



The Role of Natural Gas in the Decarbonisation of Buildings in Portugal

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INTRODUCTION

The future role of renewable gases is not decidedly aligned in Portuguese regulation, and therefore, the future of gas networks is uncertain

EMISSION REDUCTIONS FOR BUILDINGS

- Residential and commercial buildings (R&C) are major energy consumers and are an important source of CO₂ emissions.
- Portuguese long-term energy plans contemplate a high electrification of the economy and of R&C sectors in particular.
- Space & Water heating demand (S&W) is the major challenge in terms of heat decarbonisation, as other energy demands have already been electrified (space cooling, lighting...).

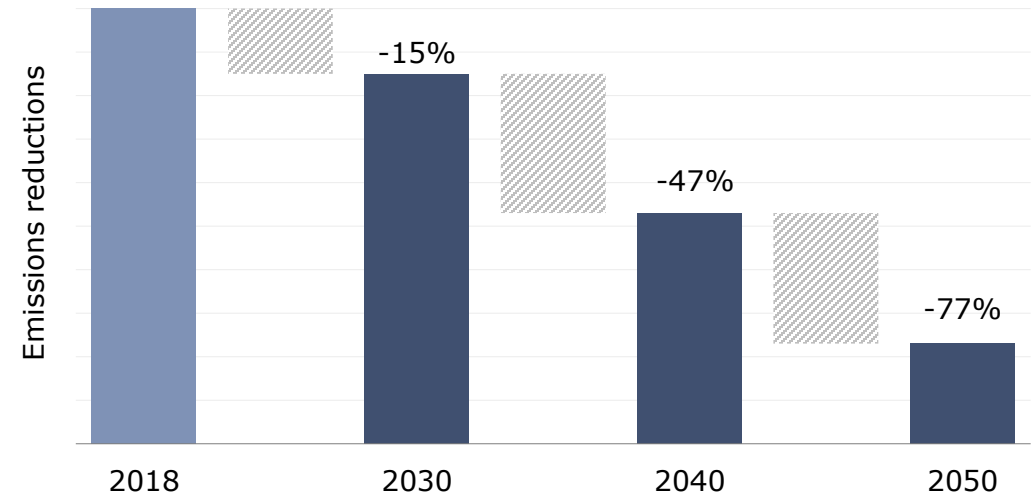


AFRY believes that renewable gases are key enablers of the decarbonisation of the S&W heating demand for buildings and that **gas networks have a major role to play in this transition.**

RNC 2050 OBJECTIVES FOR THE WHOLE ECONOMY

General objectives	2030	2040	2050
GHG reduction ¹	-45/55%	-65/75%	-85/90%
Renewable penetration ²	46/47%	71/72%	86/88%

ELPRE EMISSION TARGETS FOR R&C BUILDINGS



Source: RNC 2050, ELPRE. Notes: 1. Relative to 2005. | 2. On final energy consumption.

