



# Scaling Up Biomethane Innovation: HyFuelUp's Key Achievements in Year 3

**Progress Report – Months 24 to 36**  
January 2026

 **Expected impacts**

 **Upcoming dissemination actions**

 **Remarkable results**



# A year of acceleration

HyFuelUp enters its third year with a clear message: the gasification-to-methanation pathway is not only feasible, but advancing rapidly, scaling up and proving its potential to reshape the renewable gas landscape in Europe. Between October 2024 (M24) and October 2025 (M36), the project has moved beyond design and early testing into a stage where pilots, data, engineering integration and tangible results converge. Process flexibility, syngas quality, plant integration progress and increasing cross-WP collaboration demonstrate that HyFuelUp is becoming a frontrunner in advanced biomethane production.

This report summarises the key achievements, technical advances and next steps towards integrated demonstration.

## **HyFuelUp (*Hybrid Biomethane Production from Integrated Biomass Conversion*) is a project funded by the European Union's Horizon Europe Research and Innovation Programme**

HyFuelUp is validating an innovative, competitive, and clean biomethane production technology based on local residual biomass (crops, bio-waste, bio-residues) that could be replicated Europe-wide.

Growing geopolitical tensions over fossil fuel imports have pushed the European Union (EU) in recent years to turn its attention to biomethane — a readily available and promising solution to boost resilience, speed up the green transition, and enhance energy efficiency.

Through the REPowerEU Plan, the EU has set an ambitious target: produce 35 bcm of biogas and/or biomethane by 2030. Beyond that goal, the plan seeks to strengthen collaboration among policymakers, investors, and the entire biomethane value chain — driving technological innovation, tackling bottlenecks, and accelerating the sector's expansion across Europe.

### **HyFuelUp is powering the shift toward cleaner transport and energy through biomethane**

That's where HyFuelUp comes in. Launched in November 2022, this research project is developing cutting-edge technology to produce biomethane through gasification and methanation.

The resulting biomethane will be liquefied and used to decarbonise long-distance road freight and maritime transport, paving the way for a more sustainable future.

## **MAIN GOALS OF THE HYFUELUP PROJECT**



- Demonstrate an innovative pathway for the efficient and cost-effective production of biomethane at TRL 7.
- Demonstrate a complete deployment value chain, including biomethane offtake and distribution.

# CONCEPT, INNOVATIONS AND ADDED VALUE

HyFuelUp is demonstrating an innovative, cost-effective, and clean biomethane production technology that harnesses local renewable resources — using only low-cost biogenic waste. This breakthrough aims to accelerate the EU's energy transition, enhance sustainability in the transport and energy sectors (with replication potential across Europe), and cut greenhouse gas emissions by over 90% compared to natural gas, driving competitive and sustainable growth.

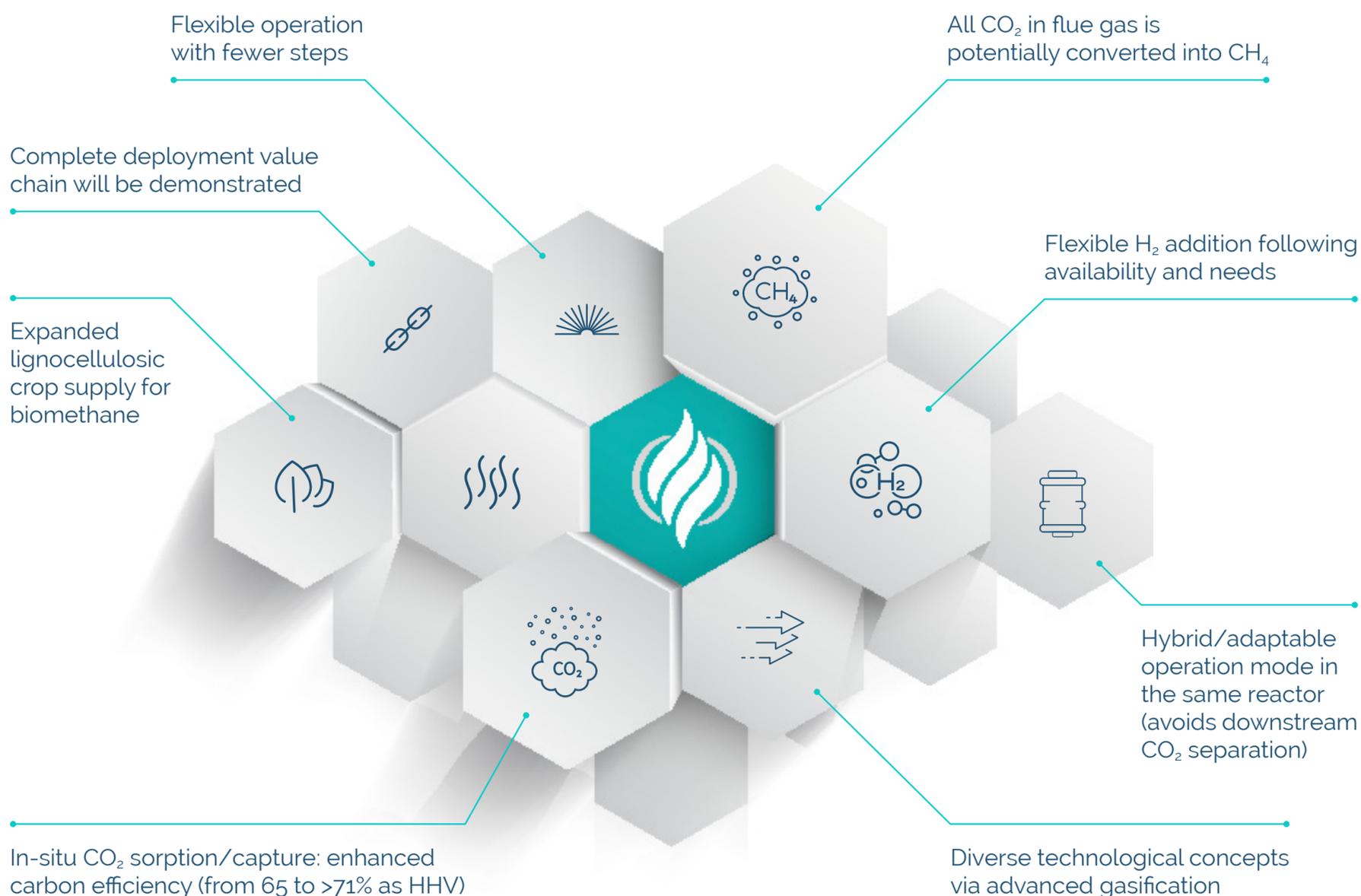


Figure 1. HyFuelUp's added value: Advances and innovations.

