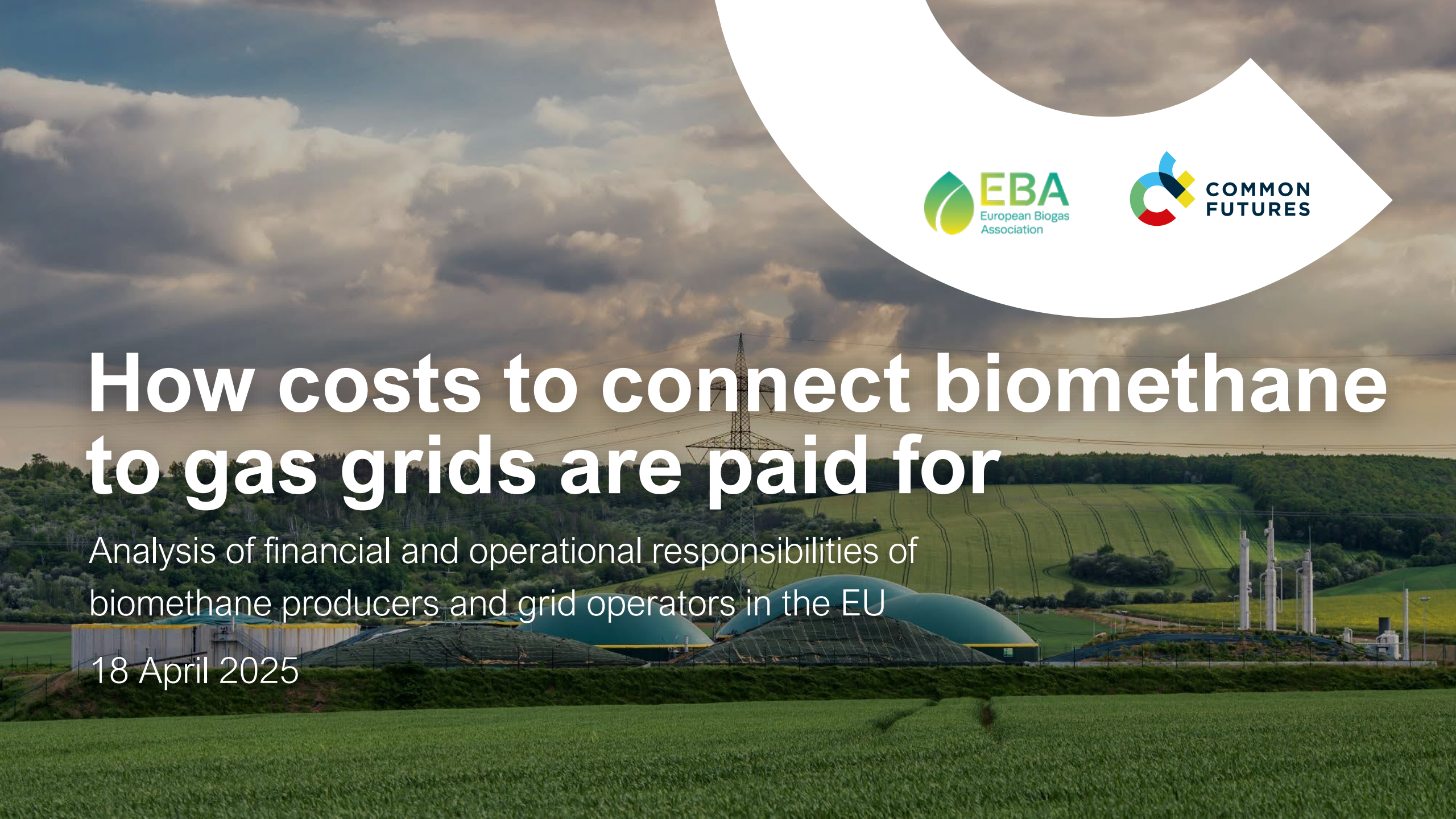

How costs to connect biomethane to gas grids are paid for

Analysis of financial and operational responsibilities of biomethane producers and grid operators in the EU

18 April 2025

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Study conducted for:

EBA European Biogas Association

Authors:

Daan Peters
Leo Gray
Steffan Brosschot
Evelien Smit

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Common Futures. Energy Transition Specialists B.V.
Vondellaan 54, 3521 GH Utrecht
The Netherlands

info@commonfutures.com
+31 30 281 9699

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Executive Summary (1/3)

Analysis of five investment categories show grid costs related to biomethane injection are commonly shared in EU MS

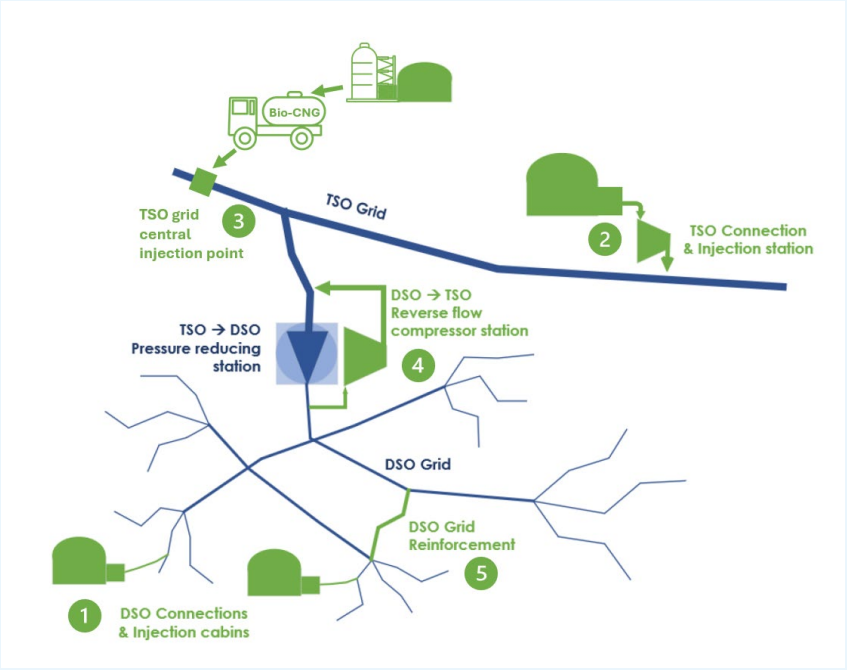
This study investigates how **financial and operational responsibility** for connecting biomethane to gas grids and for associated grid investments is shared between biomethane producers and gas grid operators in EU Member States. The report also gives an estimate of **injection fees applicable to biomethane plants** and the **capital costs of grid injection units**.

The costs for grid connections are usually shared between biomethane producers and gas grid operators. Costs covered by gas grid operators become a part of their regulated asset base and are paid for by all tariff payers. This study investigated the cost-sharing arrangements for **five different types** of grid connections and upgrades (see figure), using insights from 22 EU MS.

Approximately 60% of plants today are **DSO-connected biomethane plants (type 1). For DSO connections cost sharing tends to be common, as many countries have more experience with connecting plants to distribution grids** than transmission grids. In contrast, for **TSO-connected plants (type 2)**, cost sharing is less commonly reported by participants. This is likely a result of the lack of experience in some EU MS in connecting plants to transmission grids because in countries where plants are connected to the TSO grid, cost sharing is applied about 95% of the time.

Central injection points (type 3) are a relatively new type of grid connection, mainly in emerging biomethane markets with less dense gas grids, and thus the **cost sharing mechanism is still in development**.

Grid upgrades, **reverse compression (type 4)** and **DSO network meshing (type 5**), are typically **paid by grid operators** in developed biomethane markets.

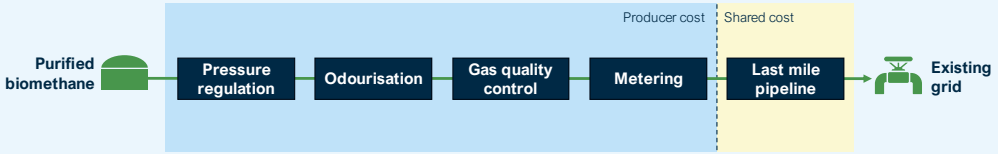


Executive Summary (2/3)

Cost sharing is common, but the method of cost sharing varies, with several methods identified

In this study, each type of grid connection or grid upgrade is broken down to **key components,** with the financial and operational responsibility indicated for each component, as shown in the example below for DSO grid connections in France.

Example: Cost sharing of DSO grid connections in France



In EU Member States, several trends can be identified. Pressure regulation (which can be compression or pressure reduction) to reach the required grid pressure is often a cost for the producer. The costs for the last-mile pipeline, which is required to connect the producer to the closest grid, are in many cases shared between the producer and the operator. For the other components (gas quality control, metering and odourisation), approaches vary significantly per member state, with no clear trend.

Cost sharing can be used as a method to promote grid connections of biomethane; however, cost sharing is not done in the same way in every EU Member State.

The cost sharing methods are used, can be described as:

- **Splitting the CAPEX & OPEX** (e.g., in Portugal, where the producer pays the CAPEX, and the DSO pays the OPEX)
- **Charging the producer a regulated percentage** (e.g., in Germany, where the DSO pays 75% of costs).
- **Component level cost sharing,** where regulation requires different financial responsibility for different components (e.g. the last-mile pipeline in the Netherlands is a TSO investment).

Grid operators can also promote connections by **lowering the initial investment burden for producers**. Instead of requiring upfront payment, the operator covers the investment and **recovers the cost over time through a usage fee**. While the producer ultimately pays, spreading the cost **reduces upfront capital requirements** and **mitigates investment risk**.

Grid related costs represent only a relatively small portion of total biomethane production costs, and a large share of biomethane production is subsidised. However, it remains **important to promote effective cost sharing** mechanisms to strike a **balance between keeping costs low for biomethane producers and minimising the overall grid connection costs**, which are ultimately borne by all grid users.

Executive Summary (3/3)

Grid operators largely operate gas grid connections, with pressure regulation often a task for the biomethane producer

The study also analyses the **operational responsibility** for each grid connection type and component, as shown below for the DSO grid connections in France.

Example: Operational responsibility sharing of DSO grid connections in France

There is no standard approach to assigning responsibility for the operation of grid connections. The last mile pipeline and odourisation are almost always a grid operator responsibility. Gas quality control and metering are steps that can have a mixed operation, with some countries even requiring both producers and gas grid operators to own and operate gas quality control and metering. **Pressure regulation is more commonly a task for the producer**, especially when compression is required.

Central grid injection points are new grid connections with **relatively high complexity** as it is potentially operated by three parties: producers, network operators and the logistical service provider, who is responsible for the trucking of the gas from the producers' location to the injection point.

Injection fees

Some grid operators charge biomethane plants a fee for injecting biomethane in the grid. This **can be biomethane specific** to recover costs of the grid injection unit, **or it can also be a charge that is for all connections injecting to the grid**. These charges can be **commodity or capacity based**. The EU Decarbonised Gas Regulation Article 18 mentions the possibility of exempting biomethane plants from this charge as a method of promoting biomethane grid connections, however, the impact of this is yet to be seen, with **8 countries applying DSO fees and 8 countries applying TSO fees in the EU today.**

Injection unit costs

When focusing on the injection unit costs (excluding the compression and last-mile pipeline), it is notable that **national law and grid requirements can impact the cost of injection units between EU Member States**. Requirements around contaminants, composition, calorific value, and odourisation all influence the average grid unit cost. Investment costs for a unit varies significantly between **€200,000 – €1,800,000 (excl. compression & last mile pipeline**), for both DSO and TSO grids. The size of these injection units is a determining factor as well, and the data provided indicates that economies of scale are possible.

Introduction

Increasing volumes of biomethane get fed in Europe's gas grids, but who pays for the injection?

Background

Biomethane is a domestically produced, circular, and dispatchable form of renewable energy. It is invaluable to the energy transition in the EU. Biomethane production in Europe is growing rapidly, and increasingly this production is delivered to end consumers via the gas grid. Biomethane can thus help to reduce reliance on natural gas, lowering overall carbon emissions while maintaining a reliable energy supply. Biomethane can be blended with natural gas in existing gas infrastructure without issue.

Across the EU, different practices exist on how costs of connecting biomethane production installations to gas networks are paid for: by the producer, by network companies and ultimately their users through tariffs or a combination of both. So far, no comprehensive overview exists of how this cost allocation is organised in EU Member States.

Study aim: assess cost allocation and operational responsibilities

The aim of this study is to analyse **how the cost of integrating biomethane into the gas grid is currently split between producers and infrastructure companies** in EU Member States. The study analyses various types of infrastructure-related investments, breaking each of them down to various cost items, as will be explained on the next pages.

Additionally, the study will **create an inventory of which party is operationally responsible** for specific grid-connection and upgrade equipment.

Next to the main study aim, there are **two secondary goals**:

1. Create an **inventory of which party is operationally responsible** for specific grid-connection equipment or grid asset types in each EU MS.
2. Highlight **differences in injection fees and injection unit costs in the EU.**

Introduction

Five categories of investments that enable the injection of increasing volumes of biomethane to gas grids

The five grid connections and upgrades analysed in this study are;

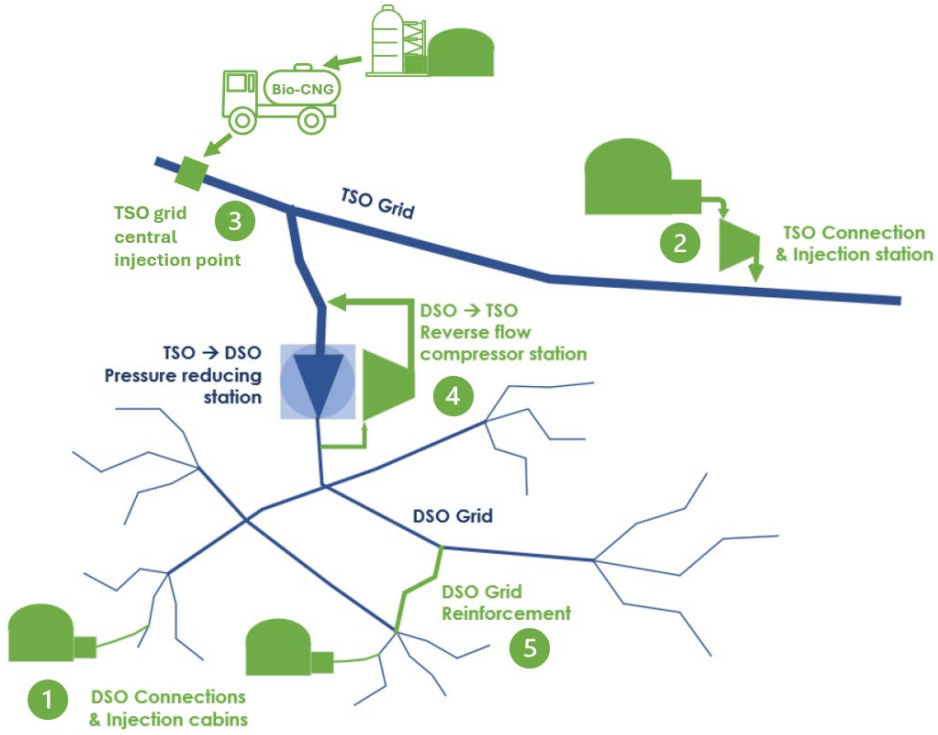
1) DSO grid injection: The required steps to bring purified biomethane from the production facility into the existing low to medium pressure gas grid.

2) TSO grid injection: The required steps to bring purified biomethane from the production facility into the existing high-pressure gas grid.

3) Central Injection point ('virtual pipeline'): The facility required to bring biomethane produced at a distance from the grid to a central injection point. This includes processing purified biomethane into Compressed or Liquefied Natural Gas (BioCNG / BioLNG), trucking to the injection point, and injection into the gas grid for further transport to consumers. This is an important solution for biomethane plants in regions with low gas grid coverage.

4) Reverse compression: The components required to bring gas from the DSO networks to the higher pressure TSO networks, namely the compression step and gas quality and volume control. Deployment of reverse compression units can increase the capacity for grids to absorb biomethane injection and allow biomethane production to reach transmission pipelines, large users, and underground gas storages.

5) DSO grid meshing: The required assets to join two DSO grids together by building an additional pipeline. This creates a larger interconnected distribution network that can absorb larger quantities of injected biomethane.



Scope of analysis

Many components relevant to grid connections and upgrades are evaluated in this study

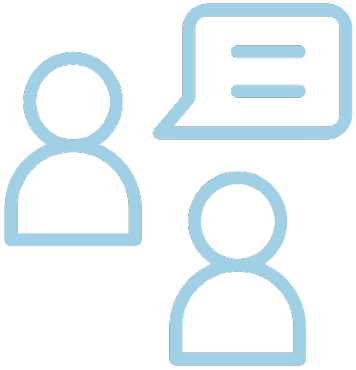
To analyse the considered grid connections and upgrades at a more granular level, each type of grid connection or grid upgrade is broken down into key components. This is a simplified representation of the actual situation, but it still aims to provide insights with a degree of detail. The following components have been included in the analysis:

- **Grid injection unit:** The station where the gas pressure is regulated, the gas quality and quantity are measured, and the gas is given an odour, if required.
- **Gas quality control:** Ensures that biomethane meets the required standards before grid injection, including checks for contaminants, calorific value, and composition.
- **Metering:** Measures the volume of biomethane entering the grid for billing, regulatory compliance, and system balancing.
- **Compression:** Increases the pressure of biomethane to match the grid pressure or facilitate transportation via pipelines or trucks.
- **Last mile pipeline:** The final section of the pipeline network that connects a biomethane production site to the existing gas grid.
- **Pressure regulation:** Controls and adjusts the pressure of biomethane to ensure compatibility with the grid and safe operation.
- **Odourisation:** Adds an artificial odour to biomethane for safety purposes, making leaks detectable.
- **Deodourisation:** Removes unwanted odours from biomethane, often necessary when upgrading biogas to meet grid injection standards.
- **Conversion to CNG/LNG:** Converts biomethane into BioCNG or BioLNG for storage and transport.
- **Trucking:** The transportation of biomethane as BioCNG or BioLNG to locations without direct pipeline access.
- **Injection point:** The location where biomethane enters the gas grid.

Methodology

How the analysis has been performed

Common Futures and EBA approached several organisations per EU Member State with a request to provide information via a questionnaire. These include: **national biogas/biomethane associations, DSOs and TSOs**. Also, CEER approached **national energy regulators**. All parties were asked to **fill out a questionnaire** detailing how the financial and operational responsibility of the five mentioned grid connections and upgrades are shared in their country or region.



Common Futures processed insights obtained via questionnaires and **contacted all parties that provided information to obtain confirmation on whether their information was correctly interpreted**. Where needed, clarification **interviews** were held. This allowed Common Futures to create a correct overview of the situation in 22 Member States.

