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THE STATE OF THE ITALIAN GAS

What infrastructure does Italy require?

ANALYSIS

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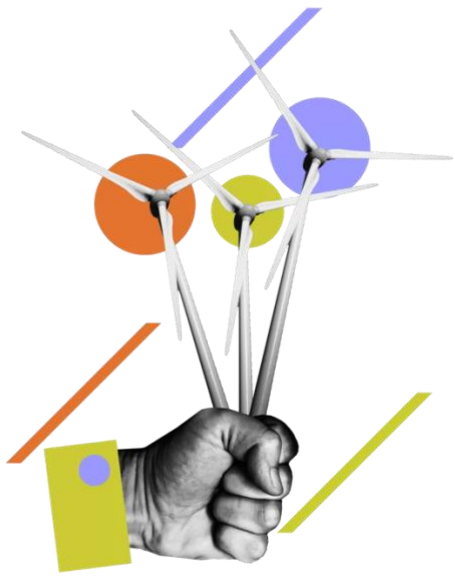

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EXECUTIVE SUMMARY

The work aims to identify the minimum gas infrastructure Italy requires to ensure national energy security, after the consequences of the Russian invasion of Ukraine have shaped the European market and considering the progress on climate targets.

The result must consider guaranteeing a supply independent of Russian sources and competitive gas prices within international markets. Hence, the ability to overcome the crisis relies on the capacity to develop an energy system capable of better managing the risks related to geopolitical instability on the one hand and avoiding developing infrastructure not aligned with market evolution on the other.

As the REPowerEU plan highlights well, the actions for diversifying the energy supply must consider the evolution of gas demand in light of the development of renewable sources, electrification processes, energy efficiency, storage systems, and demand-side management. The combination of these options made it possible to overcome the crisis of 2022.

An integrated vision is essential in guaranteeing an efficient and competitive system. This is why, within the context of the transition process, it is important to ensure that the development of gas infrastructure does not exceed the future gas demand. The risk is the creation of expensive stranded costs, which will weigh most heavily on those struggling to shift away from fossil fuels. At the same time, providing public support for infrastructure that is not in the public interest would mean moving resources from decarbonisation policies needed to build future competitiveness and protect investors from climate risks. All of this is to maintain credibility in relations with the gas-supplying countries that will replace Russia.

We compared three Italian and European gas demand scenarios with several hypothetical evolutions of gas infrastructure.

The study was carried out using an optimisation model that simulates the balance between gas demand and supply in the European market for Italy with a daily granularity for 2030, 2040, and 2050.

The three gas demand scenarios are:

- The ***Late Transition* (LT)** scenario, which draws the values from the *Late Transition* scenario elaborated by Snam-Terna (the Italian gas and electricity TSOs). In this scenario, demand in 2030 - 62 bcm/y—is higher than in 2023 - 61 bcm/y. This scenario fails to reach medium—and **long-term climate goals.**
- The ***Fit-For-55*** (FF55) scenario, as the draft 2023 NECP—59 bcm/y in 2030. This scenario presents an emission gap of 22-29 mtCO_2eq from the goals planned in the EU Fit For 55 Package.
- The ***G7*** scenario developed by ECCO, which envisages the full alignment of energy markets with climate goals, thus achieving a “substantially” decarbonised electricity system by 2035, as committed in 2022 and reinforced in 2023 by the Italian Government within the context of the G7. This scenario foresees a gas demand of 48 bcm/y in 2030.

The 20% decrease in gas consumption observed in 2022-2023 compared to 2021 is not considered in the scenarios to avoid accounting for a structural decrease due to the energy crisis.

The three demand scenarios are evaluated with respect to two different infrastructure developments that, for Italy, correspond to:

- A scenario that considers the existing gas infrastructure and includes only the floating LNG terminal in Ravenna, currently under construction. It excludes the terminal in Piombino as its temporary authorisation expires in 2026.
- A scenario that considers the following infrastructure development: LNG terminals in Ravenna and Vado Ligure (the latter is the current terminal in Piombino that will be transferred to Vado Ligure), a 50% increase in TAP import capacity and the Adriatic line.

In addition, we evaluate an extreme infrastructure scenario that considers additional gas capacity investments. These simulations include the on-shore LNG terminals in Gioia Tauro and Porto Empedocle, a full doubling of the TAP import capacity and the *Poseidon-Eastmed* project.

Estimates of the gas price are the same in all scenarios. They depend on an economic ranking based on the distance from the entry and exit points and the price difference between gas pipelines and LNG terminals. Imports via pipelines are assumed to be cheaper than LNG.

The combinations of supply and demand scenarios are assessed based on three indicators:

1. The capacity of the infrastructure to guarantee energy system security in 2030, 2040 and 2050.
2. Security of peak demand coverage in the case of a complete interruption of Russian gas supply, which didn't happen over the last two years, and no imports from Algeria.
3. Alignment with climate goals.

Main results

In the FF55 scenario, **the existing infrastructure**, including the newly authorised LNG terminal in Ravenna, covers the required demand. In 2030, the LNG load factor is high (92%), and the system guarantees exports of more than 7 bcm/year.

