The gas role in the transition: natural gas, hydrogen and other renewable gases

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Market Analysis and Energy Scenarios

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E N E R G Y I N F R A S T R U C T U R E F O R A S U S T A I N A B L E F U T U R E

Agenda

For presentation

Italian gas demand: stable in 2024

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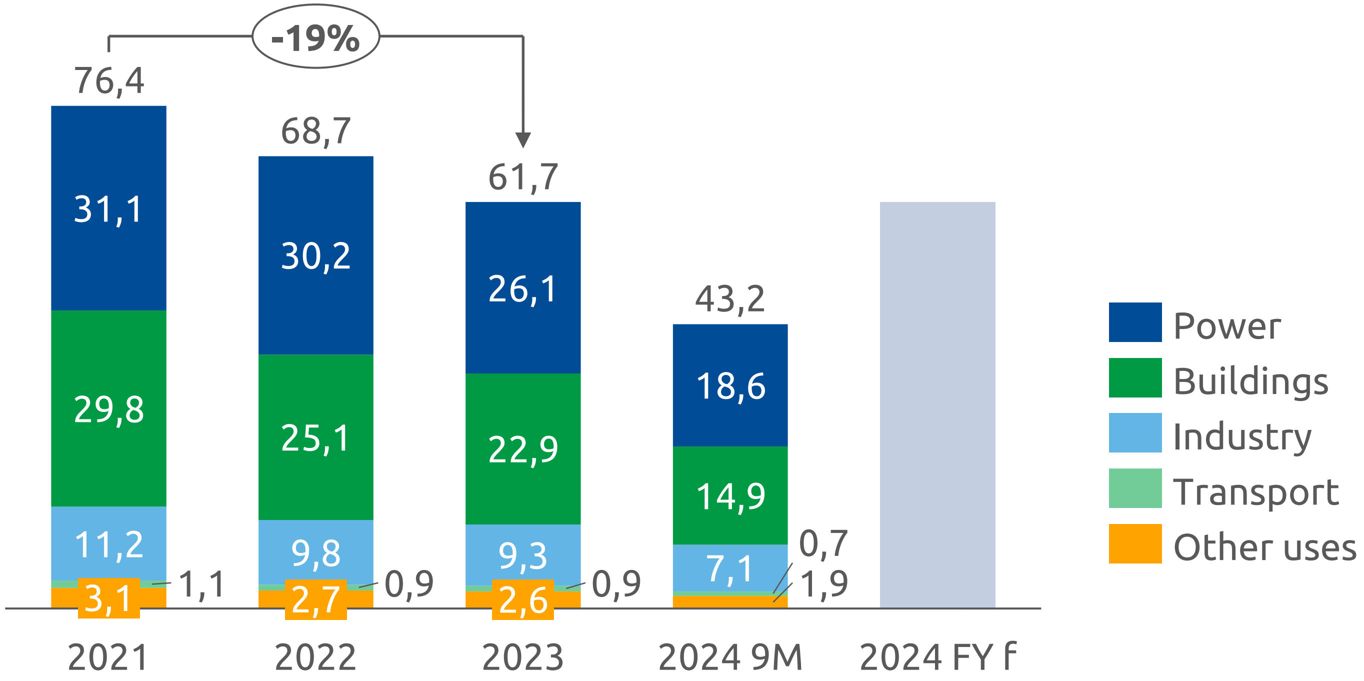


Natural gas in 2023 represents the 35% of the gross inland consumption energy mix and 27% of the energy mix in the final uses

In the last years gas demand show a reduction driven by weak thermoelectric production and reduction in residential driven by measures to contain gas consumption mild weather and efficiency

Gas Demand main highlights:

2021-2023: -15 bcm

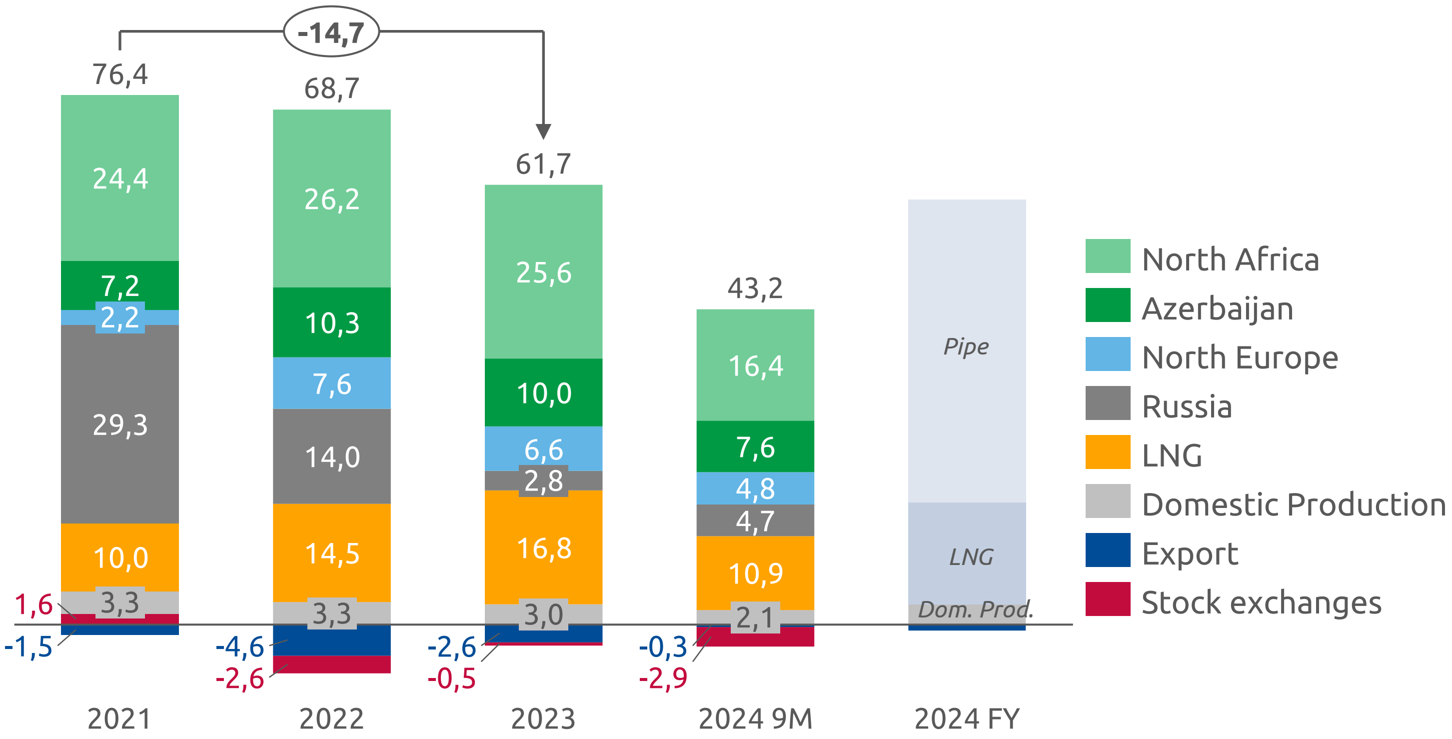
- **Power:** -5 bcm (-25 TWh) due to power demand reduction (-15 TWh) increased import (+9 TWh), growth of wind and solar generation compensate hydro reduction.,
- **Buildings:** -7 bcm, driven by measures to contain gas consumption, mild winter in '22 and '23 and increasing building efficiency (superbonus)
- **Industry**: -2 bcm due to weak industry production driven by shock in gas price after Russian gas crisis

