SWOT analysis in target countries.

Deliverable 2.2

GREENMEUP

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Abbreviations

AD: Anaerobic Digestion
CAPEX: Capital Expenditure
CfDs: contracts for difference
CNG: Compressed Natural Gas
CHP: Combined Heat and Power
CRES: Center For Renewable Energy Sources
CZ Biom: Czech Biomass Association
DAPEEP: Renewable Energy Sources Operator and Guarantees of Origin (Greece)
EU: European Union
FaB: Food and Beverage
FIP: Feed-in Premium
FIT: Feed-in Tariff
GoO: Guarantee of Origin
GIPL: Gas Interconnection Poland–Lithuania
GHG: Greenhouse Gas
IEC: Installed Electricity Capacity
INECP: Integrated National Energy and Climate Plan
LNG: Liquefied Natural Gas
MRAA: Ministry of Regional Affairs and Agriculture
NECP: National Energy and Climate Plan
NGO: Non-Governmental Organization
OPEX: Operational Expenditure
PESTEL: Political, Economic, Social, Technological, Environmental, and Legal
PIGEOR: Polish Economic Chamber of Renewable and Distributed Energy
PNIESC: Integrated National Energy and Climate Change Plan (Romania)
RES: Renewable Energy Sources
RePowerEU: Joint European Action for more affordable, secure and sustainable energy
RS: Republic of Serbia
SOFC: Solid Oxide Fuel Cells
SWL: Solid Waste Landfills
TSO: Transmission System Operator
WWTP: Wastewater Treatment Plant

List of tables

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Executive Summary

The GreenMeUp project aims to accelerate the market uptake of biomethane across Europe, with a particular focus on the seven target countries participating in the project. This document presents the results of the SWOT analysis conducted in each target country, and the developed strategies to leverage Opportunities and Strengths and minimize the effect of Weaknesses and Threats. These strategies were collaboratively formulated by GreenMeUp's target countries partners and validated with their expert stakeholders involved in their Policy, Market and Society Hubs.

The developed strategies point towards urgent support from national governments to prioritize biomethane within their renewable energy agendas by establishing binding targets, included in strategic documents and plans at national level. In addition, they emphasize the need for technological upgrades and corresponding financial support (CAPEX) to effectively utilise available feedstocks, particularly those derived from waste sources such as wastewater treatment plants and agricultural residues (e.g., manure). Thus, biomethane can be effectively integrated into circular economy plans, promoting sustainability and resource efficiency. Besides policy and market instruments, the strategies also emphasise the importance of collaborative approaches. This includes promoting synergistic activities with local actors through active engagement, such as the joint development of technology concepts and their participation in biomethane-related innovation and knowledge transfer activities. The GreenMeUp project supports these collaborative efforts to build a robust, interconnected biomethane ecosystem to supports target countries' objectives.

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Index

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1 Introduction

Biomethane represents a strategic solution for the EU energy transition with the potential to reduce dependence from natural gas imports and contributing to decarbonisation goals. It plays a crucial role to reduce GHG emissions in hard-to-abate sectors that remain reliant on fossil-based resources, as reinforced by the REPowerEU Plan for the future of the EU´s energy mix. However, expanding the biomethane market from the current 3 billion cubic meters (bcm) to the expected 35 bcm by 2030 is a paramount task with a myriad of challenges. The need for support mechanisms, enabling infrastructure for grid connection, facilitating common Guarantee of Origin (GoO) and other key enabling factors require a strategic planning in each Member State (MS).

For a look at the most important factors that affect each target country´s biomethane market we have utilised a SWOT analysis (Strengths, Weaknesses, Opportunities and Threats). This tool also promotes a participatory selection of the most urgent strategic actions for biomethane market deployment in each country, given the involvement of society, politic and market stakeholders. Utilising the SWOT tool and results of the present factors, a particular emphasis of this work is placed on the development of strategies to neutralize potential weaknesses and threats or to leverage potential strengths and opportunities in synergy.

- Structured analysis of framework conditions and market dynamics for the uptake of biomethane in the target countries.
- Engagement of stakeholders for the co-creation of strategies to leverage strengths and opportunities, and minimize threat and weaknesses identified in the SWOT analysis
- Strategic perspective of current status-quo and a future perspective on key activities to reached the desired biomethane market development.

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2 Methodology

2.1 Introduction to SWOT Analysis and TOWS Analysis

A SWOT analysis is a strategic technique to systematically identify strength (S), weaknesses (W), opportunities (O) and threats (T). It supports the identification of the current competitive advantages, contrasted against internal and/or external factors that can keep the target country´s biomethane market from reaching its potential. For this, a matrix is used to identify internal (strength and weaknesses) and external (opportunities and threats) factors.

By matching internal and external factors identified in the SWOT analysis, specific strategies that enhance the opportunities and strengths, diminish weaknesses and reduce treats can be identified. For this, is customary the utilisation of the TOWS matrix. The TOWS matrix and supportive questions per quadrant as seen in Figure 1, facilitates the cross-analysis of external with internal factors.

TOWS Matrix		External factors	
		Opportunities	Threats
Internal factors	Strengths	SO How to exploit strengths to respond to the opportunities?	ST How to use strengths to mitigate threats?
	Weaknesses	WO How to prevent weaknesses to risk opportunities? How identified opportunities can remove weaknesses?	WT How to avoid weaknesses from enhancing the threats? How to minimize both weaknesses and threats?

Figure 1. TOWS Matrix and supportive questions for the development of strategies.

In the specific case of the analysis carried out in Task 2.4, the analyses were regarded towards the national technical, economic and environmental performance with reference to the uptake of biomethane and biohydrogen in selected target countries, namely Czech Republic, Danube Region (representative countries: Hungary, Romania, Serbia), Latvia, Poland, Estonia, Greece and Spain.

2.2 Process for the SWOT-TOWS analysis with the target countries and their Hubs

The preparation of the SWOT-TOWS analysis in the GreenMeUp project, utilised several information sources to complete the SWOT section. This include key information from the target countries already collected in the project, such as the analysis of existing production routes and end uses (D2.1), and analysis of key policy requirements for improved market uptake of

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biomethane (D4.1). Additionally, the results of the PESTEL analysis, carried out in a co-creation format with stakeholders from the Policy, Market and society Hubs in the target countries (D3.2), provided valuable insights from biomethane experts regarding current challenges and potential solutions.

As a second step the gathered information was structured by DBFZ and assigned to the respective area of the SWOT analysis. For this, DBFZ provided a template to support target country partners to complement their SWOT factors and to perform their individual TOWS analysis following the same structure. Following the template and as a third step, strategies were developed by target countries using a TOWS matrix with the above formulated guiding questions. Each strategy results from a cross-analysis that is made up of one or more internal and one or more external factor. Together they form synergies or mitigate threats/weaknesses. In crossing factors one by one, it is possible to define strategies that tackle all aspects that have been identified in the SWOT analysis. The strategies are then structured regarding their quadrant (S-O, S-T, W-O, W-T). As a fourth step, the target countries were instructed to share these findings with their network of stakeholders, already engaged in GreenMeUp hubs, as well as validate and complement them (if necessary) in the framework of the 4th Hub´s workshop to be celebrated in the second quartal of 2024. The workshops were conducted between June and July 2024 and supported the dissemination and discussion about developed strategies. Finally, target countries considerations about stakeholders that could possibly implement them have bee included as a first step to consider their implementation.

In the following section, the results from target countries SWOT-TOWs analysis, with focus on the developed strategies is presented and an analysis of commonalities and key priorities among the 7 target countries is included in the conclusions (section 4).

3 TOWS Analysis and derived strategies for each target country

This section presents detailed results from each target country´s analysis, first highlighting key findings from the SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) that influence the environmental, technical and economic competitiveness of the biomethane sector in each country. Emphasis is placed on presenting the strategies developed by cross-analysing the identified SWOT factors.

3.1 Czech Republic

SWOT analysis

The SWOT analysis highlights several important factors that are advantageous for the further steps towards a stronger and wider biomethane market. Key factors influencing the development of the biogas/biomethane sector include market stimulation through the creation of market incentives and operational (or investment) support from the state.

Table 1. SWOT Analysis – Czech Republic

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SWOT Analysis – Czech Republic

S – Strengths	W - Weaknesses
S1- High use and availability of animal waste (slurry and manure) for biogas production. **S2-** Investment support for biomethane available. **S3-** Operational support for biomethane available for 20 years. **S4**- Strong knowledge of the biogas sector. **S5-** High consumption of bioCNG in transport. **S6-** Dense network of gas pipelines in the Czech Republic, especially low pressure, medium pressure. **S7-** More than 400 agricultural biogas plants with a high average energy output are currently in operation. **S8-** EU targets (REPowerEU) and taxonomy requirements (share of green investments in total investments) for biomethane development. **S9-**Legislative readiness for biomethane development (RES Act, Energy Act and accompanying legislation). **S10-** End landfilling of sustainable biodegradable waste by 2030	**W1-** Existing technologies are designed to use purpose-grown biomass. **W2-** Lack of advanced substrate to cover the consumption of all installed 400 biogas plants. **W3-** Legislative constraints on energy crop production (Common Agricultural Policy and climate protection) **W4-** Low declaration of biomethane needs - currently it is a low priority. **W5-** Lack of binding and enforceable biomethane targets (NECP) **W6-** Support gaps (combination of multiple factors) **W7-** Issue with connection to the medium pressure natural gas network (legislative obstacles) **W8-** Problematic application of digestate from sludge (WWTP) and from biodegradable part of municipal waste (inability of application in organic farming) **W9-** Notified operating support for biomethane was only for 2 years (applications will expire in 2025) **W10**-Large investment costs. No sense without investment support from the state. **W11-** Lengthy permitting processes. **W12-** Low involvement of the state apparatus in adjusting legislation, lengthy removal of barriers. **W13**- Diversity of lobbying interests leading to low acceptance of development proposals by industry associations.
O – Opportunities	**T – Threats**
O1- Most of the 400 biogas plants are half or a third of the way through their operation and are considering further development and upgrading to biomethane. **O2-**Update of the NECP which includes targets for biomethane production and its use in transport, heating and other industries. **O3-** Resource potential still available in manure, biodegradable waste, by-products and cultivated biomass. **O4-** We have support available that is operational, investment and in the form of trading guarantees of origin (GoO). **O5-** The potential use of bio-waste (about 2 million tons per year) that ends up in landfills is potentially available on the market. **O6-** Large number of CNG stations (about 230) that can buy biomethane. **O7-** Agriculture at a high level (both crop and livestock production). **O8-** From 2025, most likely there will be a new operational support for biomethane. **O9-** Availability of technologies for the construction of biogas and biomethane plants.	**T1-** In order to increase the use of modern substrates, a technological change of the equipment is necessary. **T2-** Biogas and biomethane legislation are becoming increasingly complex and complicated, resulting in a slowdown in the development of the sector. **T3-** The methodology for determining the support (and the amount) depends on the Energy Regulatory Office **T4-** Operational support ends in 2025 and there is uncertainty beyond that year. **T5-** Instability of the political and legislative environment where the biogas/biomethane sector has different priorities over time. **T6-** Future development of climate protection instruments (GoO, emission allowances, sustainability criteria, etc.) in relation to biomass use **T7-** Uncertain economic stability and return on investment. **T8-** Loss of availability of human resources, lack of interest to work in this sector in the future. **T9-** Low demand for biomethane.

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O10- High demand for biomethane from end consumers	

Involvement of stakeholders

Input data for the SWOT analysis was obtained during the internal CZ Biom workshop held on 16 May 2024, with participation of association experts. Subsequently, the SWOT analysis was included in the GMU interview for the creation of the FCM (Fuzzy Cognitive Mapping), where it was presented before the actual creation of the FCM. Within the FCM, the SWOT analysis was presented to 11 people from whom feedback was obtained during the interview. After that, the SWOT analysis was presented in the fourth HUB workshop, which took place in the framework of the Biogas and the Legislation conference on 28 June 2024, which was attended by representatives of the market, the policy and the society hubs. As part of the feedback, we received a number of useful and complementary information that helped to further deepen the impact of each strategy. In principle, all participants agreed on the factors and strategies presented.

Resulting strategies

On the basis of an internal CZ Biom workshop and subsequent validation of the SWOT results of with CZ Biom partners during the FCM mapping and latter with stakeholders during the 4th Hub´s workshop, 10 strategies were developed, which can be consulted in the **Annex I: Czech Republic – TWOS Analysis Results**. The following five are the most crucial:

SO4-Preparation of new operating and investment aids

Taking into consideration a possible new operational support from 2025 onwards, it is the right time to engage in the support mechanism that will foster the upgrade of installed biogas plants, detached the biogas/biomethane production from purpose grown biomass towards the use of other residue biomass streams available and make use of installed infrastructure for higher biomethane use (CNG stations).

- **SWOT Factors:** This strategy addresses the Strengths factors S1, S2, S8, S9, and the Obstacles factors O1, O3, O5, O6, O7, O8, identified in the SWOT analysis (see table 1).

- **Actors:** Ministry of Industry and Trade with other ministries (agricultural, environmental…) and NGOs
- **Timeframe:** Long-term.

ST2- Ensuring the competitiveness of biomethane through economic instruments

Given the possibilities that open with finalization of landfilling of sustainable biodegradable waste by 2030 and other available sources of feedstocks, as well as a strong trajectory and expertise in the biogas sector, it is imperative de-risking the biomethane production by strengthening the

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operational support and offering economic support to biomethane projects. Likewise, it is paramount to stabilize the perspective in the sector with clear targets in the long-term.

- **SWOT Factors:** This strategy addresses the Strengths factors S10, S1, S2, S3, S4 and the Threat factors T9, T5, T8, identified in the SWOT analysis.
- **Actors:** Government (initially Ministry of Industry and Trade) and market actors
- **Timeframe:** Medium to long-term.

WO3- Update of the NECP and biomethane targets

The finalization on the update of Czech Republic´s NECP, due in 2024 opens a window of opportunity for ambitious biomethane targets to drive its utilisation in transport, heating and other industries, and to include mechanisms to reduce support gaps to the sector.

- **SWOT Factors:** This strategy addresses the Weaknesses factors W3, W4, W5, W6, and the Opportunity factors O2, O3, O4, O5, O8 identified in the SWOT analysis.
- **Actors:** Government, RES Chamber, CZ Biom partners, NGOs
- **Timeframe:** Short-term.

SO2- Conversion (modernisation) of existing biogas plants to supply biomethane to the natural gas network

Upgrading existing biogas plants to biomethane and including technologies to utilize available waste biomass streams will boost the sector. Building also on existing capabilities, such as the dense network of gas pipelines (low and medium pressure) and existing expertise on biogas and biomethane technologies.

- **SWOT Factors:** This strategy addresses the Strength factors S6, S7, S2, S3, and the Opportunity factors O9, O2, O4, identified in the SWOT analysis.
- **Actors:** Biogas plant operators (in CZ mostly agriculture cooperatives)
- **Timeframe:** Medium-to long-term

SO3- Construction of new biomethane station (near to the end of biomethane consumption)

Successful biomethane projects are mainly located at the end use of biomethane (in case of injection into the grid near the connection to the natural gas network, in case of use in transport near transport companies and other transport hubs). This, saves both the investment costs of building the connection and the operating costs of transporting the biomethane. Good access to feedstock is also very important for the location of a biomethane plant.

- **SWOT Factors:** This strategy addresses the Strength factors S10, S8, S2, S3, and the Opportunity factors O10, O5, O9, identified in the SWOT analysis.
- **Actors:** RES investors
- **Timeframe:** Medium-to long-term

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Based on the SWOT factors analysis, the top strategies focus on creating new operational and investment support, as well as introducing economic instruments to actively stimulate demand for biomethane. Increasing economic attractiveness for investors and achieving profitability within the operational lifetime of biomethane plants are crucial for meeting the objectives and commitments set by the EU and the Czech Republic.

This is also linked to the update of the National Energy and Climate Plan (NECP) and the specific targets set for biomethane. This strategic document is currently being updated with the support of CZ Biom. The aim is to create a binding strategy within the NECP to achieve the set biomethane production targets.

The NECP includes, among other objectives, the determination of how to achieve the given biomethane production targets, in particular through the conversion of a significant part of biogas plants to biomethane (which currently receive a CHP subsidy, which, according to the biogas plant's entitlement to the subsidy, will cease from 2028 to 2033). Out of a total of about 400 agricultural biogas plants, most will be motivated to upgrade to biomethane, for example in combination with CHP. At the same time, the NECP foresees the creation of new biomethane stations, which should be located close to infrastructure for end-use of biomethane. For example, such projects have already been developed (the biomethane station in Mladá Boleslav, which produces bioCNG for public transport, as well as the Herálec biomethane station project).

The main actors that have the possibility to implement or participate in these strategies are mainly the state (government) and market actors as such with the help of third parties such as NGOs. The first strategy of preparing a new operational and investment subsidy is a long-term commitment in terms of time, which will take several years to achieve. This is similar to the second strategy, which relies on the government to create an environment where biomethane is a desirable commodity, thereby stimulating its production. This is a long-term commitment in terms of time.