In the LT scenario, the demand is satisfied with an infrastructural capacity that includes the two LNG terminals in Ravenna and Vado Ligure, an increase in TAP capacity, and the Adriatic line. In this scenario, the gas demand in 2030 is higher than the 2023 level, and it is not in line with medium- **and long-term decarbonisation goals.**

The G7 scenario is the only one that guarantees the satisfaction of all three criteria, both with the hypothesis of new investments in gas and with existing infrastructure. In this scenario, which is in line with climate goals, the LNG load factor is less than 40%, even with the same volume of exports. **This highlights how, in a transition pathway aligned with climate goals, existing infrastructure offers more than satisfactory margins and guarantees a secure energy system in terms of gas volume and price.**

The analysis of peak demand shows how the existing capacity covers a peak of 367 million mc/day by considering no gas supply from Russia and Algeria (criteria N-2). The current infrastructure is sufficient for covering peak demand in the G7 scenario and covers 92% of the peak demand estimated by Snam in the LT scenario.

Italian exports range between 6.4 and 9.2 bcm/year in 2030. This represents the bandwidth for defining Italy as the European gas hub if Russian gas imports cease and there are no further gas

infrastructure projects other than the ones already authorised in Europe. Furthermore, in the FF55 scenario, Italian gas exports are set to reduce significantly by around 2 bcm/year by 2040.
Lastly, the increased south-north transport capacity due to the Adriatic line between Sulmona and Minerbio is used exclusively in the scenario with the highest gas demand (LT). **In the other scenarios, the volume of imports from the south does not justify the need to increase south-north transportation capacity.**

Conclusions

A gas demand scenario that includes the full integration of renewable sources, energy efficiency and electrification guarantees the lowest risks in terms of energy, climate, and economic security. This scenario (G7) does not require new investment in gas infrastructure, not even the relocation of the LNG terminal from Piombino to Vado Ligure.

The development of additional infrastructural capacity - besides the floating LNG terminals (Vado Ligure and Ravenna), the increase in TAP capacity and the Adriatic line - **does not appear justified in any simulated scenario**. The on-shore terminals in Gioia Tauro and Porto Empedocle, considered "strategic and urgent" by the Energy Security Decree Law (Italian Decree Law 181/2023), are not operative in any of the scenarios neither to satisfy national demand nor to export further gas volume towards Europe. On the contrary, the simulations considering additional European LNG infrastructure beyond the ready-to-build plants, thus including Gioia Tauro and Porto Empedocle, show lower LNG load factor and exports. This highlights the risks of excessive investments in gas infrastructure.

Italian "gas hub" shows export volumes between 6 and 9 bcm/year to the European market, according to the different scenarios. This is by considering no supplies to Europe from Russia, which were still at 25 bcm via gas pipeline in 2023. This level of exports could also be subject to European competition due to a higher regasification capacity in Germany or other Northern European countries. The European gas demand simulated here must be seen in light of international relations based on new agreements to purchase gas.

The evaluation of the N-2 criteria for assessing energy gas supply requires further study, particularly for the identification of peak demand. In its scenarios, Snam explains that the peak of 425 million mc/day could have an error of 30 million mc. Consequently, strategic gas investment decisions cannot rely on this criterion. Other elements, such as the significant decrease in demand, rising temperatures, and the effect of the energy transition on gas consumption, require more attention. When investing in new gas infrastructure to cover peak demand, these elements must be adequately considered.

Furthermore, uncertainty regarding the security of gas supply is justified not so much by technical aspects as by geopolitical instability. Thus, **even a significant increase in gas infrastructure would not eliminate the risk of a shortfall in gas supplies** – it is worth mentioning, for example, the Red Sea instability or the geopolitical situation in Azerbaijan and Qatar. On the contrary, it would lead to an exponential increase in the risk of stranded costs, further amplified by the possible reopening of Libyan and/or Russian supplies or the achievement of climate goals.

In defining the boundaries of the Italian gas hub, the study highlights that these must not include an unnecessary expansion of gas infrastructure. This would expose the energy system to new risks, such as higher gas costs caused by an increase in stranded costs and by moving public and private resources away from decarbonisation efforts, which, instead, guarantee security even in the face of geopolitical instability.

1. INTRODUCTION

The Russian invasion of Ukraine in February 2022 set the dawn of a period of gas crisis that has led to significant changes in the internal European energy market. We have seen a reshuffling of the foundations of traditional gas supply and demand due to the divorce from the previous source of energy, Russia, which has exported large quantities of gas to Europe at competitive prices for decades. European countries have responded to this crisis by heavily curtailing consumption through renewable sources, efficiency, and energy savings, and in terms of the offer, switching from pipeline gas (Russian) to LNG.