EU Member States overview

Overview of the financial and operational responsibility of grid connections and upgrades

The costs to connect to distribution grids are mostly shared between producers and DSOs

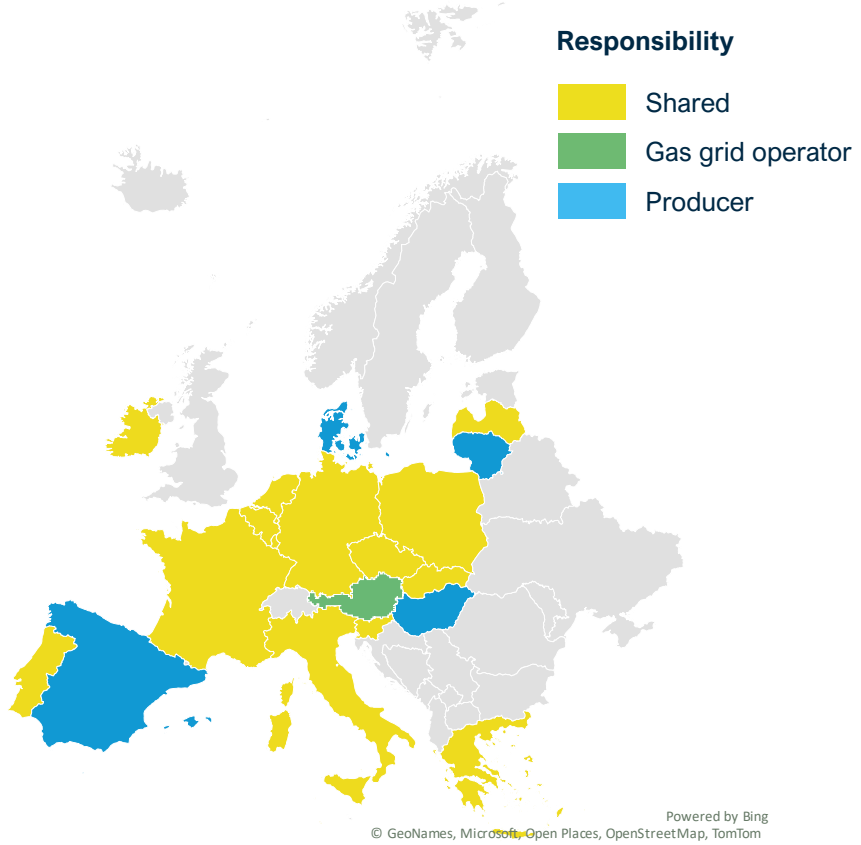
There are over **2,000,000 km of DSO pipelines** in the EU. The large size and its low operating pressure have lead to a situation in which **the majority of EU biomethane plants (58%) are connected to the DSO network.**[1]

The cost of **connecting a biomethane plant to the DSO grid** is commonly **shared between the biomethane producer and gas grid operator** in most EU Member States. The method of this cost sharing differs largely between countries. Approximately 70% of DSO-connected plants in the EU are situated in France, where the producer pays for everything except for the last-mile pipeline, which is shared at a rate dependent on the pipeline length. Other countries also share the total costs based on a regulated percentage (Germany, Ireland, etc.), some countries allocate the CAPEX to one party and the OPEX to another (Estonia, Portugal, etc.), and other countries have more detailed cost-sharing methodologies.

The share of the cost borne by the producer can often change between plants in the same country as well, with producers typically paying a higher share of the grid costs for biomethane plants that are smaller and at a further distance from the existing grid.

Some gas grid operators charge producers injection fees to recover their expenditure into the grid, and the viability to recover their investment through the regulated injection fees can also determine the degree of cost sharing.

DSO grid connections: Cost allocation



[1] ***EBA 2024.*** *Plant to grid navigating biomethane injection (link).*

Overview of financial and operational responsibility for DSO grid connections in 19 EU MS

Country	Financial Responsibility					Operational Responsbility					# of DSO connected plants
	Pressure regulation	Gas quality control	Odourisation	Metering	Last mile pipeline	Pressure regulation	Gas quality control	Odourisation	Metering	Last mile pipeline	
Austria											14
Belgium											7
Czech Republic											9
Denmark											57
France											642
Germany											52
Greece											0
Hungary											0
Ireland											1
Italy											7
Latvia											0
Lithuania											2
Luxembourg											3
The Netherlands											90
Poland											0
Portugal											1
Slovakia											1
Slovenia											0
Spain											7

Responsibility:

Shared | Gas grid operator | Producer | TBC / Not applicable

Cost and operational responsibility sharing takes place across EU Member States, but varies significantly between grid connection components, reflecting a clear lack of harmonisation.

Some trends are visible, with the **pressure regulation step often the producers' responsibility, while the last mile pipeline is commonly a shared cost that the DSOs operate.** In general, more costs are assigned to the producer in emerging markets, and a more shared cost approach is deployed in more mature markets.

DSO grid connection results in key markets and countries with highest potential

Country	Financial Responsibility: Pressure regulation	Gas quality control	Odourisation	Metering	Last mile pipeline	Operational Responsbility: Pressure regulation	Gas quality control	Odourisation	Metering	Last mile pipeline	# DSO connected plants	Potential in 2040 (bcm)
Top 5 producers today												
Germany	Shared	Shared	Shared	Shared	Shared	Gas grid operator	Gas grid operator	Gas grid operator	Gas grid operator	Gas grid operator	52	15.5
France	Producer	Producer	Producer	Producer	Shared	Producer	Gas grid operator	Gas grid operator	Gas grid operator	Gas grid operator	642	14.6
Italy	Shared	Producer	Shared	Producer	Shared	Gas grid operator	Producer	Gas grid operator	Producer	Gas grid operator	7	10.3
Denmark	Producer	Producer	Producer	Producer	Producer	Gas grid operator	Gas grid operator	Gas grid operator	Gas grid operator	Gas grid operator	57	1.8
The Netherlands	Producer	Shared	Producer	Shared	Shared	Producer	Gas grid operator	Producer	Producer	Gas grid operator	90	2.3
Top 5 potential												
Germany	Shared	Shared	Shared	Shared	Shared	Gas grid operator	Gas grid operator	Gas grid operator	Gas grid operator	Gas grid operator	52	15.5
France	Producer	Producer	Producer	Producer	Shared	Producer	Gas grid operator	Gas grid operator	Gas grid operator	Gas grid operator	642	14.6
Spain	Producer	Producer	Producer	Producer	Producer	Producer	Producer	Gas grid operator	Gas grid operator	Gas grid operator	7	13.1
Italy	Shared	Producer	Shared	Producer	Shared	Gas grid operator	Producer	Gas grid operator	Producer	Gas grid operator	7	10.3
Poland	Producer	Producer	Shared	Shared	Shared	Producer	Producer	Gas grid operator	Gas grid operator	Gas grid operator	0	8.8

Responsibility:

Shared | Gas grid operator | Producer | TBC / Not applicable

Cost-sharing practices vary significantly across developed markets. For example, in France and Denmark, most of the components for grid connections are fully paid for by the producer, either upfront or via a reoccurring fee. In contrast, Germany employs a favourable cost-sharing model for the producer, where 75% of the total cost is covered by the grid operator for plants located within 10km of the grid.

Among today's top five producers, Germany, France, and Italy remain in the top five for production potential in 2040. **When comparing their cost-sharing mechanisms with emerging markets** today with significant potential, Spain & Poland, we see a large difference. In Spain and Poland, **producers are currently expected to pay for the full cost of gas grid connections** to the DSO grid, providing a financial challenge for market growth.

Connections to the TSO grid are reported to be less commonly shared than DSO grid connections

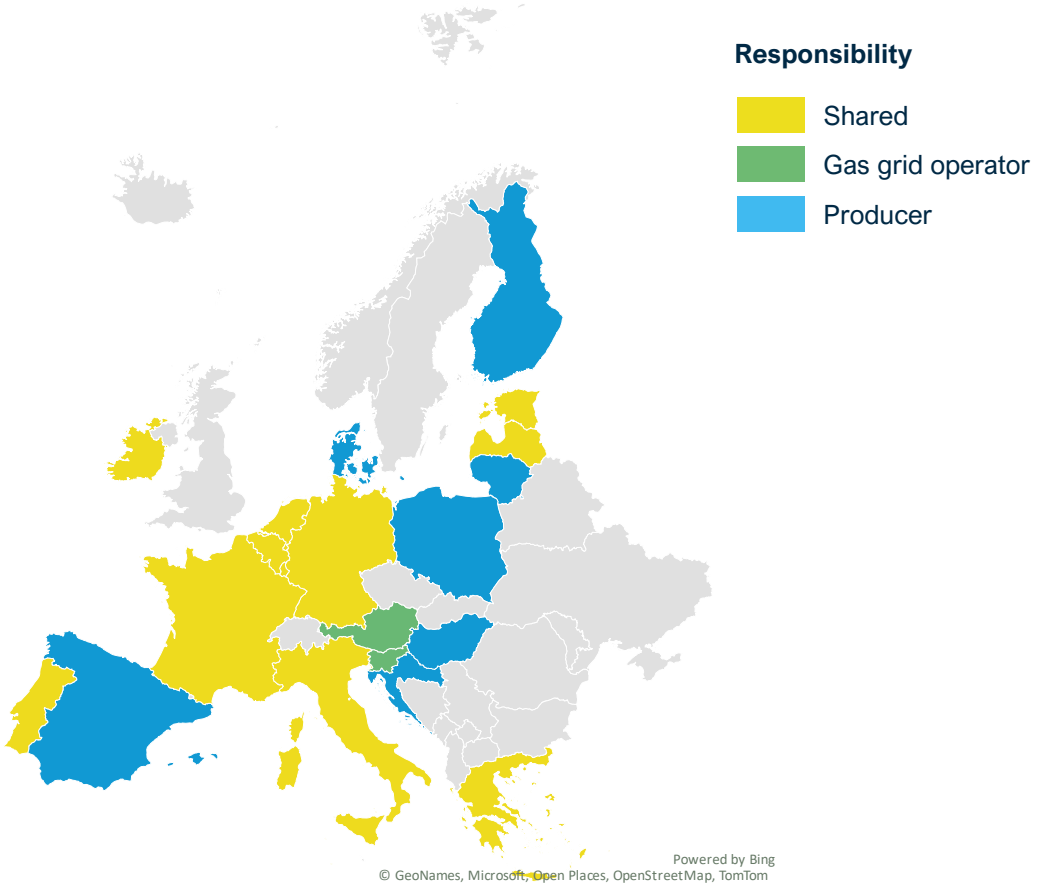
The TSO high-pressure pipeline network in the EU is over 260,000 km in length. This grid enables the long-distance transport of methane supplies to large industries and the EU's underground storages.

Connecting biomethane plants directly to the TSO grid is less common in the EU as a result of the relatively high pressure and costs of compression, but there are **some countries where local conditions and average plant size, among other things, make this the preferred option (e.g. Germany, Finland, Italy).**

Similar to the situation on the DSO grid, **most Member States have some degree of cost sharing** for the grid connection of biomethane plants to the TSO grid. This majority is not as overwhelming as for the DSO grid, as 9 countries require the producer or gas grid operator to pay for the full connection, compared to 4 for the DSO grids.

Of all TSO-connected biomethane plants in the EU, >90% are found in either Germany, France, or Italy, where there is some degree of cost sharing with the grid operator.

TSO grid connections: Cost allocation



Overview of financial and operational responsibility for TSO grid connections in 19 EU MS

Country	Financial Responsibility					Operational Responsbility					# TSO connected plants
	Compression	Gas quality control	Odourisation	Metering	Last mile pipeline	Compression	Gas quality control	Odourisation	Metering	Last mile pipeline	
Austria	TBC	Gas grid operator	TBC	Gas grid operator	Gas grid operator	Gas grid operator	Gas grid operator	TBC	Gas grid operator	Gas grid operator	0
Belgium	Shared	Shared	TBC	Shared	Shared	Gas grid operator	Gas grid operator	TBC	Gas grid operator	Gas grid operator	1
Croatia	Producer	Producer	TBC	Producer	Producer	Producer	Gas grid operator	TBC	Gas grid operator	Producer	0
Denmark	Producer	Producer	TBC	Producer	Producer	Gas grid operator	Gas grid operator	TBC	Gas grid operator	Gas grid operator	1
Estonia	Producer	Shared	TBC	Shared	Shared	Producer	Gas grid operator	TBC	Gas grid operator	Gas grid operator	0
Finland	Producer	Producer	TBC	Producer	Producer	Producer	Producer	TBC	Gas grid operator	Producer	4
France	Producer	Producer	Producer	Producer	Shared	Producer	Gas grid operator	Gas grid operator	Gas grid operator	Gas grid operator	106
Germany	Shared	Shared	TBC	Shared	Shared	Gas grid operator	Gas grid operator	TBC	Gas grid operator	Gas grid operator	106
Hungary	Producer	Producer	TBC	Producer	Producer	Producer	Producer	TBC	Producer	Gas grid operator	0
Ireland	Shared	Shared	TBC	Shared	Shared	Gas grid operator	Gas grid operator	TBC	Gas grid operator	Gas grid operator	0
Italy	Producer	Shared	TBC	Gas grid operator	Shared	Producer	Gas grid operator	TBC	Gas grid operator	Gas grid operator	40
Latvia	Producer	Gas grid operator	TBC	Gas grid operator	Producer	Producer	Gas grid operator	TBC	Gas grid operator	Gas grid operator	0
Lithuania	Producer	Producer	TBC	Producer	Producer	Producer	Producer	TBC	Producer	Gas grid operator	2
Luxembourg	Producer	Producer	Producer	Shared	Shared	Producer	Producer	Gas grid operator	Gas grid operator	Gas grid operator	0
The Netherlands	Producer	Producer	Producer	Producer	Gas grid operator	Producer	Producer	Producer	Producer	Gas grid operator	4
Poland	Producer	Producer	TBC	Producer	Producer	Producer	Producer	TBC	Producer	Producer	0
Portugal	Producer	Shared	TBC	Shared	Shared	Producer	Gas grid operator	TBC	Gas grid operator	Gas grid operator	0
Slovenia	TBC	Gas grid operator	TBC	Gas grid operator	Gas grid operator	Gas grid operator	Gas grid operator	TBC	Gas grid operator	Gas grid operator	0
Spain	Producer	Producer	Producer	Producer	Producer	Producer	Producer	Gas grid operator	Gas grid operator	Gas grid operator	2

TSO grid connections entail more financial responsibility for the biomethane producer than DSO grid connections. Compression can be a large share of the cost of TSO grid connections (~30%), and this is predominantly a financial responsibility of the producer across the EU. Long established favourable cost-sharing of compression in Germany could be why they have the most TSO grid-connected plants in the EU. Again, a lack of harmonisation is notable, and there are not substantial numbers of TSO grid-connected plants. However, **over 90% of the TSO-connected plants in the EU are in countries where at least some cost sharing exists.**

Responsibility:

Shared | Gas grid operator | Producer | TBC / Not applicable

TSO grid connection results in key markets and countries with highest potential

Country	Financial Responsibility: Compression	Gas quality control	Odourisation	Metering	Last mile pipeline	Operational Responsbility: Compression	Gas quality control	Odourisation	Metering	Last mile pipeline	# TSO connected plants	Potential in 2040 (bcm)
Top 5 producers												
Germany	Shared	Shared	TBC	Shared	Shared	Gas grid operator	Gas grid operator	TBC	Gas grid operator	Gas grid operator	106	15.5
France	Producer	Producer	Producer	Producer	Shared	Producer	Gas grid operator	Gas grid operator	Gas grid operator	Gas grid operator	90	14.6
Italy	Producer	Shared	TBC	Shared	Shared	Producer	Shared	TBC	Shared	Gas grid operator	40	10.3
The Netherlands	Producer	Producer	Producer	Producer	Gas grid operator	Producer	Producer	Producer	Producer	Gas grid operator	4	2.3
Denmark	Producer	Producer	Producer	Producer	Producer	Gas grid operator	Gas grid operator	Gas grid operator	Gas grid operator	Gas grid operator	1	1.8
Top 5 potential												
Germany	Shared	Shared	TBC	Shared	Shared	Gas grid operator	Gas grid operator	TBC	Gas grid operator	Gas grid operator	106	15.5
France	Producer	Producer	Producer	Producer	Shared	Producer	Gas grid operator	Gas grid operator	Gas grid operator	Gas grid operator	90	14.6
Spain	Producer	Producer	Producer	Producer	Producer	Producer	Producer	Gas grid operator	Gas grid operator	Gas grid operator	2	13.1
Italy	Producer	Shared	TBC	Shared	Shared	Producer	Shared	TBC	Shared	Gas grid operator	40	10.3
Poland	Producer	Producer	TBC	Producer	Producer	Producer	Producer	TBC	Producer	Producer	0	8.8

Responsibility:

Shared | Gas grid operator | Producer | TBC / Not applicable

Sharing the cost of TSO grid connections is common in the top 5 producing countries today. Countries such as Italy and Germany have large shares of cost sharing, while France and the Netherlands require the producer to pay for all elements of the connection except the pipeline. Denmark again stands out with no cost sharing.

As noticed for DSO grid connections, **high potential countries from outside the top 5 producers (Spain, Poland) required biomethane producers to pay the full cost of the grid connection**.

Central Injection Points to TSO grids are new projects with no clearly defined cost sharing methodology yet

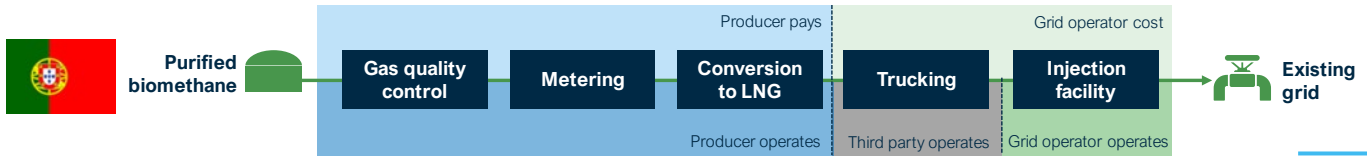
Seven submissions outlined the cost-sharing methodology for central injection points. Despite this, it is worth noting **there are no current examples of public access central injection points to TSO grids, and only one country where public central injection for DSO grids occurs, in Portugal.**[1] Alongside this, **TSOs in Latvia and Ireland are currently developing public access injection points.**

Private injection points to the grid exist; e.g. in Spain and Latvia, however, this is not overly relevant for cost-sharing methodologies.

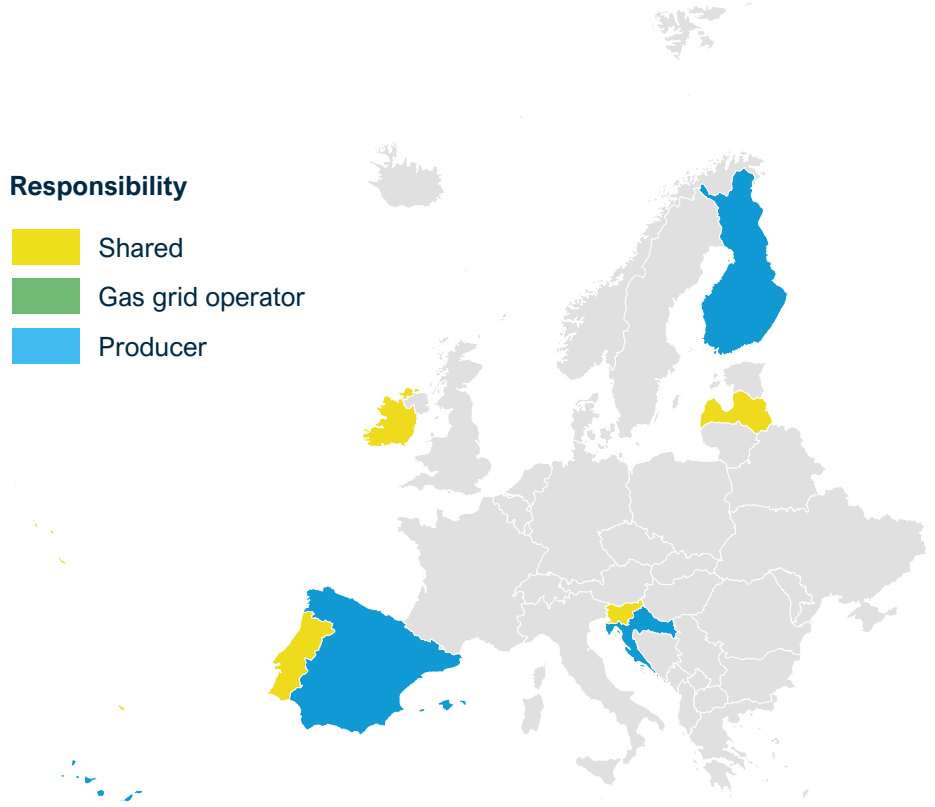
Submissions received indicate that regulation is at an early stage of development. Countries with less experience in central injection projects report that existing regulation would require the producer to pay for every step (FI, HR, ES), while others with more experience indicate the costs could be shared (IE, LV, PT, SI).