The ultimate goal is to contribute to promoting a truly circular bioeconomy. By transforming biogenic by-products sustainably, we can close production loops and turn waste into valuable resources.

This shift not only lightens our footprint on the planet but also sparks new opportunities for innovation, collaboration, and local prosperity.

**HyFuelUp is validating an innovative, competitive, and clean biomethane production technology based on local renewable resources that could be replicated Europe-wide**

# HYFUELUP'S CONSORTIUM AND WORK PACKAGES

The HyFuelUp consortium brings together a diverse team of partners, creating a strong balance between industry and research. It includes two small and medium-sized enterprises (SMEs), one large company, two universities, three national laboratories or organisations, and two research and technology centres. This mix ensures a powerful combination of industrial know-how, academic insight, and expertise in scaling up innovations. In addition, the European Biogas Association (EBA) plays a key role in sharing and expanding the project's knowledge and results, helping to strengthen and add value to the European biogas sector.



Figure 2. HyFuelUp's partners.

After three years of joint effort, the HyFuelUp partners are entering their second Reporting Period with exciting momentum. The project's multidisciplinary approach —covering everything from feedstock supply chains to technology development and final biomethane off-take— is now showing its full potential.

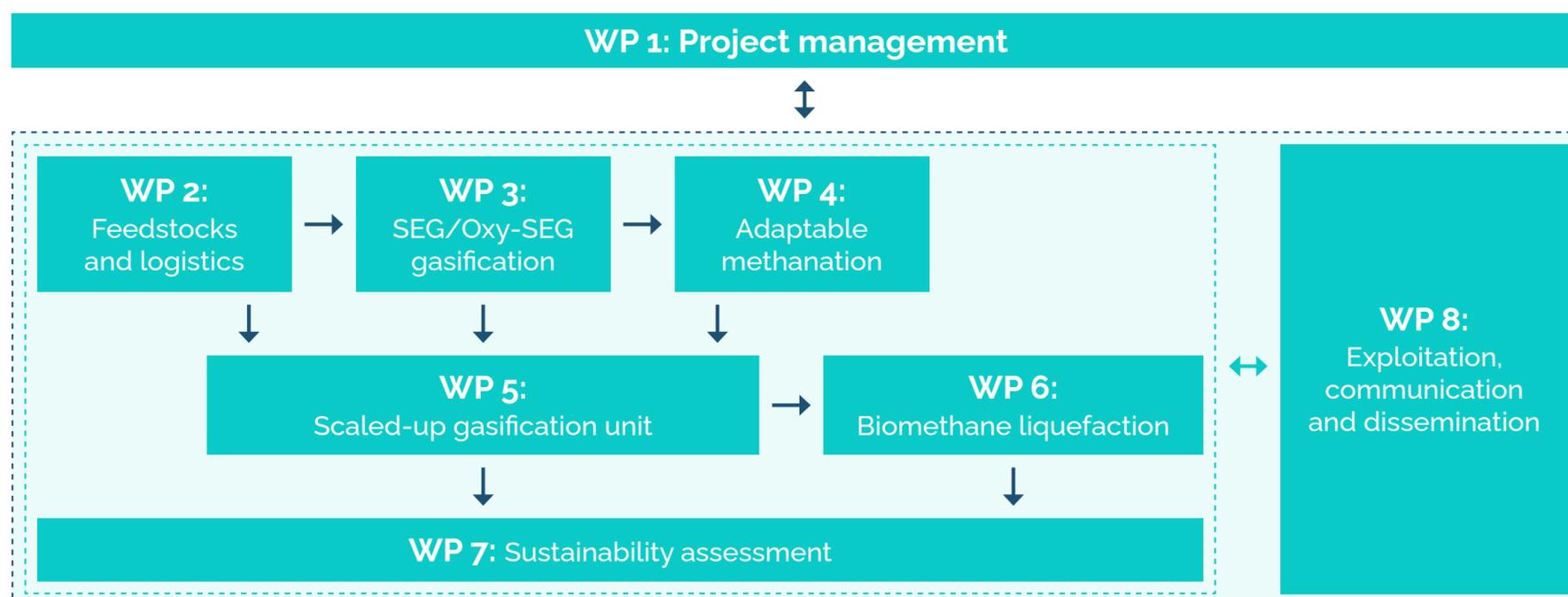


Figure 3. Work Packages' diagram.

In this phase, connections between the eight Work Packages increase, which translates into tangible results that endorse the new sustainable route for biomethane production proposed by HyFuelUp.

# HYFUELUP'S STEERING COMMITTEE MEETINGS

Over the past three years, the HyFuelUp consortium has come together seven times — three of them in person and four online — to share progress, align goals, and strengthen collaboration across all teams. The face-to-face meetings took place in Porto (Portugal), for the kick-off in November 2022; in Athens (Greece) in November 2023 (M12); Stuttgart (Germany) in April 2024 (M18); and Villigen (Switzerland) in April 2025 (M30); while the online gatherings (April 2023 - M6, October 2024 - M24, and October 2025 - M36) helped maintain momentum between milestones.

The in-person meetings also offered a unique chance to step beyond the presentations and see the project come to life. Consortium members visited several partner facilities, including the Teaching and Research Sewage Treatment Plant (LFKW) and IFK's Pilot Scale Test facilities in Stuttgart (Germany), the Psyttalia Water Treatment Plant in Athens (Greece), and PSI's Pilot-scale Test facilities in Villigen (Switzerland).

These on-site visits brought the progress of HyFuelUp into clear focus — allowing everyone to grasp the scale of the technological advances, witness innovation in action, and appreciate the project's tangible contribution to Europe's race toward sustainable biomethane. As results start to converge, these experiences strengthen the shared vision and collaborative momentum driving HyFuelUp forward.



Figure 4. Pictures taken during HyFuelUp's Steering Committee meetings.

# YEAR 3 KEY RESULTS AND PROGRESS (M24-M36)

## Feedstock potential and supply chains

WP 2 assessed the availability and characteristics of lignocellulosic feedstocks across Greece, Portugal, Germany, Switzerland and Spain (Deliverable D2.1: "Lignocellulosic potential assessment and feedstock characterisation"). Based on those inventories, the biomethane potential attainable via gasification was estimated at 78.81 TWh. Beyond conversion technologies, the project underscores the need for reliable, cost-efficient supply chains to ensure effective collection and transport of residues and crops to gasification plants.