With the REPowerEU plan, the European Commission has begun a process to gradually eliminate Russian gas by 2027, adopting a range of measures, including support for new gas infrastructure and a change in pace for energy efficiency and renewable sources. Europe has, therefore, started to purchase large quantities of liquid gas to guarantee secure supplies while reducing the dependency on gas from Moscow, triggering a transformation in the dynamics surrounding the supply of LNG. The shifts in the market led the LNG transported by sea to play a definitive central role. In 2022, the gas industry saw exceptionally high profits and unprecedented financial capacity, while national measures to mitigate energy prices have totalled 651 billion euros since September 2021 in the EU (91 billion in Italy). In the meantime, supplies from Russia have never been fully interrupted despite being at an all-time low.

The Israeli-Palestine crisis, which intensified after the event of 7th October 2023, has further complicated the geopolitical situation, with additional repercussions on the security of supply and energy infrastructure and causing considerable uncertainty in the energy markets. This uncertainty could be set to continue in light of the spreading of the Middle-Eastern crisis to the Red Sea area, where attacks from pro-Iranian Yemeni rebels on passing ships have affected strategic commercial routes. These attacks threatened to slow energy supplies to Southern Europe, including Italy, from Gulf Nations. The decision taken by Qatar- the main user of the Red Sea route for the transportation of LNG - to suspend transit for security reasons may affect the cost of energy sources, even if the European spot gas markets do not currently appear to be showing many signs of worry, and consequential price rises are yet to be seen.

In light of this context, the possibility of new investments in infrastructural gas capacity has emerged throughout Europe, mostly in the form of regasification terminals, justified by the need to improve the security of energy infrastructure in line with an all-hazards approach. These investments are partially funded with European resources. The suspension of the "Do No Significant Harm" principle to access REPowerEU resources has allowed the funding of gas infrastructure to be considered necessary to emancipate the EU from Russian gas supplies and ensure that climate goals are met. The EU Regulation to amend the National Recovery and Resilience Plan (NRRP) according to the REPowerEU plan includes clauses safeguarding climate goals. In particular, all investments in fossil fuels that qualify for funding from REPowerEU must be operational by 2026, must not hinder achieving climate goals set for 2030 and 2050, and must be proved necessary regarding future demand for gas and alternative solutions.

In this context, investments in new gas infrastructure capacity aim to increase energy system security and, in theory, its process of decarbonisation. In light of this it is necessary to guarantee the supply and the security of the system during transition and to avoid having to fall back on more polluting fuels, such as coal, in the event of possible future imbalances in the gas market.

Energy security and decarbonisation must not be seen as divergent and contrasting goals but rather as synergic objectives. This requires a careful assessment of the risk of creating excessive infrastructure that does not only consider the criteria of "redundancy" for supply security but also the requirements related to the transition process and climate goals. These include the "*transitioning away from fossil fuels*" agreement signed during COP28 in Dubai and the economic feasibility of the investments.

In these terms, the study aims to analyse how the emerging balance of the gas market could reshape the Italian and European energy systems in light of the trends seen in recent years, which, on the one hand, foreshadow possible new import flows from the South, and on the other the implementation of decarbonisation policies. **The study assesses the feasibility and effectiveness of the scenario where Italy plays a new role as a European gas hub, considering its central position in the Mediterranean, thus shifting from being an importer to an exporter. The study not only analyses the scenario regarding energy security for the country and Europe but also includes the economic viability of the system and the coherence with climate goals and environmental sustainability.**

By applying an optimisation model, the study provides estimates of the balance between gas supply and demand as of 2030, 2040 and 2050 to highlight the minimum infrastructure required to cover expected demand with an appropriate margin. The analysis focuses on Italy, seen as part of the European market divided by macro areas. In terms of demand, three different scenarios are envisaged, while in terms of supply, the new investments in the public discussion are considered according to their current state of progress.

Following an analysis of the international context in the wake of the 2021-2022 crisis and short-, medium- and long-term scenarios for global gas demand, the report describes the hypothetical levels of gas supply and demand that form the basis of the model. Chapter 6 presents the results, which are then discussed in chapter 7.

2. THE INTERNATIONAL CONTEXT: VARIATION IN DEMAND FOR GAS IN 2022-2023

In its 2023 World Energy Outlook, the International Energy Agency identifies the beginning of the end of the "golden age of gas", which meant the decade from 2011 to 2021, during which global consumption of natural gas increased by almost 25%, contributing to 40% of the global growth in primary energy supply, more than any other fuel. However, the energy shock caused by Russia in 2022 led to an increase in gas prices that the IEA itself defines as structural, thus leading to mid-term uncertainty over demand.

In 2023, gas markets gradually rebalanced thanks to rapid political action, effective market forces and favourable weather conditions. Global demand for gas has grown by an estimated 0.5% (approximately 20 bcm), not enough to recover the losses seen in 2022, when overall demand fell by 1.5% (i.e., 60 bcm). The increase in global production of LNG (a rise of 13 bcm) has not been enough to compensate for the continuing fall in gas supplied to Europe (a drop of 38 bcm). The global demand for gas began to recover in the second half of 2023, mainly thanks to North America and rapidly growing markets in Asia, the Middle East and Africa. The industrial sector has proved to be the main driver for growth in demand, followed by the energy sector.

