Using gas infrastructure for biomethane

How existing pipelines and storages enable the future use of biomethane in the EU

Webinar - 30 April 2025

GIE Gas Infrastructure Europe

COMMON FUTURES

Agenda

- Context and purpose
- Executive Summary
- Study assumptions
- EU storage needs
- Pipeline capacity needs
- Cost competitiveness
- Key messages and Q&A

Shaping Change

Biomethane is a rapidly growing source of domestically produced renewable energy

European biomethane production is growing strongly:

2020: 2.9 bcm ➡ 2024: 6.4 bcm **Investment pipeline: 6.3 bcm**

Increasing **system-wide importance** as a dispatchable, storable form of renewable energy compatible with current infrastructure

This study investigates the **role of existing gas storages and pipelines in enabling biomethane scale up** into an important energy carrier of Europe's future

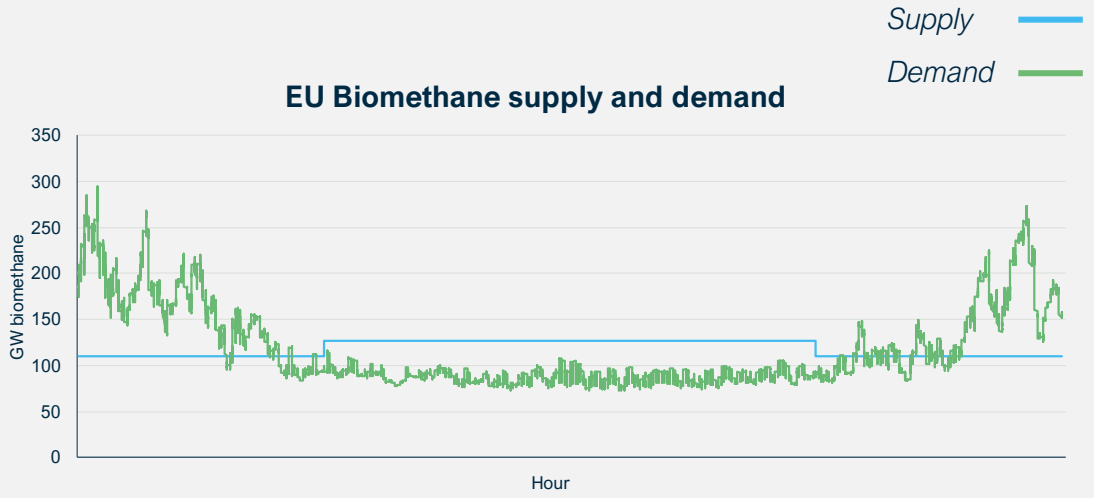
This study shows gas infrastructure is essential in unlocking biomethane's future

Gas demand will be **peakier** in 2040

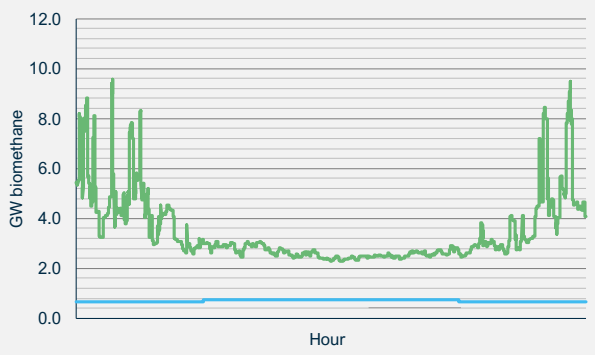
Storage required to enable 100 bcm biomethane:
183 TWh gas storage volume
184 GW of withdrawal capacity

Pipelines bring dispersed biomethane supply to concentrated demands and storages

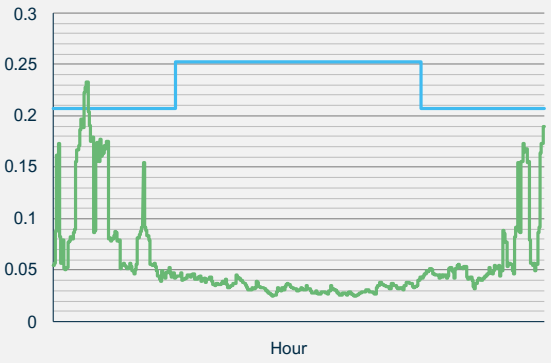
Modifications require investments of **€ 2.5 billion/year**, 40 times less than the electricity grid needs to 2040



