

The Strategic Role of Off-Grid Renewable Gases | Executive Summary



Challenges of Off-Grid Decarbonisation



There are **49.2 million rural households in the EU**, most of which are **not connected to a gas grid**. These buildings primarily use higher carbon fossil fuels for heating, such as oil and coal.



Rural building stock is often old and less energy efficient. 36% of domestic buildings in the EU were built **before the first thermal regulations in 1970s**. On average in the EU, the walls of properties built before 1945 lose heat five times faster than those built after 2010.¹



Heating demand varies significantly more than electricity generation throughout the year with much higher winter consumption than in summer. Increasing electrification and penetration of intermittent renewable energy significantly increases the difficulty of operating a reliable electricity grid and managing supply and demand, particularly in off-grid areas which generally have the worst reliability.²

Benefits of Off-Grid Renewable Gases

BioLPG, Biogas, BioLNG and rDME are all examples of off-grid renewable gases that can be used in a wide range of sectors including domestic, agriculture and industry. They can be produced in a range of processes such as bio-refining, power to gas, anaerobic digestion, gasification and pyrolysis.



Consumer Acceptability

These gases require either no or small modifications to existing infrastructure such as boilers, CHP or engines. Keeping existing heating systems makes it convenient for consumers to opt for solutions that are increasingly renewable and lower carbon.

Emissions



BioLPG, rDME, biomethane and biogas all have greenhouse gas emissions that **are significantly lower than fossil fuels** at a reduction of up to 85%³, 95%⁴, 203%⁵ and 216%⁶ respectively compared to oil, although emission savings depend on feedstock.

PM_{2.5}



In 2019, 307,000 premature EU deaths were attributed to fine particulate matter (PM_{2.5})⁷. The PM_{2.5} emissions of renewable gases per unit of energy are around 37% less than oil and 99% less than coal.¹⁰

Affordability



Gas boilers which can run on renewable liquid gases are roughly **a quarter of the investment cost of heat pumps¹¹ and even cheaper compared to biomass boilers**, making them more affordable for households and business with low levels of disposable income.

System Benefits



Flexibility of renewable gases is much easier to manage than renewable electricity due to cheaper storage and more consistent generation.¹²



The use of renewable gases results in **reduced peak electricity demand¹³**, this significantly reduces power grid reinforcement and dispatchable power costs.



Hybrid systems help balance peak demand on the electricity grid. They can be installed with less requirement for electricity grid or radiator upgrades and the low carbon heating system can be installed before insulation upgrades.¹⁴



Off-grid renewable gases can be **produced locally** reducing energy distribution requirements.

Policy Recommendations



Recognise all Renewable Gas Production Pathways

to support their development and uptake, help to diversify supply, reduce cost and maximise production.



Support Renewable Ready Gas Boilers

to ensure all heating systems that allow deep decarbonisation are recognised. Hybrid solutions must also be considered where gas boilers are combined with heat pumps or solar thermal units, these can offer flexibility and resilience to the energy system on top of greenhouse gas emission savings.



Develop Markets for Renewable Gases

to stimulate supply and demand of renewable gases. Financial incentives in the form of tax rebates, capital grants and fuel subsidies should be deployed to encourage switching to all renewable technologies including renewable gases.



Facilitate Consumer Choice

to allow different solutions for different situations, recognising that there is no 'one size fits all' solution for heat decarbonisation. Policies should not pick favourites but instead should help guide consumer choices to provide solutions that meet their needs while remaining aligned with our collective climate goals.

¹ Eurostat (2022) Number of households by degree of urbanisation
² Eurostat (2019) Share of fuels in the final energy consumption in the residential sector for space heating
³ European Commission (2020) EU Buildings Database
⁴ ECOFYS (2018) Rural energy in Europe
⁵ GHV Energy (2022) Renewable DME
⁶ Codelift (2021) Emissions of (bio)LPG and other energy carriers in domestic heating, BBQs and forklift trucks
⁷ Bilans Ges (2022) Direct Emissions and Upstream Fuels

⁸ JRC (2017) Solid and gaseous bioenergy pathways: input values and GHG emissions
⁹ European Environment Agency (2021) Air Quality in Europe 2021
¹⁰ NAEI (2020) Emission factors detailed by fuel and source
¹¹ European Commission (2018) Decentralised heat pumps: system benefits under different technical configurations
¹² Imperial College London (2020) The flexibility of gas: what is it worth?
¹³ Entso-g & Entsoe (2020) Scenario Results
¹⁴ Energy (2016) Electricity, gas, heat integration via residential hybrid heating technologies