Natural gas prices have fallen considerably in all main markets following the all-time highs in 2022. The significant fall in demand in Europe and mature Asian markets has put pressure on gas prices. TTF gas prices have fallen by almost 70% since 2022, with an average of 0.43 USD/m^3 in 2023, still two-and-a-half times the five-year average for 2016-2020. A strong fall in demand, together with a reduced need to bolster gas deposits and consistent flows of LNG, has kept the price of natural gas down despite the continuing fall in the supply of gas from Russia. Prices have remained highly volatile, with an average of more than 100% in 2023, the highest ever recorded, except for 2022.

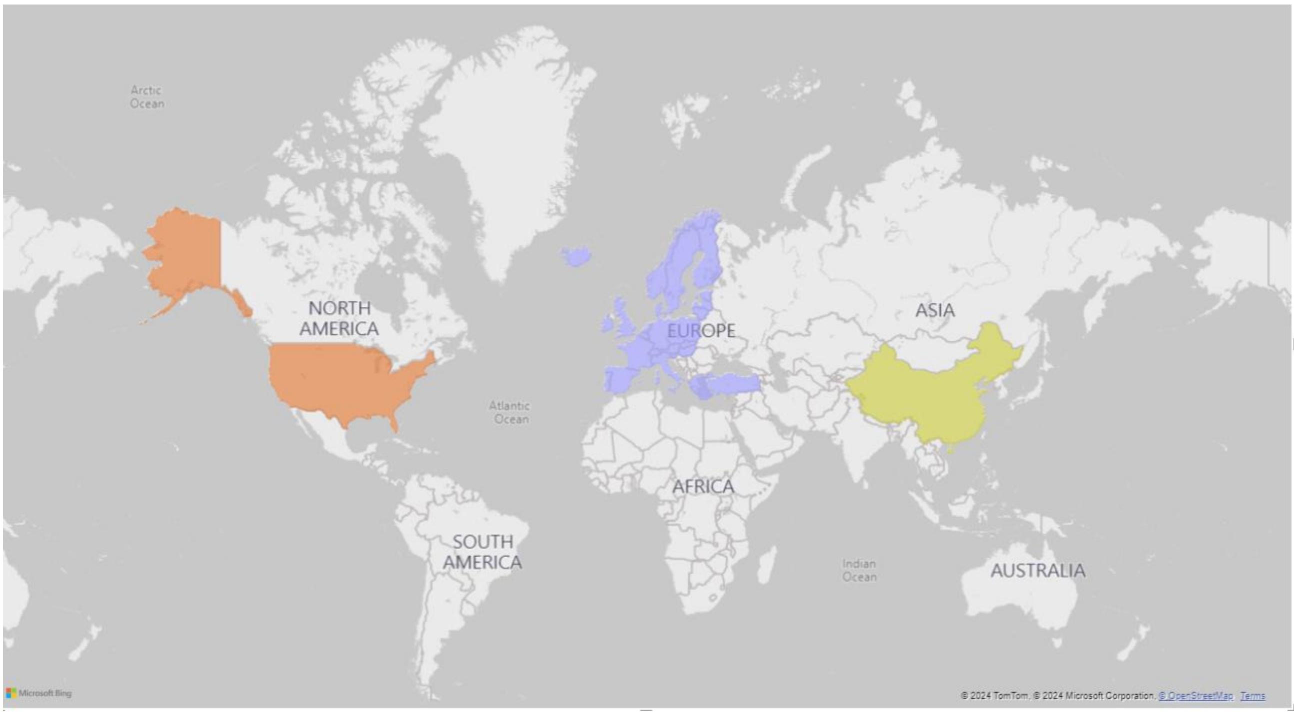

Figure 1 *– Important geographic areas within the international context*

It is estimated that natural gas consumption has increased in the United States by approximately 0.8% (or around 7 bcm). However, the residential and commercial sectors have seen a fall of more than 7% (over 15 bcm) due to a fall in the demand for heating influenced by periods of less intense heating in the first and last quarter of 2023. Domestic production has risen by 4%, or 40 bcm, setting a new record of 1,065 bcm of gas. This significant increase in production, combined with relatively mild winters, has pushed gas prices down, with a drastic fall of 60% compared to 2022. This has consequentially facilitated switching from carbon to gas in the electricity sector, also aided by lower hydroelectric production, leading to an increase of natural gas share in the United States energy mix to a record 42%. The abundant availability of domestic gas has also allowed the United States to increase its own exports of LNG by 10%, becoming the leading international supplier of LNG.

At the same time, China has regained its position as the major global importer of LNG, with a 14% increase (or 12 bcm), without yet exceeding 2021 levels. It has been estimated that China saw an increase in gas demand of 7%, or approximately 26 bcm, in 2023, mainly due to the recovery in industrial activity following the lifting of COVID-related restrictions and the constant fall in global gas prices over the year. The industrial sector represents approximately 40% of overall growth in the country's demand for natural gas. Heavy and energy intense industry, which is susceptible to fuel prices, has partially diverted the previous trend, switching from gas to other fuels, while the brighter economic outlook has also led to an overall increase in the sector's energy demands. Lower gas prices, combined with limited availability of hydroelectric energy in the first half of 2023, resulted in increased gas consumption in the energy sector, which saw an increase of more than 6% year to year.