### Logistics and Supply Chain

Assess the potential of waste and biomass feedstocks across the involved countries

Provide a comprehensive database

Establish and optimise the supply chains for waste and biomass feedstocks

Identify optimum scenarios for sustainable production of lignocellulosic feedstocks

## Digestate potential and uses

Deliverable D2.2: "Digestate potential assessment and feedstock characterisation" evaluated digestate potentials in all five countries. As a byproduct of anaerobic digestion (AD), digestate can substitute synthetic fertilisers and soil conditioners.

Sensitivity analyses show that varying the share of agricultural wastes in the anaerobic digestion (AD) feed mix can change digestate quantities by up to 38 %. Overall, total digestate potential spans 52.7–57.7 million tonnes/year across participating countries.

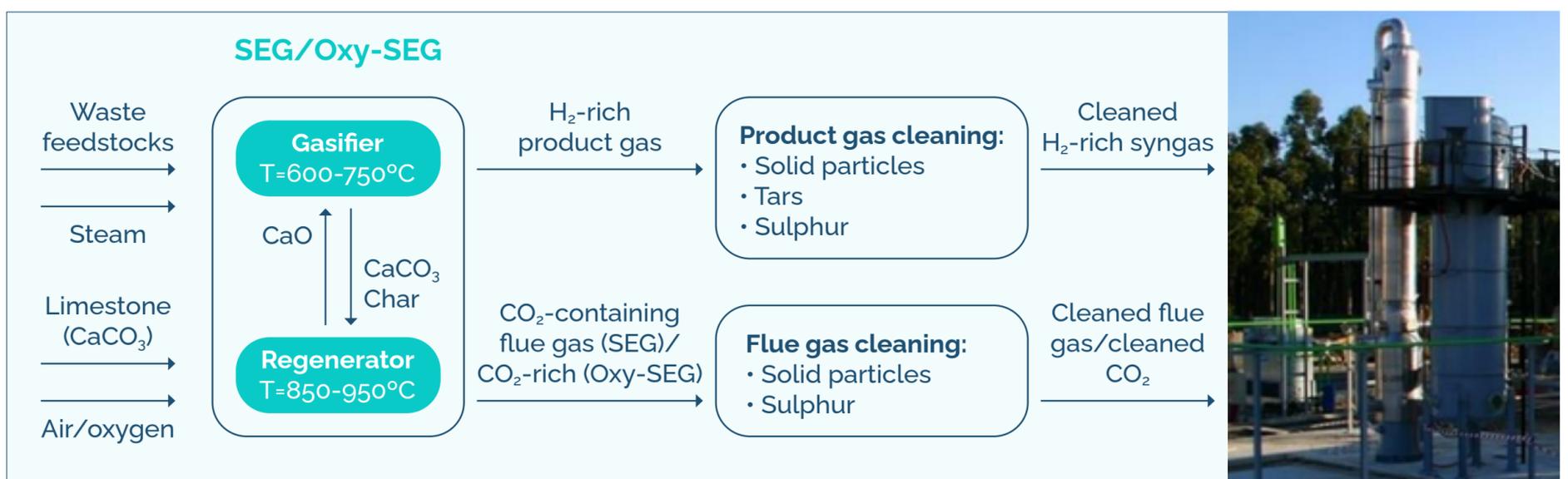
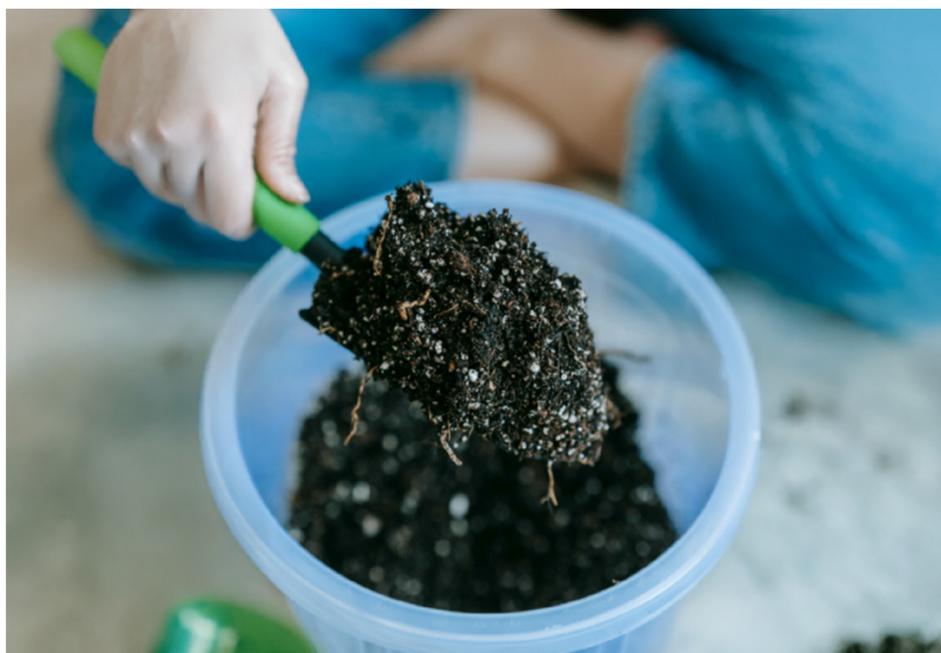


FEEDSTOCK TYPE	GREECE TWh	PORTUGAL TWh	GERMANY TWh	SWITZERLAND TWh	SPAIN TWh
CEREALS	1.49	2.57	20.39	0.00	2.43
TREE PRUNING	1.22	7.83	0.96		2.38
FOREST RESIDUES	0.00	5.73	10.15	7.40	1.22
LANDSCAPE CARE	0.96	4.51	4.53	1.23	
WASTE WOOD	0.67	0.00	0.00	2.63	
<b>TOTAL</b>	<b>4.35</b>	<b>20.64</b>	<b>36.04</b>	<b>11.26</b>	<b>6.03</b>

Figure 5. Annual biomethane potential per feedstock type and country (in TWh).

TYPE OF FEEDSTOCK	GREECE	PORTUGAL	GERMANY	SPAIN	SWITZERLAND
Agricultural waste, tons/y	349,915 - 562,861	12,525	43,683,537 - 48,671,719	204,440 - 227,842	196,756 - 177,340
Sewage sludge, tons/y	364,863	85,254	6,633,865	426,271	545,626
<b>TOTAL, tons/y</b>	<b>699,829 - 912,776</b>	<b>97,780</b>	<b>50,317,402 - 55,305,584</b>	<b>630,711 - 654,112</b>	<b>722,966 - 742,382</b>

Figure 6. Digestate potential in HyFuelUp participant countries.