Archetype 1: High Demand and Supply region



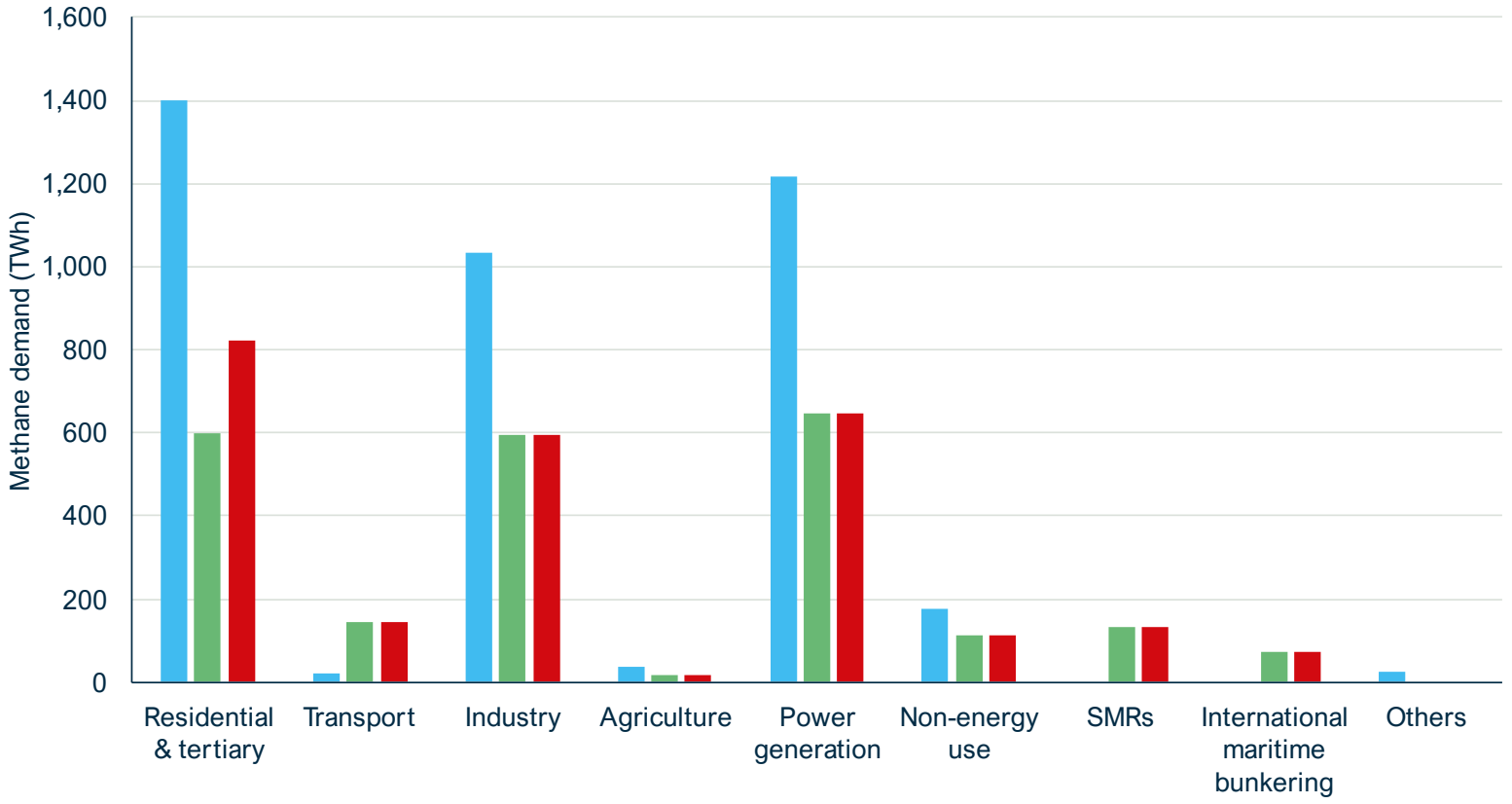
Archetype 4: Net Supply region



Best estimate of 2040 methane demand used with analysis of a 1-in-20-year cold event

Methane, 2040:
European grid operators scenario National Trends + (TYNDP 2024)

& Complementary analysis on the gas demand in the built environment for a 1-in-20 cold weather year



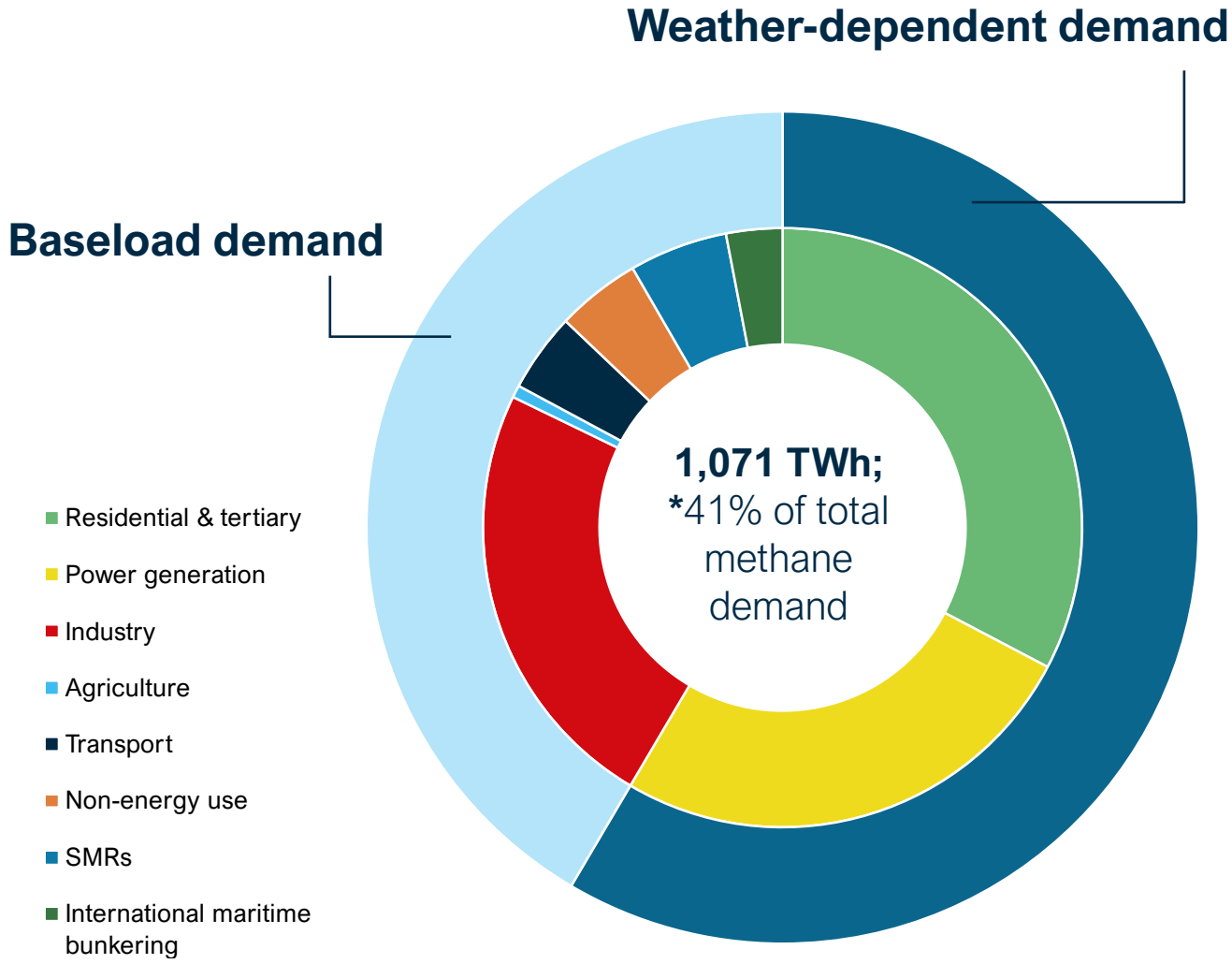
	2019 (Reference)	2040 (TYNDP NT+)	2040 (This study)
Total methane demand (TWh):	**3,918**	**2,328**	**2,514**