The lack of examples is understandable, as mature markets for biomethane are most commonly those with widespread grids to allow convenient and cost-effective offtake.

Example: DSO grid central injection point in Portugal



TSO central injection point: cost allocation



[1] On the Azores and Madeira islands there are isolated DSO grids where LNG brought from trucks has supplied the grid for over 20 years via Autonomous Gasification Units.

Reverse compression is largely treated as a cost for the gas grid operator

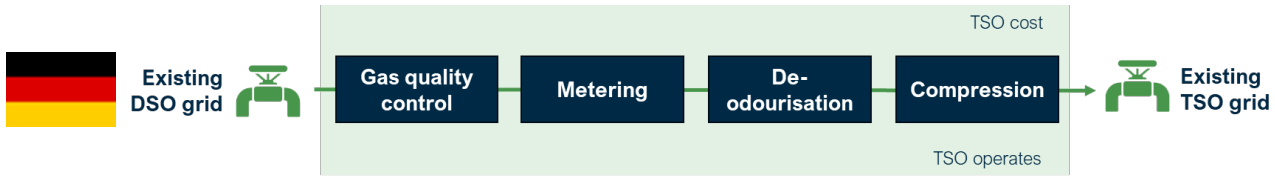
Nine Member States elaborated on the methodology in place to share the cost of reverse compression units. The components required for reverse compression stations differ depending on the need for odourisation and gas drying on the transmission grid.

The **majority of submissions indicate that the costs would be fully borne by the operators of high-pressure gas grids and socialised across their users.** This is the case in most countries with mature biomethane markets, e.g. DE, NL, DK.

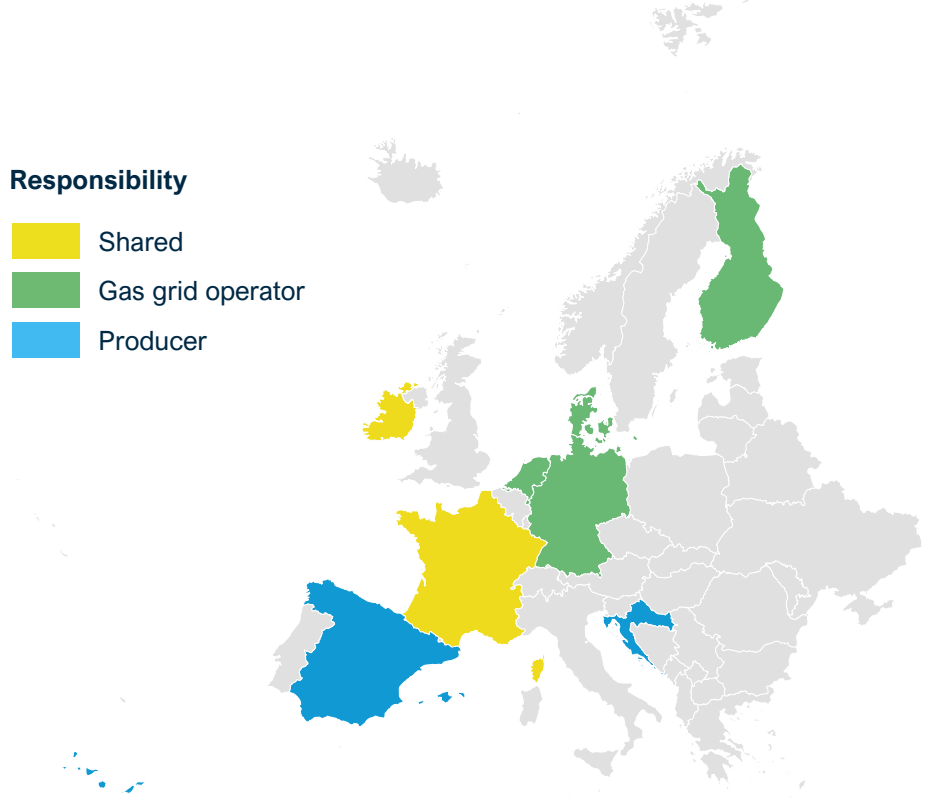
France and Ireland have cost-sharing methodologies. France charges a commodity-based injection tariff to plants injecting into grids with reverse compression of €0.70/MWh. Meanwhile, costs in Ireland would be split with 30% for the producer and 70% for the TSO, subject to an economic test, but this policy is currently under review.

Countries which indicate the producer will have to fully pay for reverse compression, HR, ES, & PT appear to **have limited experience** with reverse compression to date.

Example: Reverse compression station in Germany



DSO-TSO Reverse compression: cost allocation



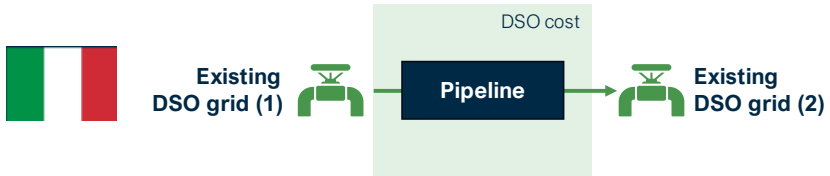
DSO network meshing is considered grid expansion and paid for by the grid operator

The large majority of the 10 submissions indicate that **DSO grid meshing is** commonly viewed as grid expansion, and thus, **a cost for the gas grid operator**.

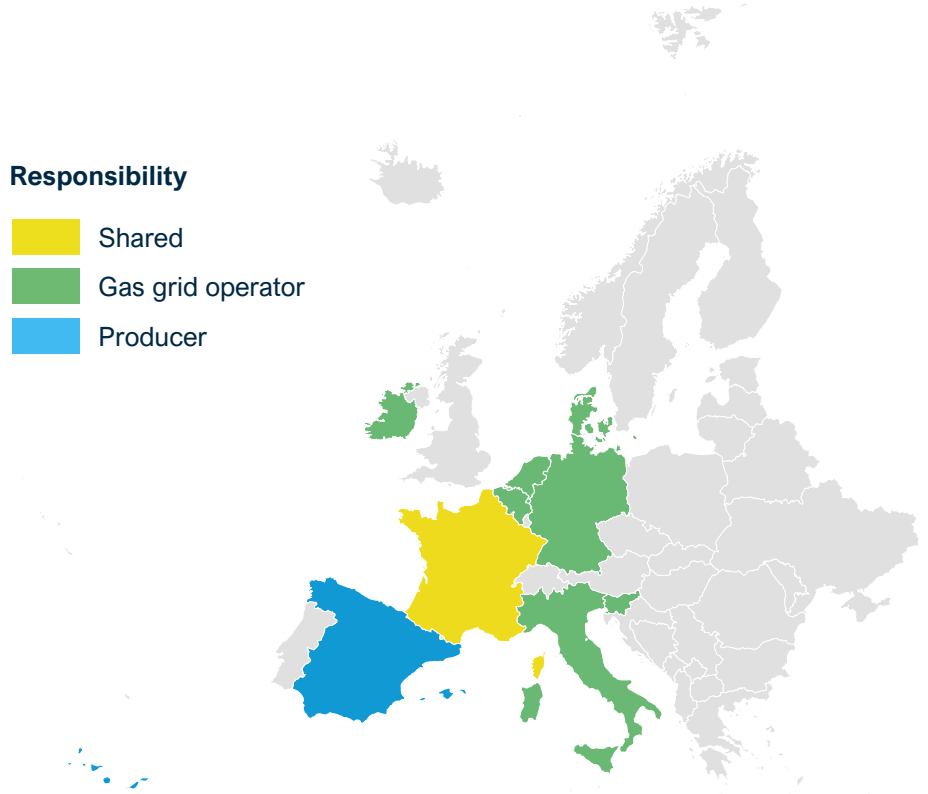
Depending on the local conditions, DSO grid meshing can connect two local grids from separate DSOs. If this is the case, metering is commonly required alongside the extra pipeline segment, a cost socialised across the grid users.

Cost sharing was only indicated in France, where again a commodity-based injection fee is used to share the costs of meshing grids with installations injecting to these grids (€0.40/MWh).

Example: DSO network meshing in Italy



DSO network meshing: cost allocation



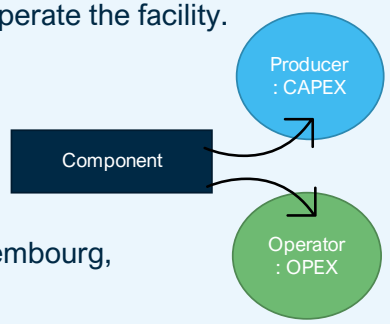
Overview of different cost sharing mechanisms

How can costs be shared between producers and grid operators?

Costs of grid connections and upgrades can be shared between the biomethane producer and the gas grid operators, this can be done in different ways, with many countries having a combination of the following cost sharing methodologies:

CAPEX / OPEX split

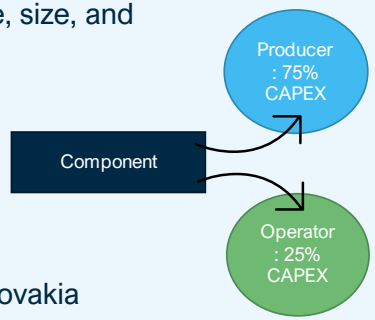
This is **typical when the producer pays for the full investment** required for the grid connection, but this is then given as a **concession asset to the gas grid operator**. The grid operator then pays to maintain and operate the facility.



Examples:
Estonia, Portugal, Luxembourg, Poland.

Regulated percentage contribution

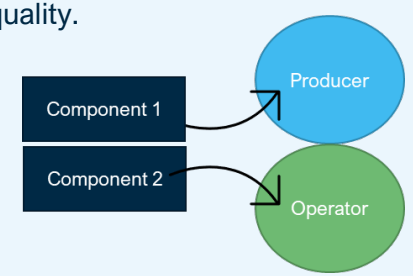
Here, **the CAPEX of the full connection or one component is shared at a rate set by the regulator**. This percentage can be fixed, or variable, with some countries setting limits based on distance, size, and economic viability.



Examples:
Belgium, Germany, France, Ireland, Italy, Slovakia

Component level cost sharing

The cost of components can also be **fully split between the parties based on regulation for the financial responsibility of certain components**. This is commonly observed where the producer is required to provide the gas at a certain pressure or quality.



Examples:
Czech Republic, the Netherlands

Some gas grid operators support connections, not through cost sharing but by de-risking the investment costs

In addition to cost sharing, several grid operators support the connection of biomethane to the grid by "**pre-financing**" some parts of the grid connections. This occurs in countries such as France, Denmark and others **where the gas grid operator makes the investment but bills the cost in full back to the producer over a longer time**. This can potentially be preferential for producers to reduce investment risk.


Five largest biomethane markets today

Legend

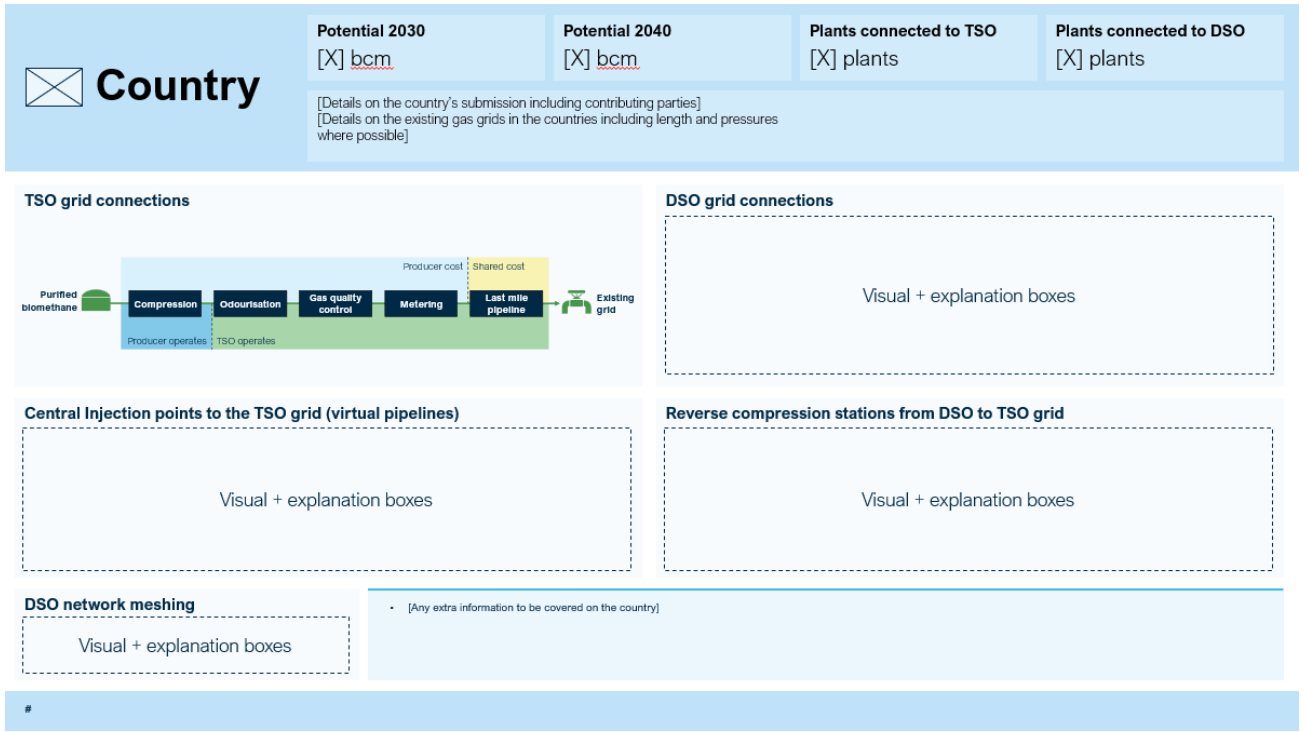
Introduction to country fact sheets

This report shows detailed results per EU Member States in the *Country Factsheets,* with the layout largely following the template shown on the right. Each factsheet shows results for each of the five grid investment categories explained on slide 9.

Financial and operational responsibilities are colour-coded, and notes are provided to clarify how this is distributed between the operator and the producer:

- **Green**: A gas grid operator responsibility.
- **Blue:** A biomethane producer responsibility.
- **Yellow**: A shared responsibility.
- **Grey:** Unknown / disputed responsibility, or a third party.

Additionally, the factsheets provide a brief overview of biomethane potential in each country[1], the number of plants connected to the DSO/TSO grids[2], and details on the contributing parties to this study, as well as information on the respective DSO and TSO networks[3]. Country fact sheets for the five EU MS with the most biomethane plants follow in this chapter, with the other EU MS fact sheets found in the Appendix.



[1] Guidehouse & EBA (2024) (link).
[2] EBA Statistical Database (2023).
[3] Marcogaz (2023) (link) and other country sources.

France

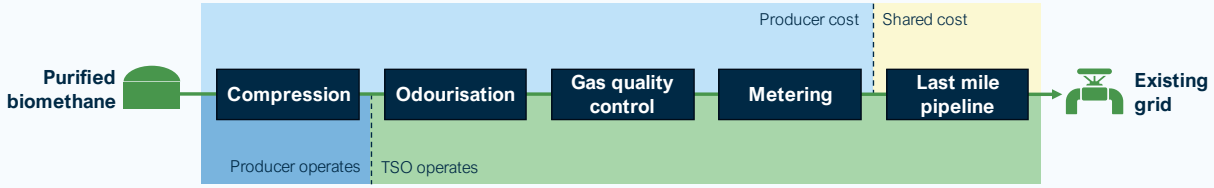
Potential 2030[1]	Potential 2040	Plants connected to TSO	Plants connected to DSO
5.1 bcm	14.6 bcm	106 plants	642 plants

In France the largest gas DSO **(GRDF**), TSO **(NaTran),** and the energy regulator (**CRE)** contributed to this study.

In France TSO networks are around 38,000 km in length and operated at pressures of between 16 and 95 bar, with DSO networks most commonly operating at pressures of 4 bar, up to a maximum of 25 bar, and are around 195,000 km in length.

TSO grid connections

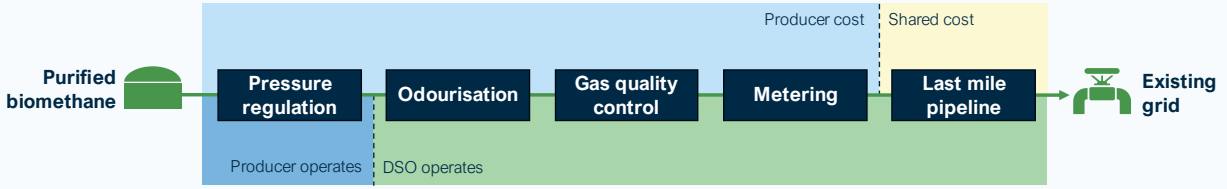
Producers pay for compression. The injection station is paid for initially by the TSO and rented to the biomethane producer up to a maximum of €60,000/yr. Next to this, there is an injection fee to recuperate the network costs for the TSO.[2] The pipeline is a shared cost.[3]



The TSO is responsible for the operation of the grid connection excl. compression

DSO grid connections

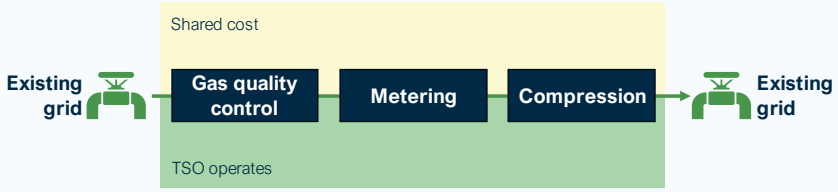
Producers pay for compression. The injection station is paid initially by the DSO and rented to the biomethane producer up to a maximum of €60,000/yr. Next to this, there is an injection fee to recuperate the network costs for the DSO.[2] The pipeline is a shared cost.[3]



The DSO grids are owned by local authorities. Through concession contracts, DSO designs, builds, operates and maintains the network grid.