## Gasification and methanation: flexibility validated

The WP3 team demonstrated a flexible SEG/oxy-SEG process at the University of Stuttgart's DFB pilot under industry-relevant conditions, optimising temperature and steam-to-carbon ratios to tailor syngas for methanation. Oxy-SEG tests confirmed the feasibility across biomass types and the ability to tune syngas composition.

The use of dried sewage sludge received particular attention. Mode-switching between SEG and oxy-SEG was validated, showing the chain's ability to adapt to variable renewable power availability.

### Methanation and gasification processes

Demonstrate and optimise the conversion of dried digestate sludge and lignocellulosic biomass wastes by SEG and oxy-SEG

Test the flexibility of switching between oxy-SEG and SEG and derive a gas cleaning concept for SEG and oxy-GEN

Assess the performance of methanation by introducing a flexible hydrogen supply

Validate numerical computer models used to simulate real methanation tests

Optimise process parameters defining the operation of the plant

Design, construct and commission the integrated plant

At PSI, WP4 operated the "GanyMeth" pilot methanation unit, generating performance data with gases representative of (i) SEG (with in-situ CO separation via calcite/carbonate cycle, and optional CO addition) and (ii) DFB "Güssing-type" gasification (with flexible H<sub>2</sub> addition). Extensive instrumentation enabled axial temperature and concentration profiles for model validation.

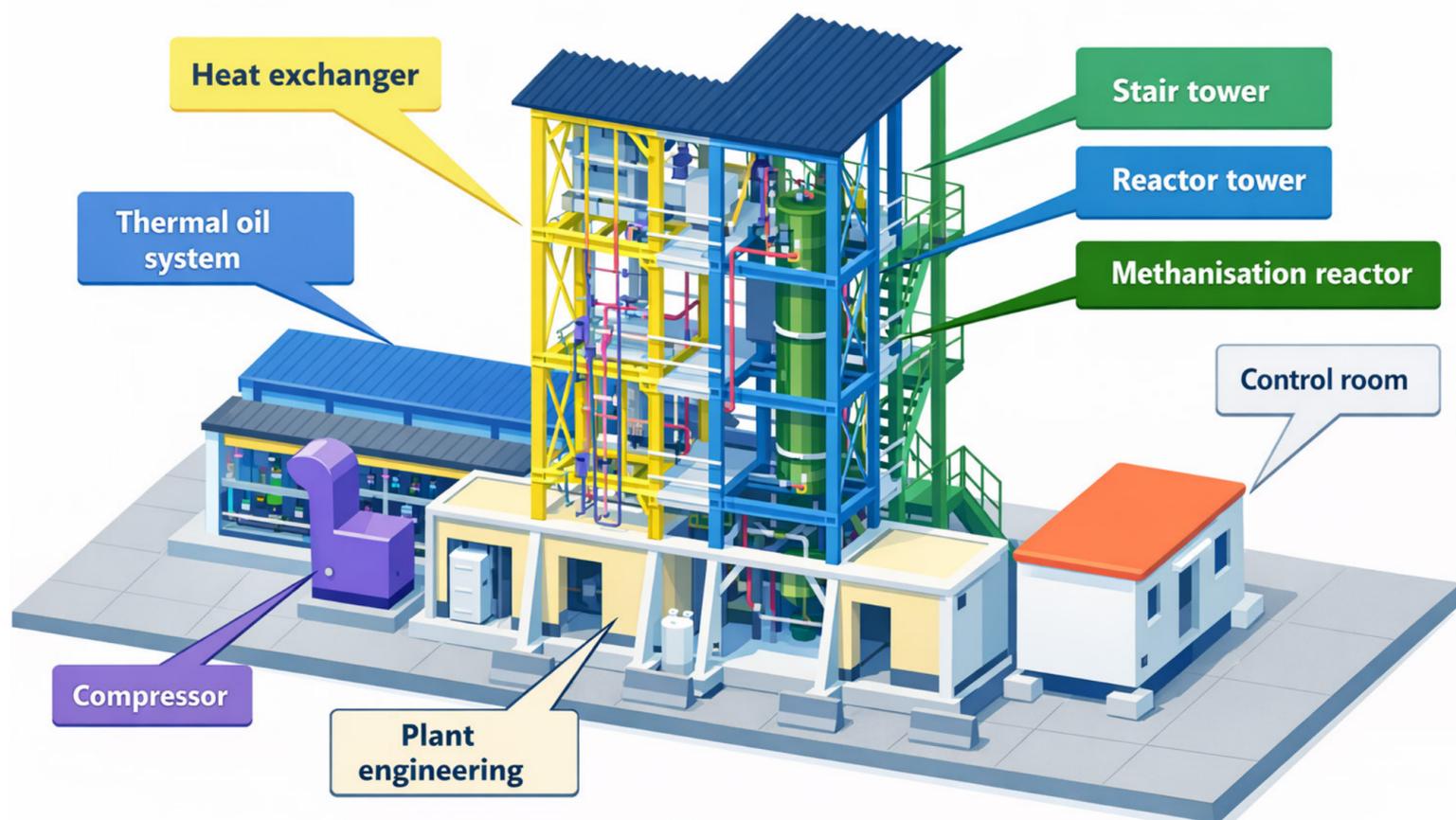


Figure 8. 3D layout of the planned AlphaSYNT methanation unit in the HYFUELUP demonstrator in Tondela (Portugal).  
© AlphaSYNT

## Scale-up, integration and flexible hydrogen

WP5 advanced the scale-up of HyFuelUp's core process, consisting of an existing gasification unit integrated with methanation and flexible hydrogen production. The team completed major engineering steps, including local dismantling, gasifier refurbishment, detailed process design, and procurement of key process components such as the electrolyser. These actions prepared the ground for installation and commissioning, paving the way for full plant testing and integration.