Biomethane demand split in 2040 and other key assumptions

Key assumptions

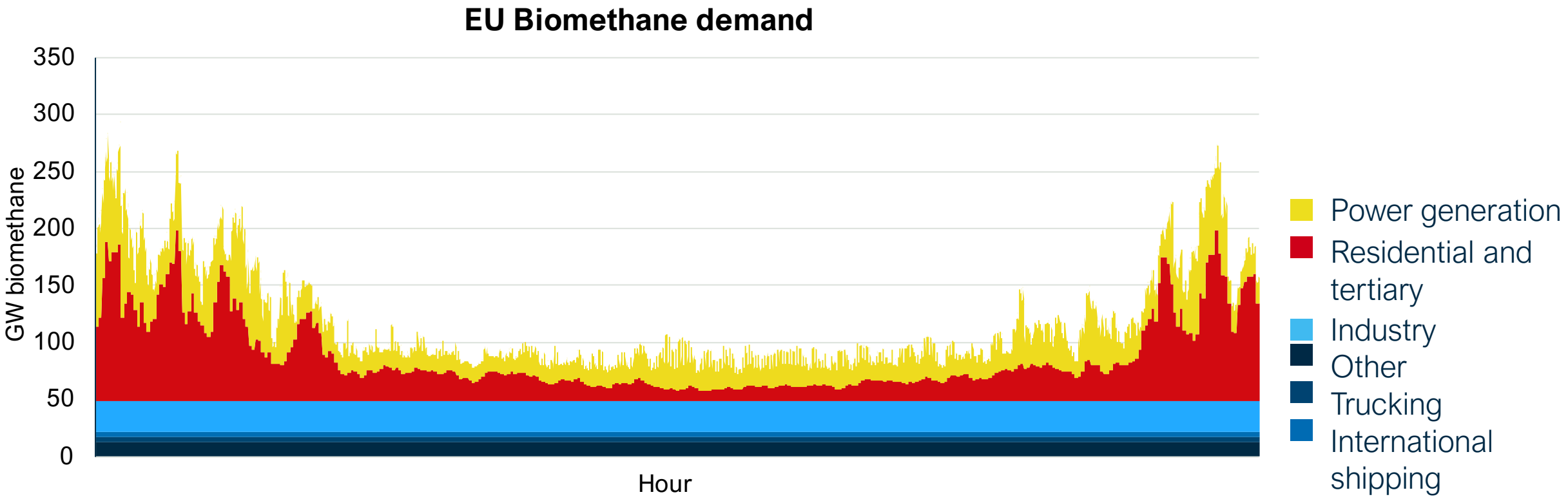
- Biomethane demand **shared proportionally** across all demands
- Biomethane production has a **slight seasonality**
- **(Hybrid) heating of buildings and power generation need storage.** Other demands are baseload
- **New buildings do not use a gas connection**. In 2040, of current gas connections, 25% no longer use gas, 25% use condensing boilers, 50% use hybrid heat pumps.
- **Hybrid heat pump operation:**

<-3°C	100% gas
-3°C to 3°C	30% gas and 70% electricity
> 3°C	100% electricity



*41% of gas on the grid is biomethane. (1,035 TWh / 2,514 TWh)
(5% of biomethane from anaerobic digestion (36 TWh) does not enter the grid, it is assumed to be made into bio-LNG and directly consumed in trucking)

Flexible use of gas storages is crucial to the energy system of the future



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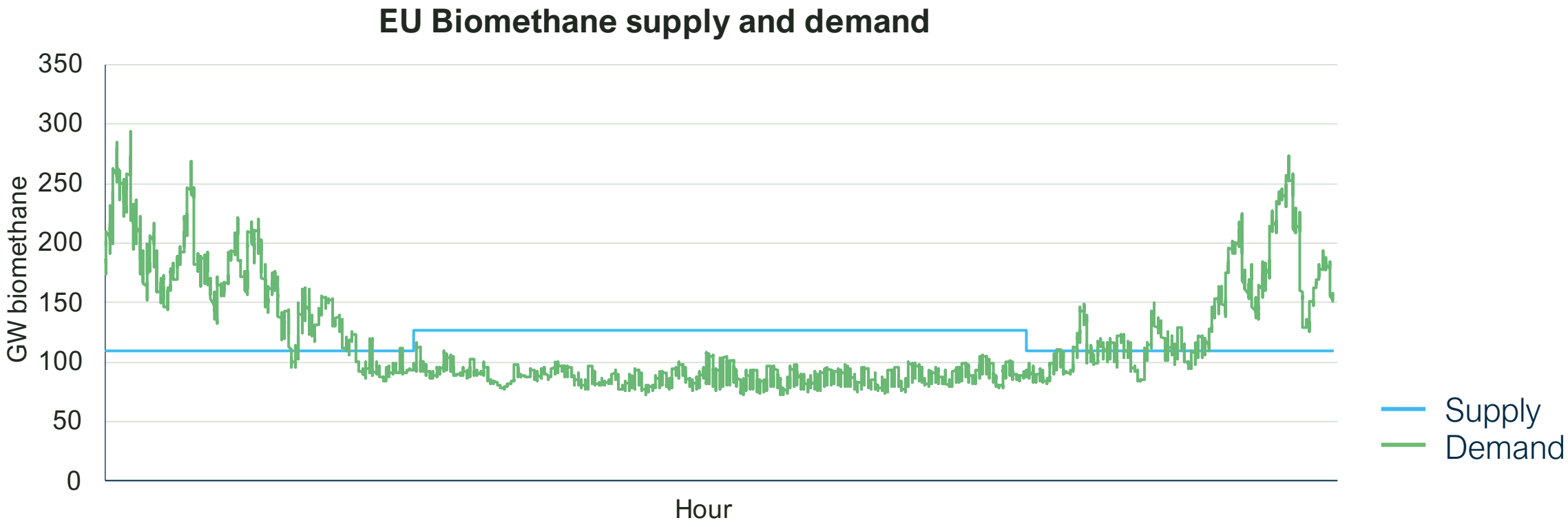