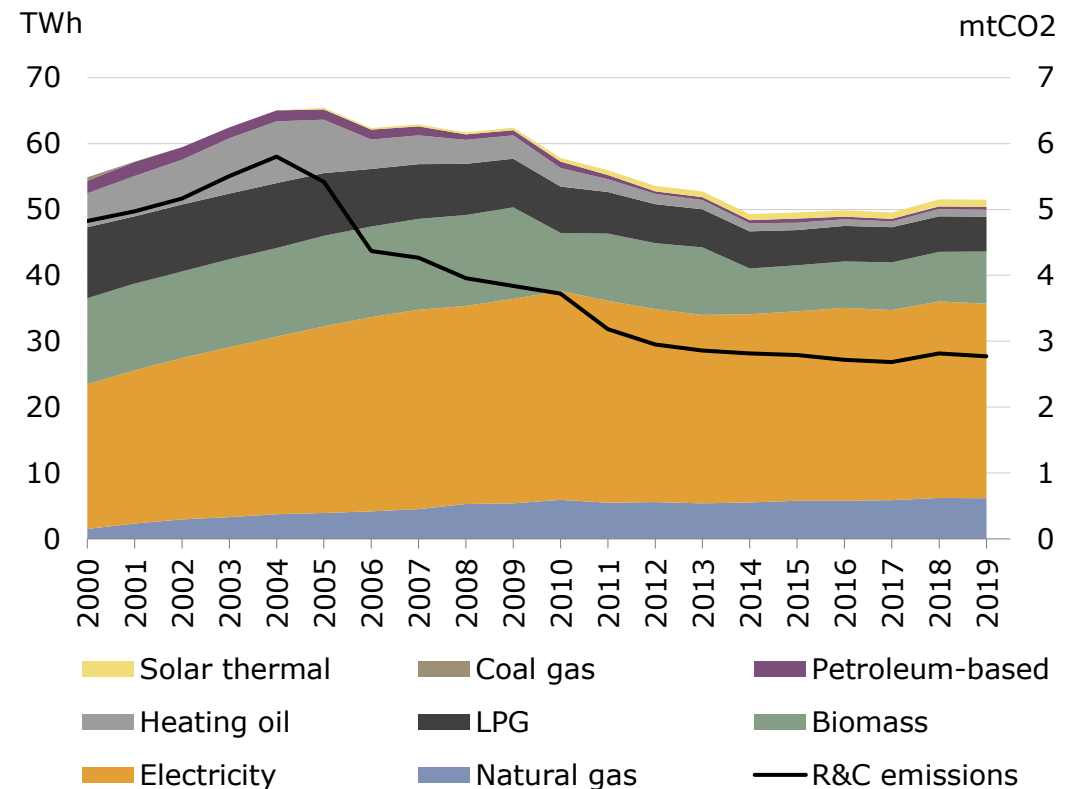
INTRODUCTION

The role of natural gas has been a critical element in replacing oil products and in helping reduce CO₂ emissions

HISTORICAL ROLE OF NATURAL GAS

- Between 2000 and 2019, CO₂ emissions have reduced by 43%. This has been achieved through the replacement of high-emitting fuels, particularly in low-income households, with less polluting alternatives, such as natural gas.
- In a regulatory context that pivots around electrification, the role of natural gas and renewable gases becomes a critical element towards reaching the objectives of a fair transition towards Nearly Zero Buildings designed by the Government in long-term strategies.
- Buildings' decarbonisation may be very challenging if insulation of households is not improved.









R&C DEMAND & EMISSIONS EVOLUTION IN PORTUGAL



Gas technology supports providing thermal comfort, reducing energy poverty in the most cost-efficient way.