2024

- **Power**: the increase of RES largely offsets the coal phase out in a scenario of weak electricity demand,
- **Buildings**: complete lifting of measures to contain gas demand and reduction of gas prices offset the increasing of efficiency in residential for the last part of Superbonus
- **Industry**: gas demand stable in a weak industrial production playgroung affected by high prices of energy and row materials

Notes: Other uses Includes agriculture, non-energy uses, refining and consumption and losses
Source: Snam internal

Italian gas supply:



Reduction of Russian gas has been offset by demand reduction, alternative import via pipe and increased LNG (including new FSRU Piombino)

Gas Supply main highlights:

2021-2023 supply

- **Russia:** -26,4 bcm reduction
- **Other pipes:** + 8,3 bcm increase from south (Algeria, Libia, Azerbaijan) and north Europe
- **LNG**: + 6,8 bcm increase mainly driven by USA LNG (+ 4,5 bcm)

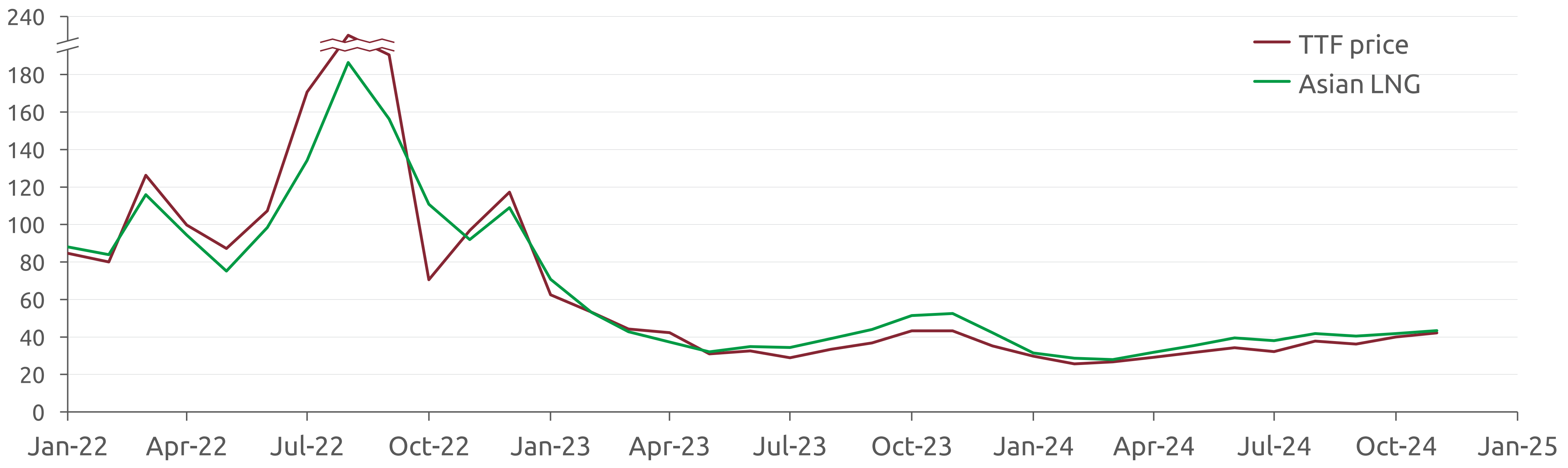
2024 expected

- **Russia:** limited volumes with expectation of total interruption in November and December
- **Other pipes**: Same dynamics as in the previous year
- **LNG**: Reduction in LNG imports due to maintenances at OLT terminal partially offset by Piombino FSRU and competition with other LNG markets

Notes: Domestic production including biomethane

Gas prices in Europe increasing and under pressure of Russian gas reduction and Asian Lng prices at premium vs TTF

TTF vs ASIAN LNG Monthly prices, *€/MWh*



European LNG market suffers of competition with Asiatic LNG demand

Average volatility in 1H 2024 was 1.7x higher than in 2019

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Setting the scene: joint Snam –Terna scenarios - DDS 2024

The joint Snam-Terna Scenario is a coherent and common vision of the possible evolutions of the Italian energy system to be used for the preparation of their TYNDP

	POLICY COMPLIANT		POLICY DELAY
2030	PNIEC Policy		PNIEC Slow
2035	Global Ambition IT	Distributed Energy IT	PNIEC Slow
2040	Global Ambition IT	Distributed Energy IT	PNIEC Slow

PNIEC Policy scenario (Italian NECP 2024)

In line with the objectives of the 2024 NECP:

- CO_2 emissions -55% in EU, -50% in Italy.
- Final consumption (~102 Mtoe to 2030, -10 Mtoe vs. 2022).
- Electricity production from RES at 63% of electricity demand.
- Green gases at 16.4% of gas demand in end use.
- Carbon Capture & Storage (CCS) to capture 4 MtonCO_2 from process and combustion.