Biomethane use alone requires notable shares of current methane storage in 2040

1 Peak withdrawal

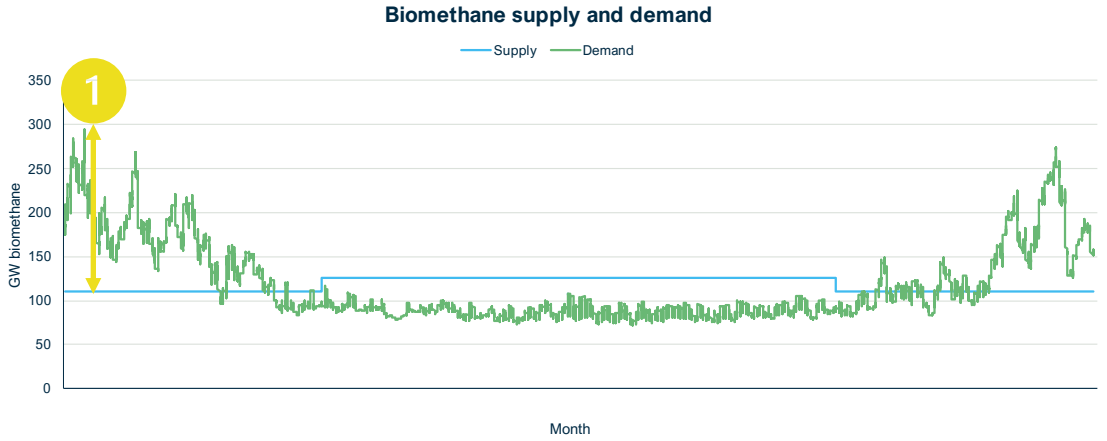
Largest hourly difference between demand and supply, when demand is greater than supply

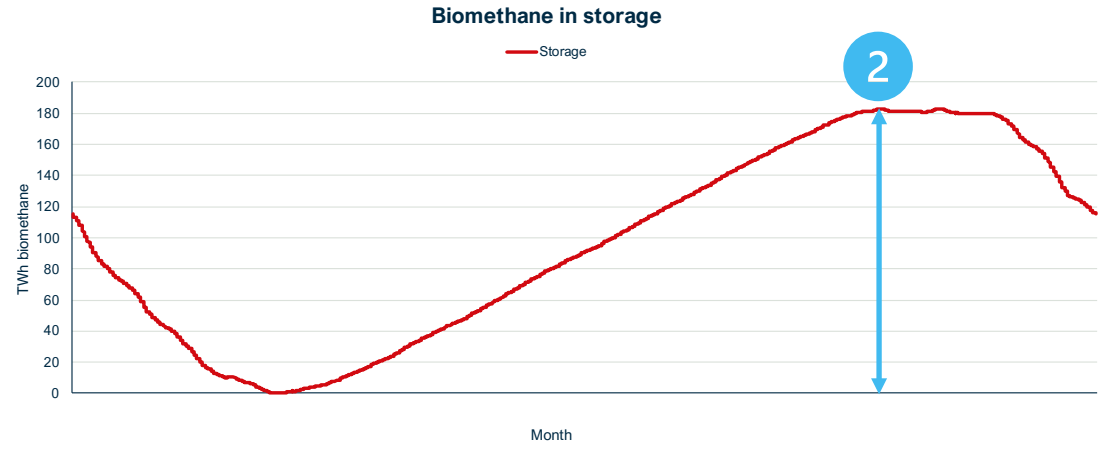
184 GW peak withdrawal for biomethane
22% of 2024 capacity*

2 Storage volume

Cumulative difference between supply and demand in the year

183 TWh storage volume needed for biomethane
16% of 2024 capacity*





** The 2024 storage volume and withdrawal capacity according to AGSI data (1,150 TWh and 20 TWh/day respectively). 20 TWh/day is simplified to 833 GW by dividing by 24 hours in the day.*

Pipelines bridge the gap between distributed, baseline production and central, seasonal demand

Supply
- Largely distributed in rural areas
- Almost baseload production

Transport by gas pipelines

Demand
- Concentrated demand centres
- Weather-dependent demands

Pipeline analyses used 4 archetype regions of 50 km radius, using data from real EU locations:

Archetype 1
High Demand and Supply

Archetype 2
Industrial gas demand focused

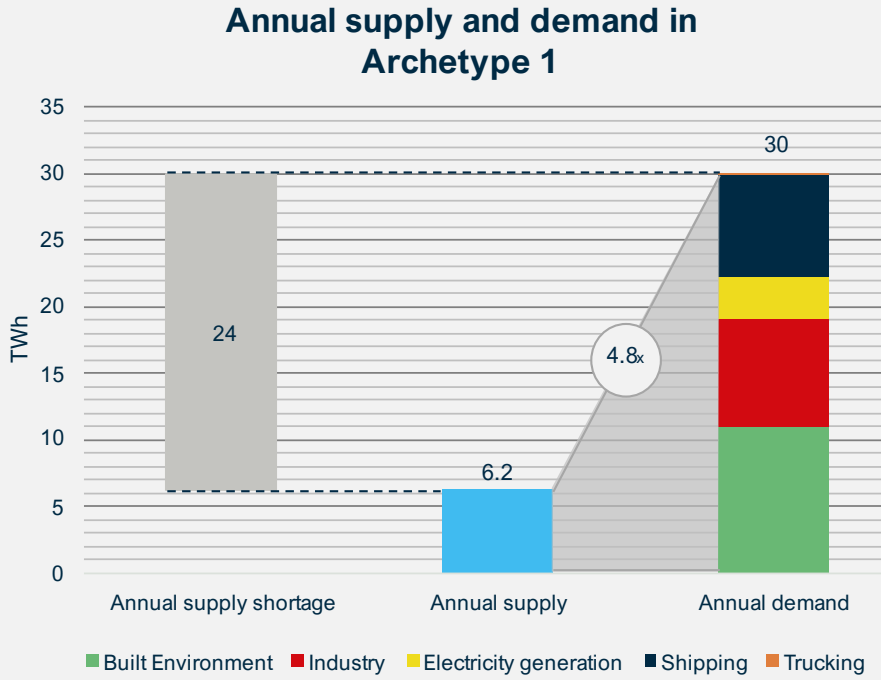
Archetype 3
Electricity production focused