Despite this growth, the gas demand for energy production in 2023 remained slightly lower than pre-crisis levels due to ongoing competition from coal and the expansion of wind and solar power. Gas consumption in the residential and commercial sectors rose by approximately 8% in 2023, marking a higher growth rate than in 2022.

In Europe, gas demand fell by 7% (or 35 bcm) in 2023 to 488 bcm, in the wake of observed demand in 2022 of 524 bcm[1]. This fall was almost entirely concentrated in the first three quarters of 2023, while gas consumption remained slightly lower than 2022 levels in the fourth quarter. The energy sector alone accounted for 75% of the fall in demand due to a lower electricity demand combined with the continuing expansion of renewable energy and an increase in nuclear power generation. Demand from the distribution network fell by approximately 7% (or more than 10 bcm) in 2023, a decrease that was almost entirely concentrated in the first quarter. Preliminary data for the fourth quarter suggest that demand remained close to 2022 levels. In the first half of the year, flows of LNG increased by 8% on a yearly basis, but this increase was more than compensated by a 10% decrease year to year in the second six-month period. Similarly, while the Netherlands, Germany, Italy and Finland increased their imports of LNG by over 15 bcm compared to 2022, these increases were mainly compensated by reductions in France, the United Kingdom and Spain. Analysis carried out by the IEA suggests that the fall in demand in the residential and commercial sectors is not tied to weather conditions but rather to structural factors. These include improvements in efficiency, gas-saving measures, the switch to other fuels, the rise of heat pumps, and changes in behaviour, also due to growing problems regarding access to funds.

The reduced demand, together with increased stocks, also led to a price fall in European hubs below the Asian LNG spot market in the second half of 2023: Platts JKM saw an average excess of 2 USD/MMBtu over the TTF, leading flexible LNG loads to favour Asian markets over those in Europe. Despite the fall in flow, the proportion represented by LNG in gas supplies to Europe increased by 33% in 2022, peaking at 37% in 2023, a percentage in line with Russian pipeline gas before the invasion of Ukraine. The flow of LNG from the United States increased by 7.5% (or 5.5 bcm), further consolidating its position as the leading supplier of LNG for Europe with a percentage of total imports of LNG rising from 43% in 2022 to 47% in 2023, covering more than 15% of Europe's demand for natural gas. Europe alone represented 31% of the overall volume of LNG traded in 2023.

3. GLOBAL DEMAND FOR GAS: SHORT-, MEDIUM- AND LONG-TERM SCENARIOS

The IEA estimates that global demand for gas will increase by 2.5% in 2024. An increase in demand is expected in the rapidly growing Asia-Pacific markets and gas-rich countries in Africa and the Middle East. The increase in demand for gas will be bolstered by industry and the residential and commercial sectors, assuming a return to average winter weather conditions following the mild season seen in 2023. It is predicted that there will only be a slight increase in demand for energy production, as the increase in gas consumption in Asia-Pacific, North America and the Middle East is likely to be partially compensated by the structural decline in Europe.

[1] The figure refers to European member countries of the OECD in accordance with the geographic areas of the IEA: Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, the Republic of Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

In the long term, however, the IEA proposes three different global energy transition scenarios in which demand for gas follows different paths:

- The Stated Policies Scenario (STEPS), which sees an increase in average global temperature by 2100 of 2.4°C above pre-industrial levels, is therefore not in line with the 1.5°C goal set by the Paris Agreement. In this scenario, global demand for natural gas will peak by 2030, to then plateau for a long period before falling gradually to approximately 100 bcm by 2050.
- The Announced Policies Scenario (APS), which is also not in line with the 1.5°C goal as it estimates an increase of 1.7°C by 2100. Here, demand peaks even earlier than in STEPS, and by 2030 is 7% lower than 2022 levels.
- The Net Zero Emissions (NZE) scenario, which forecasts net zero emissions by 2050 and an average global temperature increase of 1.4°C by 2100. Demand for gas in the NZE scenario falls by more than 2% a year between 2022 and 2030 and by almost 8% a year between 2030 and 2040. The reduction rates are balanced after 2040 by the increase in the use of natural gas with CCUS for the production of low-emission hydrogen.

In OECD member countries, demand for natural gas falls under all of these scenarios. Support for renewable sources is set to reduce the percentage of natural gas by 2030 in the energy sector, and then ever further in the civil and industrial sectors. By 2050, demand for gas in advanced economies will fall to 1200 bcm in the STEPS scenario, 40% lower than current levels. More rapid electrification of heating and increases in efficiency will take gas to 480 bcm by 2050 in the APS and to 300 bcm in the NZE scenario.

In Europe, where demand for natural gas has fallen by 20% since 2021 as previously mentioned, continuing efforts to reduce demand in the STEPS will lead to a further reduction of 50 bcm by 2030. In the APS, an acceleration in the electrification of end uses, an increase in efficiency and the expansion of renewable energy sources will mean that demand will remain lower than 60 bcm in 2030, falling to below 30 bcm by 2050.