DECARBONISATION PATHWAYS ANALYSED BY AFRY

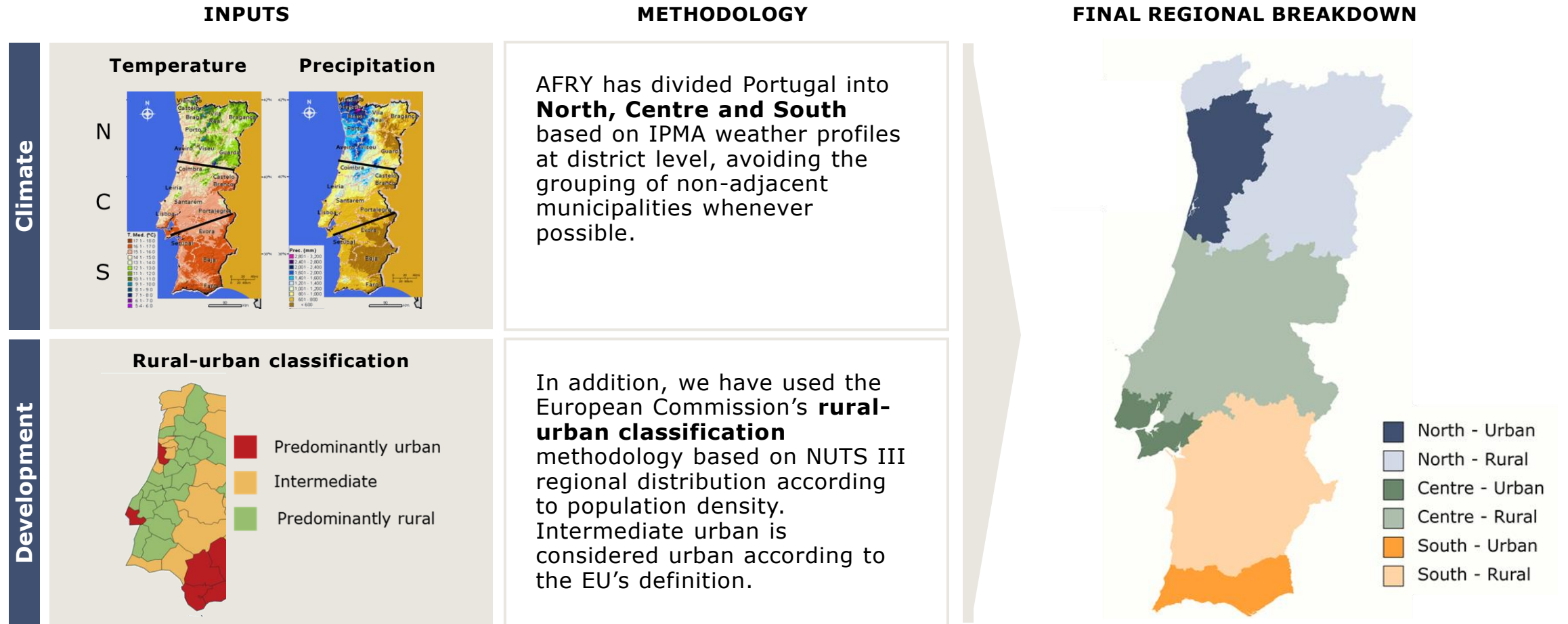
Utilising its modelling capabilities, AFRY evaluated two different pathways for the gas distribution network in order to reach the Government's emission targets for 2050 in residential and commercial heat demand

SCENARIO		NETWORK GROWTH	NETWORK REPURPOSING	LEADING TREND	EMISSION TARGETS
Gas Expansion Pathway 		 New CPs added to the network	 Repurposing to renewable gases	 Gas as a major energy vector	77% Emissions in S&W heat demand
Gas Repurposing Pathway 		 No new CPs except LPG substitution	 Repurposing to renewable gases	 Zero-emission gases	77% Emissions in S&W heat demand

Notes: ELPRE sets 77% emissions reduction by 2050 in residential/non-residential buildings, most of which is S&W heating. AFRY has taken this value as the objective for emission reductions.

REGIONAL CHARACTERISATION

AFRY divided continental Portugal into six regions based on climatic and development parameters, to be applied to the gas network growth per region