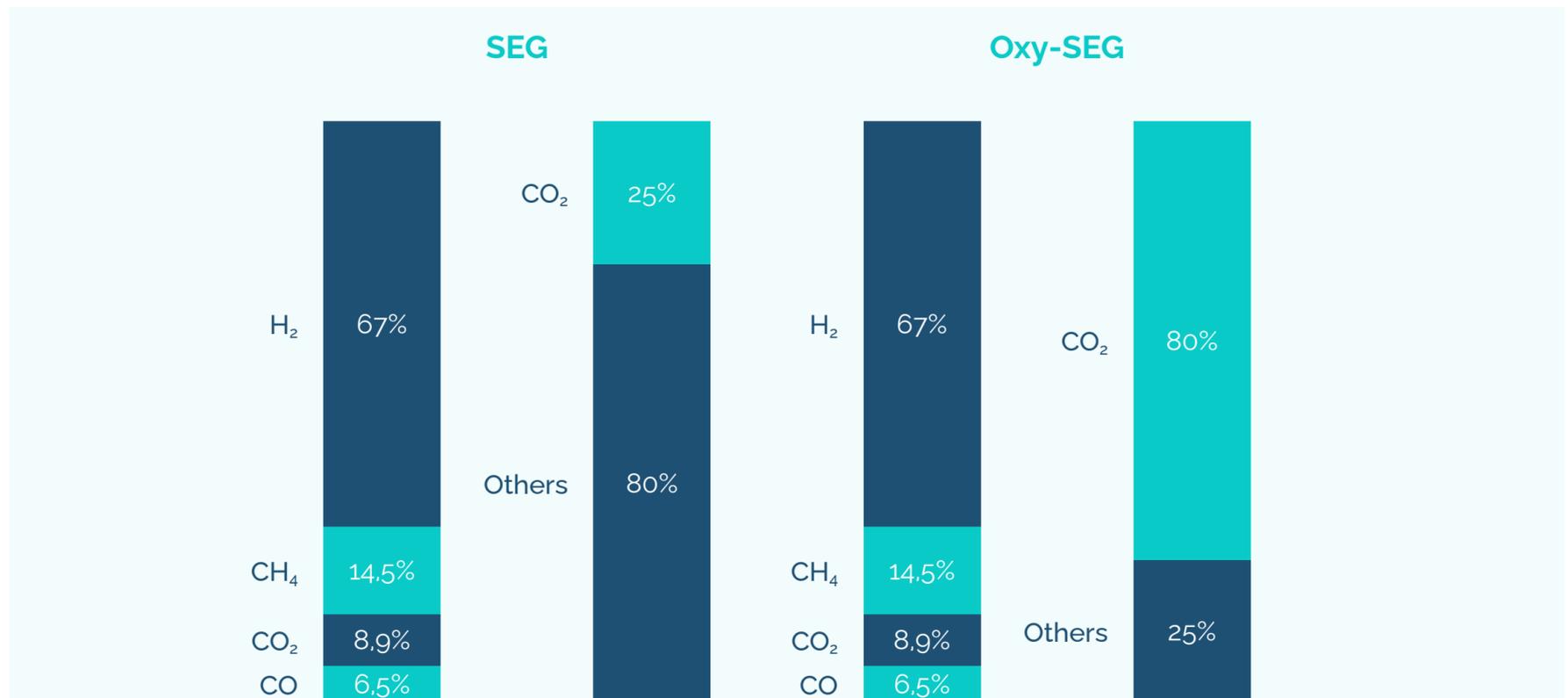
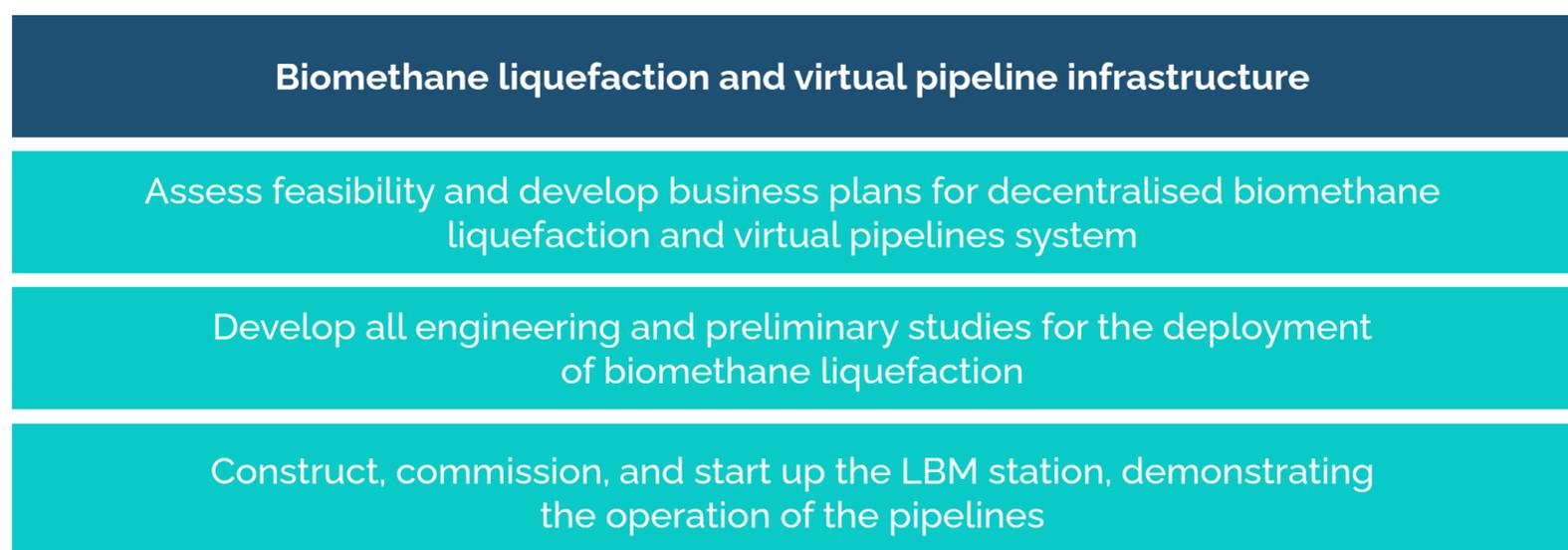


Figure 9. No effect on syngas composition from the change in operation mode.

## Biomethane liquefaction and virtual pipeline infrastructure

WP6 started to study the infrastructure required for biomethane offtake within the project. The work is part of a broader strategy to evaluate multiple downstream options to ensure technical feasibility, economic viability, and environmental alignment. Liquefaction and other pathways were assessed, focused on identifying the most suitable approach for market deployment of the produced biomethane.



# Sustainability assessment (LCA/TEA)

WP7 compiled literature data and ran a preliminary LCA in SimaPro (Ecoinvent) for four scenarios using WP5 inputs. Early results suggest a higher environmental burden than conventional natural gas processing, pointing to optimisation levers now being defined. Initial CAPEX/OPEX estimates highlight strong scale effects on total capital costs; further data collection is underway to complete the techno-economic assessment.