Global Ambition IT

- Strong development of biofuels and H_2 in the transport sector.
- Heating of buildings by means of both green gas and electric hybrid heat pumps.
- Industrial heat supplied mainly from H_2 and biomethane.
- Strong development of RES (electricity) generation.
- CCS applied to industrial and thermoelectric emissions.

Distributed Energy IT

- Strong electrification of transport and residential heating.
- Industrial heat supplied by electricity and supplemented by H_2 and biomethane.
- Maximum development of RES (electricity) generation.
- Green gases and storage used as back-up for intermittent RES generation.
- CCS applied to industrial emissions.

PNIEC Slow

Delayed compared to the objectives of the NECP Policy:

- CO_2 emissions around -46% by 2030 and -65% by 2040.
- Limited development of green gas.
- Lower development of electricity RES.
- CCS development limited to projects in existence by 2030.

Setting the scene: the role of gas in the future energy mix

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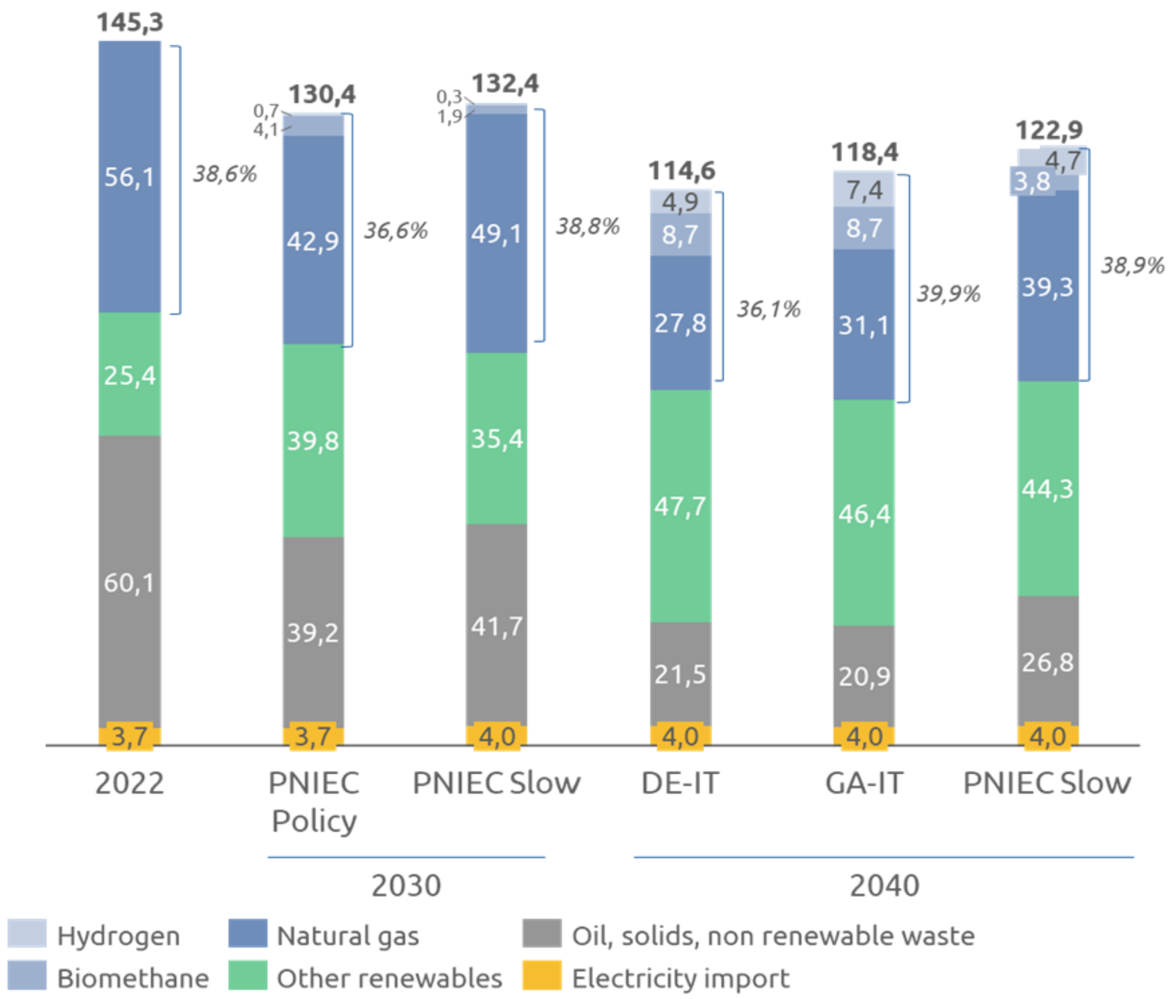
Gross Inland Consumption, Mtep



- **Efficiency first:** It is emphasized that the efficiency and electrification (up to 38% of final uses in 2040 vs 22% in 2022) dynamics of the energy system are the key drivers for the reduction of energy consumption in the scenarios (up to 30 Mtep 2022 vs 2040)