Updating the NECP is a short-term issue, we are currently talking about updating the document in 2024. However, the NECP itself will be subject to further updates. The conversion of existing biogas plants and the construction of new biomethane plants is a long-term goal that should be largely completed by the end of 2030 (according to the NECP targets).

3.2 Danube Region

3.2.1 Hungary

SWOT analysis

Hungary has a robust infrastructure suitable for biomethane integration. Furthermore, significant volumes of animal manure and slurry are available as feedstock for biogas production— providing a substantial resource for generating renewable energy. In addition, the government supports the use of bio-LNG in the heavy-duty transport sector, promoting a reduction in greenhouse gas emissions from this high-emission area. However, there are no incentives to encourage the conversion of combined heat and power plants to biomethane production. Additionally, the low natural gas prices in Hungary make biomethane less economically attractive. This issue is

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compounded by the lack of incentives to promote the consumption of biomethane over traditional natural gas— further discouraging both consumers and industries from adopting greener alternatives. Accounting that the banking sector shows low interest in financing biomethane projects, the development and expansion of biomethane production facilities are further hindered. Overall, citizens and investors lack the necessary incentives to use green gas instead of fossil natural gas, while the biomethane production sector struggles to achieve economies of scale— leading to high production costs that make biomethane a low-competitive option. In summary, despite Hungary's solid infrastructure and resources, these significant challenges must be addressed through targeted policies and financial support to foster the growth of the biomethane industry and contribute to the country's renewable energy goals.

Table 2. SWOT Analysis – Hungary (Danube Region)

SWOT Analysis – Hungary	
S – Strengths **S1-** Two exemplary biomethane installations operated successfully **S2-** Highly developed domestic natural gas network **S3-** Advanced basic and applied research and development expertise in the field **S4-** Companies are interested in producing energy for self-consumption **S5-** High penetration of solar energy calls for balancing capability **S6-** Significant amount of biodegradable municipal waste **S7-** Significant volumes of animal manure/slurry available for biogas plants **S8-** About 600.000 ha marginal land could be used for biomass production **S9-** Need to grow cover crops to prevent soil erosion (South-East region)	**W - Weaknesses** **W1**- Lack of knowledge and experience on biogas upgrading technologies **W2-** Limited access to natural gas distribution network (due to small distribution loops with low consumption in summer period) **W3-** Difficulty to achieve economies of scale in biomethane production. **W4-** Low penetration of CNG/LNG in transport **W5-** Low level of irrigation – barrier for cultivating sequential crops **W6-** Government interference with energy markets **W7-** Limited incentives for reducing energy consumption **W8-** Access to European biomethane markets is not established **W9-** High costs of grid injection to be covered by biomethane producer **W10-** Excise duty is charged on bio-CNG, and bio-LNG. **W11-** Stakeholders in agriculture don't appreciate the benefits of biogas **W12**- No investment support is available to biogas/biomethane investors **W13**- High level of inflation, high interest rates **W14**- Low use of manure and slurry for the biogas production. **W15**- Most of fermentation residue storage facilities are open **W16**- Biogas substrates are transported long distances on the roads. **W17**- Low awareness for climate protection in the population **W18**- Local residents resist building biogas installations. **W19**- Reluctance to source-separated waste collection
O – Opportunities	**T – Threats**

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O1- Huge volumes of untreated manure and slurry are distributed on cultivated land **O2**- Establishing clusters of biogas plants with central upgrading units **O3**- Co-fermentation (food & beverage industry + animal husbandry) **O4**- Support for usage of bio-LNG in heavy duty transport sector **O5**- Sequential crops – research and pilot projects **O6**- Utilisation of marginal land – research and pilot projects **O7**- Biological methanation – research and pilot projects **O8**- Digestate certification **O9**- Investment support to agriculture and food industries (EU CAP) **O10**- National biogas/biomethane action plan - support policies **O11**- Guarantees of Origin for renewable gases enabling exports **O12**- Grid injection costs: CAPEX support **O13**- Significant amount of biodegradable municipal waste **O14**- Upgrading digestate to valuable bio-fertilizer	**T1**- Reluctance of agricultural stakeholders to let manure/slurry be processed **T2**- Absence of incentives for converting CHP plants to biomethane production **T3**- No support for biogas plants to enable processing organic wastes **T4**- Unpredictable government interference on energy markets **T5**- Low natural gas prices **T6**- Absence of incentives for biomethane consumption **T7**- Missing long-term regulatory frameworks **T8**- Low interest of the bank sector in financing biomethane projects **T9**- No incentive for the public to support source-separated collection **T10**- No incentive to direct communal organic waste streams to biomethane production **T11**- No incentive for the citizens to use “green gas” instead of fossil natural gas

Involvement of stakeholders

The consolidation of TOWS strategies was made possible following an extensive process of stakeholders’ consultation on SWOT analysis, taking into consideration the political, economic, social, technological, environmental and legal (PESTEL) aspects of their national biomethane market development. PESTEL workshop was organised on 29 November 2023 in Budapest, with key representatives of biogas’ social, market and policy hubs. On 27 May 2024, in conjunction with another biogas industry event, a workshop was held with relevant local stakeholders in Hungarian language, where further discussion took place on the biomethane’s production and uptake through SWOT prism. With all their inputs, strategies were formulated using a TOWS matrix that address all aspects identified in the SWOT analysis. These strategies were then validated during the 4th Danube Biomethane Hub meeting, held online on 19 June 2024. Some of the key aspects that emerged more often from stakeholders’ feedback were focused on legislation, more precisely, the setting up of natural biogas/biomethane support schemes in long-term (as current measures are rather temporary), as well as more uniformed regulation of the injection scheme all over the country.

Resulting strategies

The Hungarian GreenMeUp hub put forward in total 17 strategies that can be consulted in the **Annex II-Danube Region – TOWS Analysis ResultsDanube Region – TOWS Analysis Results**. The following four key strategies have been selected based on the number of contributing SWOT elements (unlike other Hubs of the Danube Region, the selection was less evident in this case):

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SO1- To elaborate a national action plan with defined biomethane targets

Defining specific biomethane targets in a binding national action plan will provide stability to market actors (biogas producers, biomethane developers, investors) to exploit available feedstocks, and strengthen the supply chain to established end-use sectors (e.g. transport sector).

- **SWOT Factors:** This strategy addresses the Strength factors S2, S7, and the Opportunity factors O1, O4, O9, O12 identified in the SWOT analysis (see Table 2).
- **Actors:** Government, supported by market actors
- **Timeframe:** Short-term.

ST1- To corroborate the regulatory framework foreseeing grid injection cost sharing between network operators and biomethane producers

Such measures could increase the overall competitiveness of the biogas/biomethane value chain by de-risking CAPEX through cost-sharing that would result in reduced OPEX on the production side, with additional resources released for upgrading biogas production.

- **SWOT Factors:** This strategy addresses the Strength factors S2, S7, Threat factors T2, T5, and Weaknesses factors W9, W12 identified in the SWOT analysis.
- **Actors:** Ministry of Energy, Energy Agency (MEKH), Gas industry
- **Timeframe:** Medium-term

WT1- To apply contracts for difference (CfD) in terms of biomethane purchases

The introduction of CfDs for biomethane purchases would further contribute to de-risking investments in the sector and to stabilizing the financial flows by fostering investor's confidence. Concurrently with other measures, the introduction of CfDs could strengthen the investment environment and consequently trigger growth for biogas/biomethane value chains. .

- **SWOT Factors:** This strategy addresses the Weaknesses factors W5, W8, W12, W13, and Threat factors T5, T6, T8, T11 identified in the SWOT analysis.
- **Actors:** Ministry of Energy, Energy Agency (MEKH), Gas industry
- **Timeframe:** Short-term.

WT3- To elaborate on financial support measures to sustain CAPEX for building clusters of biogas plants with a centralized upgrading facility.

Support for CAPEX for biogas and biomethane facilities will reduce one of the most critical obstacles to biomethane development and leverage interest of private investors in the biomethane sector.

- **SWOT Factors:** This strategy addresses the Weaknesses factors W3, W9, W12 and Threat factors T5, T6, T8, T11 identified in the SWOT analysis.
- **Actors:** Government
- **Timeframe:** Short- to medium-term

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Unlike in Romania and Serbia, respondents mobilized through the Hungarian GreenMeUp hub focused predominantly on financial support, which emerges as the critical missing link that could become a decisive enabling factor if corroborated by a consistent national action plan with targets (market uptake). The SWOT analysis highlighted the need for a comprehensive set of financial support measures that are expected to contribute to/de-risk CAPEX and regulate the allocation of costs for grid injection. These measures require enhanced cooperation of policymakers, financial institutions and industry and could be deployable in the medium-/short-term.

3.2.2 Romania

SWOT analysis

Romania has significant agricultural potential with 15 million hectares of agricultural land, providing a strong basis for biogas production. Currently, two biogas plants are operating in the West Region: one in Gătaia, Timiș County, and another in Arad. These plants utilize feedstock mixtures comprising energy crops and organic residues from animal farms and the food industry. That said, there is a pressing need for a strong governmental lobby to promote transformative changes in biomethane and biogas production. Developing anaerobic digestion plants requires specific financing tools. However, local communities often show reticence towards new biogas and biomethane projects due to concerns about waste management in their vicinity. Furthermore, biogas is overlooked in Romania's "Integrated National Energy and Climate Change Plan for 2021-2030" (PNIESC), and biomethane is entirely absent— and there is a concrete risk that the revised version of PNIESC will continue to neglect these energy sources. Furthermore, the insufficient number of compressed natural gas (CNG) filling stations limits biomethane's accessibility to the wider public. Additionally, there is a lack of adopted laws and governmental decisions at strategic, legislative, regulatory, or technical levels dedicated to biomethane. Local administrations and representatives often prioritize and promote projects— such as high-tech devices, e-mobility, or attractive constructions— which they consider more appealing to the local community than investments in circular bioeconomy, green energy, and waste management projects. Addressing these challenges through targeted policies and community engagement is essential for advancing Romania's biomethane and biogas sectors.

Table 3. SWOT Analysis – Romania (Danube Region)

SWOT Analysis – Romania	
S – Strengths **S1-** Romanian agricultural potential is exceptionally high due to the approximately 15 million hectares of agricultural land. **S2-** Two biogas plants are operating in West Region: the biogas plant in Gătaia, Timiș County and the biogas plant in Arad. Both processes use as feedstock mixtures (energy crops and organic residues from animal farms and organics from the food industry) **S3-** Small plants easier to manage and less sensitive to availability of feedstock but economically less efficient **S4-** There are sixteen operating biogas plants - considering large-scale operations, without counting	**W - Weaknesses** **W1-**Lack of adopted laws and governmental decisions of either strategic, legislative, regulatory or technical level dedicated to biomethane **W2-** Currently, no biomethane plants are operating or under construction in Romania. **W3-** Lack of incentives for CAPEX in biomethane **W4-** Dysfunctional system of Green Certificates supporting RES in Romania **W5-** Local administration and representatives prioritizing and promoting other projects (high-tech devices, e-mobility or attractive constructions for instance) as being more attractive for local community

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anaerobic treatment technologies applied in wastewater treatment plants, mini-biogas plants, or experimental anaerobic digestion installations **S5-** In 2022, Romania adopted the National Strategy for Circular Economy and National Action Plan **S6-** The Romanian Parliament issued Law no. 254/20.07.2022 to amend and complete the Land Fund Law no. 18/1991 and other normative acts. As a notable innovation, the law also introduces third-class quality land into the category of agricultural land on which renewable energy projects can be carried out, including biomass for bioenergy	than investments in circular bioeconomy, green energy and waste management projects. **W6-** Long processes are a major barrier identified in constructing biogas plants - engineering and permitting/licensing procedures to be addressed, **W7-** Insufficient number of compressed natural gas (CNG) filling stations limits the accessibility of biomethane to the wider public. W8- The only support scheme for RES (expired since December 2016) - green certificates are currently calculated per MWh electricity fed into the national electricity grid registry (no support scheme per MWh biomethane) **W9-** The term digester does not exist in the legislation (only composter) to be offered for the management of organic residues from households; **W10-** Absence of a connection between agriculture and biomethane and the absence of a biomethane register hinders cross-border trading through Guarantees of Origin (GoO)
O – Opportunities **O1**- There is need for a strong lobby at the governmental level for a transformative change related to the need of producing biomethane and biogas. **O2-** Financing tools to develop anaerobic digestion plants **O3**- Biomethane and biogas plants as tools to bioremediate marginal lands and polluted areas **O4**- No competition for substrate. An underdeveloped biogas sector can make feedstock available for development of a strong biomethane sector **O5-** December 2023, the European Commission provided feedback to Bucharest on the National Integrated Energy and Climate Change Plan 2023-2030. Among the Commission's concerns were the lack of detailed measures on renewables **O6**- Unlikely to meet the 30 June deadline for government approval set by the Energy Union Governance Regulation for the revised version of the National Integrated Energy and Climate Change Plan (PNIESC)	**T – Threats** **T1**- Reticence of local communities regarding new biogas & biomethane projects managing (bringing) wastes in their vicinity (History in complains of local communities regarding smells issues connected with biogas plants) **T2-** Biogas is overlooked in "Integrated National Energy and Climate Change Plan for 2021 - 2030" (PNIESC), while biomethane is absent - the threat is to be the same situation in the revised version of PNIESC

Involvement of stakeholders

The development of TOWS strategies was achieved through a comprehensive process of stakeholder consultations focused on the SWOT analysis. This process incorporated extensive input on the political, economic, social, technological, environmental, and legal (PESTEL) factors influencing their national biomethane market. By engaging stakeholders and considering these multifaceted aspects, the consolidation of effective and holistic TOWS strategies became possible, ensuring that all relevant dimensions of the market development were addressed. PESTEL workshop was organised online on 19 December 2023 with representatives of Romanian biogas' social, market

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and policy hubs. Using the insights gathered from stakeholders, strategies were developed with a TOWS matrix to address all aspects identified in the SWOT analysis. TOWS strategies were validated during the 4th Danube Biomethane Hub meeting, held online on 19 June 2024. Key aspects frequently highlighted in stakeholders' feedback cantered on policy. Specifically, there was an emphasis on adopting a national strategy or roadmap for biogas and biomethane, which includes official targets for biomethane production and consumption. Additionally, stakeholders stressed the need to promote the development of biogas technologies, given that no biomethane plants are currently operating or under construction in Romania.

Resulting strategies

From engaging with Romanian stakeholders a total of 9 strategies were develop, which can be consulted in the **Annex II-Danube Region – TOWS Analysis ResultsDanube Region – TOWS Analysis Results**. The following top five strategies have been selected based on the extent and scope of constituting factors:

SO1- To strengthen knowledge of biogas/biomethane potentials through official assessments, which should include an estimation of the contribution of anaerobic digestion to different sectors of the economy.

While the region is accredited for large amounts of available feedstocks, there is a need for official assessments that could corroborate this information with predictable economic and environmental outlooks in the short- and medium-term. This would foster the commitment of the primary producers, while also building confidence in investors by offering a clear pathway and development perspectives.

- **SWOT Factors:** This strategy addresses the Strength factors S10, S13, and the Opportunity factors O11, O14 identified in the SWOT analysis (see Table 3).

- **Actors:** Ministry of environment, agriculture and education
- **Timeframe:** Short-term.

ST1 - To elaborate on a dedicated governmental roadmap for biogas/biomethane that could/should be integrated in other strategic documents, such as the RES strategy or the National strategy for economy and agriculture.

A favourable and enabling environment for the uptake of biogas/biomethane goes beyond a clear and supportive regulatory framework and consistent financial support schemes: biomass producers' and investors' confidence would be significantly underpinned by an official roadmap that would plot the medium- and long-term development trajectories, thus giving the sector a clear outlook.

- **SWOT Factors:** This strategy addresses the Strength factors S10, S12, S8, S9, and the Threat factors T14, T10 identified in the SWOT analysis.

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- **Actors:** Ministry of Energy
- **Timeframe:** Medium-term.

WT1- To set mandatory production/consumption targets for biogas/biomethane in national strategic frameworks.

Market uptake remains a critical stabilising factor for the sector in the medium- and long-term, also to reduce the financial burden of continued incentives. Mandatory targets would enable an initial market niche that could serve as an incubator for further development (or, at least, achieve pre-defined minimum environmental targets).

- **SWOT Factors:** This strategy addresses the Weaknesses factors W1, W8, W2, W5, and the Threat factors T3, T9 identified in the SWOT analysis.

- **Actors:** Government
- **Timeframe:** Medium-term.

WO3 - To interlink biogas/biomethane targets with waste management policies by fostering anaerobic digestion.

Linking waste management policies and relevant targets with biogas/biomethane production would allow leveraging an additional reliable source of feedstocks. Besides obvious environmental and (in the longer term) economic advantages deriving from the valorisation of biogenic waste streams, this would allow strengthening the biogas/biomethane sector by stabilizing supply chains, thus de-risking investments and boosting confidence.