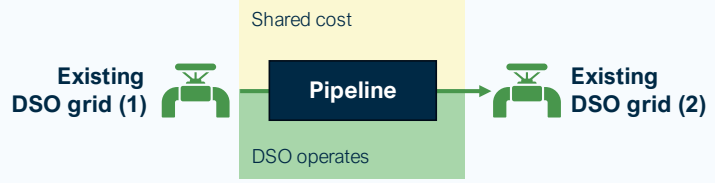
Reverse compression stations from DSO to TSO grid[4]

CAPEX is covered by the gas grid operator.
OPEX is financed by producers via a commodity-based injection tariff.[2]



DSO network meshing[4]

CAPEX is covered by the gas grid operator.
OPEX is financed by producers via a commodity-based injection tariff.[2]



Central Injection points to the TSO grid (virtual pipelines)

Not applicable as a result of the widespread gas grid coverage

[1] Based on the government's target (50 TWh biomethane in 2030, of which 44 TWh injected into the grid). The technical potential is 6.3 bcm (Guidehouse and EBA 2024).
[2] All injectors pay a capacity-based injection cost of €50/MWh/day/year and a commodity-based injection tariff. This is to recover the costs of the network, as well as grid upgrades. The commodity-based tariff is broken up into 3 categories:
Category 3: zones with a reverse compression or mutualised compression (€0.7 /MWh injected)
Category 2: zones with a meshing pipeline or a mutualised grid extension (€0.4 /MWh injected)
Category 1: all other zones (€0.0 /MWh injected)
[3] 60% of the CAPEX for the pipeline is for the grid operator up to a maximum of € 600,000. Above this, the producer pays the additional cost. OPEX is paid by the producer via an injection fee.
[4] Investments in **DSO grid meshing** and TSO **reverse compression stations** are only possible when the business case meets the techno-economic criteria for a good investment set by the regulator. Also, cumulated reinforcement investments shall not exceed 2% of the TSO's annual allowed revenues and 2% of the DSO's annual allowed revenues.

Germany

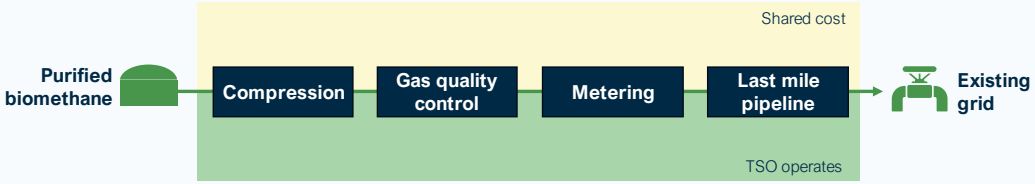
Potential 2030	Potential 2040	Plants connected to TSO	Plants connected to DSO
7.6 bcm	15.5 bcm	106 plants	52 plants

In Germany **Fachverband Biogas,** gas TSO **Thyssengas**, and the national energy regulator **BNetzA**, were the contributors to the study. It is important to note that the regulation depicted here represents the regulation until 2025, with a new regulation being developed for the end of 2025.

In Germany, the TSO network is around 47,000 km and typically operates at pressures of above 16 bar, while DSO networks are around 557,000 km and typically operate at 16 bar or less.

TSO grid connections[1]

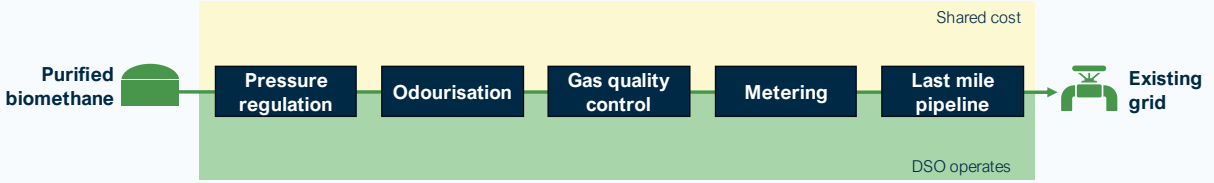
All costs for the grid feed-in station and pipeline are shared, with 75% of the cost to the grid operator, 25% of the costs to the producer, depending on the distance.[2]



The feed-in station and pipeline are owned and operated by the TSO

DSO grid connections

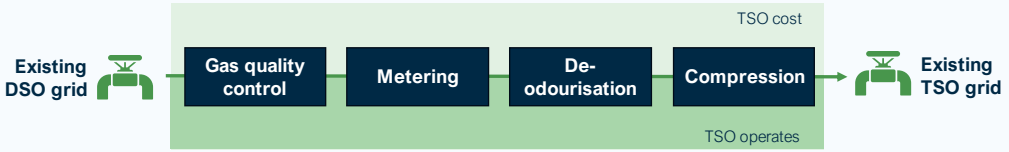
All costs for the grid feed-in station and pipeline are shared, with 75% of the cost to the grid operator, 25% of the costs to the producer, depending on the distance[2]



The feed-in station and pipeline are owned and operated by the DSO

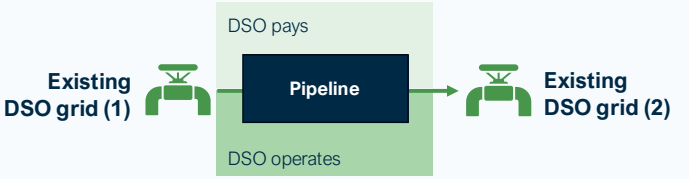
Reverse compression stations from DSO to TSO grid

100% of the CAPEX & OPEX are for the grid operators. Reverse compression investments are required to ensure biomethane plants can achieve injection 96% of the time, as required by law.



DSO network meshing

100% of the CAPEX & OPEX are for the DSO operator(s). In the case of two separate DSOs, metering is also required.



Central Injection points to the TSO grid (virtual pipelines)

Not applicable as a result of the widespread gas grid coverage

[1] Odourisation is required for a part of some TSO networks in Germany.
[2] The regulation on cost sharing is the same for TSO and DSO grid connections. If the connecting pipeline is below 10 km in length, then the costs are shared with a split of 75% for the gas grid operator and 25% for the producer. If the pipeline is longer than 10 km, the plant operator bears 100% of the additional costs. For connections with a pipeline length less than 1 km, the cost for the biomethane plant operator must not exceed €250,000. Costs related to biomethane grid connections and grid upgrades are covered by all gas grid users via the biogas levy, a charge to all gas grid users in their gas bill.

The biomethane producer can choose whether to connect to the DSO or TSO grid, depending on bids for the construction of the connection.

Italy

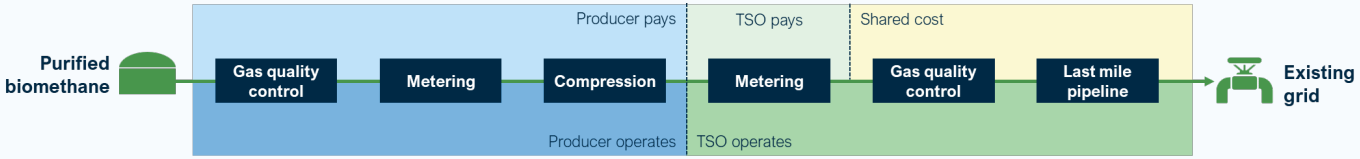
Potential 2030	Potential 2040	Plants connected to TSO	Plants connected to DSO
5.7 bcm	10.3 bcm	40 plants	7 plants

In Italy, **Italgas** (DSO) and **Consortzio Italiano Biogas** were the main contributors to the study.

The Italian TSO network is around 24,000 km and is operated above 5 bar, while the DSO grid is around 272,000 km and operates below 5 bar.

TSO grid connections

The biomethane producer is responsible for supplying biomethane at the quality and pressure required for grid injection. The TSO pays fully for the metering step in the grid connection, with the final quality control and pipeline costs shared using a formula defined in Snam's Transport code chapter 6.[1]

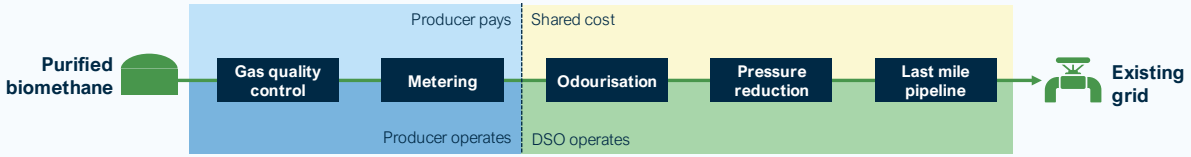


Producer operates their own metering and gas quality control alongside compression. The TSO also operates a metering and gas quality control step and the last mile pipeline becomes a TSO asset

DSO grid connections

100% CAPEX & OPEX for the producer

80% CAPEX for producer, 20% for the DSO. 100% OPEX for the DSO.



Operational responsibility is regulated by Resolution 64/2020, issued by the Italian Regulatory Authority for Energy, Networks, and Environment (ARERA).

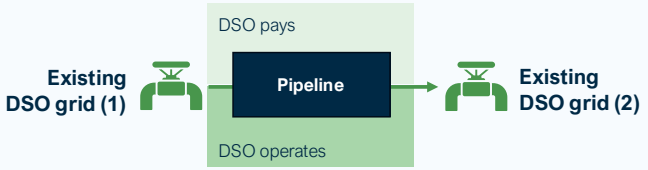
Central Injection points to the TSO grid (virtual pipelines)

Not applicable. Strong gas grid coverage in Italy reduces the immediate need for this solution

Reverse compression stations from DSO to TSO grid

Not applicable. This is currently being piloted, with no agreement currently on the regulation for cost sharing. There is no actual regulation for the reverse flow asset, but as of today, Resolution 404/R/GAS/2022 exists for experimentation.

DSO network meshing



[1] **Snam's transport code Chapter 6 paragraph 1.1.3** indicates the cost-sharing methodology. The calculated contribution (C) is based on the investment required into the shared costs (I) minus the costs of the eligible investment (Iamm) **C = I-Iamm**
I is calculated using the unit costs for the pipeline in € / metre [580 €/meter (pipeline) + 495 €/meter (other devices e.g. quality/automatic interception devices)], the distance of the connection, multiplied by any geographical/environmental cost factor **Iamm is calculated as CPe *Q * R** where CPe is the entry capacity charge (€/m^3/day/year) published in the regulated transport tariff session of the TSO website (i.e in 2025, the approved CPe values are in the following range: min = 0.985255 €/Scm/day/year and max =3.181543 €/Scm/day/year), Q = daily capacity transport at entry point, R is a discount factor (as published on Snam website, in 2024, R = 1/5.9%). For biomethane injection points, a value reduction coefficient of 0.8 is applied to the contribution. On the final contribution (C) a cap (franchise) defined by Snam that is equal to 148.825,00 € in 2024 is removed. **E.g. for a 500m3/h facility, 700m from the grid with an entry charge of €1/m^3/day/year, the shared investment is ~€ 750,000, with the producer contributing ~€ 290,000.**

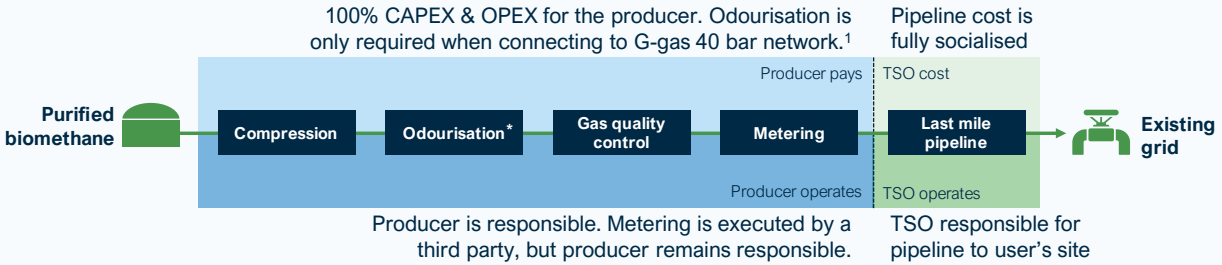
Netherlands

Potential 2030	Potential 2040	Plants connected to TSO	Plants connected to DSO
1.2 bcm	2.3 bcm	4 plants	90 plants

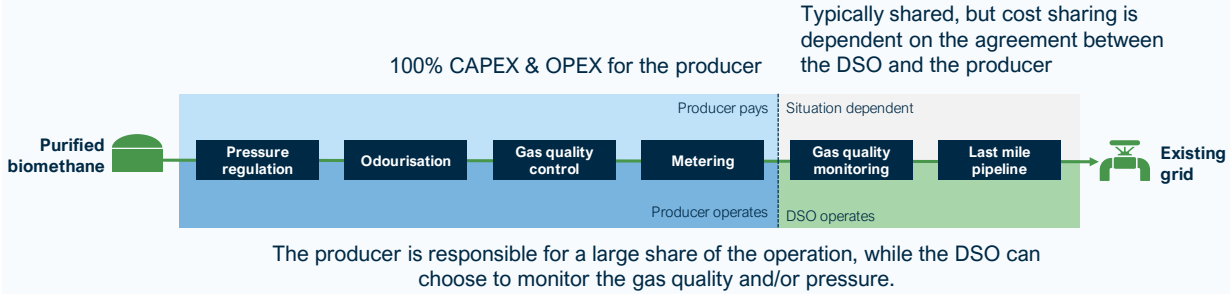
In the Netherlands, **Platform Groen Gas**, was the main contributor to the study, collecting insights from **Netbeheer Nederland**, the national association for grid operators.

The Dutch TSO network is around 12,000 km and operated between 40-80 bar, while the DSO network is around 123,600 km and operated under 8 bar.

TSO grid connections



DSO grid connections[2]



Central Injection points to the TSO grid (virtual pipelines)

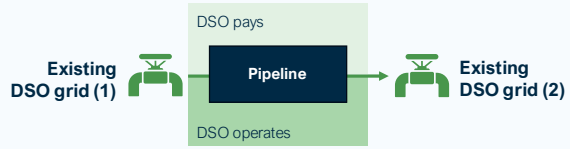
Not applicable as a result of the widespread gas grid coverage

Reverse compression stations from DSO to TSO grid

100% CAPEX & OPEX for the grid operators. A gas drying step can be required depending on the TSO network specifications. Within the TSO grid, further reverse compression above 40 bar could lead to deodorisation being required

DSO network meshing

100% CAPEX & OPEX for the DSO operator(s). In the case of two separate DSOs, metering is also required.



[1] G-gas network is the network of pipelines in the Netherlands that transport low calorific gas.
[2] The **components required per grid connection change depending on the DSO making the connection**. The DSO determines for itself what elements it wants to have after the producer's injection station. This can include valves, gas quality monitoring, and pressure monitoring / control before the last mile pipeline. Alternatively, a large share of this can be avoided with data sharing. Cost sharing of the elements after the injection station is subject to agreement between the biomethane producer and the DSO. DSOs can also carry out periodic audits of the producer's injection station at their own cost.
Each DSO grid connection begins with a 4-week test period where the DSO uses its own temporary injection station to control gas quality and ensure the gas is up to the quality required for grid injection. This is paid for by the DSO.

It is worth noting that there are two plants in the Netherlands that have a grid connection to both the DSO and TSO gas grids, with the TSO injection point used when the DSO grid cannot absorb new biomethane injection.

Denmark

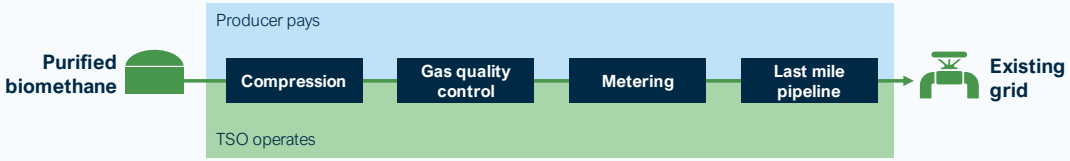
Potential 2030	Potential 2040	Plants connected to TSO	Plants connected to DSO
0.8 bcm	1.8 bcm	1 plants	57 plants

In Denmark, **Evida**, the DSO and **Energinet**, the TSO, contributed to the study.

In Denmark, the TSO network is around 860 km and operated under 80 bar, while the DSO network is around 18,000 km in length (3,000 km of which is high pressure) and is operated under 40 bar.

TSO grid connections

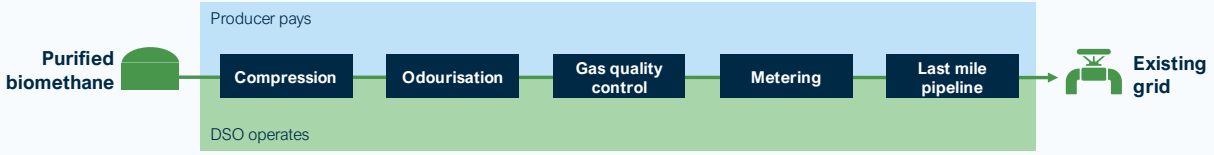
The biomethane producer pays all the CAPEX elements up front at the time of connection, with the OPEX billed quarterly.



All components are operated by the TSO.

DSO grid connections

Compression CAPEX and OPEX are paid initially by the DSO and charged to the producer via an injection side gas grid tariff. The remainder of the connection is paid by the producer up front at the time of connection, with the OPEX billed to the producer.



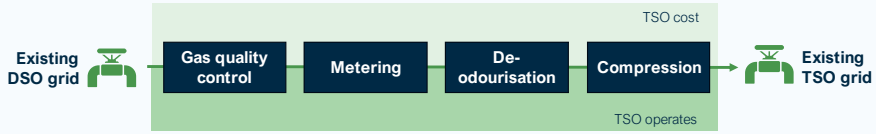
All components are operated by the DSO.

Central Injection points to the TSO grid (virtual pipelines)

Not applicable

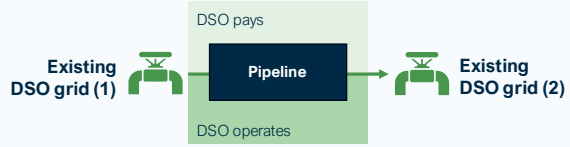
Reverse compression stations from DSO to TSO grid

The costs are borne by the TSO as it is considered part of expanding the grid.



DSO network meshing

CAPEX and OPEX are brought in as part of the injection tariff.



[1] This also includes valves and an anti-corrosion cathode system.

The injection fee charged to grid connections is a part of the new regulation applied since January 2025, where consumption and production connections have separate tariffs. Compression is a part of the injection tariff, while metering regulation stations are paid via the consumption tariff.

Injection fees and the cost of injection units

Injection fees for producers can be biomethane specific or general gas grid charges

Alongside investigating how the financial and operational responsibility of grid connection and upgrades is shared, this study investigates the presence and level of injection fees for biomethane plants, and the cost of the grid injection unit.

Injection fees

For coherency with earlier work on this topic, the definition of injection fee is taken from the GreenMeUp study (2024)[1] as: "*the charges associated with injecting biomethane into the gas grid. The charges can be related to the installation and maintenance of metering and measurement systems, grid access charges and costs for ensuring gas quality".*

Where possible, we distinguish between injection fees that are general gas grid charges and fees that are specifically for biomethane producers. These injection fees can be based on the capacity of the grid injection point, or the volume of gas injected into the grid from the injection point, named **capacity-based injection fees** and **commodity-based injection fees,** respectively.