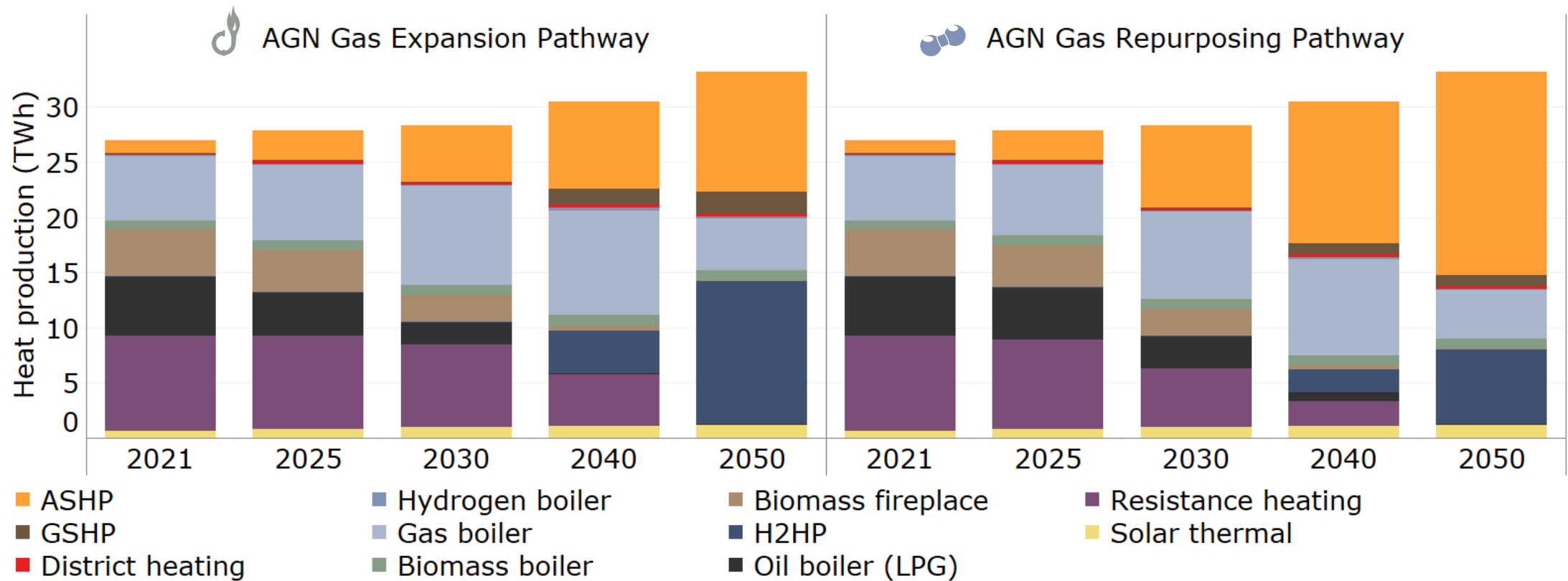


Source: IPMA, European Commission, AFRY analysis

RESULTS – HEAT PRODUCTION BY APPLIANCE

The Gas Expansion pathway eradicates LPG consumption earlier while accelerating the integration of renewable gases towards the target year