- **Increase role of renewable energies:** in 2040 renewables up to 3x vs 2022, driven by VRES in the power sector (i.e., wind and solar) and strong development of green gases, biofuels and synthetic fuels

- **Gaseous fuels:** remaining stable in the share of the energy mix (more than 1/3) and they reduce their carbon footprint thanks to higher volumes of green gases (hydrogen, biomethane and e-methane)

Gases demand expected to show resiliency in the medium to long term

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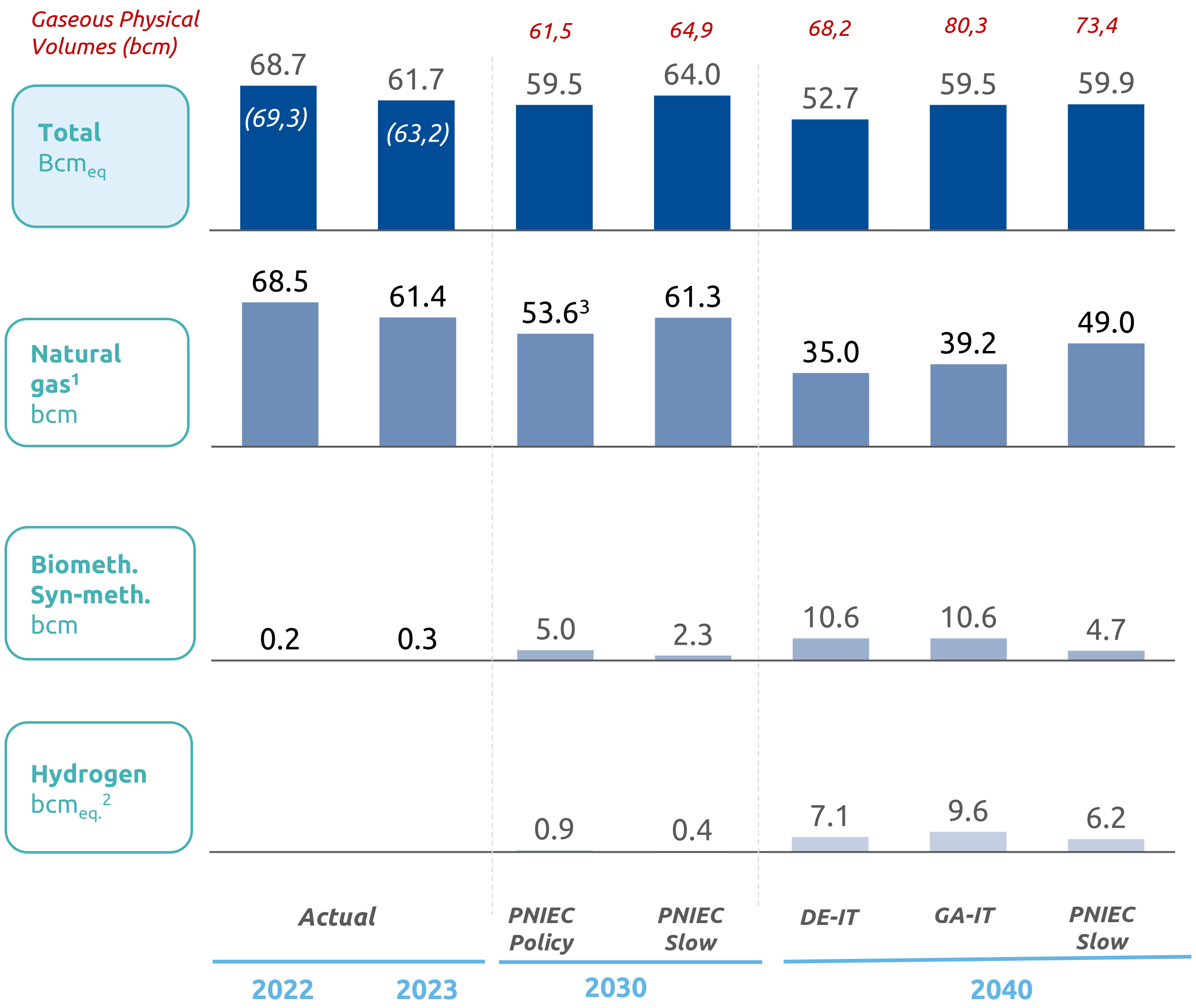
Italian gases demand



Gaseous Fuels:
between 52 and 60 bcm as methane equivalent volumes, but increasing in terms of physical volumes because the chemical and physical properties of Hydrogen that has 1/3 of energy density per cubic meter compared to natural gas

Natural Gas
Volumes reduction up to 20-25 bcm in the policy scenarios vs actual.
- ***Residential sector :*** *«efficiency first» as driver with 25% average reduction of energy demand. Improvement of buildings insulation and deep renovation of the heating systems with large use of heat pump electric and hybrids (12-13 Mln in 2040)*
- ***Industry:*** *reduction of 50% vs actual for electrification and switching to green gases*
- ***Transport:*** *increasing mainly for LNG in freight transport (road and shipping)*
- ***Power :*** *remaining relatively high to nearly 15 bcm (-10 bcm vs actual volumes)*