- Sustainability impact assessment**
- Evaluate the techno-economic viability of products and processes
- Evaluate the environmental profile of the final process through the implementation of LCA
- To assess the social impacts associated with the HyFuelUp business model

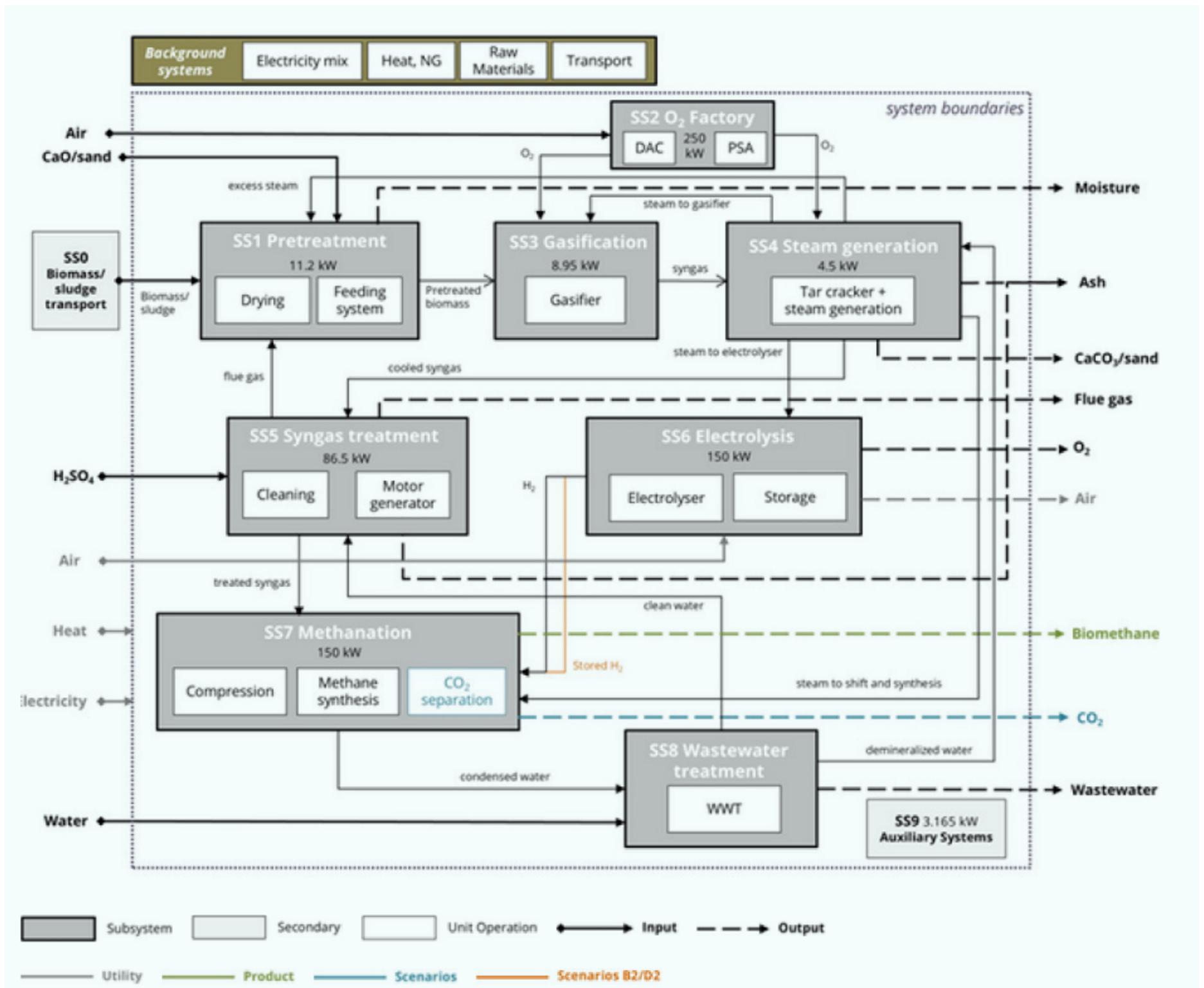


Figure 10. Input-output process system (and subsystems - SS) for Life Cycle Assessment of HyFuelUp, under a cradle-to-gate approach.

## Exploitation, communication and dissemination

WP8 focused on maximising visibility of results and paving the way for exploitation. In the last year, HyFuelUp engaged widely (EUBCE side event with Green Me Up; REGATEC participation; IV International Convention on Science and Conscience; I Spanish Biocircular Summit), published in *Acqua & Gas*, released a new short video on feedstocks and issued its second peer-reviewed paper (systematic/bibliometric review).

A publishable mid-term report (first two years) and newsletter #3 were launched, and a press release amplified the “State of Play of Biogas and Biomethane in Europe” joint report. Deliverable D8.4 (initial Exploitation Plan) sets objectives and a preliminary route to market around the identified KERs.



Figure 11. Communication and Dissemination actions carried out within the last year.

Communication actions	Dissemination actions
Participation in EUBCE 2025	Publication of HyFuelUp's second scientific paper
Launch of HyFuelUp's third short-video	Webinar on Policy Recommendations
Participation at REGATEC 2025	Launch of the publishable report on the first-two-years advances
Participation at the I Spanish Biocircular Summit	Participation in workshop on methanation and 2 <sup>nd</sup> generation fuels
Publication of an article on HyFuelUp in "Acqua & Gas" journal	Launch of the third newsletter
Participation in the IV International Convention on Science and Conscience	Press release on the "State of Play of Biogas and Biomethane in Europe"

# SISTER PROJECTS' JOINT POLICY RECOMMENDATIONS



Figure 12. The so-called Sister Projects: BIOMETHAVERSE, Sempre-Bio, HyFuelUp and METHAREN.

## COMMUNICATION AND DISSEMINATION ACTIONS CARRIED OUT WITHIN THE LAST YEAR.

HyFuelUp cooperates within the Biomethane Cluster (HyFuelUp, Sempre-Bio, Biomethaverse, Metharen; 65 partners, 14 countries, 10 demo sites). The cluster's second Joint Policy Recommendations report (led by HyFuelUp) "[State of play of Biogas and Biomethane in Europe: An update on market gaps and policy recommendations](#)" was released in October 2024, analysing EU policy, market gaps, sustainability and Guarantees of Origin; outreach included a public webinar and press activities.