BY APPLIANCE

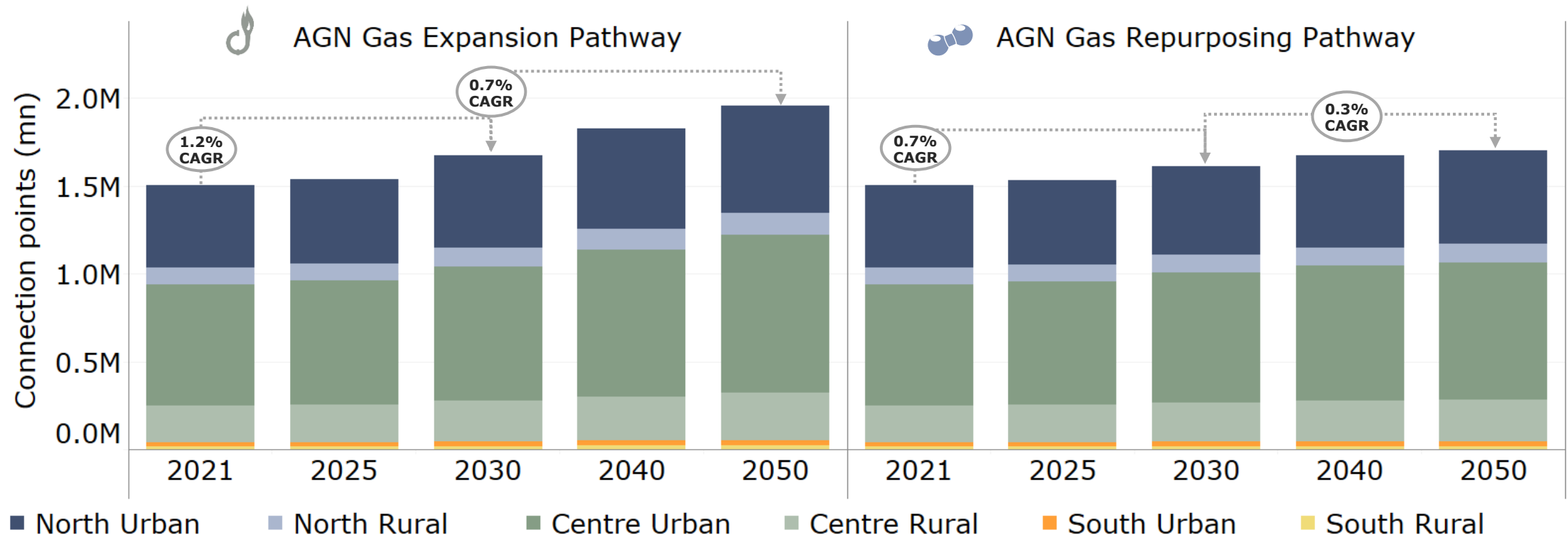


Source: AFRY

RESULTS – CONNECTION POINTS BY REGION

In the Gas Expansion pathway, connected points grow at 0.9% CAGR 2021-2050, while the Gas Repurposing pathway grows at a slower rate

BY REGION



Source: AFRY

RESULTS – INVESTMENT AND MACROECONOMIC IMPACT

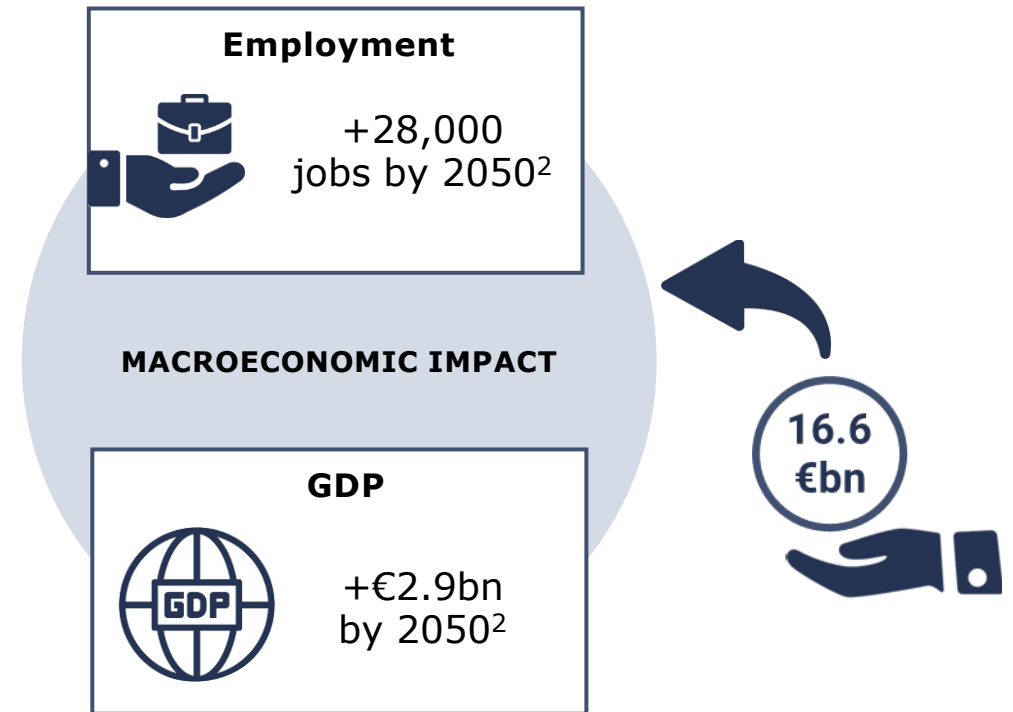
We estimate €16.6bn towards the decarbonisation of residential and commercial buildings, with a positive net impact on the Portuguese economy

INVESTMENT REQUIREMENTS

- Our results conclude that the Gas Expansion pathway is a cheaper solution in terms of end-user appliances.
- Investment needs for R&C buildings’ decarbonisation add up to €16.6bn¹.

- 1 Gas Expansion smooths the integration of renewable gases in 2040-2050 in a feasible way by harnessing existing assets.
- 2 This pathway is more cost-effective as the costs of the Gas/H2 network associated with the heat demand for the R&C sector will be split across a larger number of clients.
- 3 This investment drives a net positive impact on the Portuguese economy, in terms of both job creation and GDP.

IMPACT TO THE PORTUGUESE ECONOMY



Notes: (1) In NPV terms using a social discount rate of 4% for the 2021-2050 period. (2) Compared to Cambridge Econometrics baseline scenario, which is broadly consistent with the European Commission projections. The macroeconomic impact was performed for the residential, commercial and industrial sectors.