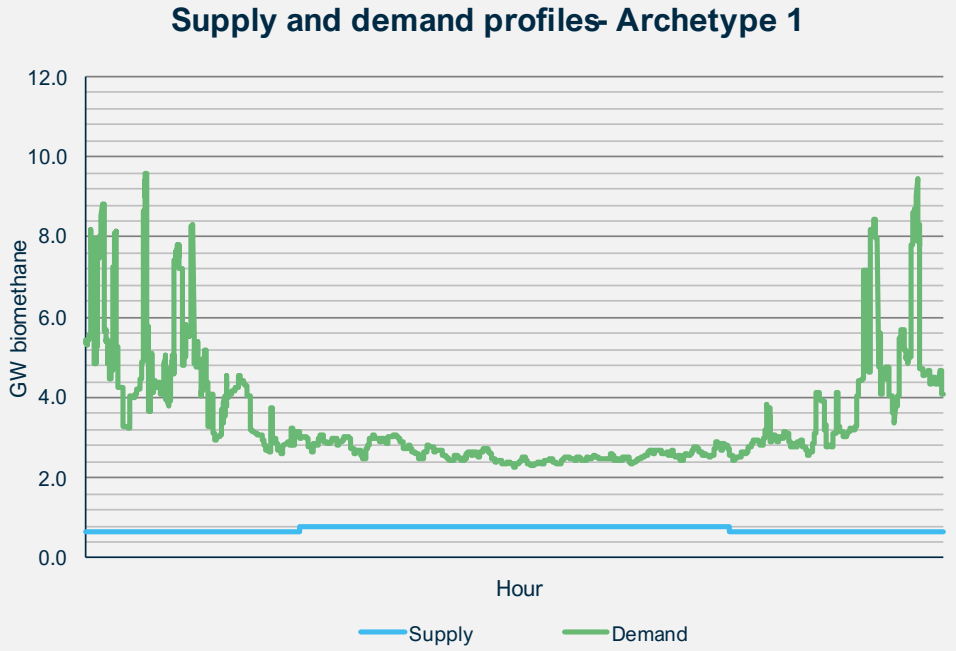
Archetype 4
Net supply region

Main findings: required pipeline capacity is largely determined by peak demand moments, and pipelines play a crucial role in bringing distributed production to required storages.

Archetype 1: Significant supply potential, exceeded by high demand with a seasonal pattern and high peaks

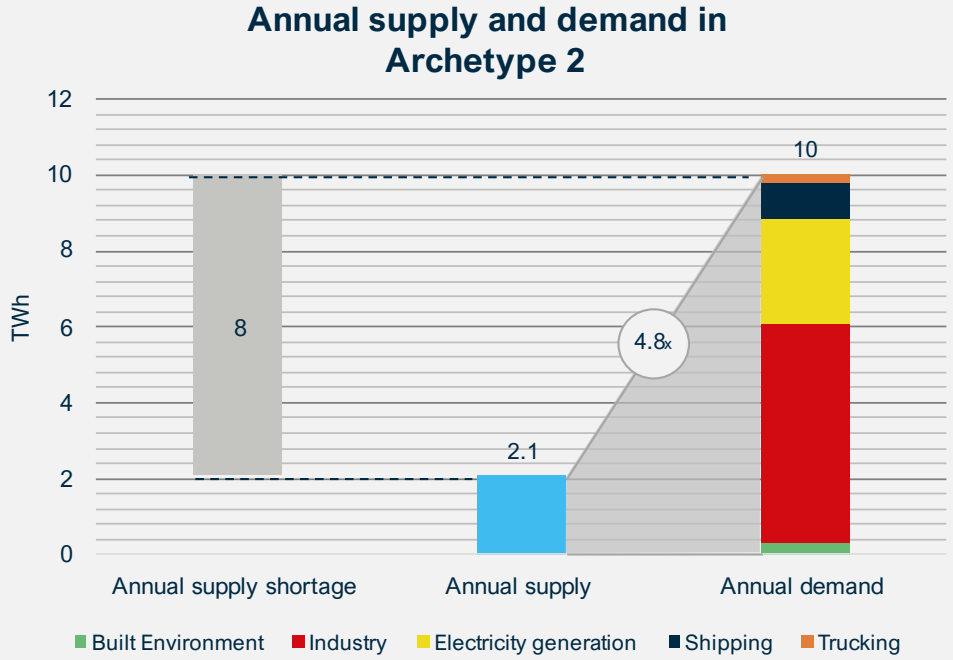
High Demand and Supply region

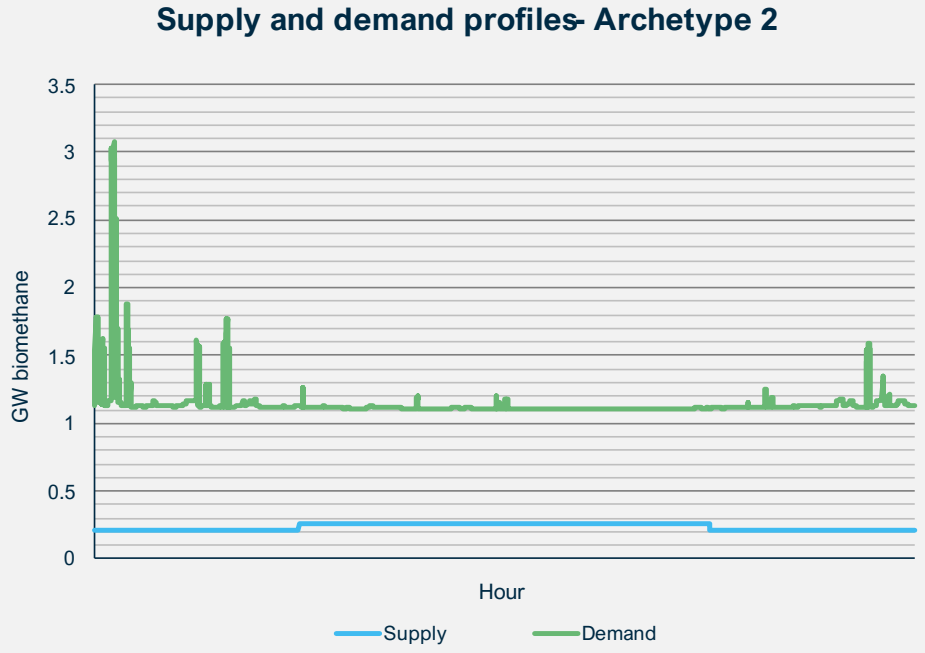




Archetype 2: Significant baseload biomethane demand from industry, demand peaks from dispatchable power