4. GAS INFRASTRUCTURE UNDER DISCUSSION IN ITALY AND EUROPE

In line with the indications of the European Commission, Italy has reacted to the crisis by adopting emergency measures aimed in part at reducing gas consumption (through voluntary actions destined to limit heating usage times and temperatures, and obligatory actions aimed at maximising electricity production with fuels other than natural gas), and in part to rapidly diversify sources of imported gases, maximising the use of available infrastructure and increasing national gas infrastructure. The Italian Government has thus signed a number of agreements in collaboration with Eni and Snam for increasing pipeline gas and sea LNG imports with: Algeria for an increasing volume of up to a potential 9 bcm, Azerbaijan to increase supply from the TAP, Egypt for 3.5 bcm, Qatar for 1.4 bcm, Congo for 4.6 bcm and other countries (Angola, Nigeria, Mozambique, Indonesia and Libya) for 3.0-3.5 bcm. Eni has signed agreements for new projects in the Mediterranean and in Africa, including new LNG terminals in Algeria, Congo, Mozambique and Qatar and new upstream capacity in Algeria, Angola, Congo, the Ivory Coast, Libya, and Egypt.

To this end, the Government has begun to consider, and in some cases has already implemented, capacity expansion of gas infrastructure (Figure 2), first and foremost with the new regasification terminals, focusing on floating structures, which are more flexible and require less time to set up - two FSRUs in Piombino and Ravenna -, on the basis of a forecasted increase in the supply of liquefied gas. Discussions are also under way for other fixed terminals in Gioia Tauro and Porto Empedocle, considered by Italian Decree Law 181/2023 (commonly known as the "Energy Security Decree") "non-deferrable and urgent" for national energy security. However, the same Decree considers the reduction in energy dependency and the achieving of decarbonisations goals to be of extreme importance, stressing the need to strengthen the decarbonisation process. Other options considered are an increase in the TAP's capacity for transportation towards Italy, to which end the company has commenced discussions for a doubling of the capacity, and an increase in national production which amounts to approximately 80 bcm, including both certain and probable reserves. The Energy Security Decree modifies the mechanism of the so-called *gas release* (art. 16 of Italian Decree Law 17/2022, amended by Italian Decree Law 176/2022), which was introduced to support gas-intensive companies in the wake of high energy costs by offering them national gas at "reasonable" prices. As was the case in the first version, the criteria for "reasonable" appears to be incoherent with the objectives of the regulation itself, both in terms of the duration of the concessions- reference is made to the useful lifespan of deposits, which could potentially last well beyond the emergency period - and for the economic feasibility for the end client. As for how the price of contracts for difference with GSE is established, it is unclear how beneficial it would be for gas-intensive companies to sign a contract with a third party rather than agreeing a price directly with the concession holders of natural gas deposits. There has also been a change in the pace for the Linea Adriatica project, which is considered to play a fundamental role in overcoming the bottlenecks in the South-North route and in guaranteeing transportation of additional supplies from their arrival points in the south. Lastly, attention has returned to the *Poseidon-Eastmed* project, which aims to transport gas from off-shore wells in Israel and Cyprus to Italy.

The list of options currently under discussion for Italy is shown in Table 1 complete with their progress as of February 2024.

Project	Purpose	Progress
FSRU in Piombino, set to be moved to Vado Ligure in 2026	An increase of 5 bcm/year in regasification capacity	Operative since May 2023, with provisional authorisation of 3 years in Piombino. The move to Vado Ligure for a useful operative period of 22 years is awaiting authorisation.
FSRU in Ravenna	An increase of 5 bcm/year in regasification capacity	Authorised and currently under construction. Set to become operational in mid-2025.
The Linea Adriatica project	An increase in northbound transportation capacity from 122 to 145 mn m³/day (from 45 bcm/year to 55 bcm/year)	Two of the three portions between Sulmona and Minerbio have already been authorised (Sulmona-Foligno and Sestino-Minerbio, with the deadline for initial works postponed to 2024), including the gas compression facility in Sulmona. The operation costs EUR 2.5 billion, and the facility should be operational by 2027. The first stage of the project (the Sulmona plant and the Sestino-Minerbio portion) will be funded through the NRRP (REPower chapter) for the amount of EUR 375 million and will see an increase in transportation capacity of 14 mn m³/day. The remaining investment will likely be included among those governed by gas prices. Furthermore, the European PCI (Projects of Common Interest) 2023 draft update refers to an "Italy-Austria-Germany hydrogen corridor" *(SouthH2Corridor)*, which includes a sector in Italy known as the "Italian H2 backbone". However, it is not described in further detail. According to indications from Snam, a partner in the project, this probably concerns