- **SWOT Factors:** This strategy addresses the Weaknesses factors W6, W7, W12, and the Opportunity factors O1, O2, O3, O12 identified in the SWOT analysis.

- **Actors:** Ministry of environment
- **Timeframe:** Short-/Medium-term.

WT1- To support the financial sustainability of biogas/biomethane plants by valorising digestate and biogenic CO2 and indemnifying additional production costs through FIT and FIP.

Creating the conditions for additional income for biogas/biomethane producers by valorising side streams (digestate, biogenic CO2) could further reinforce the economic sustainability of biogas/biomethane plants, while also contributing to meeting environmental targets and offsetting emissions, particularly in agriculture. Moreover, this would foster the establishment of circular value chains.

- **SWOT Factors:** This strategy addresses the Weaknesses factors W1, W8, W2, W5, and the Threat factors T3, T9 identified in the SWOT analysis.

- **Actors:** Ministry of Environment
- **Timeframe:** Short-term.

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Interaction with stakeholders in the Romanian GreenMeUp hub resulted in a coherent illustration of perceived needs, further corroborating knowledge previously gathered by the project through experts' assessments and stakeholder mobilisation. Like the other two countries encompassed by the Danube Region, respondents focused primarily on the need for better coordination and integration of policies and instruments that are fundamental to creating an environment that enables the consolidation of the biogas/biomethane sector. The identified strategies define a comprehensive roadmap involving the coordinated and concerted contribution of different line ministries and agencies that are expected to build a consistent framework that will reassure investors, technology developers and primary sector economic operators. This pathway - deployable in the short/medium term - foresees a rather conventional concatenation of actions: assessment of potentials - development of regulatory framework (road mapping) - definition of mandatory targets (market creation) - establishment of financial support schemes. The SWOT analysis results highlight the need for structural actions while - quite surprisingly - failing to consider factors hindering the development of the biogas/biomethane sector from the market uptake perspective.

3.2.3 Serbia

SWOT analysis

The biogas sector in Serbia is supported by skilled professionals, and the Serbian Biogas Association (SBA) plays a crucial role in promoting the industry. However, despite these strengths, significant organic waste resources, such as slaughterhouse waste, sewage sludge, and municipal organic waste, are underutilized. Efficiently harnessing these waste streams could significantly enhance biogas production, contributing to renewable energy goals and environmental sustainability. The absence of well-defined incentive schemes for biomethane is a critical issue that needs to be addressed. Creating both financial and regulatory incentives is essential to stimulate the biomethane market, encourage investment, and leverage Serbia's organic waste potential. The lack of political support and strategic planning hampers the growth of the biogas and biomethane sectors. There is also negligible policy activity supporting biogas and biomethane as other energy sources receive more attention. A clear national strategy and recognition of biomethane as a valuable product are a priority for achieving the expected biomethane goal. Additionally, the market for trading biomethane in Serbia lacks transparency, and there is a significant communication gap between the national energy administration and the SBA. Bridging this gap is crucial for effective policy-making and the sector's development. In summary, while Serbia’s biogas sector has a strong foundation and considerable growth potential, realizing this potential requires establishing incentive schemes, enhancing political support, and improving market transparency and stakeholder communication. Addressing these challenges will position Serbia to leverage its biogas sector as a key component of a sustainable and decarbonized energy future.

Table 4. SWOT Analysis – Serbia (Danube Region)

SWOT Analysis – Serbia	
S – Strengths	**W - Weaknesses**

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S1- Biogas sector is well established, with sufficient professionals (relevant for AD technology) and with strong Serbian Biogas Association (willing to pave the way for biomethane) **S2-** Well developed natural gas grid (still expanding) **S3-** Integrated National Energy and Climate Plan (INEKP) considers national targets for biomethane production only from demonstration projects with the value of 87 ktoe **S4-** Biomethane in transport is favoured over biofuels for transport (INECP: 49 ktoe of all biofuels for transport and 87 ktoe of biomethane)	**W1-** No clear political will yet for this RES field; other RES favoured. Ongoing activities of decision makers and policy makers related to the biogas/biomethane are practically negligible **W2**-No incentive measures for biomethane; lack of national plan and strategy for biomethane, both in transition period and post feed-in period of biogas to electricity. Lack of clear biomethane strategy and non-recognition of biomethane as a product. Insufficiently transparent conditions and market for trading of biomethane. **W3**- Lack of clear political willingness towards decarbonization in all sectors **W4**- Absence of long-term political framework stability. Inconsistency of law and by-law regulations. Short period of validity of legislative documents. **W5-** Many fossil fuels in the system; low natural gas price as energy carrier and low electricity price (coal power plants) **W6-** Availability of gas network to existing plants **W7-** Defining quality of the end mixture of the injected biomethane and natural gas, delivered to the consumers. The quality of natural gas in Serbia is determined centrally, nearby Belgrade, and the cost of natural gas for consumers is determined according to this quality (energy content). **W8-** Low revenue from the digestate. High costs for waste collection and transport. Lack of private financing opportunities. High logistical costs of biomass provision as feedstock to produce biomethane. Waste collection reliability. digestate disposal on agricultural soil is challenging **W9-** Insufficient level of support in all waste sectors and agriculture as providers of feedstocks for biomethane production **W10-** High investment costs of the technology that allows for crop residues use as a substrate to produce biomethane/biogas. AD technology efficiency for waste. **W11-** High specific investment costs not able to return by secured long-term income. Frequent changes in RES law and by-laws to harmonize with EU is not secure environment for investors **W12-** Negative opinion of general public towards subsidization of renewables; possible negative opinion on location of waste to biomethane plants in local community **W13-** Lack of established practices for unconventional crop production for farmers **W14-** Distrustfulness of the local community regarding the quality of consumed natural gas from the local network in the case biomethane is injected from biomethane facility in the vicinity **W15-** Migration of young people away from rural areas **W16-** Insufficient technology maturity for waste to biomethane plants where waste is contaminated, and

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	plants cannot fulfil all environmental criteria in digestate use **W17-** Variable RES have a negative effect on the stability of the power system of the RS. New amounts of balance reserve are needed **W18-** No coordinated activities among relevant ministries to adapt existing / adopt new legislation for this field; Low capacities of policy makers to respond to the needs of new and dynamic RES field; Low administrative capacity for issuing the permissions in local administrations (municipalities, cities) **W19-** No clear definition in Laws/Decrees about energy crops limits in biogas/biomethane production (types, sustainability criterion, iLUC) **W20-** No clear technical conditions regarding connection of biomethane facility to the natural gas network (gas chromatograph accuracy class and calibration frequency, pressure control, etc.).
O – Opportunities **O1**- Waste is (almost) completely unused potential (slaughterhouse, sewage sludge, organic municipal). **O2**- A project is announced to produce liquified biomethane (LBM) for export **O3**- The new policy framework in Serbia provided initial conditions for future biomethane uptake. The new Decree on conditions of delivery and supply of natural gas (GRS, 2022b) recognises biogas as a fuel suitable for injection in the natural gas grid. **O4**- National policy introduced biomethane and prepared the main framework for biomethane uptake on the Serbian market **O5**- The first interested investors in biomethane plants were and still partly are the biogas plant owners that are at the end of their biogas project lifetime since their privileged status to receive a feed-in tariff of 12 years is expiring in the coming years. Therefore, there is an opportunity to reconstruct the existing biogas plant into biomethane plants. **O6**- Vojvodina is significantly higher covered with natural gas grid than other parts. **O7**- The Integrated National Energy and Climate Plan of the Republic of Serbia for the period 2030, with the projections up to 2050 (MMERS, 2023c). There is potential to generate more ambitious biomethane potentials for biomethane demonstration projects **O8**- Natural gas consumption in the sector of transport has increasing trend and an opportunity to integrate biomethane as a substitution **O9**- Companies on the market with the production and the trade of fossil fuels are obliged to reduce emissions in the upstream chain (therefore interested to invest in biofuels and biomethane) **O10**- The incentive schemes for biomethane are still not defined and there is an opportunity to develop	**T – Threats** **T1-** Exclusion of coal-based power plants in the future could lead to the importance of electricity from RES, which would reintroduce biogas plants for electricity **T2-** In the new policy framework, the term biogas is wrongly used and unrelated to purified biogas, i.e. biomethane **T3**- National administration relevant for energy does not communicate with the national biogas association (e.g. related to the real costs of production from practice)

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appropriate incentie scheme to facilitate biomethane uptake on the Serbian market and utilize the potentials **O11**- CO2 taxes will have a negative impact on the competitiveness of RS products on the EU market **O12**- A new policy framework was adopted recently with the new Renewable energy law (MMERS, 2021). Now feed-in tariffs for all renewable electricity fed to the grid, including biogas, has been replaced by a hybrid model. This model is based on an auction system for market premiums and feed-in tariffs for plants smaller than 500 kW. The new system delayed further biogas sector development. Practically, no investors are interested in new projects	

Involvement of stakeholders

A lengthy process of consultations with key stakeholders, built on the SWOT analysis, brought out the development of TOWS strategies. This feedback collecting process took into consideration the political, economic, social, technological, environmental, and legal (PESTEL) factors relevant for the national biomethane market. By involving stakeholders and considering these various factors, effective and comprehensive TOWS strategies that addressed all relevant aspects of market development were developed. PESTEL feedback was obtained through online interviews (teleconferences/e-mails/bilateral calls) during December 2023, collecting inputs from Serbian social, market and policy hubs representatives. In the end, TOWS strategies were developed with a matrix addressing key factors identified in the SWOT analysis. These TOWS strategies were validated during the 4th Danube Biomethane Hub meeting, held online on 19 June 2024. One of the key aspects emphasized in stakeholders' consultations regarded the incentives in biogas sector. Specifically, there was an emphasis on defining appropriate incentive scheme to mobilize untapped waste potentials to produce biomethane in Serbia. Furthermore, many factors pointed to the need to enhance mutual cooperation of national administration relevant for energy, RES, transport, waste, environmental protection, decarbonization, and agriculture.

Resulting strategies

Based on the categorisation of compound factors, the five main strategies identified through the interaction with Serbian stakeholders are here below. Additional information of the strategies can be found in the **Annex II-Danube Region – TOWS Analysis ResultsDanube Region – TOWS Analysis Results**.

WO1- To perform a comprehensive framework analysis to assess the prospects and needs of biomethane integration

Biomethane is a rather new and uncharted sector in the region, therefore stakeholders express the need for clear and exhaustive information about the actual prospects (economic and environmental sustainability), as well as the needs in terms of value-chain development.

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- **SWOT Factors:** This strategy addresses the Weaknesses factor W2, and the Opportunity factor O10 identified in the SWOT analysis (see Table 4).

- **Actors:** Ministry of Mining and Energy, Serbian Biogas Association
- **Timeframe:** Short-to Medium-term.

WO2- To interlink decarbonisation and waste reduction targets with biomethane production pathways and goals, thus creating favourable conditions for investors

Embedding biogas/biomethane value-chain development into broader decarbonisation and waste reduction strategies and policies would allow creating synergies and providing the sector with a more robust outlook, thus fostering stakeholder's confidence and promoting a sound investment climate.

- **SWOT Factors:** This strategy addresses the Weaknesses factors W1, W3, and the Opportunity factors O1, O8, O9, O11 identified in the SWOT analysis

- **Actors:** Ministry of Mining and Energy, Serbian Biogas Association
- **Timeframe:** Short-to Medium-term.

SO1- To define an appropriate incentive scheme to mobilise untapped waste potentials to produce biomethane.

Biogenic waste streams could represent a sustainable and reliable feedstock base for the biogas/biomethane sector, contributing to waste reduction and decarbonization trajectories. Yet in the initial stages, it is perceived that additional support is needed in the form of incentives which are expected to offset the additional costs entailed by the establishment of a new supply chain.

- **SWOT Factors:** This strategy addresses the Strength factors S1, S3, S4, and the Opportunity factors O1, O10, O12 identified in the SWOT analysis.

- **Actors:** Ministry of Mining and Energy, Ministry of Environmental Protection, Ministry of Agriculture
- **Timeframe:** Short-to Medium-term.

WT1- To foster cross-sectoral cooperation between different line ministries and/or administrations (energy, RES, transport, waste, environmental protection, decarbonisation, agriculture).

Fragmentation of the policy-making level is one of the hindering factors identified by stakeholders. The multi-disciplinary and cross-sectoral nature of CBE in general and biogas/biomethane value-chains in particular requires concerted action and enhanced cooperation among different

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institutions and organization. This is expected to harmonize the strategic and regulatory framework, while contributing to creating a consistent ecosystem for further development.

- **SWOT Factors:** This strategy addresses the Weaknesses factors W1, W2, W3, W9, W18, W19, and the Threat factor T3 identified in the SWOT analysis.

- **Actors:** Serbian government, Ministry of Mining and Energy, Ministry of transport, Ministry of Environmental Protection, Ministry of Agriculture
- **Timeframe:** Short-term.

WT2- to promote biogas/biomethane technology as a multi-purpose technology that contributes to meeting complementary objectives (energy, waste management, decarbonisation, etc.).

Inscribing the development of biogas/biomethane value chains in broader decarbonisation and waste reduction efforts would allow creating a robust ecosystem for the deployment of relevant value chains. Besides apparent synergies that would reduce OPEX and contribute to de-risk CAPEX, this would allow mainstreaming biogas/biomethane into CBE and renewable production trends.

- **SWOT Factors:** This strategy addresses the Weaknesses factors W1, W3, W12, W14, W15 and the Threat factor T3 identified in the SWOT analysis.

- **Actors:** Serbian government, Ministry of Mining and Energy, Ministry of transport, Ministry of Environmental Protection, Ministry of Agriculture, Serbian Biogas Association, UNDP Serbia
- **Timeframe:** Short-to medium-term.

Interaction with stakeholders in the Serbian GreenMeUp hub confirmed the desk-based understanding and empirical knowledge derived from observing the state of the country's biogas/biomethane sector. The SWOT analysis results confirm the widespread perception that the biogas/biomethane value chains have substantial potential, also in terms of knowledge, HR and policy, but need extensive coordination efforts to concretise its intrinsic positive socioeconomic and environmental impacts: a targeted regulatory framework analysis would allow pointing out gaps and inconsistencies and - even more importantly - would flag the missing links in a cross-sectoral perspective; this would enable offsetting the limitations of current silo approach and maximising cross-sector synergies and consequently positive economic impacts. To this end, it would be beneficial that relevant line ministries, representatives of financial institutions and industrial stakeholders cooperatively elaborate on parallel trajectories for production/consumption targets (or decarbonisation) and sustainable support schemes. The objectives mentioned above are attainable through several coordinated efforts in the short-medium term.

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3.3 Estonia

SWOT analysis

The SWOT analysis of Estonian biomethane strategy pointed out several key findings. **Strengths** include that the biofuels are already tax-free in Estonia, which supports e-fuel production. There is support mechanism under development to subsidise building 3-4 grid injection points on transmission grid and open subsidy for constructing filling stations in rural areas. Biodegradable waste is already collected separately in Estonia and most of it will be treated into biomethane in near future. Discussion for market uptake has united several ministries, energy-, recycling- and farming companies and initiated co-operation to fill in the gaps and to make the market even more vital.

However, the strategy faces **weaknesses** such as no regulations that would obligate biowaste or agricultural residues treatment into biogas, therefore potential substrate providers are not overly motivated to co-operate with existing biogas plants and to participate in planned ones. Heavy haulage companies have not adapted gaseous fuels. Compressed biomethane is not giving transport vehicles enough range, but liquefied biomethane or LNG does not yet have availability large enough to make truck companies make the investment. In Estonia currently, there is lack of incentives for farmers to utilise manure, silage and fodder residues in the production of biomethane. Biomethane grid connection's investment and operational costs can create a barrier for producers. Procedures for environmental assessment, building permit, certification of digestate and spatial plan for urban areas are taking too long and hinder sectorial development. Digestate, which could be treated into valuable fertilizer, does not have enough market opportunities and is mostly given back to substrate suppliers for free.

Opportunities lie in potential new fields of biomethane usage (shipping, industry, long distance transport). Additional value streams are provided by bio-CO2 commercialization, surplus heat, digestate valorisation. Sequential crops to become sustainable certified II generation feedstock. Increasing opportunities of international trade via injection into transmission grid and GIPL to Europe. Biomethane/renewable fuel registers are harmonized within EU which enables international trade of biomethane throughout Europe.

Threats include the uncertainty of the market price of biomethane in the future which makes potential new projects cautious and delays further actions. Competing technologies such as hydrogen and electricity use in transport can lower policymaker interest towards biomethane production. Maritime sector moving over to competing green fuels can lower demand for liquefied biomethane. **Unclear and confusing messages from EC**, e.g. in the case of banning internal combustion engines – if the engines use 100% renewable use like liquefied biomethane, which can substitute fossil fuels in all transport modes, that ensures the renewable transport. Biomethane is not yet clearly defined as carbon neutral fuel. Contradicting studies threatening digestate fertilizing properties. Also, H_2 is promoted as climate neutral, not considering, that only green H_2 can be

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considered as climate neutral, which share is under 5% of all H_2 produced. From the H_2 consumed, 95% are fossil based.