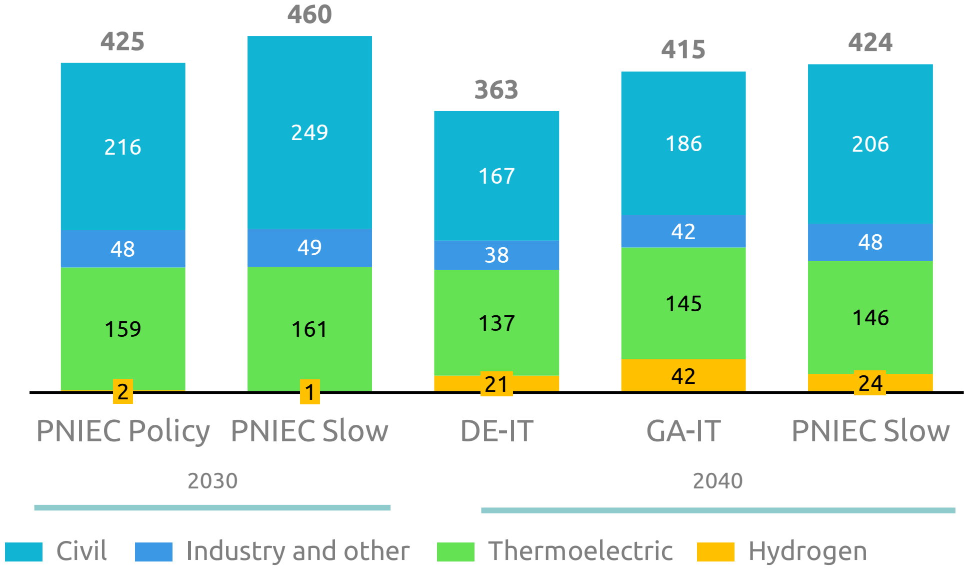
Biomethane/ Syn-methane
Only in the final uses to reduce the carbon footprint .
- ***Residential sector :*** *nearly 4 bcm in 2040 mainly used as heating fuels for condensing boilers and hybrid heat pumps*
- ***Industry:*** *nearly 4 bcm in 2040 mainly in hard to abate sector with high temperature processes*
- ***Transport:*** *used mainly in freight transport as LNG – CNG (road and shipping)*

Hydrogen
Only in the final uses and in non energy uses and refineries.
- ***Residential sector :*** *marginal penetration in the sector*
- ***Industry:*** *mainly in hard to abate sector with high temperature processes (2-3-bcm eq)*
- ***Transport****: used mainly in freight (road and shipping)*
- **Non energy uses and refineries:** switch to green/blue H2 for Syn-fuels and Ammonia*(2-3-bcm eq)*

Notes: 1) Blue H2 consumption included in natural gas demand; 2) Physical demand volume in bcm is ca. 3x the bcmeq.; 3) includes +0,3 bcm of power gen as per Terna market simulation and +1 bcm of LNG for bunkering outside perimeter of official Italian NECP published in 2024 Source: Snam internal

Peak demand stable but growing need for flexibility

Exceptional winter gas peak, $Mm^3_{eq.}$/day

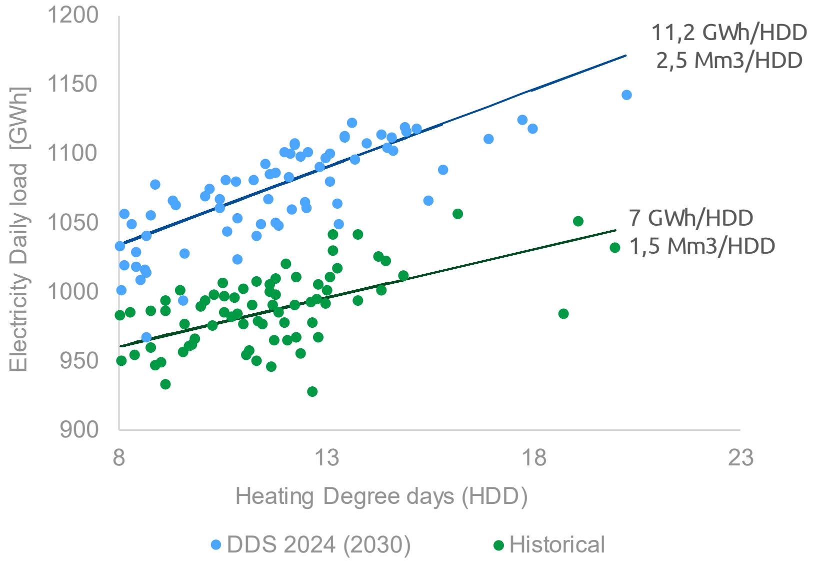


To evaluate the gas grid, a winter peak demand scenario is considered under exceptional conditions, occurring once in 20 years.

Peak demand is closely related to winter temperatures due to the extensive use of gas in the heating sector. Currently winter peak demand can range from 280 Mm^3/day to 400 Mm^3/day.

Peak demand remain consistent with the current levels but with thermoelectric increasing and offsetting residential reduction for efficiency / electrification