		the current reconversion of the Tyrrhenian backbone. However, it is unclear whether this could also include the new Adriatic backbone in the future, which is to be considered *hydrogen-ready*.
An increase in the transportation capacity of the TAP	An increase of up to two times the Italy-bound transportation capacity (from 10 to 20 bcm/year). In the model, we assumed an increase of either 5 or 10 bcm/year according to the demand scenario	In accordance with the assessment by ENTOSG, REPowerEU sees the capacity increase of the TAP as a valid compensation for Russian supplies in Central and Southeast Europe. However, the project has not been included in the 2023 update to the PCI, which is currently under review. In July 2022, the President of the EC and the President of Azerbaijan signed a Memorandum of Understanding for an increase in Azerbaijani supplies to the EU by 4 bcm in 2022, delivering up to 20 bcm by 2027. However, no binding commitments were followed for the expansion of the gas pipeline. In the wake of the 2021 Market Test, the company TAP only received binding offers for 1.2 bcm/year, considerably lower than the 10 bcm needed for a doubling of supply. During the second Market Test in 2023, no additional offers were presented by European gas customers. Nor is there any evidence of any measures to increase the transportation capacity of the SCP and TANAP, the sectors in Turkey and Greece (the Southern Corridor) of the pipeline leading to Italy. Despite this, Azerbaijani production increased in 2023 (+3.5% over 2022), with BP and TotalEnergies planning to increase production from deposits in Absheron and Shah Deniz.
Fixed regasification terminal in Gioia Tauro	An increase in the capacity for regasification of 12 bcm/year	The authorisation initially granted in 2012 was frozen with the Decree passed by the Italian Ministry for Economic Development in July 2013. However, the works have been declared as strategic by the Italian Prime Minister Meloni and the Minister for the Environment and Energy Security.
Fixed regasification terminal in Porto Empedocle	An increase of 8 bcm/year in regasification capacity	Initial work authorisation was extended to June 2022, with completion by April 2028.
The *Poseidon-Eastmed* project	An onshore and offshore pipeline that transports gas from offshore deposits in the Eastern Mediterranean area (Cyprus and Israel), via Cyprus, Crete and Greece to Italy, with a transportation capacity of approximately 10-12 bcm/year, which can be increased to 20 bcm	Awaiting authorisation. The project, which includes the portion to Greece *(Eastmed)* and the second Greek-Italian offshore gas pipeline *(Poseidon),* has been included in the fifth list of the PCI. However, the draft update excluded the portion to Italy *(Poseidon).* In theory, the Connecting Europe Facility is the vehicle for financial support for implementing the PCI. The presentation of REPowerEU was accompanied by the Commission's call for proposals, with a budget of EUR 800 million.

Table 1 *– List of infrastructural projects under examination and their status.*

***Figure 2** – New investments in gas infrastructure capacity in Italy either in progress or under examination (for the TAP, reference is made to an increase in import capacity of up to 10 bcm/year; transfer of the FSRU from Piombino to Vado Ligure is currently awaiting authorisation)*

The analysis of supply infrastructure also takes into consideration the plans of various countries to substitute gas from Russia, with a particular focus on existing and future regasification capacity (Figure 3) and on changes in the European supply mix that are to be considered as structural in the wake of the crisis in Ukraine. This allows an assessment of the situation in Italy within the context of the European market, and the import-export flows between the various countries.