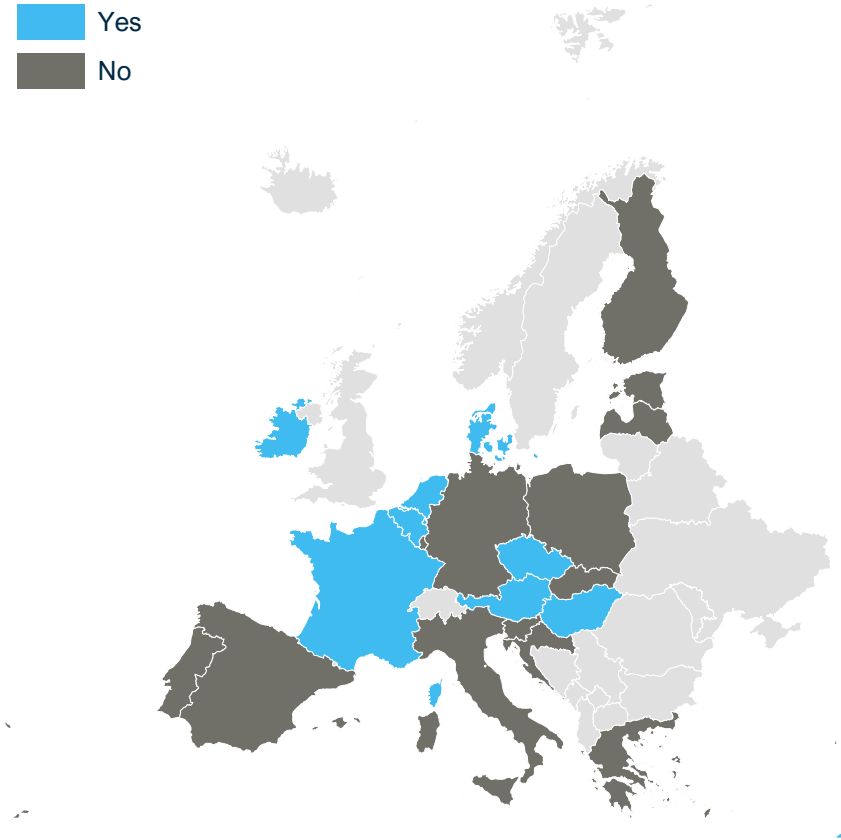
[1] **GreenMeUp 2024.** Variations in national regulations with respect to biomethane grid connection (link).

Injection fees and cost of injection units

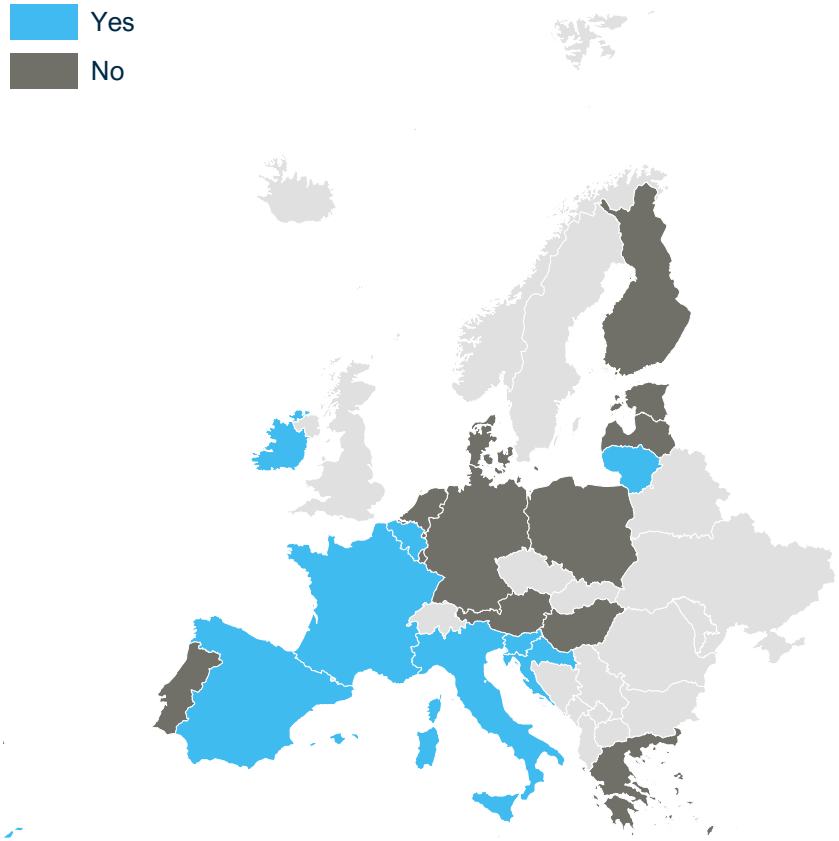
9 countries have DSO injection fees, and 8 countries have TSO injection fees for biomethane

Between countries, there is no standardisation of injection fees. Some countries choose **not to charge an injection fee** to biomethane producers. This is mentioned in the Decarbonised Gas Package by the European Commission (Article 18 of Regulation (EU) 2024/1789) as a possibility to promote renewable energy. Not all countries have chosen this option however, with both mature and emerging markets applying injection fees to biomethane producers, with 9 DSOs and 8 TSOs applying injection fees across the EU.

Is there an injection fee for biomethane plants on the DSO grid?



Is there an injection fee for biomethane plants on the TSO grid?



Injection fees and cost of injection units

DSO injection fees for producers reported in EU MS

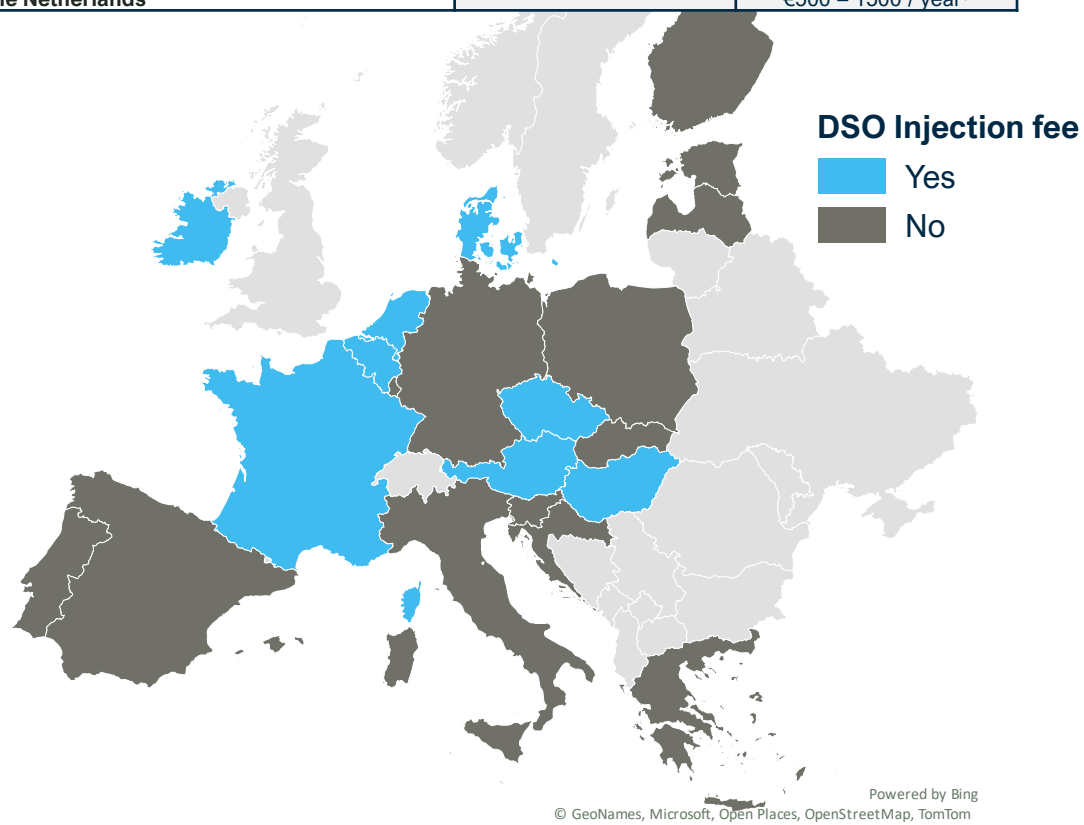
Capacity-based injection fees:
DSO grids in Denmark, France, and the Netherlands are reported to have capacity-dependent injection fees related to recovering the cost of the network (in FR), and the cost of the connection (in DK, NL).

Commodity-based injection fees:
Commodity charges are present in several countries, with varying levels and reasoning.

In the Czech Republic, this small charge aims to charge for natural gas mining, but the wording of the current law makes it applicable to biomethane injection. This fee is relatively low in Austria and Denmark but can reach up to € 0.87/MWh in Wallonia and €0.944/MWh in Flanders, albeit with maximum contributions per plant to avoid too high a charge for producers.[1]

In France, this commodity-based charge is applied to recover the costs of grid upgrades and depends on the grid category you are connected to.[2]

Country	Commodity based fee	Capacity based fee
Austria	€0.268 / MWh	/
Belgium (Flanders)	€0.944 / MWh	/
Belgium (Wallonia)	€0.87 / MWh	/
Czech Republic	€0.05 / MWh / day	/
Denmark	€0.40 / MWh	
France	€0 – 0.40 – 0.70 / MWh	€50 / MWh / day / year
Hungary	Confidential – based on too few plants	
Ireland	Confidential – based on too few plants	
The Netherlands		€500 – 1500 / year[3]



[1] In Wallonia, this injection fee is charged to a maximum contribution of €50,000 per year per plant.
[2] Category 3: zones with a reverse / mutualized compression (€0.7/MWh)
Category 2: zones with a meshing pipeline / mutualized grid extension (€0.4/MWh)
Category 1: all other zones (€0.0/MWh)
[2] Based on capacity ranges of average sized plants, estimates differ between grid operators

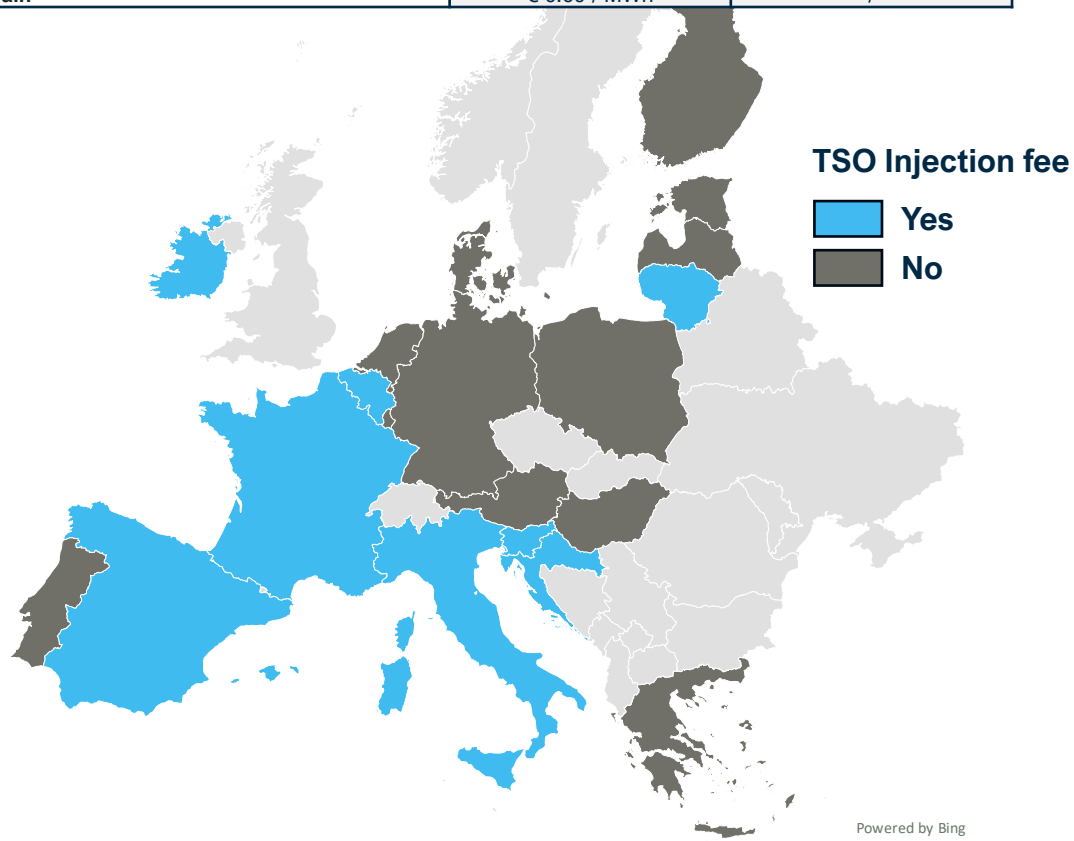
Injection fees and cost of injection units

TSO injection fees for producers reported in EU MS

Capacity-based injection fees:
TSO grids in Belgium, France, Ireland, and Lithuania have capacity-dependent injection fees. In France and Ireland, these fees are specific for renewable gas injection. In Belgium, this charge is a mix of a general entry fee, and a pressure service charge that is specific for the biomethane injection station. In Italy and Lithuania this fee is related to general gas injection onto the grid.

Commodity-based injection fees:
The commodity-based injection fees charged on the TSO grid vary significantly. In France, the same commodity charge applied to the DSO grid applies to the TSO grid. This fee is for all gas injected onto the grid in Ireland, Slovenia, and Spain.

Country	Commodity based fee	Capacity based fee
Belgium	/	€1.3 / kWh / h / year
Croatia	/	Unit dependent
France	€0 – 0.40 – 0.70 / MWh	€50 / MWh / day / year
Ireland	€0.162 / MWh	€208 / peak day MWh
Italy	/	€0.99 – 3.18 / m^3 / day / year
Lithuania	/	€143 / MWh / day / year
Slovenia	€ 0.14082 / kWh / day	/
Spain	€ 0.60 / MWh	/

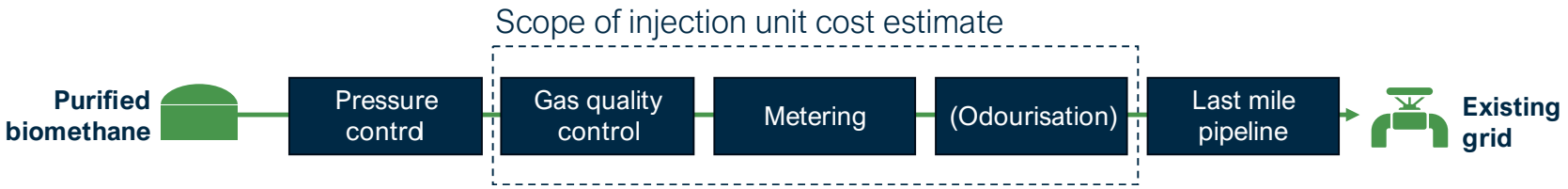


Injection fees and cost of injection units

Grid injection units costs vary significantly depending on local conditions and national law

Grid injection units are stations **where the gas pressure is regulated, the gas quality and quantity are measured, and the gas is given an odour**, if required, before being sent towards the last-mile pipeline and existing gas grid. **Grid requirements and national conditions can significantly influence the cost of grid injection units as a result of** gas quality requirements, pressure requirements, the need for odourisation, and other national conditions. As such, it can be valuable to understand how the cost of these injection units changes per country.

While compression and last-mile pipelines are commonly the largest cost elements related to injecting biomethane into the grid, it is also important to investigate how the average cost of the remainder of the grid injection units can change depending on the country and linked requirements. To focus on these elements the cost estimates provided for this study have the scope shown in the figure above, excluding the cost of compression and the last mile pipeline.



Grid injection units costs vary significantly depending on local conditions and national law

From the questionnaire and interview process participants shared some important insights into how the cost of grid injection units can change between EU MS. Some notable insights are :

- **TSO grid injection stations** in many countries **do not require odourisation** components. This removes an important cost element, however, without odourised gas the grid injection unit must use **steel pipes** to minimise the risk of undetected leaks, which can in turn be an increased cost.
- **Grid quality requirements can be country-specific**,[1] leading to more costs in countries with higher quality standards, and thus, higher equipment costs. Such an example is Germany, which has strict requirements on the gas injected into the grid in regard to oxygen content, silicone content, etc., leading to higher equipment costs.
- If the calorific value of the injected biomethane needs to be adjusted, this can require the mixing of the biomethane with other gases such as liquid petroleum gas or propane to increase the calorific value, or nitrogen to reduce the calorific value. This can be a locally determined cost that influences the cost of injection units.
- **Another important element that influences the cost of injection units is the capacity of the injection unit and the connected biomethane plant**.

[1] **Marcogaz 2024.** Quality of biomethane required in European countries for injecting into natural gas grid (link)

Injection fees and cost of injection units

Injection unit cost without compression and pipeline can range from €200,000 – €1,800,000 on average

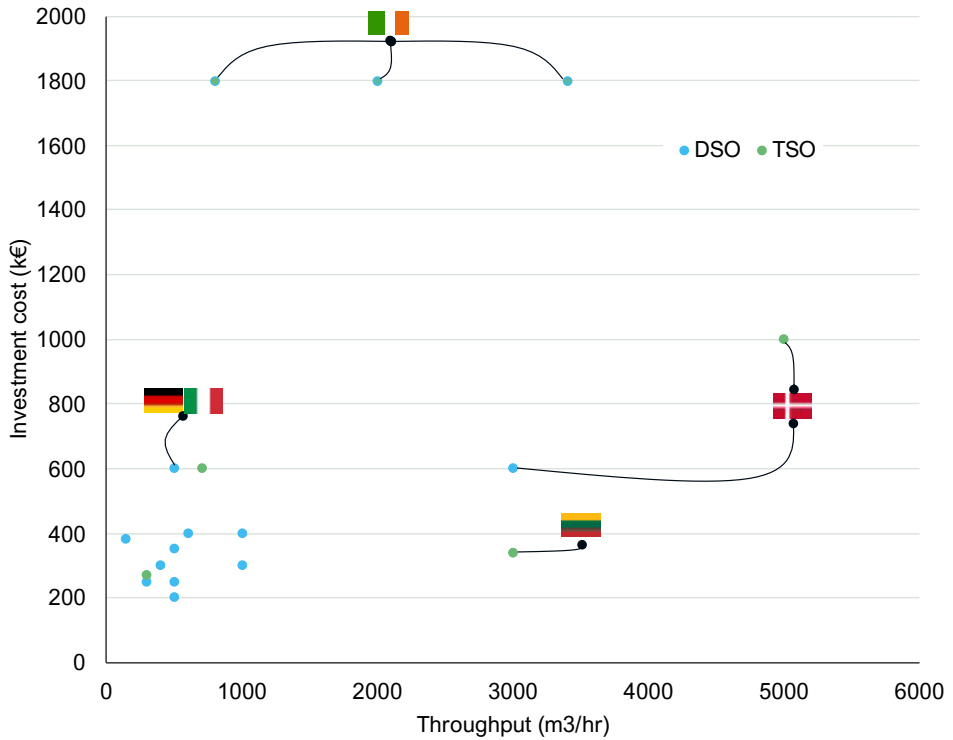
Investment costs of injection units connected to the DSO grid vary between € 200,000 and € 1,800,000, based on 8 submissions, while the investment cost of injection units connected to TSO grids varies between € 300,000 and €1,800,000 based on 3 submissions. The graph compares the investment cost of the injection unit with the capacity of the unit. It is notable that injection units in Germany or Italy of 500m^3/hr cost €600,000 with units of the same size costing between €200,000 and €380,000 in 3 other countries. **High gas quality standards could be the main cause of this**.

Submissions indicate that **size is often not the most important factor that determines the cost of an injection unit**. A clear example of this is Ireland, where the cost of the injection unit is €1,800,000 with a throughput capacity of 800 – 3,200 m^3/h. This cost estimate is significantly higher than the rest of Europe and potentially a result of national factors, with pipeline costs in Ireland also 3 to 4 times more expensive per km than pipeline costs in mainland Europe.