Table 5. SWOT Analysis – Estonia

SWOT Analysis – Estonia	
S – Strengths **S1-** Due to rapid uptake in biomethane production and focuses on using biomethane in transportation, 65% of CNG/LNG is already from biogenic origin. **S2**- Biomethane is already tax-free in Estonia. **S3**- In 2022 there were 17 biogas plants in Estonia, out of which 7 are producing biomethane. **S4**- 28 CNG filling stations, 2 LNG filling stations and 5 grid injection points on distribution network grids built. **S5**- There is support mechanism under development to subsidise building 3-4 grid injection points on transmission grid and open subsidy for constructing filling stations in rural areas. **S6**- Support to CNG stations that sell biomethane require that CNG filling should be fast filling station and opened to the public access. Subsidy is covering 35% support to CAPEX, maximum 350,000 euro per project **S7-** Strong governmental support (subsidies production, plant construction, filling stations and public transport transition to compressed gas) **S8-** Estonia has set mixing obligations to fuel companies which has created a demanding market for GOs. **S9-** According to Estonia's 2030 national energy and climate plan following the EU 2018/2001/EL renewable energy directive, Estonia has an aim to increase the share of renewable fuels consumed in the transport sector to 14% by 2030 **S10-** Estonian Biogas Association has put together Biogas & biomethane roadmap 2030 **S11-** Biodegradable waste is already collected separately in Estonia and most of it will be treated into biomethane in near future. **S12-** National Energy and Climate Plan is provided with clear targets e.g. Reduction of Estonian greenhouse gas emissions by 80% by 2050 **S13-** On 15 December 2022 the Government of Estonia announced financing proposals to be included in the Recovery Plan to the extent of the amount of REPowerEU and to start negotiations with the European Commission **S14-** Discussion for market uptake has united several ministries, energy-, recycling- and farming companies and initiated co-operation to fill in the gaps and to make the market even more vital.	**W - Weaknesses** **W1-** Demand-side support - there should be subsidy for transportation companies for purchasing gas-trucks and buses to their fleet. **W2-** Co-benefits perception- To build new plants closer to municipalities and to use more benefits biogas production, companies will have to face negative feedback regardless of new jobs and local development opportunities. **W3-** Feedstock requirements - abandoned peat fields, it will have to be allowed to use this land for feedstock production. **W4-** Heavy haulage companies for example have not adapted gaseous fuels as well, due to diesel fuel still being the most efficient transport fuel to this day **W5-** Compressed biomethane is not giving transport vehicles enough range, but liquefied biomethane or LNG does not yet have availability large enough to make truck companies make the investment **W6-** In Estonia currently there is lack of incentives for farmers to utilise manure, silage and fodder residues in the production of biomethane. Many biogas plants are operating with lower volumes than it would be possible; urgent need for synchronised agricultural and energy policy measures. **W7-** Grid connection's investment and operational costs can create a barrier for producers. **W8-** Due to most of the gas is used for heating purposes another problem is gas consumption which can differ 2-10 times in summer compared to winter. **W9-** In order to trade with Latvia and Finland it is still necessary from Latvian side Incukalns underground gas storages sensitivity to O2 level (solved in 2023 August). **W10-** Uncertainty about biomethane production subsidy has always been putting construction of new plants under a hold position. **W11-** Procedures for environmental assessment, building permit, certification of digestate and spatial plan for urban areas are taking too long and hinder sectorial development. **W12-** Amount of CNG filling stations is coming to the reasonable level (27), but most of them are in or around big cities and rural areas are still lacking of CNG/CBM filling options. LNG/LBM does not have enough stations yet.

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S15- Certification of biomethane is set in place well by AS Elering, national gas and electric transmission grid operator (TSO), and is under constant development. **S16-** At the moment biogas and biomethane are exempt from excise duty giving it another advantage for becoming profitable.	**W13-** Gas grid is dramatically underdeveloped with only 7% of households having a contract with gas retailer. Not enough development plans and framework for up-taking the options of biomethane grid injection yet. **W14-** Digestate, which could be treated into valuable fertilizer does not have enough market opportunities and is mostly given back to substrate suppliers for free. **W15**- Certification for digestate takes up to 12 months and is often too complicated so producers are not considering it to be additional revenue stream. **W16-** Long-term profitability is still uncertain. Many potential financiers and producers still find it too risky to make investment for biogas plant and even some banks have declined financing applications refer to business models with negative outcome from the past. **W17-** At the moment there is no regulations that would obligate biowaste or agricultural residues treatment into biogas, therefore potential substrate providers are not overly motivated to co-operate with existing biogas plants and to participate in planned ones
O – Opportunities **O1-** Next generation technologies implementation to gain additional benefits from biogas production. **O2-** Large amount of available/unused substrates. **O3-** Potential new fields of biomethane usage (shipping, industry). **O4-** Production expansion via applying more of the substrate potential. **O5-** Production expansion via Power-to-X technologies. **O6-** Additional value streams such as CO2, surplus heat, digestate valorisation, pyrolysis. **O7-** Higher implementation of biomethane in agricultural energy consumption. **O8-** Higher social acceptance via well paid rural jobs created. **O9-** Higher Social acceptance via lower odour emissions. **O10-** Sequential crops to become sustainable certified II gen feedstock. **O11-** Biomethane is local, renewable, non-centralized climate neutral (24/7) energy security provider and ensuring security of supply. **O12-** International trade via injection into transmission grid and GIPL to Europe. **O13-** international biomethane standard and quality requirements are harmonized. **O14-** Biomethane/renewable fuel (GO) registers are harmonized which enables international trade of biomethane throughout Europe.	**T – Threats** **T1-** Uncertain market price of biomethane in the future makes potential new projects cautious and delays further actions. **T2-** 100% of biomethane is currently used in transport sector, but due to potential internal combustion engine ban from 2035, future market for biomethane is unclear. **T3-** Competing technologies such as hydrogen and electricity production can lower policymaker interest towards biomethane production. **T4-** Maritime sector moving over to competing green fuels can lower demand for liquefied biomethane. **T5-** Unclear and confusing messages from EC, promoting and forcing new technologies (fuel cell, electric engines for heavy duty vehicles) and fuels (H_2, e-fuels, etc) without market ready applications. **T6-** Contradicting studies about digestate fertilizing properties. **T7-** Biomethane is not clearly defined as carbon neutral fuel, even it is. **T8-** Unstable European political statements for technology developers (2020 was LNG as priority, 2023 electricity). **T9-** H_2 are promoted as climate neutral, not considering, that climate neutral is only green H_2, which share is under 5% of all H_2 produced and consumed H_2, 95% are fossil based H_2. **T10-** e-fuel potential will be not used, because of lacking experience and legislation

Involvement of stakeholders

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The Estonian TOWS strategies were consolidated via an extensive process of stakeholders' consultation on SWOT analysis, taking into consideration the political, economic, social, technological, environmental and legal (PESTEL) aspects of their national biomethane market development. Estonian PESTEL workshop was organised on 27 November 2023 as virtual meeting, with key representatives of biogas' social, market and policy hubs. On 13 June 2024, in conjunction with Estonian Biogas Summer Seminar 2024, a workshop was held with relevant local stakeholders in Estonian language, where further discussion took place on the biomethane's production and uptake through SWOT analyses. Additional comments were collected during the Fussy Cognitive Mapping exercise.

TOWS matrix was shortly introduced to all members of the Hubs and the feedback was collected during the HUB's meeting. Based on the discussion, the strategies were formulated. Special emphasis was given to the fact that strategies address all aspects identified in the SWOT analysis. These strategies were then communicated to stakeholders via virtual communication and FCM interviews. Some of the key aspects that emerged more often from stakeholders' feedback were focused on following: enlarging the consumption of the biomethane, especially in liquefied mode in long distance transport and marine transport; simplifying and increasing the feasibility of the injection of the biomethane to the D-category natural gas cross-border transmission grid; LNG and CNG purchase support to transport companies; valorisation of the digestate to certified organic natural fertilizer and improvement of public procurement procedure to include methane fuelled vehicles into procurement conditions;

Resulting strategies

The Estonian GreenMeUp hub put forward in total 22 strategies that can be consulted in the **Annex III-Estonia – TOWS Analysis Results**. The following five key strategies have been selected based on the number of contributing SWOT elements:

SO4- To build the biomethane injection facilities to the Category D natural gas network to support biomethane feed-in to transmission network

AS Elering can built the biomethane injection facilities to D-category transmission network and rent it out to the producers;

To build state-owned 2-4 biomethane injection points to natural gas transmission network, which is precondition for biomethane export

- **SWOT Factors:** This strategy addresses S5, S15 vs O12, O13, O14.
- **Actors:** Ministry of Climate (MoC); AS Elering • **Timeframe:** short-term

SO3- to support the expansion of the use of biomethane into new areas of use, including liquefied, such as shipping, long-distance transport, industry, district heating

MoC can adopt needed legal regulation;

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Governmental agencies can use public green procurement procedure to order biomethane fuelled solutions;

To support the use of biogas in pilot projects for the use of solid oxide fuel cells (SOFCs), in particular for small-scale installations at source.

The heat and electricity generated in the SOFC can be used on site, including in autonomous areas without mains electricity grid, gas grid, not to mention district heating grid;

To use green CO2 from biomethane upgrading units mixed with green hydrogen (wind, PV, hydro based

- **SWOT Factors:** This strategy addresses S4 vs O3

- **Actors:** Ministry of Climate; Shipping and housing building companies; constructing and engineering companies
- **Timeframe:** long-term

WO2- Developing and receiving subsidies and incentives for transport companies for the purchase of gas trucks and buses

To support for the construction of LNG filling stations; To exempt and differentiate 40% -80% of heavy goods vehicles consuming methane fuel from road tolls in Estonia on the basis of EURO classes;

To allow the use of vehicles of higher weight and length in Estonian road transport (in order to remain competitive with neighbouring countries, at least up to 25,25 m, but consider allowing, for example, trains up to 34,50 m with a maximum weight of 76 tonnes;

Investment support; Decrease the heavy-duty tax to biomethane (LBM) trucks; Release the LMB trucks from road tax; Free parking of CNG and LNG vehicles; To exempt of heavy goods vehicle tax for gas vehicles and differentiation on the basis of EURO classes; To promote liquefied biomethane production (Bio-LNG) with objective substitute LNG by 2050 100%.

- **SWOT Factors:** This strategy addresses W4, W5 vs O3.

- **Actors:** Ministry of Climate; Ministry of Regional Affairs and Agriculture; Union of Transport Vehicles
- **Timeframe:** medium-term

WO14 - Simplification of digestate certification and expansion of marketing opportunities, including export; Explaining the suitability of digestate for organic farming Increasing

Explaining the suitability of digestate for organic farming Increasing

To promote digestate based biofertilizer certification, to support digestate based biofertilizer export

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- **SWOT Factors:** This strategy addresses W14, W15 vs O6

- **Actors:** Ministry of Regional Affairs and Agriculture (MRAA); Ministry of Climate;
- **Timeframe:** short-term

WT1- Reduction of market (biomethane price) uncertainty, stabilization of price and demand with regulations, common market port, public and green procurement

To use of more environmentally friendly biomethane-based transport when purchasing public services (setting an example in the implementation of the Clean Vehicles Directive) - so-called green procurements in road construction, State Real Estate (AS Riigi Kinnisvara) constructions, where the consumption of methane fuel provides additional points in the evaluation of tenders.

- **SWOT Factors:** This strategy addresses T1; T7; T8 vs W10; W11;

- **Actors:** Ministry of Climate; Ministry of Regional Affairs and Agriculture (MRAA); State Real Estate Agency (AS Riigi Kinnisvara)
- **Timeframe:** short-term

3.4 Greece

SWOT analysis

The SWOT analysis with the integrated results from all hubs' stakeholders, as reported in D2.1, D3.1, D4.1 and the PESTEL analysis in Greece reveals several key findings.

The strong points of the biomethane market in Greece is the existence of many biogas plants using local feedstock and the high technical availability of feedstock as well as the elaboration of the Greek NECP, that is now being updated and has dedicated targets for biomethane production.

However, the weaknesses are much more, mainly focused on the challenging logistics of the feedstock, the lack of the financing mechanisms, including a biomethane-regulating law, and the uncertainties of the distribution network.

Opportunities like on the high technical availability of feedstock, the NECP and the expected expansion of the natural gas grid. Doubts about the economic viability of a biomethane plant and its connection to the grid without any additional financial support is the main and only threat spotted by the market stakeholders.

Table 6. SWOT Analysis – Greece

SWOT Analysis – Greece	
S – Strengths (based on D2.1) **S1:** Total number of biogas plants: These 78 stations are interconnected in the power grid under the jurisdiction	**W - Weaknesses** **W1**: Biomass logistics are challenging because of difficulties in collecting raw materials (biomass), small

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of Renewable Energy Sources Operator and Guarantees of Origin (DAPEEP S.A), according to Law 4152/2013 **S2:** 118 MWe installed electricity capacity (IEC) and use mostly agricultural residues, municipal wastes from landfills (SWL) and to lesser extent sewage from wastewater treatment plants (MWTP). **S3:** National Energy and Climate Plan (NECP) - The Ministry of Environment and Energy has completed and presented its proposal for the new National Energy and Climate Plan (NECP) **S4**: High resource potential theoretically reaching 28 million tons (MT) per year, mainly consisting of manure (24 MT) followed by biowastes from households (2 MT), industrial food waste (1MT) and straw.	biomass producers (farmers, small agro-industries, long biomass transport distances **W2**: Greece has a relatively limited gas distribution network, with only 8.3% of buildings having a natural gas connection. The distribution network primarily serves the population centres of Athens and Thessaloniki. **W3**: Uncertainty for achieving the target for the promotion of biomethane due to the time that is required for the construction of the biomethane plants and the low maturity of the relevant market. **W4**: Uncertainty about the connection to the distribution network. From the 78 biogas units operating in Greece only 38 units are in close proximity to the natural gas distribution network **W5**: Lack of a targeted support scheme for the construction and operation of the biomethane plants. **W6**: Limited access to finance and difficulties in financing the construction of the biomethane plants. **W7**: Increased costs for handling the produced digestate as soil conditioner. **W8**: Economic problems of the current biogas plants for electricity production due to the limited operational hours. **W9**: Lack of biomass market **W10**: Potential social resistance **W11**: Low visibility of the delivered environmental benefits. **W12**: Lack of the legislative and regulatory framework for licencing, supporting and connecting biomethane plants. **W13**. Lack of balanced energy cost of biomethane and other incentives to investors.
O – Opportunities (D2.1) **O1-** High resource potential theoretically reaching 28 million tons (MT) per year, mainly consisting of manure (24 MT) followed by biowastes from households (2 MT), industrial food waste (1MT) and straw. **O2**: Possible strategies coming from the proposed NECP - Seven interventions / technologies form the core of the new NECP of Greece **O2**: The corresponding target of replacing Russian gas imports with biomethane in Greece, according to the New NECP, is 2.1 TWh for 2030. - . By upgrading only the existing biogas plants to biomethane plants, therefore, the 2030 target is achieved. **O3**: the total number of distribution networks managed by DEDA is expected to increase in the next 5 years **O4:** The development of the natural gas network was implemented to satisfy the expected needs of the population and the industry. From DESFA map, it is clear that in the majority of the cases the possible integration of biogas into the natural gas grid is feasible	**T – Threats** **T1-** Doubts about the economic viability of such a construction without any additional financial support.

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Involvement of stakeholders

Input data for the SWOT analysis were obtained during the three hub meetings. The SWOT analysis was presented to 11 people from whom feedback was obtained during interviews. After that, the TOWS analysis was prepared by CRES and DEDA/ENA-ON as stakeholders representing the market Hub, and representatives from the Greek Ministry of Environment and Energy as the main representative of the Policy Hub.

Resulting strategies

In total nine strategies were devised based on the SWOT analysis and its factors that ca be consulted in the **Annex IV-Greece – TOWS Analysis Results**. The following top four strategies have been selected as the most relevant:

ST1- State is to support biomethane plants with capital and/or operational subsidies.

A viable financial structure should ensure a smooth transition for biogas to biomethane production giving motive to producers to invest in the sector. The cost of acquiring the raw material and the natural gas grid connection cost should be subsidised by the State.

- **SWOT Factors:** This strategy addresses the Strengths factor S3 and the Threat factor T1 identified in the SWOT analysis.
- **Actors:** Ministry of Energy, Ministry of Economics, RRF, EU funding stakeholders
- **Timeframe:** Medium to long-term.

WO1 - Promotion of the natural gas market as this will be the main carrier of biomethane.