Relation between winter temperature and electricity demand

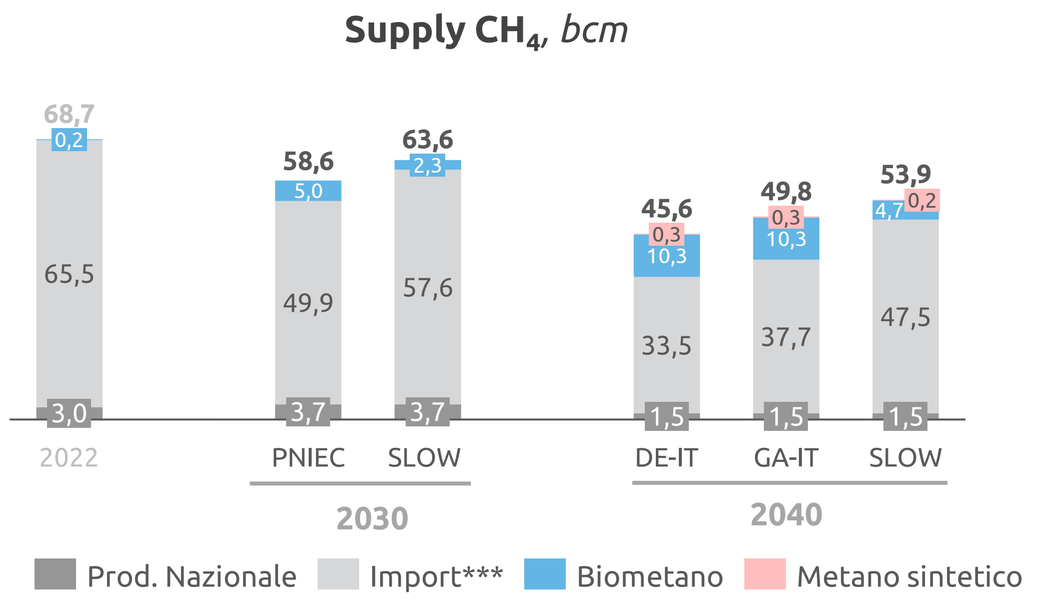


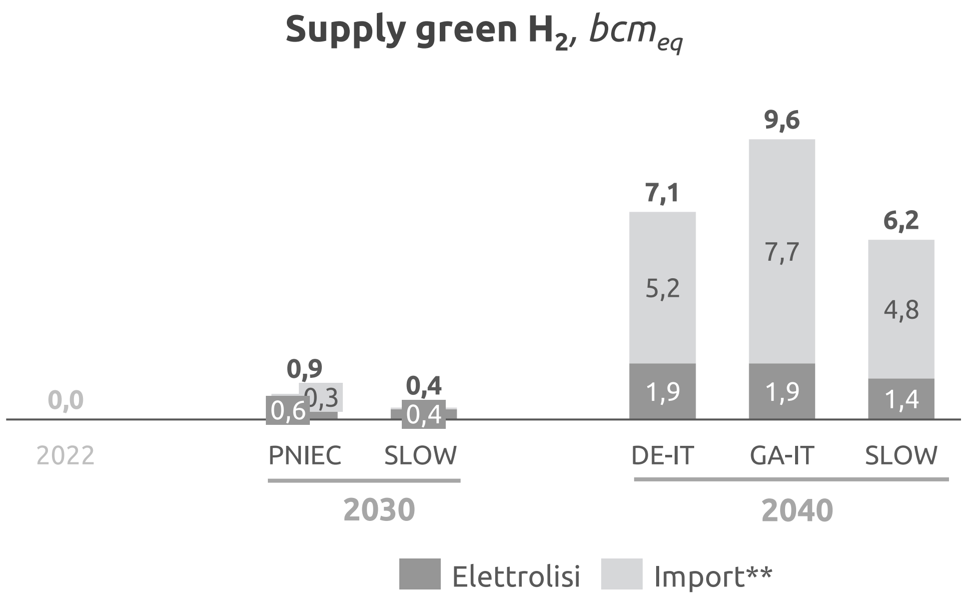
Electricity winter demand becomes more sensitive to temperature for the electrification of heating through Heat Pumps.

The winter heating peak occurs at a time of year when photovoltaic production is at its minimum (<1,5h/day). programmable thermoelectric generation is necessary for daily flexibility, and it is needed to follow/track the temperature seasonal fluctuation.

The thermoelectric peak could also be impacted by the unavailability of renewable generation (dunkeflaute). This situation may result in an increase of approximately 20-40 Mm^3/g between 2030 and 2040.

Gross Inland Consumption and Supply CH_4 e H2





In the policy scenarios, gas demand is met through imports, accounting for about 87% in 2030 and 75% in 2040. However, these scenarios reduce the share of unabated gas and the country's energy dependence due to the development of biomethane production, which grows to 10.3 bcm by 2040.

Hydrogen supply sees a gradual increase in green hydrogen production from electrolyzers and the start of imports, leading to the development of H2 infrastructure for efficient demand/supply matching.

By 2030, in line with the new PNIEC policy scenario, 70% of green hydrogen will come from electrolyzers and 30% from imports. By 2040 import increase to 70% and national production covers 30% of hydrogen (18 TWh)

** Import necessary to cover national demand. Exports are not cosidered.

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Linea Adriatica for diversification and resilience of gas supply

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Incresasing of security and diversification of supply

Increasing of competitiveness and resilience of the energy system in the light of a new geopolitical context

Incremental Capacity 24 Mm3/g from south to north, 3 Mm3/g OLT LNG , 9 Mm3/g Ravenna LNG