While injection unit costs vary with some relation to capacity, Denmark and Lithuania show that this is not a linear relationship.

National law can also impact total grid connection costs in other ways, with some countries e.g. Germany, Austria, requiring **largely uninterrupted injection capacity for producers, which can significantly impact the total cost of injection by requiring overcapacity of compression This is outside the scope of the cost estimates above.**

Investment costs of injection units (metering, gas quality control and potentially odourisation) and their throughput



*The TSO submission from Denmark is provided from experience with constructing reverse compression stations with the same components as required for an injection unit.

Appendix:
Country fact sheets

Austria

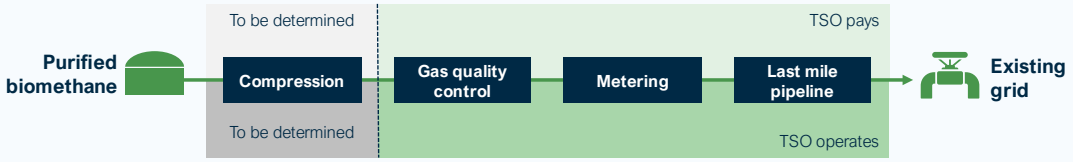
Potential 2030	Potential 2040	Plants connected to TSO	Plants connected to DSO
0.6 bcm	2.2 bcm	0 plants	14 plants

In Austria the National Biogas Association **Kompost-Biogas**, was the main contributor to the study, with a review from the energy regulator **E Control**.

In Austria, the TSO network is around 1,700 km and operates up to 70 bars, while the DSO network is around 45,300 km, with the large majority operating up to 6 bar (39,500km), and two other higher pressure level grids.

TSO grid connections

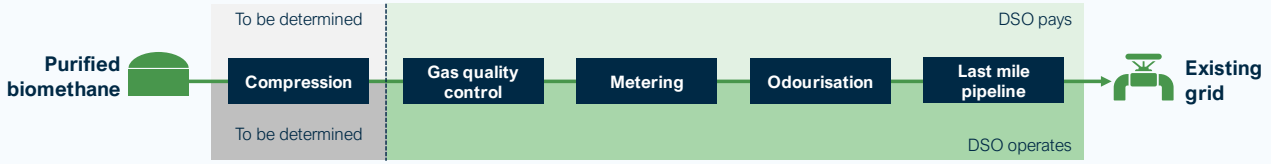
100% CAPEX & OPEX for the TSO except additional costs when the grid connection is above a defined quotient and a pipeline of over 3km.[1] Regulation on sharing the cost of compression is interpreted differently by the contacted parties



The grid connection is fully operated by the TSO

DSO grid connections

100% CAPEX & OPEX for the TSO except additional costs when the grid connection is above a defined quotient and a pipeline of over 3km.[1] Regulation on sharing the cost of compression is interpreted differently by the contacted parties



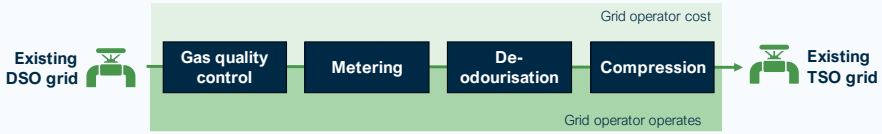
The grid connection is fully operated by the DSO

Central Injection points to the TSO grid (virtual pipelines)

Central injection points to the TSO grid (virtual pipelines) were determined by scientific studies to be uneconomical in Austria, with grid coverage and feedstock availability meaning most likely plant locations are relatively close to the current gas grid.

Reverse compression stations from DSO to TSO grid

Full cost and operation of reverse compression is the responsibility of the gas grid operators.[2]



DSO network meshing

Not applicable / No data available

[1] Pursuant to rules in § 75 of the Austrian gas law, grid connections with a quotient of up to 60 lfm/m³CH_4-eq/h shall have the following grid connection costs paid by the grid operator: 1. grid access for the feed-in of renewable gases, 2. quantity measurement, 3. the quality check, 4. any odourisation, 5. compressor stations or pipelines required for continuous feed-in. **If the quotient is up to 60 lfm/m³CH_4-eq/h the gas grid operator pays the full cost up to 3km pipeline distance for new plants and up to 10km for existing biogas plants converting to biomethane plants.** If the distance of pipeline is longer than this, then the pipeline is paid in full by the producer. In practice, most producers are within 5km of the grid.

[2] The grid operator is obliged to do reverse flow if needed, in order to guarantee availability of the gas grid of >8000 hrs/yr.

Belgium

Potential 2030	Potential 2040	Plants connected to TSO	Plants connected to DSO
0.6 bcm	1.1 bcm	1 plants	7 plants

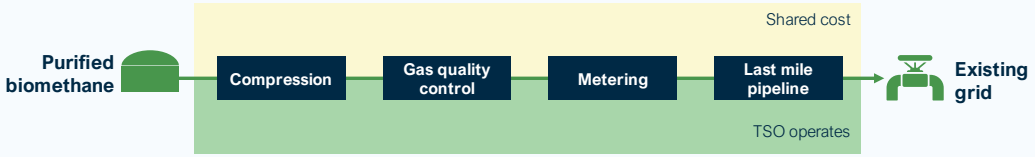
In Belgium a national biomethane association (**Gas.be**), gas grid DSOs (**Fluvius, Ores, Resa**), a gas grid TSO (**Fluxys**) and the national energy regulator (**CREG**) all played an important role in providing input for the study.

In Belgium, the TSO network is around 4,100 km and operated between 14.7 - 80 bar while the DSO network is operated under 14.7 bar, and has a total length of around 75,000 km.

TSO grid connections

CAPEX is shared 50% for the producer and 50% for the TSO.[1] Variable OPEX is for the producer, fixed OPEX is for the TSO.

Roughly 90% of the pipeline CAPEX is paid by the producer, the remainder by the TSO[2]



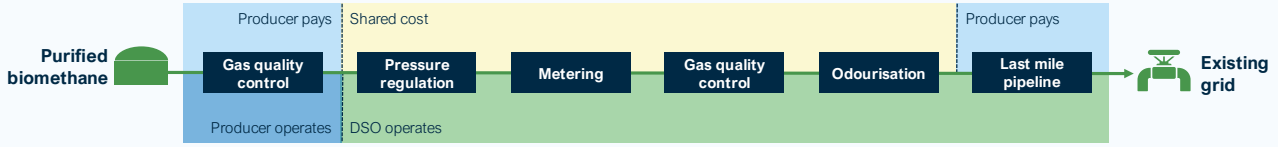
The TSO is responsible for operating the full grid connection

DSO grid connections (Flanders)

The producer must have a quality control step

The producer pays the CAPEX for the injection cabin, pressure regulation, and metering. Other CAPEX is for the DSO. The OPEX is paid by the producer via an injection fee.

Full cost for the producer



Both producer and DSO are responsible for the gas quality control

The DSO operates the remainder of the grid connection and conducts the final quality control check

Central Injection points to the TSO grid (virtual pipelines)

Not applicable / No data available

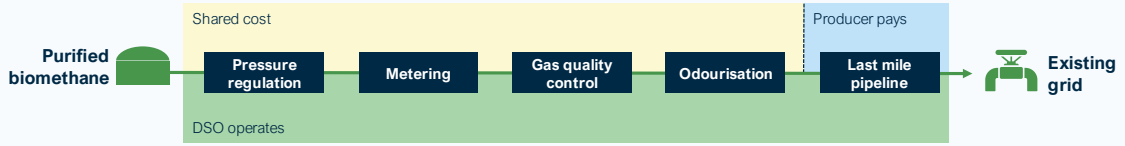
Reverse compression stations from DSO to TSO grid

Not applicable / No data available. Regulation currently under development

DSO grid connections (Wallonia)

CAPEX is covered by the DSO, socialised, and partly included in the injection fee. The OPEX is paid by the producer via an injection fee.

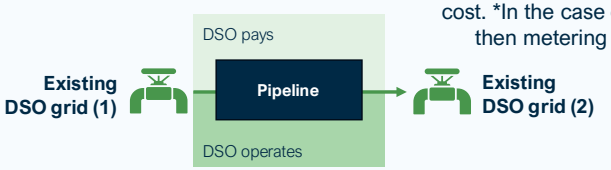
Full cost for the producer



The DSO is responsible for operating the grid connection

DSO network meshing

100% CAPEX & OPEX for the DSO operator(s) and it becomes a socialised cost. *In the case of 2 separate DSOs then metering is also required.



[1] The CAPEX cost sharing is size-dependent, with a 50:50 split above a size of ~1000m^3/h, below this, the producers' share of the cost increases. The producer has to offer financial security for 10 years and repay the CAPEX and OPEX via an injection fee to the TSO. Producers may choose to build, pay for, and operate the compressor themselves, which may be more appropriate for smaller units.

[2] The pipeline cost sharing is dependent on the size of the pipeline, but is typically split with a 90% cost to the producer and 10% to the TSO. Lengths do not exceed 4 km.

The injection fee for biomethane plants in Belgium differs per region, with a rate of €0.9449/MWh in Flanders, and €0.87/MWh in Wallonia. There is a cap of €50,000 paid by the producer per annum on the injection fee.

Croatia

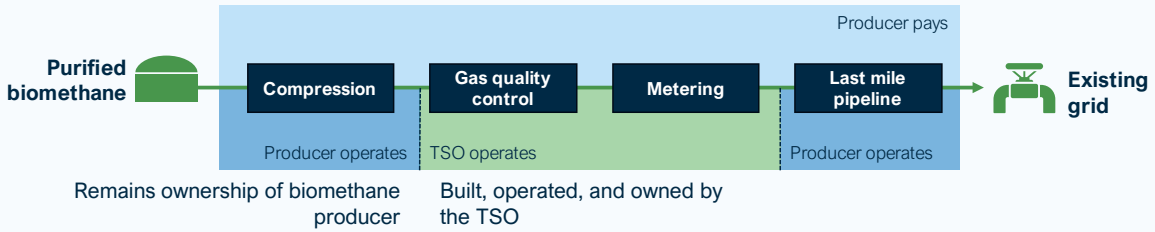
Potential 2030	Potential 2040	Plants connected to TSO	Plants connected to DSO
0.2 bcm	0.5 bcm	0 plants	0 plants

In Croatia **Plinacro**, the national TSO was the main contributor to the study.

In Croatia, the TSO network is around 2,500 km and operated around 50-70 bar. The DSO network is around 18,400 km in length.

TSO grid connections

Compression is the financial responsibility of the producer. The injection unit and last-mile pipeline are built by the TSO and then billed to the producer. The connection pipeline is paid for and built by the producer

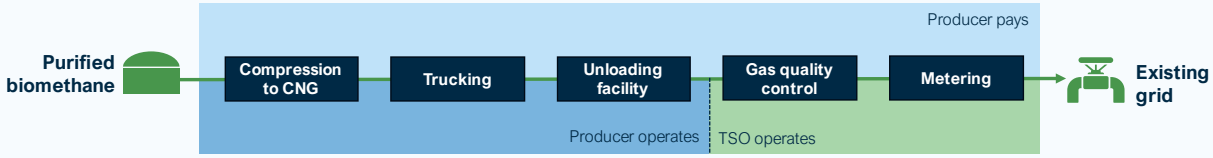


DSO grid connections

Not applicable / No data available

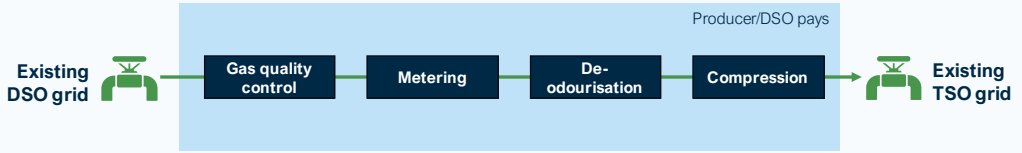
Central Injection points to the TSO grid (virtual pipelines)

The costs are the responsibility of the producers



Reverse compression stations from DSO to TSO grid

Currently not required, however, under current regulation, this cost of connecting to the TSO network would fall to the connecting party, the DSO, who could either socialise the cost or charge it to the producer.



DSO network meshing

Not applicable / No data available

Czech Republic

Potential 2030	Potential 2040	Plants connected to TSO	Plants connected to DSO
0.7 bcm	2.3 bcm	0 plants	9 plants

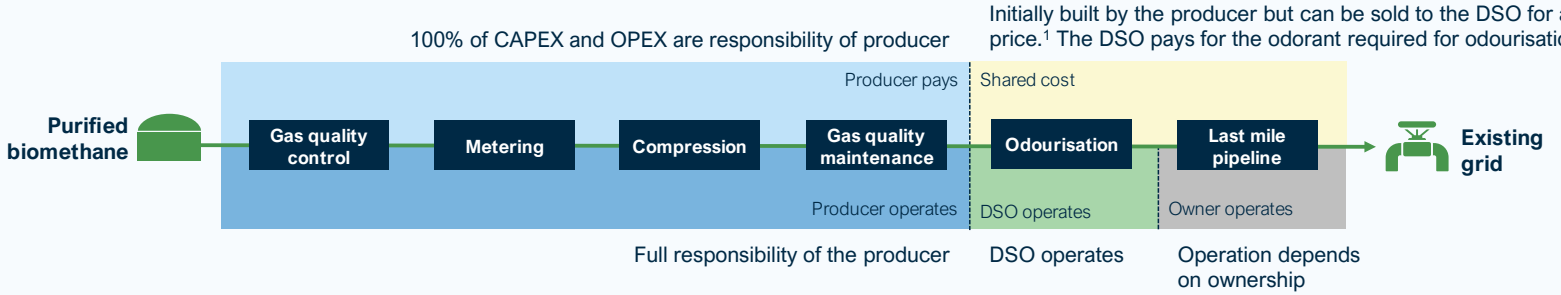
In Czech Republic the DSO **Gasnet** was the main contributor to the study.

The Czech TSO network is around 3,800 km and operated above 40 bar. The DSO network is around 72,900 km and operated under 40 bar. Gasnet operates a large network with long pipelines of relatively high pressure (even >20bar), and medium and low-pressure pipelines

TSO grid connections

Not applicable / No data available

DSO grid connections



Central Injection points to the TSO grid (virtual pipelines)

Not applicable / No data available. Could be developed in the future for the high-pressure part of the DSO grid.

Reverse compression stations from DSO to TSO grid

Not applicable / No data available. Currently a topic of discussion with the regulator

DSO network meshing

Not applicable / No data available

[1] ***Cost sharing of last mile pipeline and odourisation:*** the producer can offer these components to the DSO. In this case, the DSO has to buy it and pay a certain fraction of the components value (value is min(construction costs, tabular value)*depreciation). The fraction is computed based on a fraction of capacity and length of pipeline, so that for fraction VTP= production capacity (Nm^3/h) / length (km):
VTP> 100 (Nm3/h/km) the price for sale is 95% * value
VTP<30 (Nm3/h/km) the price is 0
VTP in between the price is [0,95-0,0136*(100-VTP)] * value (linear interpolation)

Biomethane production installations are **not connected to the TSO grid** in Czech Republic currently. Gasnet determines the connection point of the biomethane plant on the DSO network, with an NPV model calculation used to determine the most attractive option. **Central injection points** are also not yet done and unlikely to happen, although such a concept could be established in the DSO grid, some test injection from CNG cylinders has been done in an existing injection point. There are discussions on the possible need for DSO to TSO grid **reverse compression**, but so far, the Gasnet high-pressure grid can absorb injected gas. Another question is reverse flow within the DSO network. There, the discussion needs to start with the regulator. There are **no meshed DSO networks**.

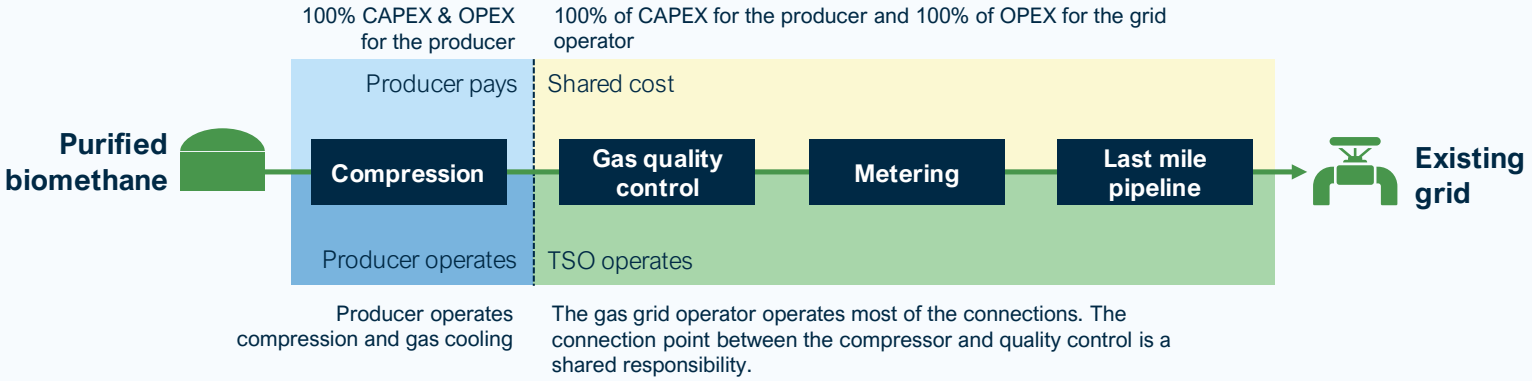
Estonia

Potential 2030	Potential 2040	Plants connected to TSO	Plants connected to DSO
0.1 bcm	0.3 bcm	0 plants	4 plants

In Estonia, **Mõnus Minek SEES - Sustainable Energy and Environment Solutions LLC**, and the gas TSO **Elering** were the main contributors to the study.

In Estonia, the TSO network is around 880 km and operates above 16 bar while the DSO network is around 2,000 km and operates under 16 bar.

TSO grid connections



DSO grid connections

Not applicable / No data available

Central Injection points to the TSO grid (virtual pipelines)

Not applicable / No data available

Reverse compression stations from DSO to TSO grid

Not applicable / No data available

DSO network meshing

Not applicable / No data available

Finland

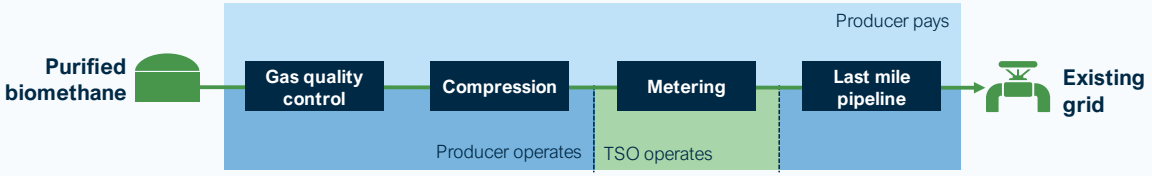
Potential 2030	Potential 2040	Plants connected to TSO	Plants connected to DSO
0.8 bcm	3.6 bcm	4 plants	1 plants

In Finland, **Gasgrid Finland**, the national gas TSO, was the main contributor to the study.

In Finland, the TSO network is around 1,200 km and can operate up to 80 bar.

TSO grid connections

100% of CAPEX and OPEX are responsibility of producer. Gasgrid Finland own and operate the metering. This is paid for through a connection fee which is determined on a case-by-case basis.