The natural gas market will be responsible to handle the majority of the biomethane produced. Therefore, the natural gas infrastructure should be supported in order to expand the number of biomethane grid injection points.

- SWOT Factors: This strategy addresses the Weaknesses factors W2, W4 and the Opportunity factors O3, O4 identified in the SWOT analysis.
- **Actors:** Ministry of Energy, Gas TSO, Gas DSO
- **Timeframe:** Long-term.

SO1 – Maximum exploitation of the theoretical biomethane potential in Greece.

The gap between the theoretical feedstock & biomethane potential and the actual feedstock used should be narrowed down. It is vital for the development of the biomethane market in Greece to map the feedstock potential and provide incentives for the market in order to utilize to most of it. Currently, the farmers have no motive to exploit their waste and the biogas producers are purchasing their feedstock, aggravating an already precarious financial situation in the biogas sector.

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- **SWOT Factors:** This strategy addresses the Strength factors S4 and the Opportunity factors O1, O2 identified in the SWOT analysis.

- **Actors:** Ministry of Energy, Ministry of Agriculture
- **Timeframe:** Medium-to long-term

WO3 – Promote and utilize the digestate as soil fertilizer and the sequential cropping.

The standardization of the digestate as soil fertilizer will create an additional revenue stream for the producer while addressing the digestate utilization issue that existing plant are facing. The bio-fertilizer can also boost the sequential cropping.

- **SWOT Factors:** This strategy addresses the Weak factors W1, W3, W6, W7, W8, W9, W10, W11, W12, W13 and the Opportunity factors O1, identified in the SWOT analysis.

- **Actors:** Ministry of Energy, Ministry of Agriculture
- **Timeframe:** Medium-to long-term

3.5 Latvia

SWOT analysis

The SWOT analysis of Latvia's biomethane strategy reveals several key findings. Strengths include abundant agricultural biomass resources and a well-developed gas infrastructure that can be adapted for biomethane production. However, the strategy faces weaknesses such as high initial investment costs, limited local support, low demand and regulatory challenges. Opportunities lie in accessing European Union funding, benefiting from technological advancements that enhance production efficiency, and meeting the increasing market demand for sustainable energy. On the other hand, threats include competition from fossil fuels, economic volatility impacting funding and investment, and policy and regulatory uncertainties that could affect long-term projects.

Table 7. SWOT Analysis – Latvia

SWOT Analysis – Latvia	
S – Strengths **S1-** Well-developed natural gas infrastructure **S2-** Sufficient biomass and organic waste as raw material potential **S3-** Significant benefits in reducing greenhouse gas emissions and solving waste problems **S4-** Development of rural regions	**W - Weaknesses** **W1-** High initial investment amounts **W2-** Low market demand; **W3-** Low awareness among the public and policymakers about the benefits of biomethane for reducing greenhouse gas emissions **W4-** Low understanding of biomethane as a promoter of energy independence
O – Opportunities **O1**- Export potential; EU funding (Green Deal, etc.);	**T – Threats**

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O2- Biomethane production can be integrated with waste processing technologies and the circular economy **O3-** Increasing demand for locally produced renewable energy	**T1-** Policymakers' inability to recognise the role of biomethane in the transport and heating sectors; **T2**- Rejection of the use of natural gas infrastructure **T3**- Comparison with natural gas prices **T4-** Political instability **T5-** 100% electrification

Involvement of stakeholders

Stakeholders were engaged through a comprehensive approach that included consultations, workshops, and feedback sessions. This inclusive process ensured that the TOWS strategies were well-rounded and incorporated diverse perspectives.

- **Workshops:** The primary platform for collecting stakeholder feedback was the 4th workshop with the hubs at 18.06 in the Latvian 1st biomethane production and injection plant Facility Bovogas. This workshop brought together industry experts, policymakers, community representatives, and other key stakeholders to discuss and validate the proposed strategies. This session provided a platform for open discussion, allowing stakeholders to provide real-time feedback, suggest modifications, and ensure that the strategies were aligned with practical needs and objectives.

  - **Surveys and Questionnaires:** Pre-workshop surveys and post-session questionnaires were distributed to participants to gather detailed input and ensure that all viewpoints were captured. LBA engaged 5 stakeholders from various sectors, including industry experts and sector representatives. Survey participants were asked to rank and prioritize strategies and factors identified in the SWOT Analysis. Key questions included:

    - How would you rank the importance of the strategies identified in our SWOT analysis?
    - Which factors (Strengths, Weaknesses, Opportunities, Threats) do you believe are most critical to address for market development?
    - What aspects of the biomethane market development do you think should be prioritized?
    - Are there any additional strategies or considerations you believe we should include?

  Responses were received from all participants, resulting in a 100% response rate.

- **Direct Meetings:** In-depth, one-on-one meetings with key stakeholders were conducted to gain deeper insights and validate the findings from the workshops and surveys.

Key Aspects Mentioned in Stakeholder Feedback

- **Financial Incentives:** Stakeholders emphasized the necessity of financial support mechanisms, such as subsidies and grants, to alleviate the high initial investment costs associated with biomethane projects.

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- **Regulatory Clarity:** There was a strong call for clearer and more supportive regulatory frameworks to facilitate the implementation and integration of biomethane technologies.
- **Public Awareness:** Increasing public awareness and understanding of biomethane's benefits was highlighted as crucial for garnering broader societal support and acceptance.
- **Technical Training:** Investment in local technical training and capacity-building programs was underscored to address the shortage of skilled labor in the biomethane sector.
- **Collaboration:** The importance of fostering collaboration between various stakeholders, including government, industry players, and educational institutions, was highlighted to ensure a cohesive and effective strategy implementation.

Resulting strategies

The consultation process with the Latvian GreenMeUp hubs generated in total 13 strategies that can be consulted in the **Annex V- Latvia – TOWS Analysis Results**. The following five key strategies have been selected based on the main aspects highlighted during the TOWS analysis.

WO2- Targeted Investments and Incentives

Financial support mechanisms are critical to mitigating the high initial investment costs associated with biomethane projects. These incentives will make it more attractive for investors and developers to enter the biomethane market.

- **SWOT Factors:** This strategy addresses the Weakness W1 (high initial investment costs) and Opportunities O3 (Increasing demand for locally produced renewable energy) identified in the SWOT analysis. (see Table 7).
- **Actors:** Government, financial institutions, and international funding organizations such as the EU.
- **Timeframe:** Short to Medium-term. Immediate implementation can drive early adoption and project initiation

WT4- Regulatory Framework Enhancement

Developing a clearer and more supportive regulatory environment will streamline the process of establishing and integrating biomethane projects. This includes simplifying permitting processes and ensuring supportive legislation to develop biomethane facilities and use biomethane in Latvia.

- **SWOT Factors:** This strategy addresses Weaknesses W3 (Low awareness among the public and policymakers about the benefits of biomethane, regulatory barriers) and Threats T4 (policy instabilities) and T1 (Policymakers' inability to recognise the role of biomethane in the transport and heating sectors).

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- **Actors:** Government, regulatory bodies, and industry associations
- **Timeframe:** Short-term. Rapid implementation is necessary to remove current obstacles and provide a clear path forward for project developers

WO1- Increase Awareness and Education

Increasing public awareness about the benefits of biomethane will build societal support, which is crucial for the long-term success and acceptance of biomethane projects.

- **SWOT Factors:** This strategy addresses Weaknesses W3, W2, W4 and Opportunities O3
- **Actors:** NGOs, educational institutions, media organizations, and community groups
- **Timeframe:** Short-term. Immediate efforts are needed to build public support and understanding.

SO4 - Integrate Biomethane with Circular Economy

Integrating biomethane production with circular economy initiatives will enhance resource efficiency and sustainability. This involves using waste materials from agriculture and forestry as feedstock for biomethane, thereby closing the resource loop.

- **SWOT Factors:** This strategy leverages Strengths S2, S3 (biomass resources) and Opportunities O2, O3 (technological advancements and market demand).
- **Actors:** Agricultural sector, waste management companies, local municipalities, and environmental organizations.
- **Timeframe:** Medium to Long-term. Developing and implementing circular economy initiatives will take time, but planning and initial integration steps should begin immediately.

SO1- Leverage Existing Infrastructure for EU Funding

Leveraging available European Union funding will help mitigate financial barriers and support the development and scaling of biomethane projects.

- **SWOT Factors:** This strategy leverages Strengths S1 (Well-developed natural gas infrastructure) and Opportunities (access to EU funding).
- **Actors:** Project developers, government, and international funding organisations
- **Timeframe:** Short to Medium-term. Immediate action to secure funding can support early project stages and ongoing development

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3.6 Poland

SWOT analysis

The SWOT analysis was carried out based on previous discussions with stakeholders and information collected by PIGEOR during the first year of the GreenMeUp project. During the 4th hub workshop on 27 June 2024 in PIGEOR´s office with participants from the policy, market and society hubs the discussion with stakeholders generated the following key findings:

1. Significant development potential: Poland has large substrates potential and developed infrastructure that can support the development of the biomethane market.

2. Necessary political and financial support: Successful development of the biomethane market requires government commitment and financial support, including EU structural funds.

3. Important role of innovation and education: Promoting innovation and educating the society are key to increase acceptance and support for biomethane.

4. Simplification of formal and legal processes: Simplifying administrative procedures and reducing the time to obtain permits is key to accelerate biomethane projects

A complete overview of the SWOT analysis is presented here in the following table.

Table 8. SWOT Analysis – Poland

SWOT Analysis – Poland	
S – Strengths **S1**- Poland has a large feedstock potential resulting from the agri-food industry and wast management **S2**- In 2019 the amendment of the BIO Act (19-07-2019) introduced new biofuels – biomethane and biohydrogen for the fulfilment of the national indicative target (NIT). **S3**- According to the Energy Policy of Poland until 2040 (PEP2040), 10% of gaseous fuels transported via gas grids should be renewable and low-emission ones in 2030 **S4**- 8 working groups formed by Ministry of Climate within Sector Deal; national biomethane stakeholders increased significantly cooperation. **S5**- Financial support for renewable energy projects (in that biogas and biomethane) is possible under various structural funds and EU programs (CAPEX) **S6**- OPEX support by biogas plants (an auction system, FIP, FIT) **S7**- System for biomethane installations up to 1 MW (OPEX); introduced reference prices for biomethane **S8**- Act on Excise Duty – zero excise duty for CNG/biomethane, LNG, H2 used as transport fuel **S9**- Amendment of the RES Act in 2023: introduction of a definition of biomethane, introduction of a biomethane guarantee and a register for it **S10**- Developed gas network	**W - Weaknesses** **W1-** Lack of strong political push to develop the biomethane market **W2**- Lack of flexible business models adapted to the specific nature of biomethane production and limited cooperation between producers **W3**- Difficulties in obtaining financing for biomethane projects, as well as the lack of effective cost optimization strategies. **W4-** Low level of knowledge about biomethane plants in society **W5-** Social protests against biogas and biomethane projects **W6**- Lack of a strategy to develop a circular economy, e.g. base on biomethane production **W7**- No clear rules of cooperation between gas system operators and producers. **W8**- no regulations regarding the use of biomethane in transport **W9**- Lack of a biomethane development strategy with clear targets **W10**- Low absorption capacity of the gas network

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O – Opportunities	T – Threats
O1- Poland has the ability to replace about 20% of current natural gas imports with biomethane. **O2**- Activating the society towards the selective collection of the biodegradable fraction of municipal waste may affect the rapid and intensive development of the substrate market. **O3**- An amendment of PEP 2040 is under preparation. **O4**- Driver for biomethane use is the current geopolitical situation (war in Ukraine, gas and energy prices). **O5**- Decarbonisation of transport: difficulties with fulfilment of EU requirements concerning share of RES in transport in RED (10% in 2020) and RED II (advanced biofuels) **O6**- Industry e.g. agrofood sector are interested in use of green gas - reduction of GHG emissions from their production (e.g. green labels)	**T1-** Significant delays in the introduction of regulations **T2**- Lack of support system for larger biomethane installations (> 1 MW) **T3**- Problems with obtaining administrative permissions **T4**- Termination of acceptance of biomethane into the gas grid in case of minimal quality deviations **T5**- Technical problems with the exploitation and servicing biomethane technology

Involvement of stakeholders

Hub stakeholders were involved in the process in several ways. First, by sending the preliminary SWOT-TOWS analysis elaborated by PIGEOR to hub stakeholders by mail, several additional suggestions were provided by them and included in the final analysis. Final validation was carried out during the 4th workshop held on 27 June 2024 in PIGEOR offices.

Resulting strategies

By analysing the different factors of the SWOT with hub stakeholders a total of 9 strategies were developed, which can be consulted in the **Annex VI-Poland – TOWS Analysis Results**. The following 5 strategies were identified as the most important and necessary for the Polish conditions in order to start with biomethane production:

SO3- Develop a biomethane strategy with a clear target in different energy sectors

Clear targets for the biomethane production and end-uses cases will increase the integration and use of renewable energy sources and contribute to development of biomethane sector.

- **SWOT Factors:** This strategy addresses the Strengths factors S1, S3, S9, S10, and Opportunities factors O1, O2, O4, O6 identified in the SWOT analysis (see Table 8).
- **Actors:** Government with NGOs
- **Timeframe:** Short-term.

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SO4- Promote the decarbonisation of the transport sector by including biomethane as key transportation fuel.

The use of biomethane as a less carbon-intensive fuel, will support the attainment of EU RES requirements EU requirements concerning share of RES in transport in RED (10% in 2020) and RED II (advanced biofuels) to reduce transportation emissions.

- **SWOT Factors:** This strategy addresses the Strengths factors S1, S2, S8, S9, and Opportunities factors O1, O5 identified in the SWOT analysis.
- **Actors:** Government with market actors and NGOs
- **Timeframe:** Short-term.

WO1- Promote the involvement of local actors in knowledge transfer and innovation

Involving local actors will increase public awareness and acceptance for biomethane projects, helping to overcome public opposition type NIMY based on lack of knowledge about possible benefits.

- **SWOT Factors:** This strategy addresses the Weaknesses factors W4, W5, and Opportunities factors O1, O2, O4, O6 identified in the SWOT analysis.
- **Actors:** NGOs and market actors
- **Timeframe:** Short-term.

WT1- Introduce economic instruments to support the biomethane market

Increasing economic support to market actors will help overcome financial and regulatory barriers, which will increase the investment attractiveness of the sector.

- **SWOT Factors:** This strategy addresses the Weaknesses factors W2, W3, W9 and Threats factor T2 identified in the SWOT analysis.
- **Actors:** Government
- **Timeframe:** Short- to medium-term

ST1- Introduce improvements to obtaining required permits (biomethane projects)

By streamlining the processes to obtain the required permits, implementation of biomethane projects will speed up, minimizing the risk of regulatory and technical delays.

- **SWOT Factors:** This strategy addresses the Weaknesses factors W2, W3, W9 and Threats factor T2 identified in the SWOT analysis.
- **Actors:** Government with market actors
- **Timeframe:** Short-term.

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3.7 Spain

SWOT analysis

The SWOT analysis of Spain's biomethane strategy shows critical key factors for the adequate sector development.

Strengths are based on the importance of a realistic Roadmap with clear biomethane targets and consumption incentive system with quotas for gas traders. However, the strategy faces weaknesses such as a common framework for cooperation and dialogue between stakeholders: producers, investors, traders, final consumers. Opportunities lie in positive externalities: biomethane is much more than an energy solution, it is a solution for the environment, agriculture, livestock, and demographic challenge of depopulation. On the other hand, threats include the reverse-flow units for guarantee the injection capacity and a system of economic and fiscal incentives for the development of projects.

Table 9. SWOT Analysis – Spain

SWOT Analysis – Spain	
S – Strengths **S1**- Focus on positive externalities: BM is much more than an energy solution, it is a solution for the Environment + Agriculture + Livestock + Demographic challenge of depopulation	**W - Weaknesses** **W1-** Missing common framework for cooperation and dialogue between stakeholders: producers, investors, traders, final consumers. **W2**- Lack of greater intensity of coordination to integrate the solutions that biogas/biomethane brings to the problems of Environment + Agriculture + Livestock + Demographic challenge of depopulation **W3**- Missing for Circular Economy cooperation **W4**- Missing Declaration of Interest for the biomethane sector
O – Opportunities **O1**- Forthcoming roadmap with clear biomethane targets, in sync with the RePowerEU objectives **O2**- Lack of consumption incentive system with quotas for gas traders: increasing percentages over time **O3**- Missing legal frame and legal certainty to provide confidence to promoters	**T – Threats** **T1-** Difficulty in guaranteeing the injection capacity **T2**- Difficulty of connections to the medium pressure natural gas network. High-pressure networks tend to be quite distant from current biogas plants **T3**- Difficulties in implementing a system of economic and fiscal incentives **T4**- Missing CAPEX aid for the connection of biomethane plants to the grid and recognition of investment for the reinforcement of gas infrastructures for the connection of biomethane plants **T5**- Lack of regulation about the establishment of the "Polluter Pays Principle" through the implementation of "win-win" mechanisms that accelerate its development

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Involvement of stakeholders

For the validation of the SWOT analysis and development of TOWS strategies, AEBIG made use of previously collected input with the GreenMeUp Hubs and its members. Including the feedback collected during the Kick-off meeting of the Hubs (13 March 2024,) as well as the PESTEL analysis in which a majority of the stakeholders contributed together with AEBIG: Ministry of Ecological Transition and Demographic Challenge – MITERD, Center for Energy, Environmental and Technological Research – CIEMAT, AXPO, ENGIE, NATURGY NUEVAS ENERGÍAS, NORTEGAS, REDEXIS, REPSOL, SUMA CAPITAL, University of Barcelona, University of Santiago Compostela and University of Valladolid.