Under Construction

Commissioning
Phase 1: 141 km + 33 MW CS - 2026
Phase 2: 284 km - 2027

Fonte: Piano Decennale Snam

European Hydrogen Backbone and Italian Hydrogen Backbone

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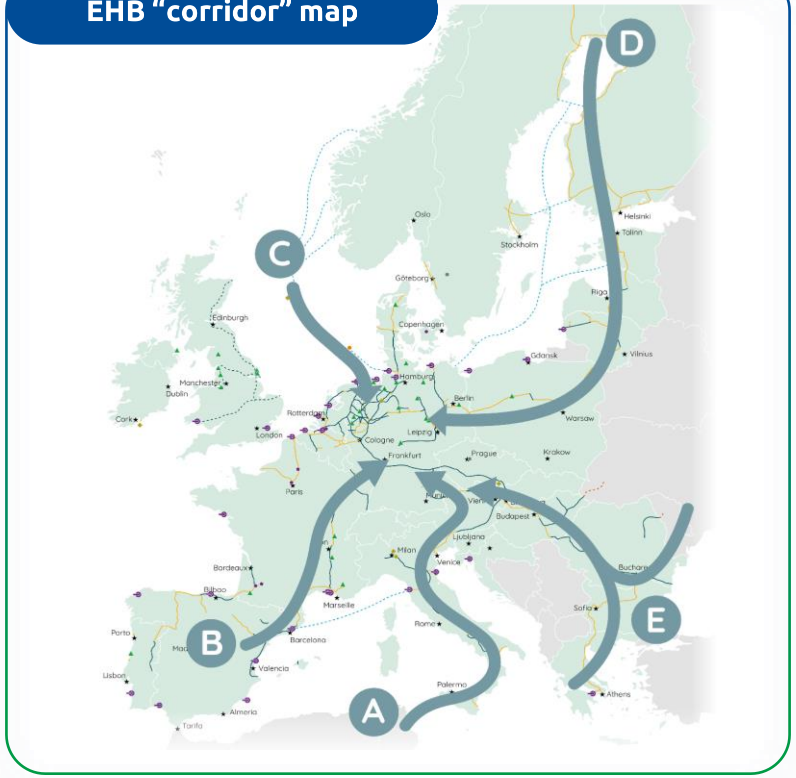
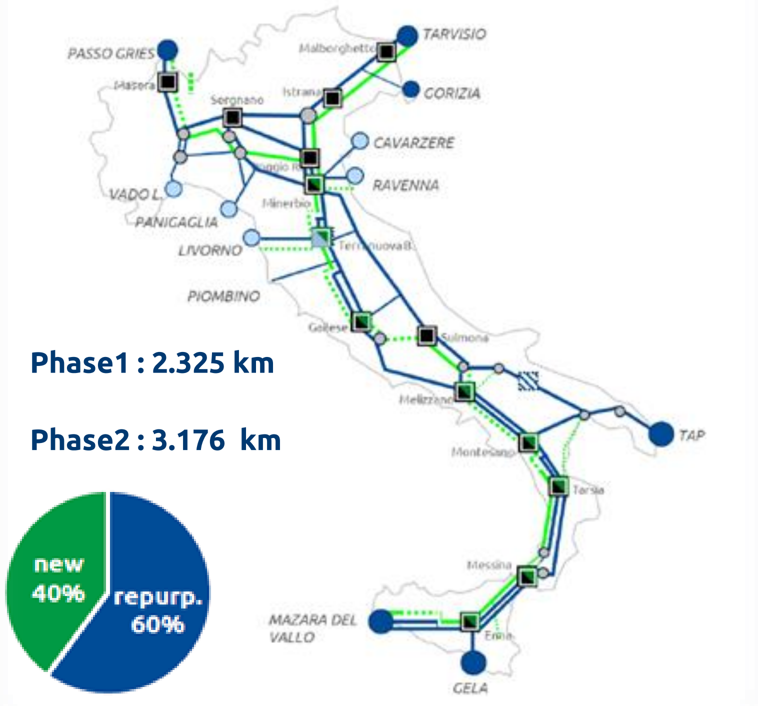
EHB “corridor” map



Increase the energy security and independency developing five priority corridors for hydrogen supply at European level

Italian H2 Backbone



Development of a hydrogen backbone using mainly existing gas infrastructure converted to hydrogen transport, together with new sections to be built.

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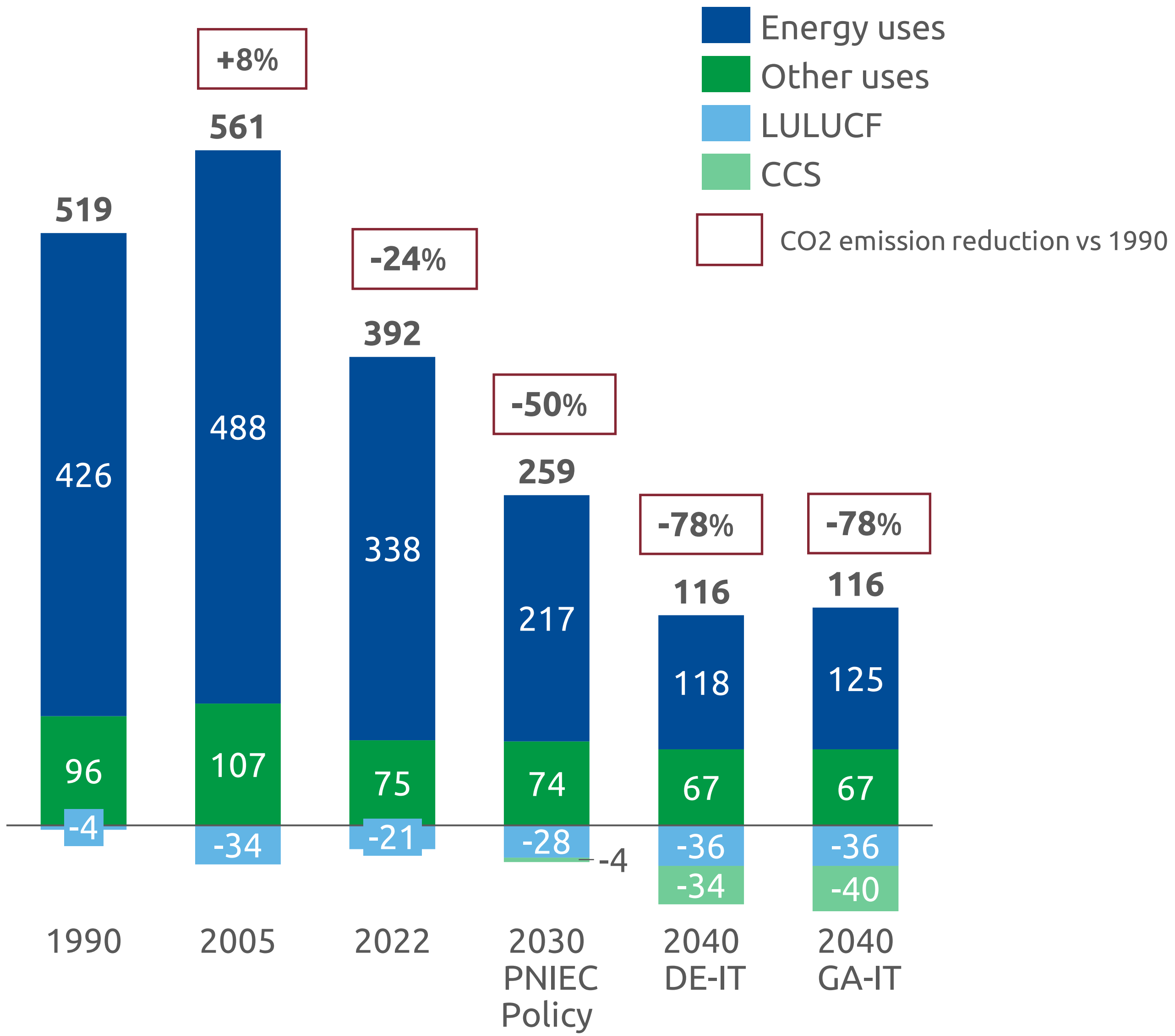
The role of CCS



