large plant, with a total investment estimated at €53 million. To research on anaerobic digestion LIPOR invested €651,000 in a pilot anaerobic digestion plant.

The aforementioned Nutrimais® is an excellent example of circular economy by a waste treatment company that shifted their mindset to the obtention of a high-quality and marketable product rather than treating the maximum possible amount of waste no matter the final outcome. However, this change in concept means also the generation of a higher amount of composting refuse, mainly of lignocellulosic nature. The pyrolysis of this material to produce biochar was selected as Best Available Technology to increase circularity. This same approach might be also used for invasive plants. However, the particular nature of the compost refuse made necessary intense characterisation and testing in the PDA to prove the technical feasibility. This has been performed also for invasive plants. Despite the fact that the refuse is now used for other purposes, the results from PDA are very promising and have high replicability potential. Despite the challenges, the HOOP financial model showed the profitability of the project.

Unlocking new value chains also requires the need to promote the new bioproducts. This has been the main action in the pilot activities to increase the acceptance of bioproducts (i.e. biochar, struvite) with exhibitions. All the processes run by LIPOR have finally as clear target the circular application to regional agriculture of all the considered bioproducts: compost, biochar, digestate and recovered nutrients. Besides this, the full implementation of separate collection in households also requires to continue with education campaigns.

HOOP PDA has provided support on the decision-making process to shape the future anaerobic digestion plant by the use of open market consultation and technical studies, integrating circularity in the €53 million investment.

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Greater Porto: Circular Agriculture

Partner in HOOP

lipor

Population

1 million

Starting point

- Leader in compost production
- High level of biowaste production, with relatively low separate collection
- Reference region in their commitment to sustainable waste management

Urban Circular Bioeconomy Projects

- Digestate effluent from AD → Nutrient recovery → Fertilisers
- Lignocellulosic biomass / invasive species → Pyrolysis → Biochar

Actions

- Preparation and launch of an Open Market Consultation for nutrient recovery technologies
- Technical and financial feasibility studies for the pyrolysis project
- Technical studies for the nutrient recovery technologies

Challenges

Special nature of the lignocellulosic biomass (leftovers from composting) made characterisation and testing difficult

Status

Open Market Consultation is ongoing and will help to shape the tender book for the procurement of the new Anaerobic Digestion plant, coupled with a nutrient recovery unit.

Investments

- €53 million for the procurement of a new Anaerobic Digestion plant €€€€€€€€€€ €€€€€€€€€€ €€€€€€€€€€ €€€€€€€€€€
- €651,000 in a pilot Anaerobic Digestion plant to test solutions €€€€€€€

The HOOP project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°101000836.

Western Macedonia: Cluster and Circular Playgrounds

Western Macedonia is a region of Greece where lignite mining has been the basis of the economy for decades, as indicated in the baseline analysis. The transition to a new economy is driven by sustainability, with special attention given to Bioeconomy. The regional cluster for bioeconomy and environment, CluBE, formed by the different regional stakeholders, is representing the region in HOOP. In this framework, Western Macedonia is the Lighthouse with the highest participation in European research projects.

Biowaste management is performed by the public regional company DIADYMA. The separate collection has been progressively implemented since 2016, starting in the capital Kozani. Data from HOOP urban metabolism analysis, coming from 2019, still showed a low separate collection rate (3.6%). The implementation of separate collection requires intensive social actions for awareness raising and for education in schools and kindergarten, organised by stakeholder engagement PDA. Another issue identified in the baseline was the low acceptability of bioproducts (namely compost), which implied their promotion with very intensive campaigns in the framework of HOOP to help citizens understand, experience and accept a wide range of bioproducts. These actions were complemented with the extensive use of HOOP citizen science app in the high schools of Western Macedonia.

Regarding the projects, there have been two main areas of focus. One of them is about the management of used cooking oils (UCO) from households, currently collected from automated machine bins. The HOOP state-of-the-art portfolio has been an inspiration to develop a project for the valorisation of UCO into bioplastics with the technology from Nafigate Corporation. This was recommended as Best Available Technology due to the availability of raw materials. HOOP PDA showed that currently there is not enough oil available to build a full-scale economically feasible plant, as the largest amounts from industrial or HoReCa sector are employed for the production of biodiesel. However, DIADYMA is promoting the construction of a pilot plant for UCO valorisation for strategic purposes, considering future constraints for the use of biodiesel. Moreover, an LCA study performed by HOOP PDA demonstrates that valorisation through the production of biopolymers provide GHG savings 8 times higher than through the production of biodiesel. The concept of the pilot in DIADYMA has been identified in the evaluation of business models.

The second project was also inspired by the HOOP state-of-the-art portfolio and uses spent coffee grounds (SCG) as feedstock. The impact of this selection has been so high that the first steps to implement the separate collection of spent coffee grounds were taken in Kozani, using Biowaste Club meetings to engage the HoReCa sector, with an investment of €72,500 until now. In addition to this, DIADYMA led, guided by HOOP PDA, an application to get Horizon 2020 funding to launch a pre-commercial procurement (PCP) for the valorisation of spent coffee grounds with the participation of Albano Laziale. The application was positively evaluated but due to the limited funds it was placed on the waiting list. In between, the SCG have been characterised and tested for the extraction of oil, polyphenols and for the production of carotenoids. The good results of the tests on HOOP PDA were the starting point for an application for funding (Interreg), clustering to other technology (hair valorisation) due to the small size.

The separate collection and valorisation of SCG are the most important impact of HOOP PDA in Western Macedonia, as a new value-chain is being created. The first steps of collection have been taken with an investment of €72,500 up to now. The next step is exploring their valorisation, with a funding application pending.

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Western Macedonia: Cluster and Circular Playgrounds

Partner in HOOP

CluBE
Bioeconomy & Environment Cluster
Western Macedonia

Population

280,000

Starting point

- Recently started to introduce separate collection pilots
- Low acceptability of bioproducts

Urban Circular Bioeconomy Projects

- Used Cooking Oils → Fermentation → Bioplastics
- Spent coffee grounds → Extraction of oils and nutrients → Cosmetics and food applications

Actions

- LCA and financial feasibility conducted for the Used Cooking Oils project
- Characterisation and testing of spent coffee grounds.
- Citizen campaigns to raise awareness on biowaste collection and bioproducts

Challenges

- Low availability of Used Cooking Oils makes it impossible to build an economically feasible production plant.
- Funding application for a commercial public procurement on the valorisation of spent coffee grounds was not successful.

Status

- Local waste management company is considering a pilot plant to test applications for Used Cooking Oils.
- Funding application pending for the valorisation of spent coffee grounds.

Investments

- €72,500 in the collection of spent coffee grounds €

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