Finally, a presentation of the SWOT proposal and discussion of the diverse factors (Strengths, Weaknesses, Opportunities and Threats) was held during the hub meeting organized on 27 June 2024 as a hybrid event at the AEBIG offices. The SWOT proposal was discussed, analysing each Strengths, Weaknesses, Opportunities and Threats with the feedback of the stakeholders.

Key Aspects Mentioned in Stakeholder Feedback

- It is essential to have a clear and stable regulatory framework that provides certainty to encourage the development of new projects. In this context, all agents have been invited to participate in the public consultation prior to the transposition of the recently published gas and hydrogen directive to national regulation, contributing regulatory proposals.
- After the moratorium on feed-in tariffs for renewable energy in 2012, it became clear that a stable legal framework is essential to avoid paralysis of the sector.
- It is essential to coordinate efforts to integrate the solutions that biogas and biomethane offer to the challenges of the environment, agriculture, livestock farming and depopulation. It is important to focus on the positive externalities: biogas and biomethane represent not only an energy solution, but also a comprehensive response to the environmental, agricultural, livestock and demographic challenge. These key factors underline the importance of biogas and biomethane as environmental, economic and productive efficiency needs for various sectors of activity.
- It is needed a clear legislation to encourage and promote the production of organic fertilisers and amendments from digestate, facilitating the processes for determining end-of-waste status.
- It is crucial a realistic roadmap with clear targets for biomethane is needed, establishing this energy source as the cornerstone for 'building' the development of the sector.
- It is needed by the sector adequate guarantees of return on investment that do not depend on market fluctuations, as the payback of investments is very long term. Furthermore, it is crucial to ensure that these guarantees are compatible with the marketing of any sustainability certificate.
- Encouraging investment will increase investor confidence in relation to future demand prospects.
- Establish uniform and clear rules of the game for all actors in the biogas value chain.
- Reverse flow units are needed to ensure injection capacity.

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- It is essential to implement the 'right to inject' for plants. In addition, a clear will at the national level, with a defined objective for all actors and a real political commitment backed by the necessary means, would accelerate the development of projects.
- Optimising the management and valorisation of digestate is crucial because it would not only address current constraints, but also enhance the environmental and economic benefits of biogas.

Resulting strategies

The top 5 strategies that are most pressing and have resulted to be most necessary, after the discussion with stakeholders during the 4th Hub´s workshop are here presented. Additional strategies developed can be consulted in the **Annex VII**- **Spain – TOWS Analysis Results**.

SO1- Adjust of realistic roadmap with clear biomethane targets, in sync with the RePowerEU objectives.

To have an initial document that outlines what/how to continue with the development of the sector. It is the cornerstone from which to "build".

- **SWOT Factors:** This strategy addresses the Opportunities factors O1, O3 and in a collateral sense the Strength factor S1 identified in the SWOT analysis.
- **Actors:** Spanish Biogas Association – AEBIG, Secretariat of state of energy – MITERD, Spanish Government's Institute for the Diversification and Saving of Energy – IDAE.
- **Timeframe:** Medium-term.

SO3- Implement a consumption incentive system with quotas for gas traders: increasing percentages over time.

To guarantee the achievement of MWh of biomethane in the system, with traders being obliged to have their quota of biomethane (as with liquid biofuels).

- **SWOT Factors:** This strategy addresses the Opportunities factors O2, O3 and in a collateral sense the Strength factor S1 identified in the SWOT analysis.
- **Actors:** Spanish Biogas Association – AEBIG, Ministry of Ecological Transition – MITERD, Ministry of Finance, Ministry of Consumption
- **Timeframe:** Medium-term.

WO1- Increase intensity of coordination to integrate the solutions that biogas/biomethane brings to the problems of Environment, Agriculture, Livestock and Demographic challenge of depopulation.

Rational: to coordinate efforts to integrate the solutions that biogas and biomethane offer to the challenges of the environment, agriculture, livestock farming and depopulation. It is important to

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focus on the positive externalities: biogas and biomethane represent not only an energy solution, but also a comprehensive response to the environmental, agricultural, livestock and demographic challenge.

- **SWOT Factors:** This strategy addresses the Weaknesses factors W2, W3 and in a collateral sense the Threat factor T5 identified in the SWOT analysis.
- **Actors:** Spanish Biogas Association – AEBIG, Ministry of Ecological Transition – MITERD, Spanish Office of Climate Change – MITECO, Ministry of Agriculture, Demographic Challenge Agency – MITERD
- **Timeframe:** Medium-term.

WO2- Promote a common framework for cooperation and dialogue between stakeholders: producers, investors, traders, final consumers.

To face one aspect that can affect the implementation of new projects is social opposition, which is why collaboration between developers, owners of gas system facilities, gas retailers, the agricultural and livestock sector, local authorities, autonomous communities, civil society and other agents involved, from an early stage, can help to overcome this conflict

- **SWOT Factors:** This strategy addresses the Weakness factors W1, W4 and in a collateral sense the Opportunity factor O3 identified in the SWOT analysis.
- **Actors:** Spanish Biogas Association – AEBIG, AEBIG members
- **Timeframe:** Short-term.

WT1- Propose a system of economic and fiscal incentives for the development of projects: development of investment incentive mechanisms (FiT, FiP, tax benefits, etc.)

To the most effective mechanism to develop biomethane in Spain, in the same way as has been done in other European countries: creating a stable framework and a defined revenue system. In addition, it would be beneficial to incentivise small and medium-sized projects

- **SWOT Factors:** This strategy addresses the Threat factors T3, T4 and in a collateral sense the Opportunity factor O3 identified in the SWOT analysis.
- **Actors:** Spanish Biogas Association – AEBIG, AEBIG members
- **Timeframe:** Short-term.

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Conclusions

The SWOT-TOWS analysis of target countries highlights common aspects to tackle and strategic measures to apply. A recurring issue is the lack of clear, supportive and long-term regulatory frameworks. Each country has highlighted specific legislative needs to encourage biomethane production, distribution and entry in end-use markets. This uncertainty hinders market development, investment and the long-term integration of biomethane in the national energetic system. In connection to the required political support, financial support measures are crucial, to reduce investment risks, and secure the economic viability of biomethane projects. Logistic challenges, such as feedstock supply chain management, high costs of grid connection and lengthy permitting processes are the most prominent. While there are also concerns about the future market price and demand for biomethane, particularly in light of competing technologies such as hydrogen and electric fuels. In addition, there is need to increase awareness about biomethane´s role in the defossilisation of national economies and continue stakeholder´s engagement to increase acceptance and disseminate knowledge about biomethane´s benefits.

Key strategies proposed by target countries partners and policy, market and society stakeholders include:

- Clear and comprehensive regulatory frameworks (Roadmaps and strategies) that provide long-term stability and certainty for biomethane stakeholders and investors. Binding targets are necessary as well as streamlined permitting processes.
- Financial support and incentives, including subsidies, grants and tax incentives. A stable return of investment and reducing the market price fluctuations effects are important for the business case.
- Improvements in infrastructure and technical support, such as grid connections, filling stations and reverse flow units. This is key to reduce logistical and operational obstacles.
- Harmonisation of registers within the EU (i.e. GoO) can enhance market stability.
- Exploring and promoting additional value streams, such as bio-CO2 commercialization, surplus heat utilization, and digestate valorisation, can increase the economic attractiveness of biomethane projects and enhance overall sustainability.

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Annex

I. Czech Republic – TWOS Analysis Results

TOWS matrix	Opportunities	Threats
Strengths	**SO1.** Creation of new biomethane stations (S1, S2, S3) vs (O9, O4, O2) **SO2.** Conversion of existing biogas plants to supply biomethane to the natural gas network (S6, S7, S2, S3) vs (O9, O2, O4) **SO3.** Construction of a new facility near the end of biomethane consumption (e.g. bioCNG-powered public transport) (S10, S8, S2, S3) vs (O10, O5, O9) **SO4.** Preparation of new operating and investment aids (S9, S1, S2, S3, S8) vs (O8, O1, O3, O5, O6, O7)	**ST1.** Conversion of existing facilities (modernization) (S4, S2, S3, S8) vs (T1, T4) **ST2.** Ensuring the competitiveness of biomethane through economic instruments (S10, S1, S2, S3, S4) vs (T9, T5, T8)
Weaknesses	**WO1.** Ensuring plant uptime for years to come with biomethane (W1, W13) vs (O4, O1, O7, O9) **WO2.** Providing sustainable and advanced substrates (W2) vs (O4, O5, O7, O9) **WO3.** Update of the NECP and biomethane targets (W3, W4, W5, W6) vs (O2, O3, O4, O5, O8)	**WT1.** Transnational objectives will ensure the stability of national legislation (W5) vs (T5)

Analysis of actor´s agency

S-O strategies	Actors with agency for strategy implementation	How can the proposed actors implement the strategy/action?
SO1. Creation of new biomethane stations	RES investors	As soon as there is an interesting environment for investors (especially when there is a great interest in buying biomethane, well-functioning and well-established operational support...), investors will launch new biomethane projects.
SO2. Conversion of existing biogas plants to supply biomethane to the natural gas network	Biogas plant operators (in Czechia mostly agriculture cooperatives)	Biogas plant operators will be faced with the question of whether to switch to biomethane or to cease operations as support for biogas cogeneration is coming to an end. Support for biogas cogeneration will end between 2028 and 2033

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		depending on the year of construction of the biogas plant.
SO3. Construction of a new facility near the end of biomethane consumption (e.g. bioCNG-powered public transport)	RES investors	As soon as there is an interesting environment for investors (especially when there is a great interest in buying biomethane, well-functioning and well-established operational support...), investors will launch new biomethane projects.
SO4. Preparation of new operating and investment aids	Ministry of Industry and Trade with other ministries (agricultural, environmental…) + NGOs	At the moment it is very important to have discussions with the Ministry of Industry and Trade about the importance of supporting the biogas/biomethane sector and to come up with proposals on how to kick-start this sector through market incentives and government support.

S-T strategies	**Actors with agency for strategy implementation**	**How can the proposed actors implement the strategy/action?**
ST1. Conversion of existing facilities (modernization)	Biogas plant operators (in Czechia mostly agriculture cooperatives)	Biogas plant operators will be faced with the question of whether to switch to biomethane or to cease operations as support for biogas cogeneration is coming to an end. Support for biogas cogeneration will end between 2028 and 2033 depending on the year of construction of the biogas plant.
ST2. Ensuring the competitiveness of biomethane through economic instruments	Government and market	At the moment it is very important to have discussions with the Ministry of Industry and Trade about the importance of supporting the biogas/biomethane sector and to come up with proposals on how to kick-start this sector through market incentives and government support.

W-O strategies	**Actors with agency for strategy implementation**	**How can the proposed actors implement the strategy/action?**

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WO1. Ensuring plant uptime for years to come with biomethane	Government	At the moment it is very important to have discussions with the Ministry of Industry and Trade about the importance of supporting the biogas/biomethane sector and to come up with proposals on how to kick-start this sector through market incentives and government support.
WO2. Providing sustainable and advanced substrates	Agricultural cooperatives, waste collection companies	The collection of biodegradable waste from households still has its weak points. If there is a better legislative framework to give waste collection companies more incentive to separate and collect waste more accurately at source, this will free up another significant part of recoverable waste for biogas plants. At the same time, the biogas sector helps to stabilize animal and plant production, which also produces a significant proportion of usable waste for biogas production
WO3. Update of the NECP and biomethane targets	Government	At the moment it is very important to have discussions with the Ministry of Industry and Trade about the importance of supporting the biogas/biomethane sector and to come up with proposals on how to kick-start this sector through market incentives and government support.

W-T strategies	**Actors with agency for strategy implementation**	**How can the proposed actors implement the strategy/action?**
WT1. Transnational objectives will ensure the stability of national legislation	EU + Czechia government	A key role in establishing EU and Czech legislation is played by legislators, to whom it is important to show the importance of the sector for energy independence and job stabilization beyond the big cities. In addition to NGOs, the media also play a major role here.

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II. Danube Region – TOWS Analysis Results

Hungary – TOWS Matrix

TOWS matrix	Opportunities	Threats
Strengths	SO1 - National biogas/biomethane action plan with biomethane target SO2 - Research on increasing the production of sequential crops for biogas industry SO3 - Country map of best available natural gas DSO/TSO connection points SO4 - Research in integrating solar energy with anaerobic digestion (biological methanation)	ST1 - Regulation on sharing grid injection costs between network operator and biomethane producer ST2 - CAPEX support to animal farms for building anaerobe digestion units ST3 - Collection of source-separated biodegradable municipal waste ST4 - CAPEX support to biogas plans for converting from electricity to biomethane production ST5 - Financial incentives for producing renewable gases for self-consumption
Weaknesses	WO1 - Enabling the biogas producers to monetize the value of digestate (certification) WO2 - Financial support to CNG/LNG consumption (release from excise duty and highway toll fees) WO3 - System for issuing guarantees of origin to renewable gas producers WO4 - Research - Pilot projects for producing biogas feedstocks on marginal land	WT1 - Contracts for difference (CfD) applied in term biomethane purchases WT2 - CAPEX to FAB industry WT3 - CAPEX support for building clusters of biogas plans with central upgrading facility WT4 - Long-term strategy for increasing the production of sequential crops for biogas

Analysis Actor´s Agency

S-O (specific devised strategies/actions)	Actors with agency to implement the strategy or specific actions	How can the proposed actors implement the strategy/action?
National biogas/biomethane action plan with biomethane target	Government	Policy instruments
Research on increasing the production of sequential crops for biogas industry	Ministry of Agriculture, farmers, universities	Research
Country map of best available natural gas DSO/TSO connection points	Gas industry (TSO, DSO)	Collaboration
Research in integrating solar energy with anaerobic digestion (biological methanation)	Ministry of Energy, research Institutions	Research

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S-T (specific devised strategies/actions)	Actors with agency to implement the strategy or specific actions	How can the proposed actors implement the strategy/action?
Regulation on sharing grid injection costs between network operator and biomethane producer	Ministry of Energy, Energy Agency (MEKH), Gas industry	Policy instruments
CAPEX support to animal farms for building anaerobe digestion units	Ministry of Agriculture	Policy instruments
Collection of source-separated biodegradable municipal waste	Government, Concession owner (MOL MOHU), biogas plants	Collaboration
CAPEX support to biogas plans for converting from electricity to biomethane production	Government, Energy Agency	Policy instruments
Financial incentives for producing renewable gases for self-consumption	Government	Financial instruments

W-O (specific devised strategies/actions)	Actors with agency to implement the strategy or specific actions	How can the proposed actors implement the strategy/action?
Enabling the biogas producers to monetize the value of digestate (certification)	Ministry of Agriculture, research institutions, biomethane- biogas association, farmer's association	Market instruments
Financial support to CNG/LNG consumption (release from excise duty and highway toll fees)	Government	Market instruments
System for issuing guarantees of origin to renewable gas producers	Energy Agency (MKEH)	Market instruments
Research - Pilot projects for producing biogas feedstocks on marginal land	Ministry of Agriculture, research institutions, farmers	Research

W-T (specific devised strategies/actions)	Actors with agency to implement the strategy or specific actions	How can the proposed actors implement the strategy/action?
Contracts for difference (CfD) applied in term biomethane purchases	Ministry of Energy, Energy Agency (MEKH), Gas industry	Market instruments
CAPEX to FAB industry	Government	Financial instruments
CAPEX support for building clusters of biogas plans with central upgrading facility	Government	Financial instruments

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Long-term strategy for increasing the production of sequential crops for biogas	Minsitry of Agriculture, research institutions	Policy instruments

Romania – TOWS Matrix

TOWS matrix	Opportunities	Threats
Strengths	SO1 - Circular bioeconomy action plan should include anaerobic digestion of organics generated in every sector of economy SO2 - Government-mandated assessment of biogas and biomethane production potentials.	ST1 - Governmental strategy and roadmap for biogas and biomethane. It can be a section within the renewable energy strategy. ST2 - The national strategy on economy and agriculture need to include an action plan also for circular bioeconomy.
Weaknesses	WO3 - Official binding targets anchored into national legislation promoting organic waste management by anaerobic digestion. WO4 - FIT and FIP calculated to support the additional production costs of biomethane from residues and biomass WO5 - Development of biogas technologies with local companies from similar sectors (oil&gas, wastewater, energy etc)	WT1 - Official targets on production & consumption of biomethane to be adopted on the national strategy. protection, decarbonization, agriculture WT2 - Improve profitability of biomethane plants, valorising digestate and biogenic CO2

Analysis Actor´s Agency

S-O (specific devised strategies/actions)	Actors with agency to implement the strategy or specific actions	How can the proposed actors implement the strategy/action?
Circular bioeconomy action plan should include anaerobic digestion of organics generated in every sector of economy	Ministry of environment, agriculture and education	Policy instruments
Government-mandated assessment of biogas and biomethane production potentials	Government	Policy instruments

S-T (specific devised strategies/actions)	Actors with agency to implement the strategy or specific actions	How can the proposed actors implement the strategy/action?
Governmental strategy and roadmap for biogas and biomethane. It can be a section within the renewable energy strategy.	Ministry of energy	Policy instruments
The national strategy on economy and agriculture need to	Ministry of economy and agriculture	Policy instruments

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include an action plan also for circular bioeconomy.		