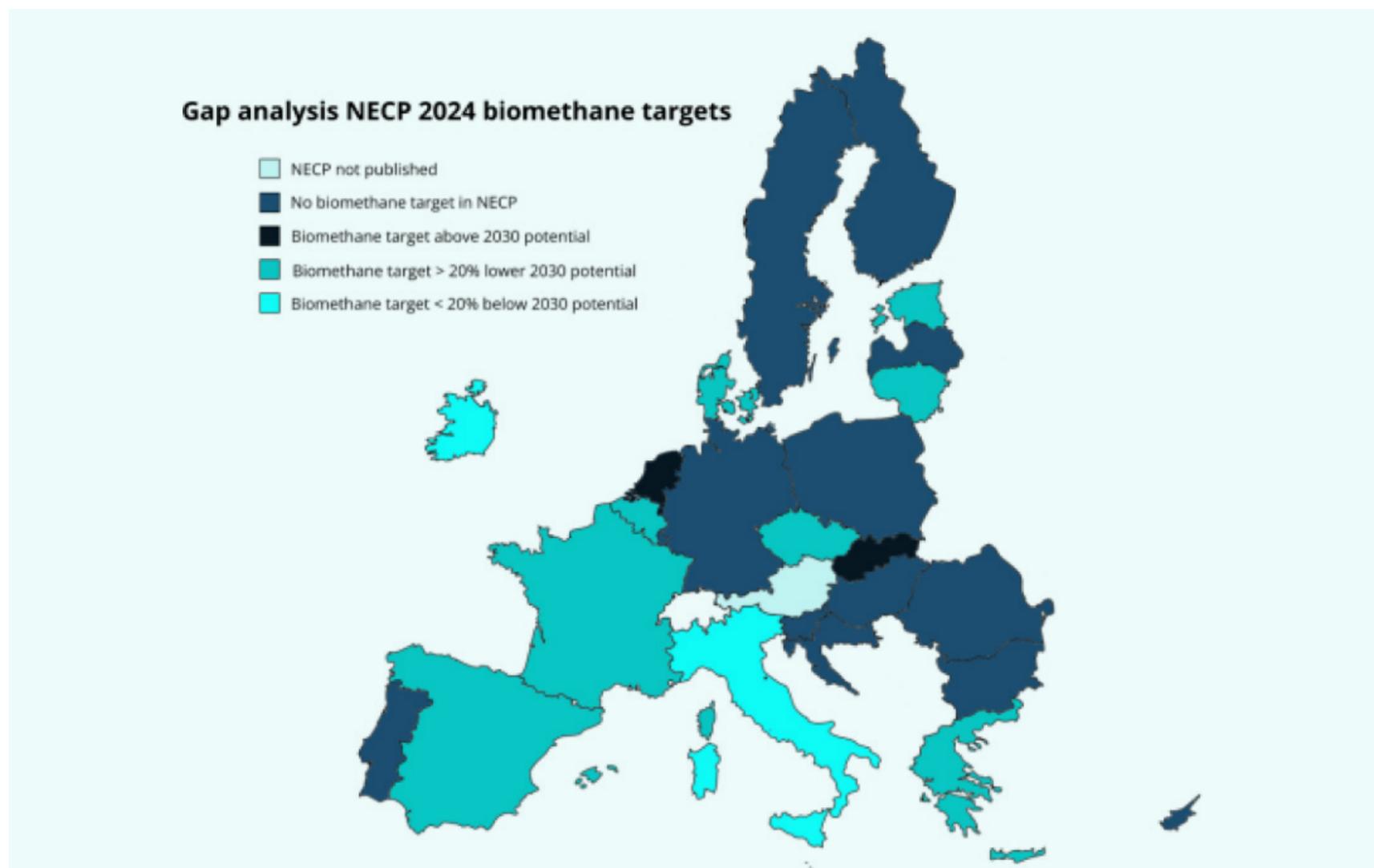


Figure 13. Countries' NECPs with a 2030 biomethane target (Source: EBA - State of Play of Biogas and Biomethane report).

# OUTCOMES

Biomethane offtake pathways influence technical feasibility, economic viability, and alignment with environmental goals.

After three years of intense work, HyFuelUp project has reached a key point in which tangible results emerge. At this stage, the teams have moved beyond the initial design and coordination phase and are entering a stage where ideas are transformed into prototypes, data, pilots or publications that validate the direction of the project.

This is the turning point when collaboration among partners bears visible fruit, and the joint effort begins to leave its mark beyond the laboratory or the screen:

## Intermediade conclusions (M24-M36)

Sufficient feedstock availability exists to supply advanced gasification routes to biomethane

The selected SEG/oxy-SEG + methanation pathway is well-suited for HyFuelUp's integrated pilot

Total CAPEX is highly sensitive to scale (strong economies of scale observed)

Given current biomethane quality and budget constraints, liquefaction is not feasible; compression is proposed to ensure technical and economic viability

Deployment barriers persist: policy uncertainty, social licence issues, and permitting bottlenecks



# UPCOMING RESULTS

## What's next (M36+)

WP2: Optimised logistics/value chains for agricultural/forestry residues: ongoing trials on dedicated biomass production

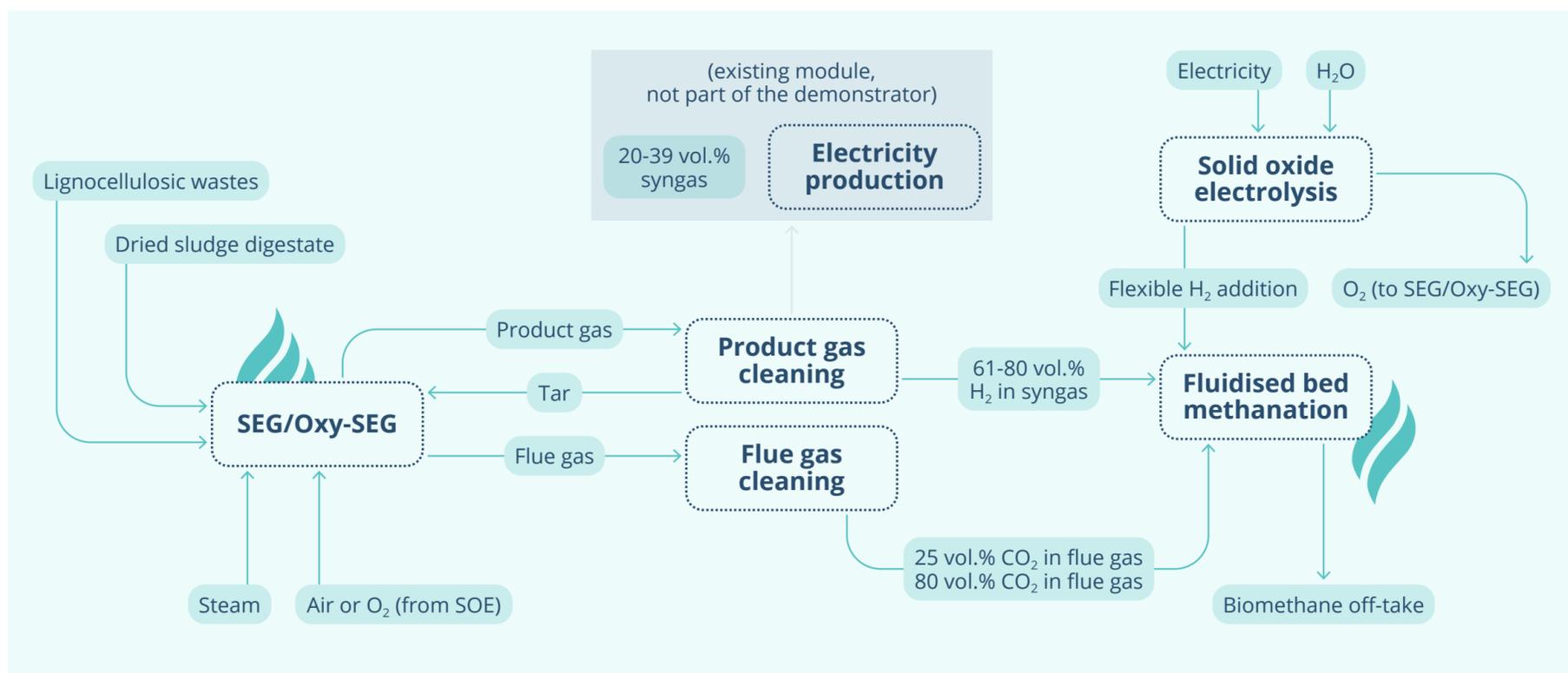
WP3: Final design of an integrated gas cleaning concept for tar reforming and sulphur removal