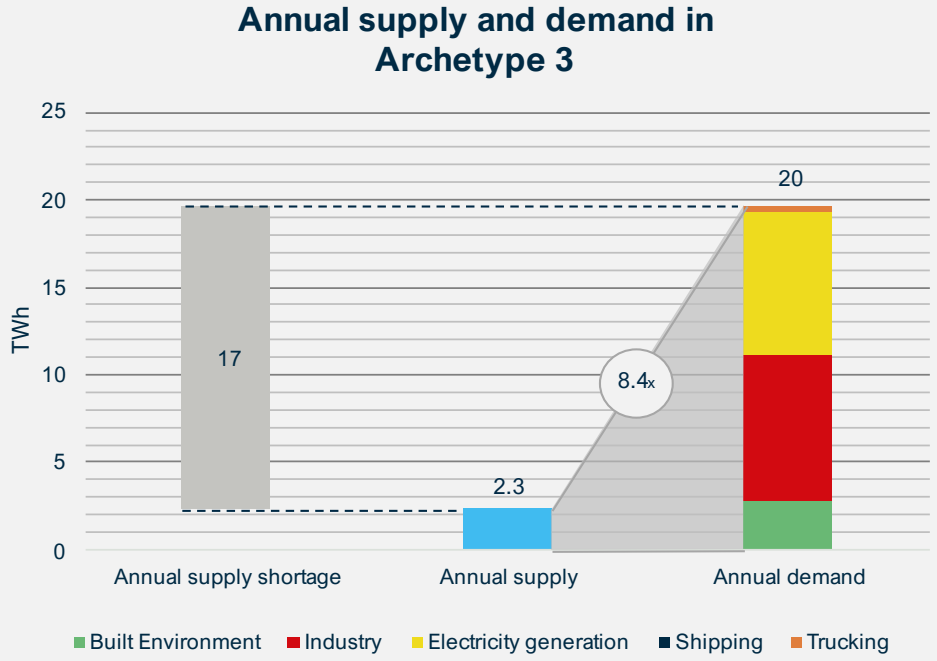
Industrial gas demand focused region

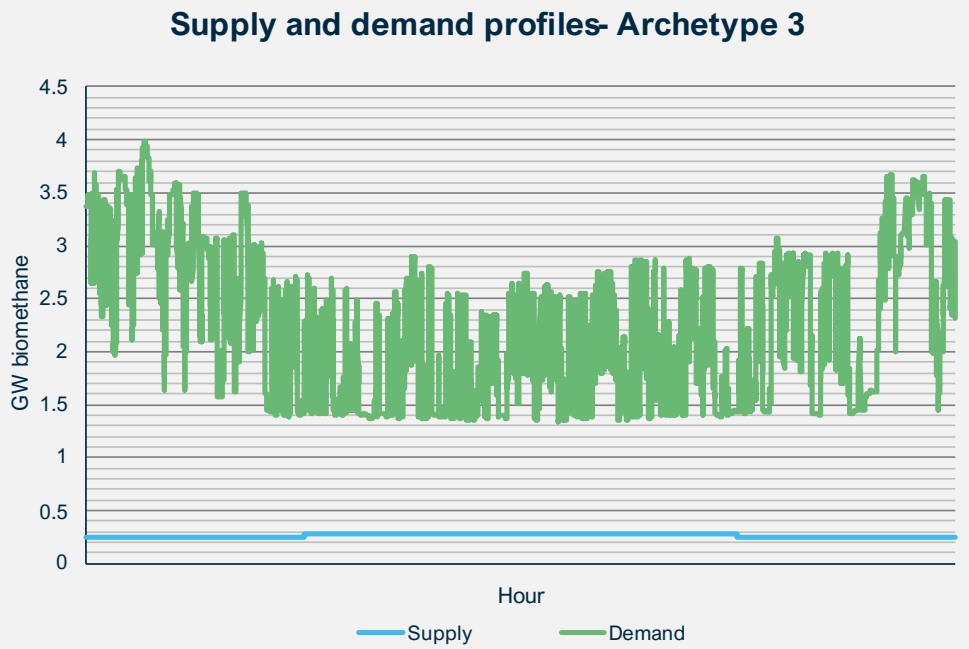




Archetype 3: Gas-fired electricity demand running at high full load hours, baseload demand from industry