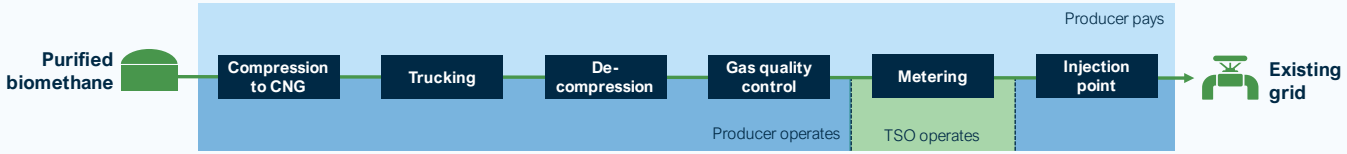


DSO grid connections

Not applicable / No data available

Central Injection points to the TSO grid (virtual pipelines)

The producer pays for the CAPEX and OPEX of onsite assets, though sharing the costs of compression / liquefaction. The grid injection facility is a cost for the grid operator.



Reverse compression stations from DSO to TSO grid

DSO network meshing

Not applicable / No data available

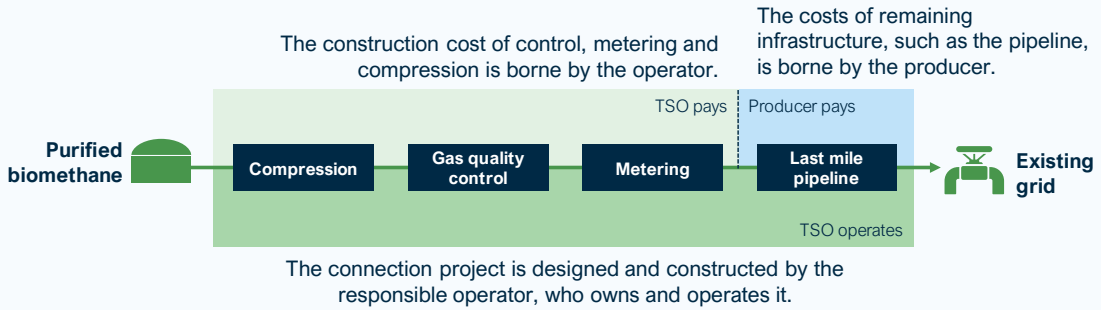
Greece

Potential 2030	Potential 2040	Plants connected to TSO	Plants connected to DSO
0.5 bcm	1.7 bcm	0 plants	0 plants

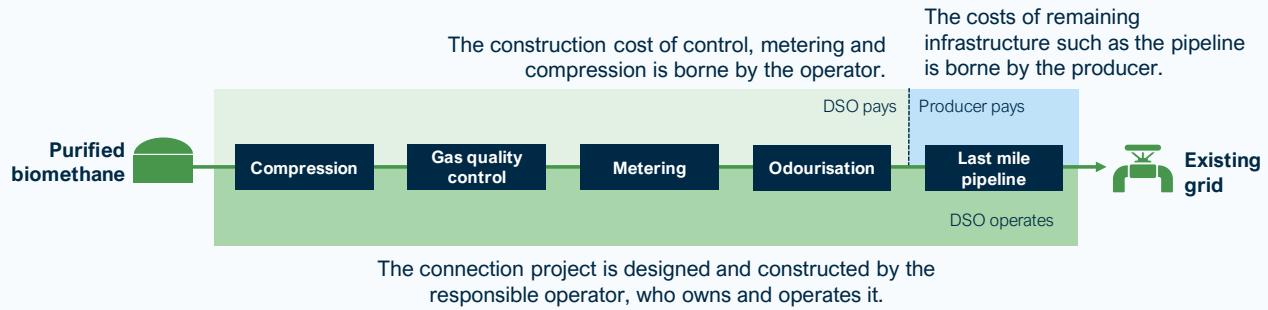
In Greece, the **Hellenic Association of Biogas Producers (HABIO - Ελληνικός Σύνδεσμος Παραγωγών Βιοαερίου)**, was the main contributor to the study.

In Greece, the TSO network is around 1,200 km operating between 16 and 80 bar, while the DSO grid is around 3,800 km and operates under 16 bar.

TSO grid connections[1]



DSO grid connections[1]



Central Injection points to the TSO grid (virtual pipelines)

Not applicable / No data available

Reverse compression stations from DSO to TSO grid

Not applicable / No data available

DSO network meshing

Not applicable / No data available

[1] **The information displayed above is based on the draft legislation on the connection of biomethane plants to the grid in Greece, as such it is subject to change.**

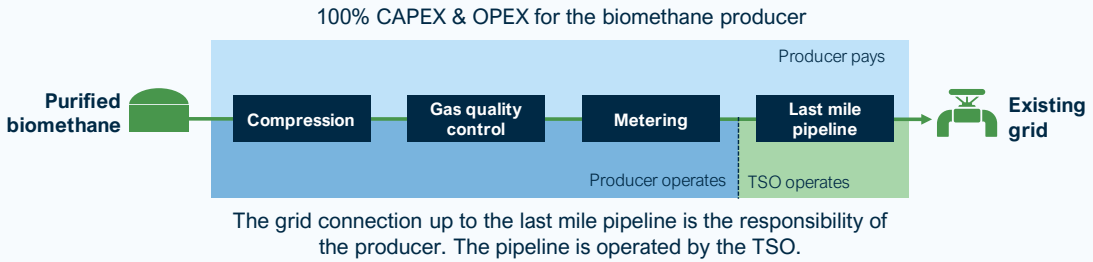
Hungary

Potential 2030	Potential 2040	Plants connected to TSO	Plants connected to DSO
1.0 bcm	2.6 bcm	0 plants	0 plants

In Hungary, the National Biogas Association **EMPB**, was the main contributor to the study.

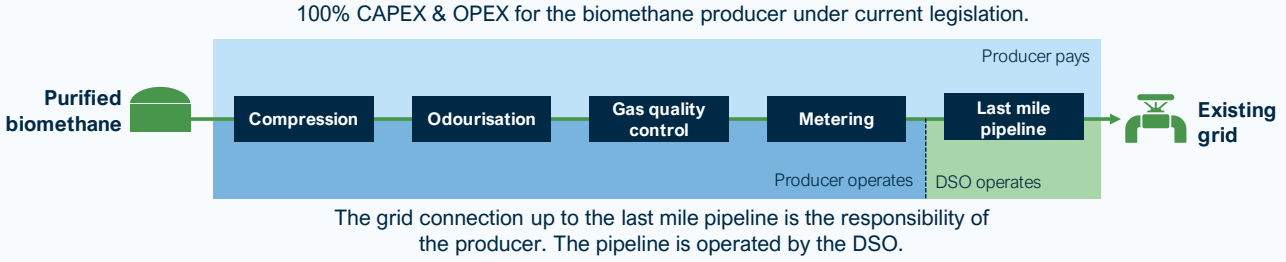
The Hungarian TSO network is around 5,800 km and operates above 25 bar, while the DSO is operated below 25 bar.

TSO grid connections



The grid connection up to the last mile pipeline is the responsibility of the producer. The pipeline is operated by the TSO.

DSO grid connections



The grid connection up to the last mile pipeline is the responsibility of the producer. The pipeline is operated by the DSO.

Central Injection points to the TSO grid (virtual pipelines)

Not applicable / No data available

Reverse compression stations from DSO to TSO grid

Not applicable / No data available

DSO network meshing

Not applicable / No data available

Ireland

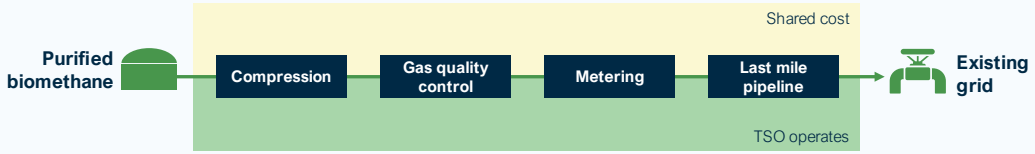
Potential 2030	Potential 2040	Plants connected to TSO	Plants connected to DSO
0.7 bcm	1.1 bcm	0 plants	1 plants

In Ireland **Commission for Regulation of Utilities (CRU)** and the **Renewal Gas Forum Ireland (RGFI)** were the main contributors to the study, with a review from **Gas Networks Ireland (GNI).**

In Ireland, the TSO and DSO are one party, Gas Networks Ireland. The TSO network is around 2,100 km and typically operated between the pressures of 4 and 70 bar, with the DSO network all pipelines below 4 bar, and the network length being around 11,900 km.

TSO grid connections

CAPEX is shared, with 30% from the producer and 70% from the gas grid operator.[1]
100% of the OPEX is provided by the gas grid operator.



Gas grid operator is fully responsible for the operation of the grid connection

DSO grid connections

CAPEX is shared, with 30% from the producer and 70% from the gas grid operator.[1] The OPEX for compression is a producer cost, with the remaining OPEX provided by the gas grid operator.

Gas grid operator is fully responsible for the operation of the grid connection

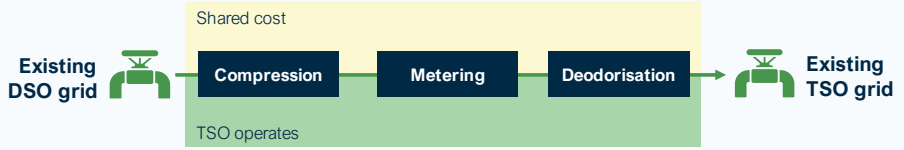
Central Injection points to the TSO grid (virtual pipelines)

CAPEX is shared, with 30% from the producer and 70% from the gas grid operator.[1] The OPEX for compression is a producer cost, with the remaining OPEX provided by the gas grid operator.

Gas grid operator is fully responsible for the operation of the grid connection

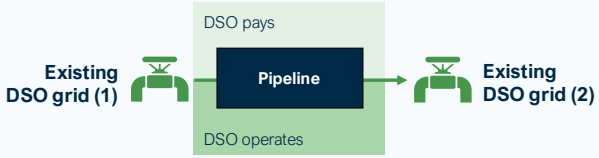
Reverse compression stations from DSO to TSO grid

CAPEX is shared, with 30% from the producer and 70% from the gas grid operator.[1] 100% of the OPEX is provided by the gas grid operator. Policy under review.



DSO network meshing

The cost is considered an expansion of the grid and thus for the DSO



[1] GNI undertake an **economic test for connections** (inc. reverse compression if required). The economic test assesses the net present value (NPV) and whether the tariffs collected from the volume of gas produced from both injecting parties and demand customers cover the cost for GNI. This is done for a 10-year lifetime. If not, then the connecting party may pay a supplementary charge to bring the economic business case to an NPV evaluation of 0.
[2] **Policy under review**, in relation to the biomethane connection to the grid and required upgrades. This is in relation to the Financial Security, Economic Test, Reverse Compression and Charging policy.

The Network Operator also requires Financial Security for the value of the assets placed on the RAB. The Financial Security is required for 7 years of operation of the Biomethane connection and for the construction period. Therefore, it is usually required for 8 to 9 years

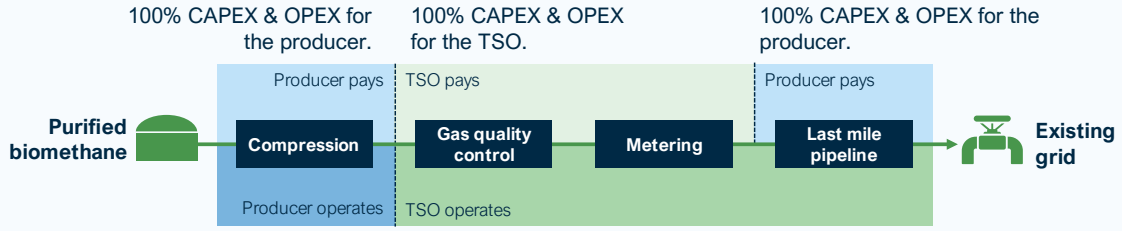
Latvia

Potential 2030	Potential 2040	Plants connected to TSO	Plants connected to DSO
0.2 bcm	0.7 bcm	0 plants	2 plants

In Latvia, the **Latvian Biogas Association**, gas DSO **JSC Gaso**, gas TSO **Conexus Baltic Grid**, and energy regulator, **SPRK,** provided input.

More plants are being developed on both the TSO and DSO networks. The TSO grid is around 1,200 km and operates typically between 28 – 42 bar, while the DSO grid is around 4,800 km and operates with pressures of up to 16 bar. There is already one privately owned central injection point developed in Latvia where truck-transported CNG can be injected into the TSO network.

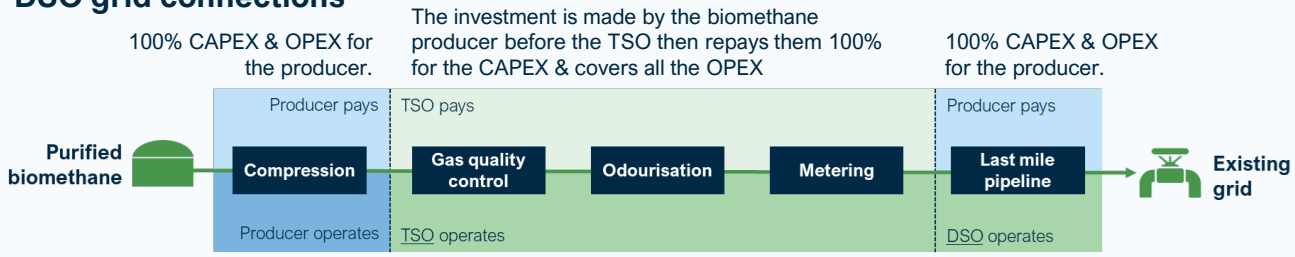
TSO grid connections



According to the national Energy Law, the TSO is responsible for gas quality control and metering. However, it is the producer's responsibility to ensure that biomethane corresponds to the grid-injected gas quality requirements.

The pipeline between the plant and grid is the TSOs responsibility

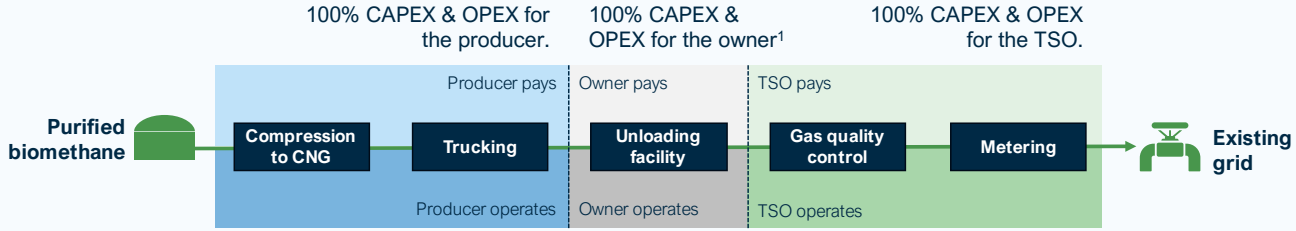
DSO grid connections



According to the national Energy Law, the TSO is responsible for gas quality control and metering. However, it is the producer's responsibility to ensure that biomethane corresponds to the grid-injected gas quality requirements.

The pipeline between the plant and grid is the DSOs responsibility

Central Injection points to the TSO grid (virtual pipelines)



Reverse compression stations from DSO to TSO grid

Not applicable / No data available

DSO network meshing

Not applicable / No data available

[1] The unloading facility can be owned by the biomethane producer, a private party, or the TSO. The owner is fully responsible for the costs and operation of the facility. The TSO is developing the first public injection station, and as such, there is no regulation on how access can be confirmed via these injection points yet.

Reverse compression stations have been a topic of discussion in recent years, but there is currently no regulatory framework around cost-sharing. DSO networks in Latvia are typically well dispersed, making **DSO network meshing** unlikely.

Discussions and planning are currently underway at the national level regarding the implementation of usage fees/tariffs for biomethane systems.

Lithuania

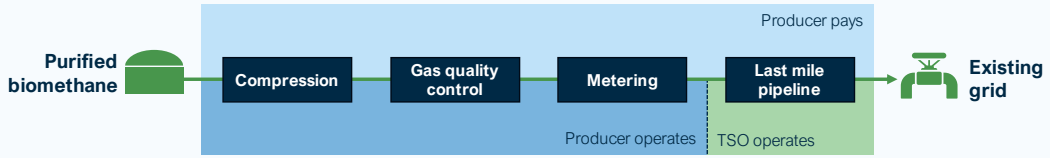
Potential 2030	Potential 2040	Plants connected to TSO	Plants connected to DSO
0.4 bcm	0.7 bcm	2 plants	0 plants

In Lithuania **Amber Grid**, the national TSO, and **Enmin**, the national energy regulator, were the main contributors to the study.

In Lithuania, the TSO network is around 2,000 km, operating up to 54 bar, while the DSO network is around 8,000 km.

TSO grid connections

All costs of the grid connection are paid by the producer

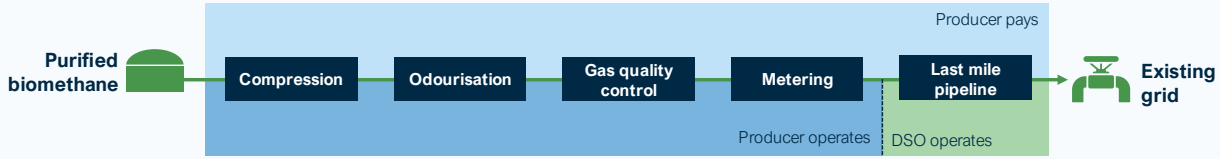


The biomethane producer operates the above components. The TSO retains the right to control the metering and quality control

TSO operates the last mile pipeline

DSO grid connections

All costs of the grid connection are paid by the producer



The biomethane producer operates the above components. The DSO retains the right to control the metering and quality control

DSO operates the last mile pipeline

Central Injection points to the TSO grid (virtual pipelines)

Not applicable / No data available

Reverse compression stations from DSO to TSO grid

Not applicable / No data available

DSO network meshing

Not applicable / No data available

Central injection points are unlikely, as Amber grid is not planning to install a public off-grid entry point currently. Some customers of Amber grid are planning to install such connections as a private initiative for their Amber grid connection point, offering delivery to the gas grid via pipeline connections or via vehicle transport.