WP4: Use the pilot dataset (75-226 kW CH<sub>4</sub> output range) to validate a rate-based reactor model

WP5/6: Plant integration continues with local works focused on equipment delivery, installation, and commissioning: as part of a broader downstream strategy for the renewable gas, the team evaluates multiple offtake pathways to determine the most suitable approach for market deployment

WP7: Complete TEA with refined data and optimisation scenarios: launch social acceptance surveys with local communities, workforce and value-chain actors

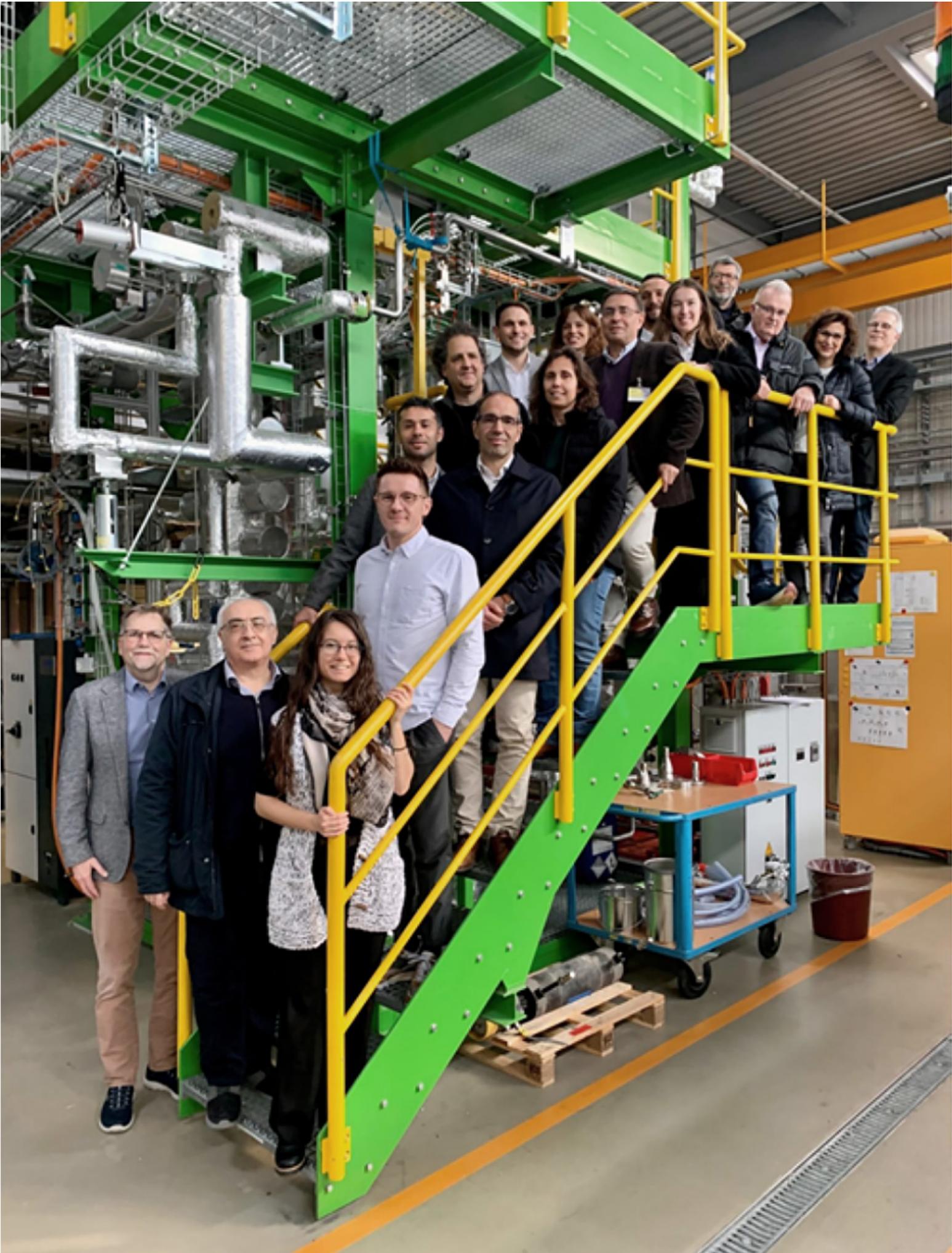
WP8: Update the Exploitation Plan (D8. 10) by April 2026; upcoming actions include a final publishable report, final conference & technical workshop, a science-and-technology video, additional newsletters, and the third joint Policy Recommendations with the Sister Projects



**Figure 14.** HyFuelUp is integrating a SEG\*/Oxy-SEG process to turn biowaste into syngas or flue gas. Syngas with high H content (>65 %) and a CO<sub>2</sub>-rich flue gas suitable for catalytic methanation are obtained as a result.

# Contribution to EU strategies

The concept and results achieved in the last year strengthen the gasification-to-biomethane pathway and contribute to the SET Plan objectives by advancing cleaner, more scalable and more flexible renewable gas solutions for hard-to-abate sectors.





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