W-O (specific devised strategies/actions)	**Actors with agency to implement the strategy or specific actions**	**How can the proposed actors implement the strategy/action?**
Official binding targets anchored into national legislation promoting organic waste management by anaerobic digestion.	Ministry of environment	Market instrument
FIT and FIP calculated to support the additional production costs of biomethane from residues and biomass	National Agency for Regulation in Energy	Collaboration
Development of biogas technologies with local companies from similar sectors (oil&gas, wastewater, energy etc)	Market actors	Collaboration

W-T (specific devised strategies/actions)	**Actors with agency to implement the strategy or specific actions**	**How can the proposed actors implement the strategy/action?**
Official targets on production & consumption of biomethane to be adopted on the national strategy. protection, decarbonization, agriculture		Policy instrument
Improve profitability of biomethane plants, valorising digestate and biogenic CO2		Market instrument

- Government-mandated assessment of biogas and biomethane production potentials (CBE action plan should estimate and foster the contribution of anaerobic digestion to different sectors of the economy)
- Governmental strategy and roadmap for biogas and biomethane. It can be a section within the renewable energy strategy. (the national strategy for economy and agriculture shall include CBE)
- Official targets on production & consumption of biomethane to be adopted on the national strategy. protection, decarbonization, agriculture
    - Official binding targets anchored into national legislation promoting organic waste management by anaerobic digestion.
    - Improve profitability of biomethane plants, valorizing digestate and biogenic CO2 (FIT and FIP calculated to support the additional production costs of biomethane from residues and biomass)

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Serbia – TOWS Matrix

TOWS matrix	Opportunities	Threats
Strengths	SO1 - Define appropriate incentive scheme to mobilize untapped waste potentials to produce biomethane	ST1 - Independent mediator engaged to organize communication and exchange of needs and potential contributions to them
Weaknesses	WO1 - Comprehensive analysis of the framework for biomethane integration WO2 - Connect the national targets in waste/decarbonization with biomethane as an instrument and facilitate the conditions for investors	WT1 - Enhance mutual cooperation of national administration relevant for energy, RES, transport, waste, environmental protection, decarbonization, agriculture WT2 - Promote biogas/biomethane technology as all-rounder technology and multisectoral contributor

Analysis Actor´s Agency

S-O (specific devised strategies/actions)	Actors with agency to implement the strategy or specific actions	How can the proposed actors implement the strategy/action?
Define appropriate incentive scheme to mobilize untapped waste potentials to produce biomethane	Ministry of Mining and Energy, Ministry of Environmental Protection, Ministry of Agriculture	Policy instruments

S-T (specific devised strategies/actions)	Actors with agency to implement the strategy or specific actions	How can the proposed actors implement the strategy/action?
Independent mediator engaged to organize communication and exchange of needs and potential contributions to them	Ministry of Mining and Energy, Ministry of Environmental Protection, Ministry of Agriculture, UNDP Serbia	Collaboration

W-O (specific devised strategies/actions)	Actors with agency to implement the strategy or specific actions	How can the proposed actors implement the strategy/action?
WO1 - Comprehensive analysis of the framework for biomethane integration	Ministry of Mining and Energy, Serbian Biogas Association	Policy instrument
WO2 - Connect the national targets in waste/decarbonization with biomethane as an instrument and facilitate the conditions for investors	Ministry of Mining and Energy, Serbian Biogas Association	Policy instrument, Market instrument

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W-T (specific devised strategies/actions)	Actors with agency to implement the strategy or specific actions	How can the proposed actors implement the strategy/action?
Enhance mutual cooperation of national administration relevant for energy, RES, transport, waste, environmental protection, decarbonization, agriculture	Serbian government, Ministry of Mining and Energy, Ministry of transport, Ministry of Environmental Protection, Ministry of Agriculture	Collaboration, Policy instrument
Promote biogas/biomethane technology as all-rounder technology and multisectoral contributor	Serbian government, Ministry of Mining and Energy, Ministry of transport, Ministry of Environmental Protection, Ministry of Agriculture, Serbian Biogas Association, UNDP Serbia	Collaboration

III. Estonia – TOWS Analysis Results

TOWS matrix	Opportunities	Threats
Strengths	SO1 to promote the deployment of existing substrates to achieve a biomethane production volume of 1 TWh in 2035 and 2 TWh in 2050 S1 VS O2	ST1 to ensure the long-term competitiveness of biomethane by covering the price difference between natural gas and biomethane (S7) vs. (T1)
	SO2 prioritize the development of new technologies for more efficient, bioindustrial complex-type biomethane production with diverse inputs and outputs, but at the same time remaining maximally waste and emission-free production (S7, S11) vs (O1, O4, O6)	ST2 to continue promoting the consumption of biomethane in transit, especially in heavy trucks, ships and trains (T2)
	SO3 to support the expansion of the use of biomethane into new areas of use, including liquefied, such as shipping, long-distance transport, industry, district heating) (S4) vs (O3 Construction of	ST3 Explain the advantages of biomethane over hydrogen and electric transport, especially to the public and decision makers (T3)
	SO4 Building the biomethane injection facilities to the Category D natural gas network to support biomethane feed-in to transmission network (S5, S15) vs (O12, O13, O14)	ST4 Encourage the transition to liquefied biomethane in the maritime sector and its use (obligation to mix with LNG) (T4)
	SO5 open support for the construction of LNG filling stations, including in rural areas. (S5, S6) vs (O16)	ST5 Highlighting and emphasizing the market maturity of biomethane production and consumption technologies compared to hydrogen and electric vehicles (T5)
	SO6 Use of biomethane in agricultural machinery and other agricultural energy consumption (S0, S10) vs (O7, O11)	ST10 to promote e-fuels, via support to the production cost, development of legislation to make e-fuel projects feasible. S2 vs T10

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	SO7 Ensure the continuity of legislative regulations (biomethane excise duty exemption, blending obligation, stipulation of proportion reduction in areas other than transport, etc.) (S2, S8, S16) vs (O16)	
	SO8 State institutions have a clear function, activities and purpose to achieve biomethane production (1 TWh) and consumption (50 filling stations, 15,000 vehicles) targets (S3, S5, S12, S14) vs (O17)	
	SO9 Greater social acceptance in rural areas through the creation of well-paid jobs (O8,O9, O10) SO10 Greater social acceptance through less odour emission (O8,O9, O10) SO11 Successive crops to become a sustainable certified 2nd generation feedstock (O8,O9, O10)	
Weaknesses	WO1 Encouraging the processing of biowaste or agricultural residues into biogas W1 O2, O4 WO2 Developing and receiving subsidies and incentives for transport companies for the purchase of gas trucks and buses W4; W5 vs O3	WT1 Reduction of market (biomethane price) uncertainty, stabilization of price and demand with regulations, common market port, public and green procurement T1; T7; T8; W10; W11;
	WO3 Construction of biogas plants creates new jobs W3 O8	WT2 Expansion of Biomethane consumption opportunities, new consumers, in addition to transport T2; T4; W17; W14; W10; W5; W2;
	WO4 Building biogas plants reduces odour pollution and thus increases social acceptance for building plants O9	WT3 Reduction of competition among renewable energy types (with HVO, H2) T3; T5; T9; W13; W17;
	WO5 Promotion of biomass cultivation in low-value areas (low-value areas with peat soils, closed peat mines, other low-value areas W4 O11	WT4 Encouraging the recovery of fermentation residue into fertilizer, simplifying permits and regulations, re-evaluating the entire waste policy from the point of view of the circular economy, there is no waste, there are residues, by-products, secondary raw materials, which should have a separate classification T6; W1; W4; W7; W15; W16;
	WO6 Encouraging the conversion of HGVs to biomethane W5 O3	WT5 Standardization, simplification, one-shop-stop of issuing all kinds of permits related to biomethane production W1; W3; T6; W7; W11; W12; Increasing the availability of
	WO7 Development of liquefied biomethane infrastructure, including filling stations, according to TEN plan W6	WT6 liquefied biomethane in long-haul and maritime transport for trucking and shipping companies to invest. T4; W6,

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	WO8 Encouraging the use of manure, silage and fodder residues in biomethane production W7 O2, O4	WT7 Promote developments in the gas market to create an international market for both gas and GOs T4; T7; T8; W2; W6; W8; W10
	WO9 Supporting investment in network connection, especially in category D pipe W8 O12	
	WO10 Encouraging the use of biogas for heating W9	
	WO11 Extension of biomethane price support to all sectors W11	
	WO12 Standardization, clustering and simplification of procedures for environmental impact assessment, building permit, AD and spatial planning of urban areas W12	
	WO13 A more uniform distribution and doubling of the network of filling stations for both compressed gas and liquefied biomethane W13	
	WO14 Simplification of digestate certification and expansion of marketing opportunities, including export W14, W15 vs O6	
	WO15 Explaining the suitability of digestate for organic farming	
	WO16 biogas plant investment certainty, offering additional loan guarantees (MES) to commercial banks	

Analysis actor´s agency

S-O (specific devised strategies/actions)	**Actors with agency to implement the strategy or specific actions**	**How can the proposed actors implement the strategy/action?**
SO4 Building the biomethane injection facilities to the Category D natural gas network to support biomethane feed-in to transmission network	Ministry of Climate (MoC); AS Elering	AS Elering can built the biomethane injection facilities to D-category transmission network and rent it out to the producers; To build state-owned 2-4 biomethane injection points to natural gas transmission network, which is precondition for biomethane export.
SO3 to support the expansion of the use of biomethane into new areas of use, including liquefied, such as shipping, long-distance transport, industry, district heating)	Ministry of Climate; Shipping and housing building companies; constructing and engineering companies;	MoC can adopt needed legal regulation; Governmental agencies can use public green procurement procedure to order biomethane fuelled solutions;

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		To support the use of biogas in pilot projects for the use of solid oxide fuel cells (SOFCs), in particular for small-scale installations at source. The heat and electricity generated in the SOFC can be used on site, including in autonomous areas without mains electricity grid, gas grid, not to mention district heating grid; To use green CO2 from biomethane upgrading units mixed with green hydrogen (wind, PV, hydro based).
SO1 to promote the deployment of existing substrates	Ministry of Climate; Ministry of Regional Affairs and Agriculture (MRAA); Agricultural companies, biomethane production companies; Biogas Association	MoC and MRAA can adopt climate strategies including the chapter for the biomethane targets to achieve a biomethane production volume of 1 TWh in 2035 and 2 TWh in 2050; companies can build the plants and produce the biomethane
SO5 open support for the construction of LNG filling stations, including in rural areas	MoC; EU structural funds and governmental agencies; filling stations;	Investment support, Decrease the heavy duty tax to biomethane (LBM) trucks; Release the LMB trucks from road tax; Free parking of CNG and LNG vehicles; To exempt of heavy goods vehicle tax for gas vehicles and differentiation on the basis of EURO classes; To promote liquefied biomethane production (Bio-LNG) with objective substitute LNG by 2050 100%.
SO7 Ensure the continuity of legislative regulations	MoC; MRAA;	biomethane excise duty exemption, blending obligation, stipulation of proportion reduction in areas other than transport, etc.

S-T (specific devised strategies/actions)	**Actors with agency to implement the strategy or specific actions**	**How can the proposed actors implement the strategy/action?**
ST1 to ensure the long-term competitiveness of biomethane by covering the price difference between natural gas and biomethane	Ministry of Climate; Ministry of Regional Affairs and Agriculture (MRAA);	to extend the CAPEX and OPEX support for biomethane producers;
ST3 Explain the **advantages of biomethane over hydrogen** and electric transport,	Biogas Association, Media, biogas production companies, academia, Ministry of Climate;	To introduce **purchase aid for the use of local gas vehicles** in Estonia

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especially to the public and decision makers	Ministry of Regional Affairs and Agriculture (MRAA);	(renewal of the local truck fleet from EUROIII to EUROVI; To **promote green hydrogen production** from biomethane or via mixing green hydrogen with green biomethane to increase heating value of biomethane not increasing volume and pressure, especially when using natural gas network for gas distribution.
ST5 Highlighting and emphasizing the market maturity of biomethane production and consumption technologies compared to hydrogen and electric vehicles	Ministry of Climate; Ministry of Regional Affairs and Agriculture (MRAA);	To support **power-to-gas technological innovations to double** biomethane production (up to 2 TWh/a) in 2050
ST4 Encourage the transition to liquefied biomethane in the maritime sector and its use (obligation to mix with LNG	Ministry of Climate; Ministry of Regional Affairs and Agriculture (MRAA);	To **use LNG tanker for storage of the liquefied biomethane**, to establish state-owned 1 central biomethane liquefication unit, which increases the independence from natural gas market price fluctuations.
ST10 to promote e-fuels, via support to the production cost, development of legislation to make e-fuel projects feasible	Ministry of Climate; Ministry of Regional Affairs and Agriculture (MRAA);	e-fuels can create a pathway to hydrogen production as there is no demand now for hydrogen, but without production there is hard to implement hydrogen powered transportation. To promote the adaption of e-methane production

W-O (specific devised strategies/actions)	**Actors with agency to implement the strategy or specific actions**	**How can the proposed actors implement the strategy/action?**
WO2 Developing and receiving subsidies and incentives for transport companies for the purchase of gas trucks and buses	Ministry of Climate; Ministry of Regional Affairs and Agriculture (MRAA); Union of Transport Vehicles	To exempt and differentiate 40% - 80% of heavy goods vehicles consuming methane fuel from road tolls in Estonia on the basis of EURO classes; To allow the use of vehicles of higher weight and length in Estonian road transport (in order to remain competitive with neighbouring countries, at least up to 25,25 m, but consider allowing, for example, trains up to 34,50 m with a maximum weight of 76 tonnes

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WO5 Promotion of **biomass cultivation** in low-value areas (low-value areas with peat soils, closed peat mines, other low-value areas	Ministry of Regional Affairs and Agriculture (MRAA); Ministry of Climate;	To map the low-value areas and organise public procurement to rent those areas to the biomethane producers with 10 years contracts.
WO10 Encouraging the use of **biogas for heating**; Extension of biomethane price support to all sectors	Ministry of Climate; Ministry of Regional Affairs and Agriculture (MRAA);	To create opportunities for the **partial replacement of natural gas with biomethane**, synthesis gas or hydrogen in the production of heat.[1]
WO12 **simplification of procedures for environmental impact** assessment, building permit, AD and spatial planning of urban areas	Ministry of Climate; Ministry of Regional Affairs and Agriculture (MRAA);	To establish one-stop-shop service for biomethane producers to simplify them to apply all needed permits with one application form one office
WO8 Encouraging the **use of manure, silage and fodder residues** in biomethane production	Ministry of Regional Affairs and Agriculture (MRAA); Ministry of Climate;	To simplify the waste regulation for those feedstocks which can be use din biomethane plants to end-waste and produce the biomethane and organic fertilizer without waste – *(remark for press release: if the useage of waste for biomethane production is not the Green Deal and Circular economy in practice – then what is?)*
WO14 **Simplification of digestate certification** and expansion of marketing opportunities, including export; Explaining the suitability of digestate for organic farming Increasing	Ministry of Regional Affairs and Agriculture (MRAA); Ministry of Climate;	To **promote digestate based biofertilizer** certification, to support digestate based biofertilizer export
WO16 biogas plant **investment certainty,** offering additional loan guarantees (MES) to commercial banks	Ministry of Climate; Ministry of Regional Affairs and Agriculture (MRAA);	To enforce loans and loan guarantees for biomethane plant investment projects with feasible interest rate

W-T (specific devised strategies/actions)	**Actors with agency to implement the strategy or specific actions**	**How can the proposed actors implement the strategy/action?**
WT4 Encouraging the **recovery of fermentation residue** into fertilizer, simplifying permits and regulations, re-evaluating the entire waste policy from the point of view of the circular economy, there is no waste, there are residues, by-products, secondary raw	Ministry of Regional Affairs and Agriculture (MRAA); Ministry of Climate;	To establish a functioning incentive scheme for the sorting of municipal and agricultural waste in all municipalities in order to **divert all bio-waste to biomethane plants**; and composting and fertilizer production.