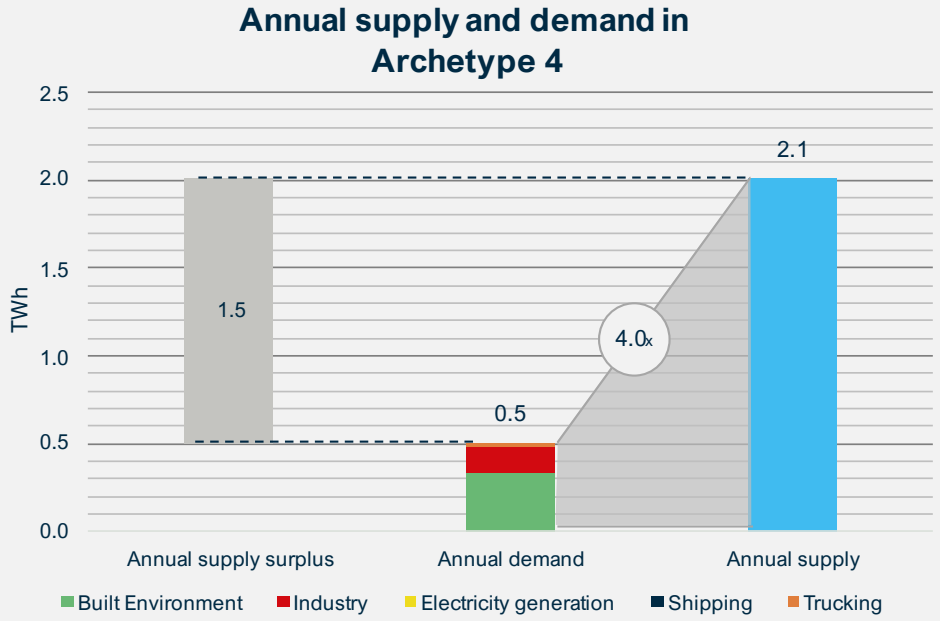
Electricity production focused region

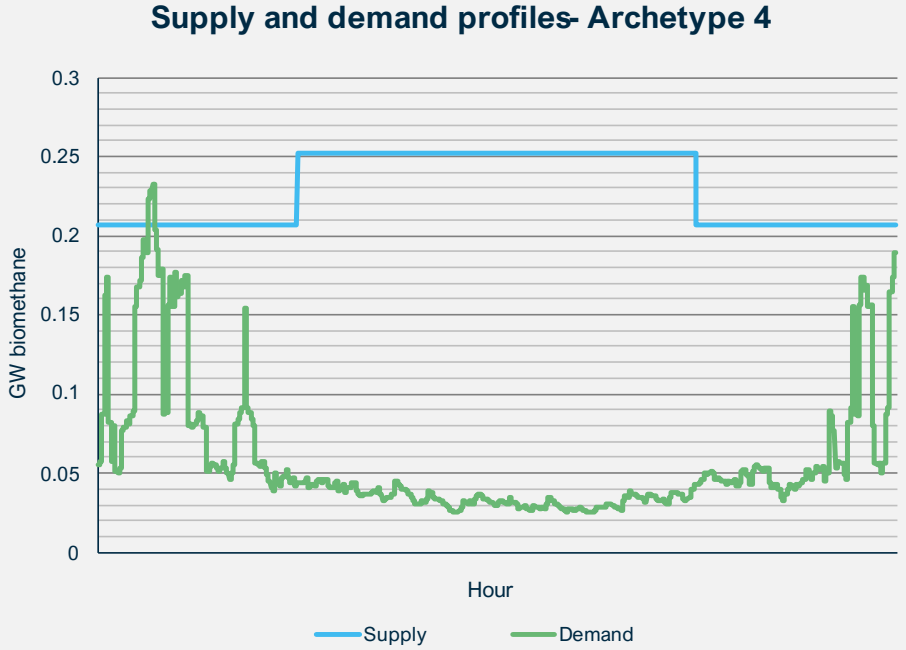




Archetype 4: annual supply potential significantly surpasses annual demand

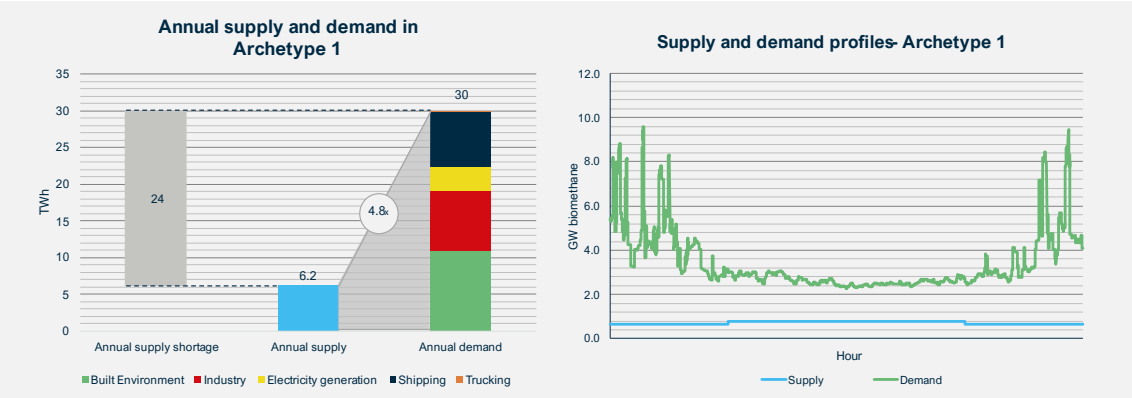
Net supply region



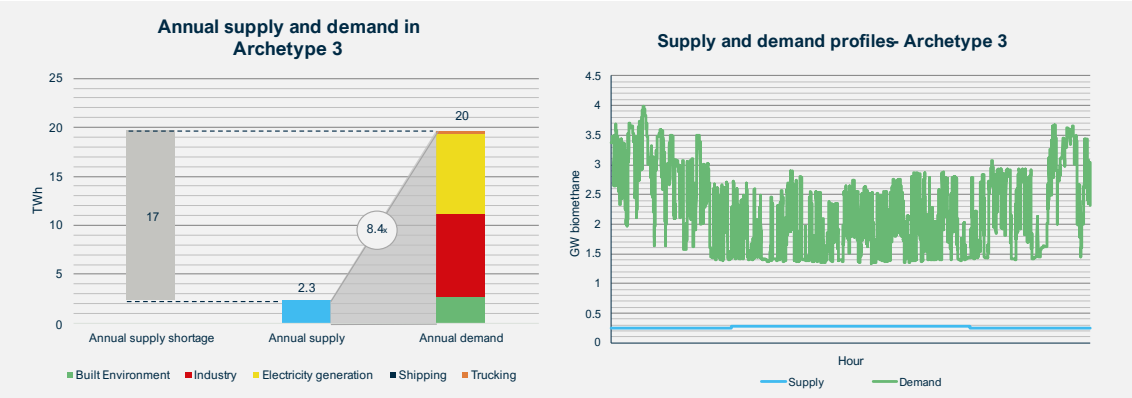


Pipelines are essential across archetype regions to connect production, demand, and storage

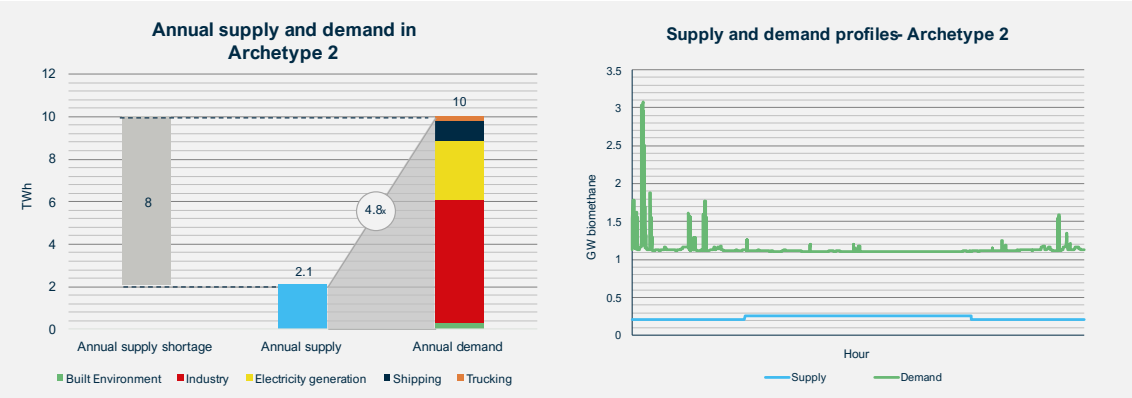
Archetype 1: High Demand and Supply region