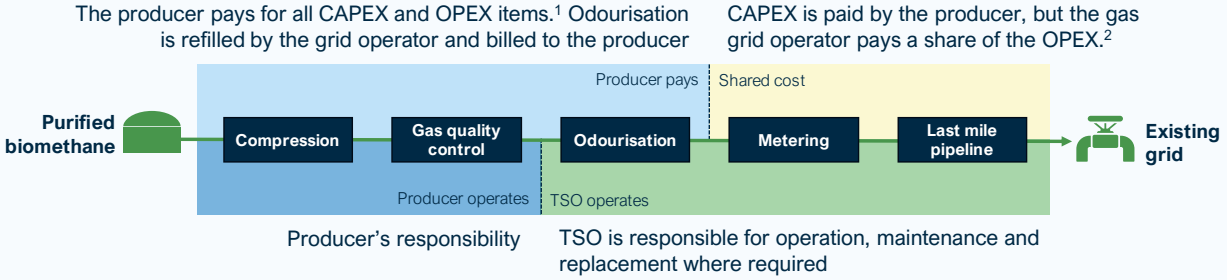
Luxembourg

Potential 2030	Potential 2040	Plants connected to TSO	Plants connected to DSO
>0 bcm	0.1 bcm	0 plants	3 plants

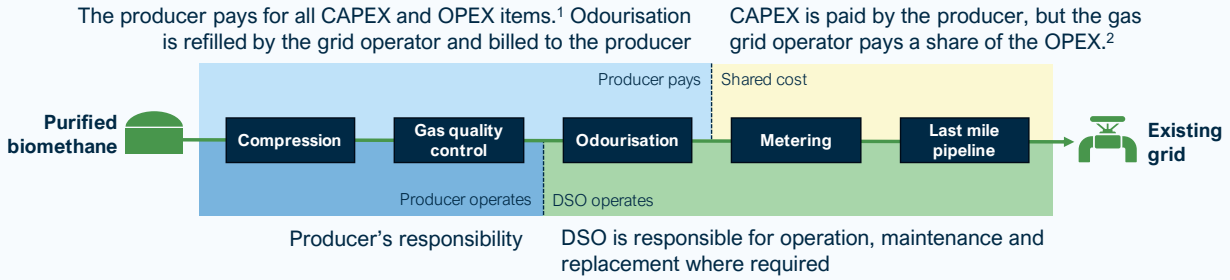
In Luxembourg **Creos**, the country's DSO and TSO was the main contributor to the study.

In Luxembourg, the TSO network is around 410 km and operated above 8 bar, while the DSO network is operated under 8 bar.

TSO grid connections



DSO grid connections



Central Injection points to the TSO grid (virtual pipelines)

Not applicable / No data available

Reverse compression stations from DSO to TSO grid

Not applicable / No data available

DSO network meshing

Not applicable / No data available

[1] For the pressure regulation, gas quality control, and odourisation, the producer can either pay for it upfront themselves or have the gas grid operator pay for it and be charged a monthly fee for it.
[2] The metering is paid for initially by the grid operator and rented to the producer for a monthly charge. Maintenance and repairs are at the gas grid operators' expense. Additionally, the gas grid operator carries out maintenance checks on the pipeline.

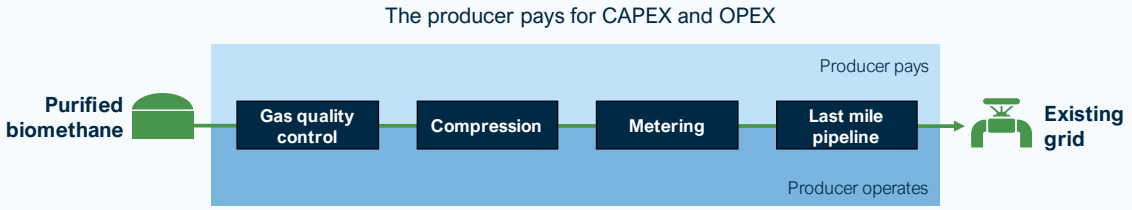
Poland

Potential 2030	Potential 2040	Plants connected to TSO	Plants connected to DSO
3.4 bcm	8.8 bcm	0 plants	0 plants

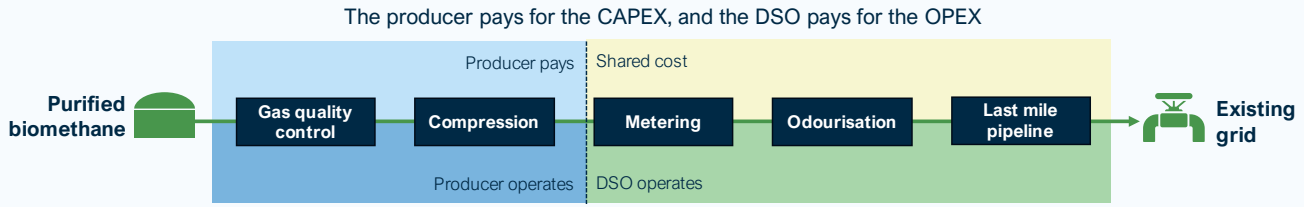
In Poland, **UPEBI**, the national association, was the main contributor to the study.

In Poland, the TSO network is around 10,600 km and operated up to 5-84 bar, while the DSO network is operated up to 5 bar and is around 133,200 km in length.

TSO grid connections



DSO grid connections



Central Injection points to the TSO grid (virtual pipelines)

Not applicable / No data available

Reverse compression stations from DSO to TSO grid

Not applicable / No data available

DSO network meshing

Not applicable / No data available

Portugal

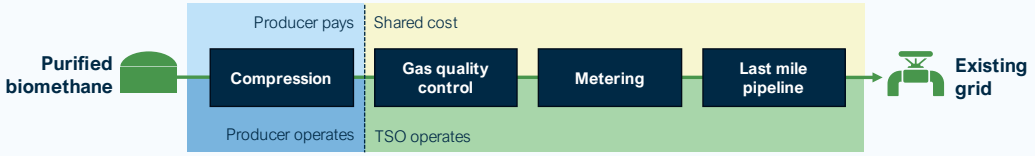
Potential 2030	Potential 2040	Plants connected to TSO	Plants connected to DSO
0.6 bcm	2.3 bcm	0 plants	1 plants

In Portugal, the National Biofuels Association, **Associação Portuguesa de Produtores de Biocombustíveis (APPB),** and large DSO **Floene** were the main contributors to the study. **It is noted that the Portuguese regulator is currently drafting new legislation on this topic to be published in 2025.**

In Portugal, the TSO network is around 1,300 km and operated up to 84 bar, while the DSO network is operated up to 20 bar and is around 19,200 km in length.

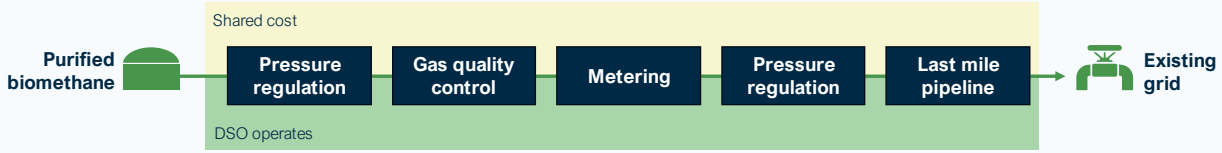
TSO grid connections

Under the current regulation, 100% of CAPEX is the responsibility of the producer. Compression is operated by the producer, and the OPEX is paid by the producer. The remainder of the grid connection becomes concession assets for the TSO, and the TSO pays the OPEX



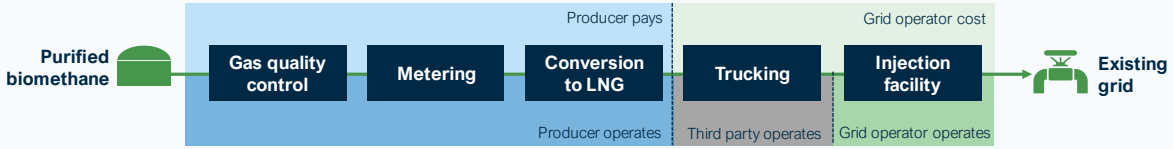
DSO grid connections

Under current regulation, 100% of CAPEX is the responsibility of the producer. Compression is not always required, if so, it is a cost for the producer (CAPEX & OPEX). The grid connection become concession assets for the DSO, and the DSO pays the OPEX



Central Injection points to the DSO grid (virtual pipelines)[1]

The producer pays for CAPEX and OPEX of onsite assets, including liquefaction. Trucking is done by a third party and paid for by the TSO. These costs and the cost of the grid injection facility are then socialised.



Reverse compression stations from DSO to TSO grid[2]

Not applicable / No data available.

DSO network meshing

Not currently done. Under the current regulatory framework this would be at the cost of the biomethane producer that creates the need for meshing. This is highlighted as one of the aspects of current regulation to be rectified in upcoming legislation.

[1] Portugal has experience with central injection, but trucking LNG to isolated DSO grids from LNG terminals. The schematic shown here is how this process will be realised for upcoming BioLNG injections to these grids, expected in Q2 2025. realised for central injection points for biomethane in the upcoming regulation. **Current regulation without any adaptations would lead to all costs being paid by the producers for BioCNG injection facilities, this could change in the upcoming revision of the regulation.** The Injection facility at a central injection point contains gas quality control and metering among other components.

[2] In the upcoming regulation it is expected that reverse compression will be the financial and operational responsibility of the higher-pressure grid operator, whether that be a DSO-DSO or DSO-TSO reverse compression station.

Slovakia

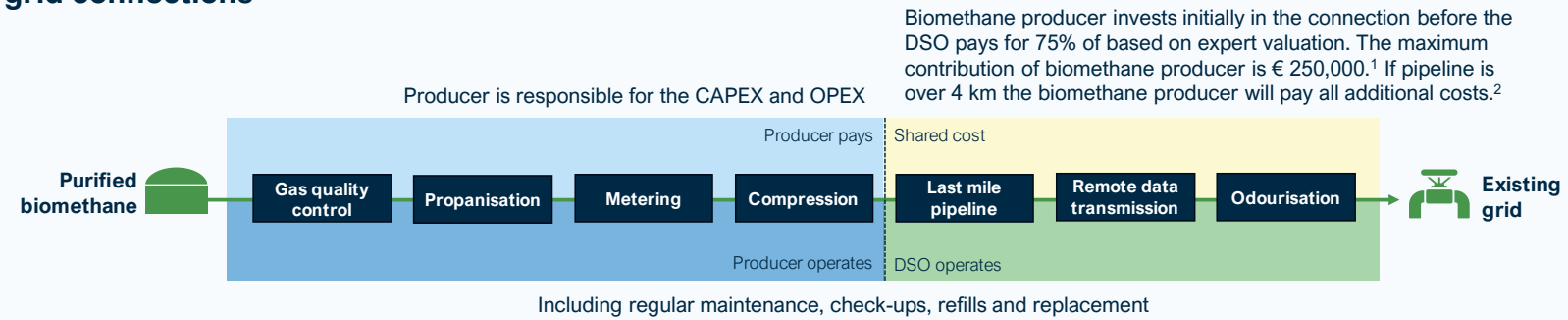
Potential 2030	Potential 2040	Plants connected to TSO	Plants connected to DSO
0.3 bcm	0.8 bcm	0 plants	1 plants

In Slovakia, **SPP – distribucia, a.s. (Inc.),** contributed to the study. SPP – distribucia are the country's largest DSO with more than 33,000 km of pipelines, distributing 98% of the consumed gas in Slovakia to consumers (more than 1.5 mln). This also includes more than 6,000 km of high-pressure distribution network. The TSO network is around 2,300 km and operated between 25-73.5 bar while the DSO network is operated under 4 bar.

TSO grid connections

Not applicable / No data available

DSO grid connections



Central Injection points to the TSO grid (virtual pipelines)

Not applicable / No data available

Reverse compression stations from DSO to TSO grid

Not applicable / No data available

DSO network meshing

Not applicable / No data available

[1] Investment costs of components 1 - 4, including technological units of biomethane producer, could be supported form EU fund calls.
[2] This is based on § 11a of the SK RES Act (No. 309/2009 Coll.), as amended by Act No. 136/2011.

There are no biomethane plants connected to the **TSO grid in Slovakia.** The Slovak transmission system (TSO) consists of four to five parallel pipes, of 1,200 or 1,400 mm in diameter, with an operating pressure of 7.35 MPa. It is unlikely that a biomethane station would be connected to the TSO network in Slovakia. **DSO network meshing** is unlikely. There are small industrial or very small residential "following distribution networks". It is very unlikely that a biomethane station would be connected to these networks. If this were to happen, or if a new distribution network were to be created, the same provisions of the SK RES act would apply to it as to our DSO. **Central injection points** to the TSO grid is not applicable. For **reverse compression stations**, Some future projects of biomethane plants count with connection to low pressure DSO network with installed compressor for a reverse flow to high-pressure DSO network. The cost allocation/responsibilities will be the same as for DSO grid connection (compressor cost covered by biomethane producer).

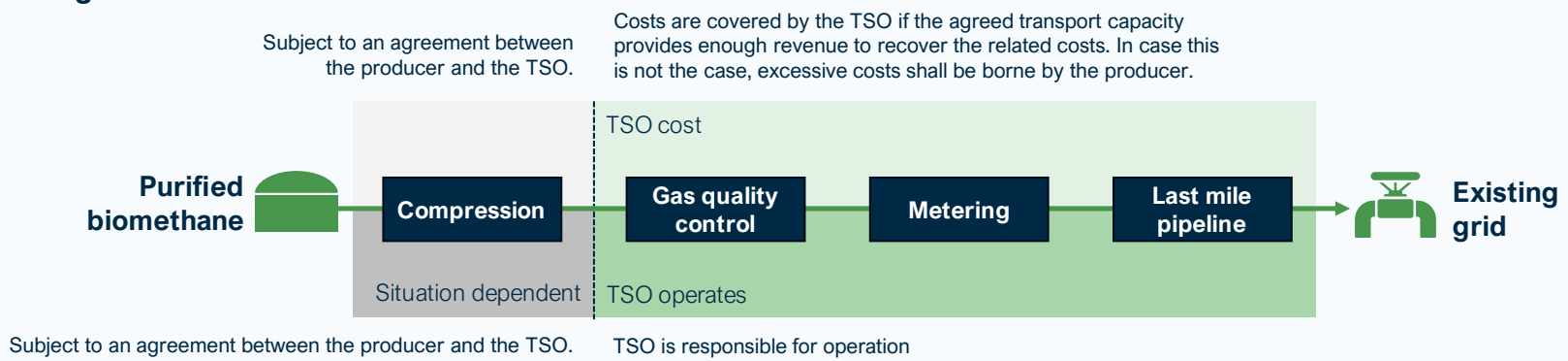
Slovenia

Potential 2030	Potential 2040	Plants connected to TSO	Plants connected to DSO
0.1 bcm	0.3 bcm	0 plants	0 plants

In Slovenia, **Gospodarska zbornica Slovenije** (the Chamber of Commerce), was the main contributor to the study, collecting insights from **large DSOs** and the national TSO **Plinovodi.**

In Slovenia, the TSO network is around 1,100 km and is operated up to 67 bar, while the DSO grid operates up to 16 bars and is around 5,100 km in length.

TSO grid connections[1]



DSO grid connections

Not applicable / No data available

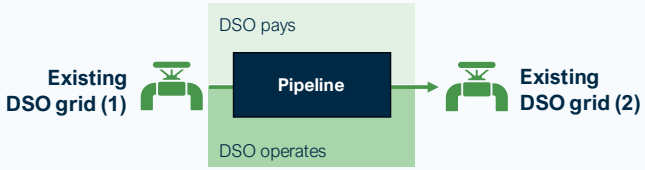
Central Injection points to the TSO grid (virtual pipelines)

Not applicable / No data available

Reverse compression stations from DSO to TSO grid

Not applicable / No data available

DSO network meshing



[1] For TSO grid connections, the priority is given to a connection to the DSO grid, if there is a DSO in place in the relevant local community.

Central injection points are not currently covered by existing regulations. If a project were to be developed the TSO could expected that the costs up to the injection unit are for the producer, the costs after injection (quality control and metering) are for the TSO if the transport capacity revenues cover it. The cost of the injection unit itself is subject to an agreement.

Spain

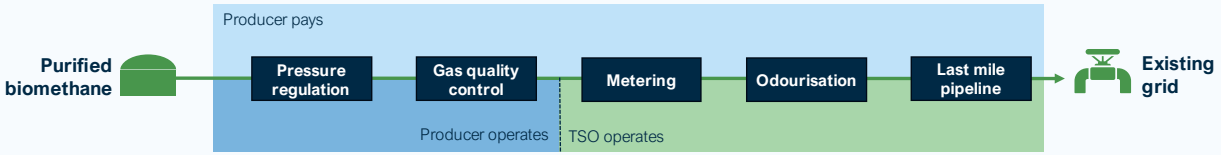
Potential 2030	Potential 2040	Plants connected to TSO	Plants connected to DSO
4.1 bcm	13.1 bcm	2 plants	7 plants

In Spain, **La Asociación Española de Biogás (AEBIG)** was the main contributor to the study.

In Spain, the TSO network is around 13,000 km and operated between 16-80 bar, while the DSO network is around 74,000 km and operated under 16 bar.

TSO grid connections

CAPEX is paid by the producer to the TSO through an infrastructure contract.
OPEX is paid by the producer to the TSO through a maintenance contract.

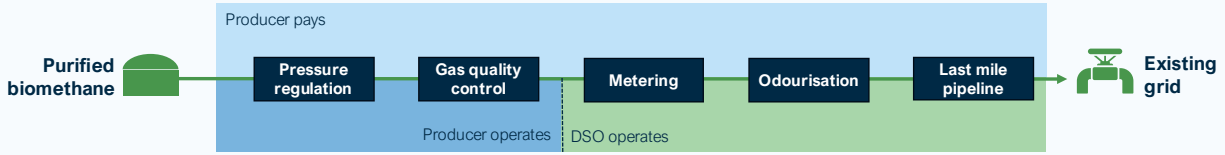


The producer is responsible for gas quality control and compression.

The producer pays the TSO through a maintenance contract for OPEX management.

DSO grid connections

CAPEX is paid by the producer to the DSO through an infrastructure contract.
OPEX is paid by the producer to the DSO through a maintenance contract.

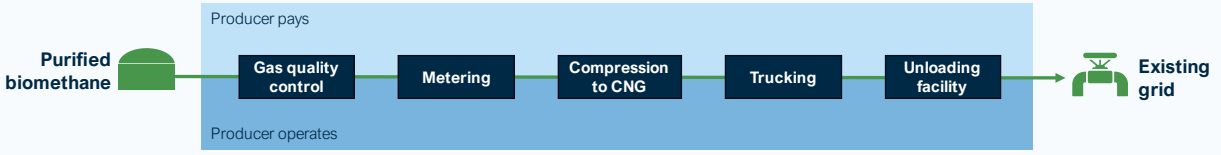


The producer is responsible for gas quality control and compression.

The producer pays the DSO through a maintenance contract for OPEX management.

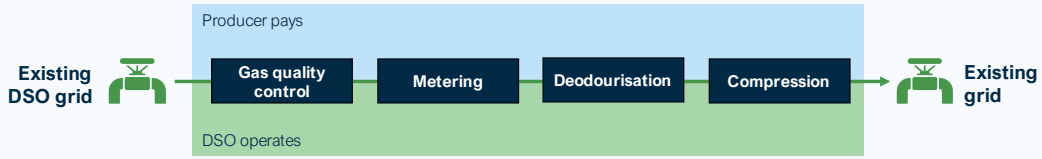
Central Injection points to the TSO grid (virtual pipelines)

CAPEX is paid by the producer to the TSO through an infrastructure contract.
OPEX is paid by the producer to the TSO through a maintenance contract.

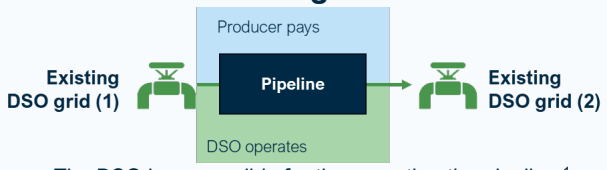


Reverse compression stations from DSO to TSO grid

CAPEX is paid by the producer to the DSO/TSO through an infrastructure contract.
OPEX is paid by the producer to the DSO/TSO through a maintenance contract.



DSO network meshing



The DSO is responsible for the operation the pipeline.[1]

[1] Although the DSO is responsible for the pipeline, the producer is also responsible for operating gas quality control by the plant.