[1] Points 12-14 are from ENERGIA TEEKAART 2021-2031-204, TalTech, Rohetiiger Energia-teekaart-17122021.pdf (rohetiiger.ee)

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materials, which should have a separate classification		
WT5 **Standardization**, simplification of permit applications	Ministry of Climate; Ministry of Regional Affairs and Agriculture (MRAA);	To establish intergovernmental service: **one- stop - shop** of issuing all kinds of permits related to biomethane production
WT7 Promote developments in the gas market to create an **international market for both gas and GOs**	Ministry of Climate; Ministry of Regional Affairs and Agriculture (MRAA);	To participate actively in the development of an **international quality standard for biomethane** that takes into account the specificities of biomethane production. To create **preconditions for cross-border trade** in biomethane, including certificates of origin;
WT1 Reduction of market (biomethane price) uncertainty, stabilization of price and demand with regulations, common market port, public and green procurement	Ministry of Climate; Ministry of Regional Affairs and Agriculture (MRAA);	To use of more environmentally friendly biomethane-based transport when purchasing public services (setting an example in the implementation of the Clean Vehicles Directive) - so-called green procurements in road construction, State Real Estate (AS Riigi Kinnisvara) constructions, where the consumption of methane fuel provides additional points in the evaluation of tenders.
WT2 Expansion of **Biomethane consumption opp**ortunities, new consumers, in addition to transport	Estonian Government and Parliament /Riigikogu); MoC	To set the target for 2030 for cars using methane is 15,000 and for heavy goods vehicles (buses and lorries) is 1,500 and the number of methane filling stations is 50; To continue to give preference **to methane-powered buses in public transport** procurement and to build methane filling stations in areas where this is not available for public transport today.

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IV. Greece – TOWS Analysis Results

TOWS matrix	Opportunities	Threats
Strengths	SO1 – Maximum exploitation of the theoretical biomethane potential in Greece. SO2 – NECP with clear targets for the biomethane development. SO3 – The majority one the biogas plants are in proximity with the TSO/DSO networks, therefore by upgrading existing biogas plants the 2.1TWh target from NECP might be feasible.	ST1 - State is to support biomethane plants with capital and/or operational subsidies. The cost of acquiring the raw material and the natural gas grid connection cost will be subsidised by the State.
Weaknesses	WO1 - Promotion of the natural gas market as this will be the main carrier of biomethane. WO2 – NECPs targets should promote biomethane securing domestic and EU funds, increasing the bankability of the sector, providing better financing for producers. WO3 – Promote and utilize the digestate as soil fertilizer, creating an additional revenue stream for the producer while addressing the digestate utilization issue that existing plant are facing. WO4 – State should regulate the waste market in Greece, giving clear incentives to farmers, small agro-industries.	WT1 - Introduction of economic instruments to support the biomethane market. WT2 – Aim for the maximum exploitation of biomethane, such as, Bio-CNG & Bio-LNG, in places where natural gas connection isn't possible.

Analysis Actor´s Agency

S-O (specific devised strategies/actions)	Actors with agency to implement the strategy or specific actions	How can the proposed actors implement the strategy/action?
SO1 – Maximum exploitation of the theoretical biomethane potential in Greece.	Ministry of Energy, Ministry of Agriculture	Map the market, Aim in biomass exploitation
SO2 – NECP with clear targets for the biomethane development.	Ministry of Energy	Biomethane and natural gas targets should be optimized for the years to come
SO3 – The majority one the biogas plants are in proximity with the TSO/DSO networks, therefore by upgrading existing biogas plants the 2.1TWh target from NECP might be feasible.	Biogas Owners TSO DSO	TSO/DSO should aim the biomethane plant's connection to the grid

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S-T (specific devised strategies/actions)	Actors with agency to implement the strategy or specific actions	How can the proposed actors implement the strategy/action?
State is to support biomethane plants with capital and/or operational subsidies. The cost of acquiring the raw material and the natural gas grid connection cost will be subsidised by the State	Ministry of Energy Ministry of Economics RRF EU funding stakeholders	A viable financial structure should ensure a smooth transition for biogas to biomethane production giving motive to producers to invest in the sector.

W-O (specific devised strategies/actions)	Actors with agency to implement the strategy or specific actions	How can the proposed actors implement the strategy/action?
WO1 - Promotion of the natural gas market as this will be the main carrier of biomethane.	Ministry of Energy TSO DSO	The natural gas market will be responsible to handle the majority of the biomethane produced. Therefore, the natural gas infrastructure should be supported in order to expand the number of biomethane grid injection points
WO2 – NECPs targets should promote biomethane securing domestic and EU funds, increasing the bankability of the sector, providing better financing for producers.	Ministry of Energy Ministry of Economics RRF EU funding stakeholders Banking stakeholders	The bankability of the sector will be capably of ensuring better terms for financing biomethane projects
WO3 – Promote and utilize the digestate as soil fertilizer.	Ministry of Energy, Ministry of Agriculture	The standardization of the digestate as soil fertilizer will create an additional revenue stream for the producer while addressing the digestate utilization issue that existing plant are facing.

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V. Latvia – TOWS Analysis Results

TOWS matrix	Opportunities	Threats
Strengths	**SO1: Leverage Existing Infrastructure for EU Funding:** Use Latvia's well-developed natural gas infrastructure to secure EU funding for biomethane projects, emphasizing the integration of waste processing technologies. **SO2: Promote Rural Development and Export Potential:** Highlight the benefits of biomethane for rural development to gain support for increasing export potential, particularly within the EU. **SO3: Emphasize Environmental Benefits:** Market the significant greenhouse gas reduction and waste management benefits to attract support and funding under the EU Green Deal and increase local renewable energy demand. **SO4: Promote Biomethane Integration in Circular Economy:** Use the opportunity to integrate biomethane production with waste processing technologies to create a more compelling value proposition for policymakers and the public.	**ST1: Policy Advocacy and Infrastructure Utilization:** Engage in policy advocacy to ensure policymakers recognize the role of biomethane, highlighting the existing natural gas infrastructure and environmental benefits to counter potential rejection. **ST2: Diversification and Resilience:** Develop strategies to diversify biomethane applications beyond transport and heating to mitigate risks from political instability and market comparisons with natural gas prices. **ST3: Highlight Rural Benefits to Combat 100% Electrification Push:** Showcase the rural development benefits of biomethane to argue against the exclusive focus on 100% electrification. **ST4: Promote involvement of rural actors (small, local, rural) in actions of knowledge to transfer and innovation**
Weaknesses	**WO1: Increase Awareness and Education:** Launch public awareness and education campaigns to highlight the benefits of biomethane, utilizing EU funds and demonstrating its role in energy independence and emissions reduction. **WO2: Targeted Investments and Incentives:** Advocate for government incentives and subsidies to lower initial investment barriers and stimulate market demand for biomethane.	**WT1: Risk Mitigation through Diversification:** Reduce reliance on a single application of biomethane to mitigate risks from political instability and fluctuations in natural gas prices. **WT2: Strategic Partnerships and Alliances:** Form strategic partnerships with other renewable energy sectors and waste management companies to strengthen the overall market position and increase lobbying power. **WT3: Long-Term Planning and Flexibility:** Develop flexible business models that can adapt to changes in policy and market conditions, ensuring long-term sustainability despite potential political and economic instability.

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VI. Poland – TOWS Analysis Results

TOWS matrix	Opportunities	Threats
Strengths	SO1 Strategy to upgrade existing biogas plants to biomethane SO2 National biomethane roadmap with clear biomethane target SO3 Development of a biomethane strategy with a clear target in different energy sectors SO4 Strategy for decarbonising transport, including biomethane	ST1 Introduction of facilities for getting required permissions
Weaknesses	WO1 Promotion of the involvement of local actors in knowledge transfer and innovation WO2 Quantify the existing resources and market niches WO3 Support instruments for new coming value chains, pilots and products	WT1 Introduction of economic instruments to support the biomethane market

Analysis Actor´s Agency

S-O (specific devised strategies/actions)	Actors with agency to implement the strategy or specific actions	How can the proposed actors implement the strategy/action?
SO1 Strategy to upgrade existing biogas plants to biomethane	Government with market actors and NGOs	Elaboration of strategy by stakeholders within Sector Deal for wider open discussion and publication by Ministry Climate and Environment final version
SO2 National biomethane roadmap with clear biomethane target	Biogas and biomethane stakeholders within Sector Deal	Elaboration of national roadmap by stakeholders for wider open discussion and including targets by government in legislation documents (PEP 2040, NCEP)
SO3 Development of a biomethane strategy with a clear target in different energy sectors	Government with market actors and NGOs	Elaboration of draft version by different energy sectors stakeholders for wider discussion and implementation by government in legislation
SO4 Strategy for decarbonising transport, including biomethane	Government with market actors and NGOs	Elaboration of draft version by transport sector stakeholders for implementation by government in legislation

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S-T (specific devised strategies/actions)	Actors with agency to implement the strategy or specific actions	How can the proposed actors implement the strategy/action?
ST1 Introduction of facilities for getting required permissions	Government with market actors	Introduction of legislation based on discussion with market actors showing gaps and problems

W-O (specific devised strategies/actions)	Actors with agency to implement the strategy or specific actions	How can the proposed actors implement the strategy/action?
WO1 Promotion of the involvement of local actors in knowledge transfer and innovation	NGOs	Activities at local level involving local actors (workshops, study tours- showing examples of good practices from other countries and benefits for circular economy etc.)
WO2 Quantify the existing resources and market niches	Market sector, RTD, NGOs	Integration of already existing studies, preparation of maps showing local resources and determinants
WO3 Support instruments for new coming value chains, pilots and products	Government with market actors and RTD	Promotion of innovation solutions dedicated to biomethane and supporting them

W-T (specific devised strategies/actions)	Actors with agency to implement the strategy or specific actions	How can the proposed actors implement the strategy/action?
WT1 Introduction of economic instruments to support the biomethane market	Government	Legislation introducing measures supporting biomethane (RES Act, BioAct etc.)

VII. Spain – TOWS Analysis Results

TOWS matrix	Opportunities	Threats
Strengths	SO1_Need of a REALISTIC Roadmap with clear biomethane targets, in sync with the RePowerEU objectives	ST1_Need of reverse-flow units for guarantee the injection capacity
	SO2_A legal frame and legal certainty to provide confidence to promoters	ST2_Difficult connection to the medium pressure natural gas network. High-pressure networks tend to be quite distant from current biogas plants
	SO3_Consumption incentive system with quotas for gas traders: increasing percentages over time	ST3_Integrated transposition of REDIII

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	SO4_Focus on positive externalities: BM is much more than an energy solution, it is a solution for the Environment + Agriculture + Livestock + Demographic challenge of depopulation	
Weaknesses	WO1_Need for greater intensity of coordination to integrate the solutions that biogas/biomethane brings to the problems of Environment + Agriculture + Livestock + Demographic challenge of depopulation	WT1_A system of economic and fiscal incentives for the development of projects: development of investment incentive mechanisms (FiT, FiP, tax benefits, etc.)
	WO2_Promote a common framework for cooperation and dialogue between stakeholders: producers, investors, traders, final consumers.	WT2_CAPEX aid for the connection of biomethane plants to the grid and recognition of investment for the reinforcement of gas infrastructures for the connection of biomethane plants
	WO3_Proposal for Circular Economy cooperation	WT3_Regulate the establishment of the "Polluter Pays Principle" through the implementation of "win-win" mechanisms that accelerate its development
	WO4_Need to open a specific Declaration of Interest for the biomethane sector	

Analysis Actor´s Agency

S-O (specific devised strategies/actions)	**Actors with agency to implement the strategy or specific actions**	**How can the proposed actors implement the strategy/action?**
SO1_ Adjust of realistic Roadmap with clear biomethane targets in sync with the RePowerEU objectives	Spanish Biogas Association - AEBIG Secretariat of state of energy - MITERD Spanish Government's Institute for the Diversification and Saving of Energy - IDAE	Concrete proposal from AEBIG to MITERD and continuous monitoring of AEBIG AEBIG providing continuous feedback from the market, domestic and EU
SO2_A legal frame and legal certainty to provide confidence to promoters	Spanish Biogas Association - AEBIG Ministry of Ecological Transition – MITERD Spanish National Markets and Competition Commission - CNMC	Support and advice from AEBIG to MITERD and continuous monitoring of AEBIG
SO3_ Implement a consumption incentive system with quotas for gas traders:	Spanish Biogas Association - AEBIG Ministry of Ecological Transition – MITERD	Support and advice from AEBIG to MITERD and continuous monitoring of AEBIG

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increasing percentages over time	Ministry of Finance Ministry of Consumption	
SO4_Focus on positive externalities: BM is much more than an energy solution, it is a solution for the Environment + Agriculture + Livestock + Demographic challenge of depopulation	Spanish Biogas Association – AEBIG Spanish Office of Climate Change – MITECO Demographic Challenge Agency – MITERD Ministry of Agriculture	Continuous dissemination at events, publications, etc. and official positioning of MITERD ("missionary marketing")

S-T (specific devised strategies/actions)	**Actors with agency to implement the strategy or specific actions**	**How can the proposed actors implement the strategy/action?**
ST1_Need of reverse-flow units for guarantee the injection capacity	Spanish Biogas Association – AEBIG DSO's	continuous monitoring of AEBIG with DSO's about reverse-flow units deployment. Cost sharing among stakeholders
ST2_Difficult connection to the medium pressure natural gas network. High-pressure networks tend to be quite distant from current biogas plants	Spanish Biogas Association – AEBIG DSO's	continuous monitoring of AEBIG with DSO's about long distance connections deployment Better capillarity of the gas network
ST3_Integrated transposition of REDIII	Spanish Biogas Association – AEBIG Spanish Government Ministry Of Ecological Transition - MITERD	Performing a "lobbying" function AEBIG jointly with the CE, to push the MITERD

W-O (specific devised strategies/actions)	**Actors with agency to implement the strategy or specific actions**	**How can the proposed actors implement the strategy/action?**
WO1_Increase intensity of coordination to integrate the solutions that biogas/biomethane brings to the problems of Environment + Agriculture + Livestock + Demographic challenge of depopulation	Spanish Biogas Association - AEBIG Ministry Of Ecological Transition – MITERD Spanish Office of Climate Change – MITECO Ministry of Agriculture Demographic Challenge Agency – MITERD Spanish Government	Active and involved role of the Public Administration: 1_Interministerial Roundtable: including Ministry of Ecological Transition, Agriculture, Livestock, etc. 2_Municipalities: obligation to revalorize into biomethane all municipal waste. 3_Enhancing the environmental understanding of the biomethanisation in the waste recovery. 4_Assessing environmental value (which includes economic value), even prioritizing it over assessing

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		economic value alone (e.g. Waste and other regulations)
WT2_Promote a common framework for cooperation and dialogue between stakeholders: producers, investors, traders, final consumers.	Spanish Biogas Association - AEBIG AEBIG members	concrete proposal from AEBIG and its Members
WO3_Proposal for Circular Economy cooperation	Spanish Biogas Association - AEBIG AEBIG members Environmental organizations Environment Dpt. - MITECO	concrete proposal from AEBIG and its Members
WO4_Need to open a specific Declaration of Interest for the biomethane sector	Spanish Biogas Association - AEBIG AEBIG members Governments of the autonomous communities in Spain (CCAA)	concrete proposal from AEBIG and its Members Governments of the autonomous communities in Spain (CCAA)

W-T (specific devised strategies/actions)	**Actors with agency to implement the strategy or specific actions**	**How can the proposed actors implement the strategy/action?**
WT1_ Propose a system of economic and fiscal incentives for the development of projects: development of investment incentive mechanisms (FiT, FiP, tax benefits, etc.)	Spanish Biogas Association - AEBIG Ministry Of Ecological Transition - MITERD Ministry of Finance Ministry of Consumption	concrete proposal from AEBIG to MITERD and continuous monitoring of AEBIG Show MITERD the reasons for success in other EC countries
WT2_CAPEX aid for the connection of biomethane plants to the grid and recognition of investment for the reinforcement of gas infrastructures for the connection of biomethane plants	Spanish Biogas Association - AEBIG Ministry Of Ecological Transition - MITERD	concrete proposal from AEBIG to MITERD and continuous monitoring of AEBIG Show MITERD the reasons for success in other EC countries
WT3_Regulate the establishment of the "Polluter Pays Principle" through the implementation of "win-win" mechanisms that accelerate its development	Spanish Biogas Association - AEBIG Ministry Of Ecological Transition – MITERD Cooperatives and agricultural and livestock companies. Spanish Office of Climate Change – MITECO Ministry of Agriculture	concrete proposal from AEBIG to MITERD and continuous monitoring of AEBIG Raising awareness of all levels of society, public and private, informing about positive externalities versus “negative externalities” Dissemination at events, conferences, exhibitions, etc.

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