Archetype 3: Electricity production focused region



Archetype 2: Industrial gas demand focused region



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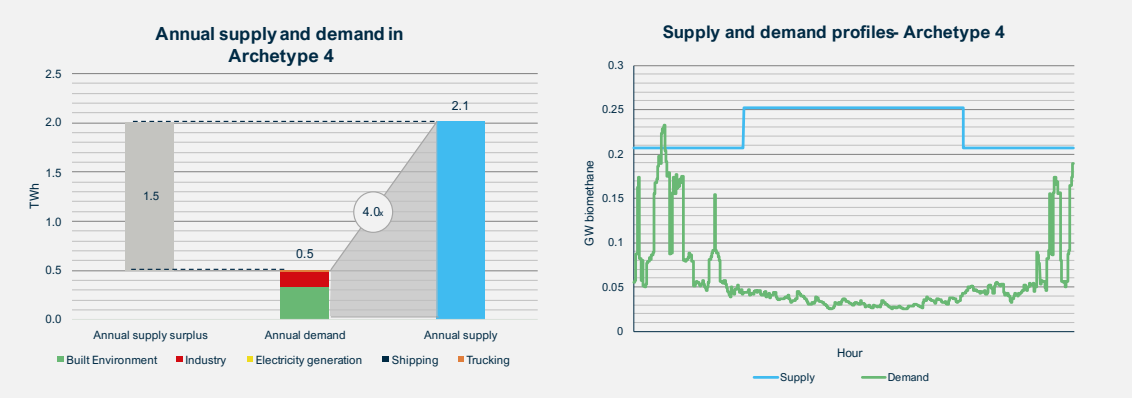
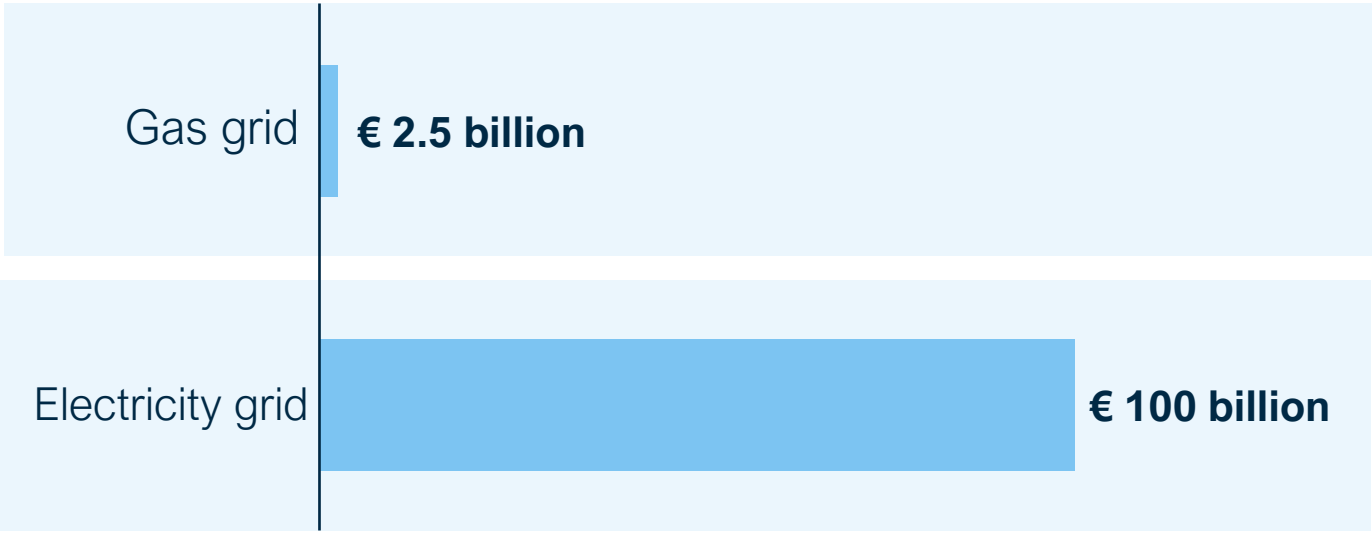


Gas grids modifications for biomethane require only modest investments

Required **annual investments** in energy grids towards 2040



Investments for ~1,000 TWh_{th} by 2040
biomethane, including gas grid connections, reverse compression stations and DSO grid meshing

Investments for ~4,000 TWh_e by 2040
€33 billion per year for the transmission grid[1] and €67 billion per year for the distribution grid[2]

Required gas grid infrastructures are already largely available:
take advantage of the **cost efficiency of using the gas grid for enabling biomethane**.

[1] ENTSO-E (2024). Regulatory systems of EU Electricity Transmission System Operators need to be adapted to ensure that the massive grid transmission investment plans can be financed.
[2] Eurelectric (2024). Grids for Speed.

Pipelines and storages are key in unlocking the full energy system value of biomethane

1. **Gas infrastructure bridges distributed, baseload biomethane production with concentrated, weather-dependent gas demand**

2. An estimated **16% of current EU storage volume** (183 TWh) and **22% of withdrawal capacity** (184 GW) is required for biomethane in 2040

3. **Gas demand profiles will become peakier in 2040,** with large storage withdrawal capacities and pipeline capacities required to ensure demand can be met.

4. **An interconnected European gas grid is important** to enable large volumes of biomethane, with 8,000 km^2 archetype regions of varying levels of demand often not producing enough biomethane in the region to satisfy demand.

5. **Gas grids are a cost effective method of enabling renewable energy**, with annual investments of € 2.5 billion required up to 2040, around 2.5% of the investments required for electricity grids across the same period, while enabling 1,000 TWh of clean energy use.

Thank you for your attention

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