Sources: AFRY, Cambridge Econometrics

CONCLUSIONS

Gas networks could play a key role in the Portuguese transition and foster the integration of renewable gases in the future, with a net positive impact on the Portuguese economy and decarbonisation



DECARBONISATION

Electrification alone is not the solution. According to our analysis, a **pathway that combines both gas and electricity, as well as renewable gases** in the longer term, can reach national targets with respect to CO₂ emissions in buildings.

It also creates a solid support base for **decarbonisation of the industrial sector** which can only decarbonise through biomethane, hydrogen, and CCS, and **avoids stranded assets**.



COMPLEMENTARITY

Current regulatory targets do not take into account the threats of full electrification at technical level, and the consequences that a single solution, single price and a technological monopoly would bring to consumers.

Gas grids provide power of choice to energy consumers as they leverage the existence of **multiple energy carriers, markets and value chains**.



MACROECONOMIC IMPACT

The transition through renewable gases unlocks benefits to the whole economy in terms of GDP and job creation.

Our analysis shows that natural gas plays a bridging role in the Portuguese transition, with **net positive impact¹ on employment and contributions to the GDP**, while also preventing the challenges from stranded assets and their associated costs.

Notes: (1) The macroeconomic impact from Cambridge Econometrics was performed for the residential, commercial and industrial sectors.

CONCLUSIONS

However, efficient decarbonisation policies must be anchored to other two main pillars needed to tackle the transition of buildings: renovation and efficiency



ENERGY POVERTY

Gas plays a major role in the substitution of LPG and inefficient fireplace systems, widely used in low-income households offering a very poor heating performance and leading to high rate of humidity and mould in homes.

Disruptiveness and readiness of households should be considered. Gas is key to prevent high costs of conversion, while guaranteeing **greater thermal comfort and reducing energy poverty**.



RENOVATION & EFFICIENCY

Measures to decarbonise buildings may not be possible unless households perform **building renovation and efficiency enhancements** through insulation.

Natural gas plays an important role as the alternative to the financial efforts inherent to electrification of heat in buildings in addition to building renovation costs, while still providing thermal comfort to families and reducing energy poverty.



REGULATORY HARMONISATION

Regulation should **focus on building efficiency and adopt a technology-neutral stand to heating systems**. Without this base, decarbonisation policies may not prove effective to tackle energy efficiency and energy poverty in Portugal.

In addition, the lack of **regulatory harmonisation** is an issue. Efforts should not be a series of independent initiatives running in parallel. Cohesive solutions are needed to align decisions and investments.

Long-term national plans should take into account the potential benefits from keeping natural gas as a bridging element to support the integration of renewable gases



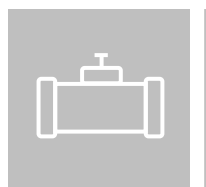
National regulatory targets should seek **harmonisation in medium and long-term targets** (electrification vs. renewable gases), in order to attune investments and ensure investor confidence.



Policies should be grounded on **technology-neutral premises** in order to guarantee fair competition amongst technologies.



Building efficiency and renovation are a necessary premise for effective decarbonisation strategies (avoiding energy waste or ineffective investments) as well as to reduce energy poverty in residential buildings.



Gas networks are key bridging assets towards the incorporation of renewable gases in the heating mix and in industrial settings. Policies should specify **long-term renewable gas targets** to provide clarity the role of gas in this transition.

Thank you very much
for your attention.

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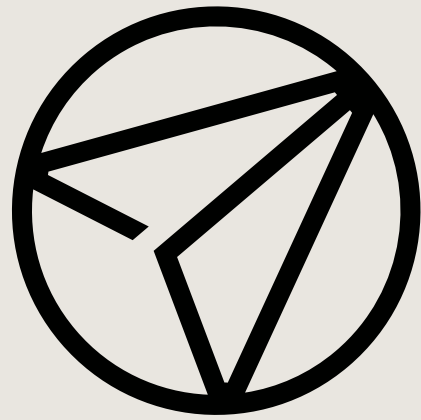
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