Current knowledge suggests that carbon neutrality will require the use of CO_2 capture and storage systems.

DDS 2024 scenarios envisage the use of CCS as early as 2030, with 4 $MtCO_2$ captured, and its expansion to 2040 in the DE-IT and GA-IT scenarios with a value of 34 $MtCO_2$ and 40 $MtCO_2$ respectively.

The capture of these quantities, combined with the other decarbonisation measures, makes it possible to achieve a reduction in emissions compared to 1990 levels of around -78%.

CCS as a reliable solution to help decarbonization of energy (market test)

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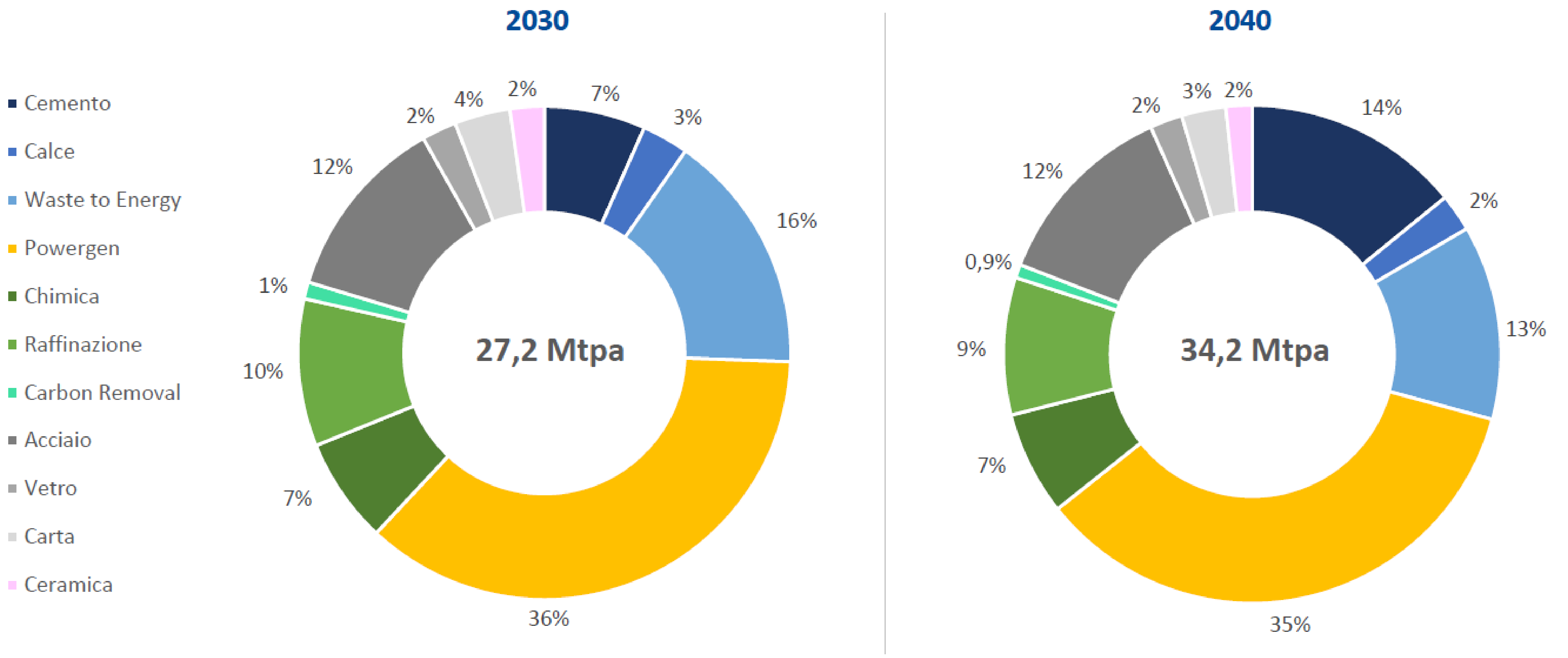
The Market Test lauched by Snam and Eni from 7 February to 5 May 2024 indicated the CCS as a reliable solution to achieve decarbonization of the hard to abate industry sector and and power generation.



Perspective to 2050 [1]

Our 2050 vision of a underlying decarbonized gas mix evolution

Illustrative[2]

Indicative Italian domestic volumes 2050

Electrification to **increase penetration** in the final energy uses	From <25% to 50-55%	
Potential **biomethane** national production	15 bcm	150 TWh
Potential **abated natural gas (CCS)**	15/20 bcm	150/200 TWh
Potential **H2** demand by 2050	45/60 bcm	150/200 TWh

The energy landscape will evolve towards a multi-molecule set up

1. 2050 long term scenarios will be subjects of a specific analysis during 2025, in collaboration with Terna, as determined by the ARERA regulation 392/2024/R/com
2. The graph shows a plausible directional evolution

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Thank you