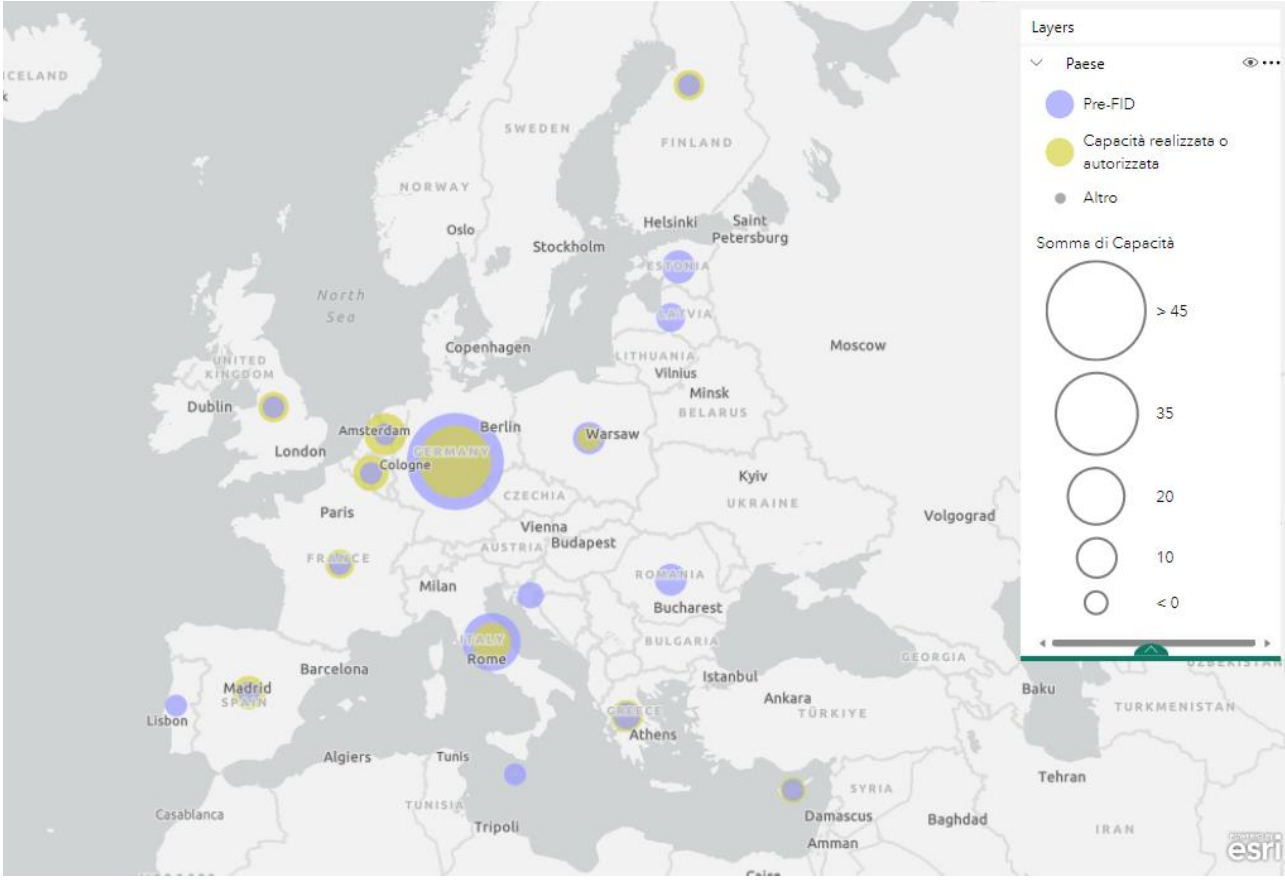

Figure 3 *– New regasification capacity in Europe (bcm/year) and relative status.*

The assessment includes those projects that became operational in 2022-2023, those that are in the implementation phase, and those that have received a positive Final Investment Decision *(FID)*. These all account for an additional Europe-wide infrastructural capacity of 90.7 bcm/year. There are other projects under discussion and in pre-FID phases that account for a further volume of 95 bcm/year. This capacity is divided by country in Table 2.

Country	Capacity as of 2021	Capacity rendered operational in 2022-2023	Capacity in the implementation or FID phase	Capacity still under discussion (pre-FID)
Italy	16.5	5.0	5.0	21.6
Belgium	9.0	2.0	6.0	0.0
Croatia	2.6	0.0	0.0	2.6
Estonia	0.0	0.0	0.0	6.8
Finland	0.6	5.0	0.0	0.0
France	36.2	4.3	0.0	0.0
Germany	0.0	15.0	15.0	45.0
Greece	6.9	0.0	6.1	3.0
Latvia	0.0	0.0	0.0	4.1
The Netherlands	12.0	8.0	4.0	0.0
Poland	6.2	0.0	1.0	6.1
United Kingdom	48.0	0.0	5.0	0.0
Romania	0.0	0.0	0.0	6.0
Spain	62.5	6.9	0.0	0.0
Lithuania	4.0	0.0	0.0	0.0
Portugal	7.6	0.0	0.0	0.0
TOTAL	**212.6**	**46.2**	**44.5**	**95.2**

Table 2 *– Additional gas infrastructure capacity at European level, subdivided by country.*

5. GAS SUPPLY AND DEMAND SCENARIOS FOR ITALY AS OF 2030, 2040 AND 2050

In an increasingly unstable international panorama, in which the conflict between energy security and transition appears to be ever stronger, it is necessary to analyse the evolution of the Italian energy system in order to understand how to address the emerging challenges. In choosing what initiatives to take, Italy needs to balance security and transition goals, bearing in mind global markets, the shifting geopolitical scene, and climate goals, which call for a move away from gas. Equally, the creation of an Italian energy hub, which will see Italy taking a relevant role in the European energy security, needs to be considered in light of the emerging criticalities of the new geopolitical panorama and the strategies adopted by the other Member States.

In these terms, the aim here is to assess the state of security of the Italian and European systems in light of the evolution of global energy markets and the transition goals, first and foremost with an analysis of the compatibility of new gas capacity with future importation requirements. To this end, three gas demand scenarios in Italy and in Europe have been compared considering the forecasted supply discussed by Governments.

5.1 THE FUNDAMENTAL ASPECTS OF THE GAS SYSTEM IN EUROPEAN MARKETS IN TERMS OF THE ENERGY CRISIS AND FUTURE SCENARIOS

The European market has been recently characterised not only by the large-scale internal substitution of (Russian) pipeline gas with LNG, but also by a decisive fall in demand, driven in part by measures to reduce consumption (of both gas and electricity) and in part by the substitution effect that has seen gas as a less competitive option than other sources or uses. Savings, energy efficiency and development of renewable sources have all contributed to a reduction in European demand for gas of approximately 50 bcm between 2021 and 2022 (-13%). Italy has seen a fall of 9.8% - from 76 bcm in 2021 to 68 bcm in 2022 - with varying percentages in a range of sectors (civil, industrial and thermoelectric). Last winter, ECCO carried out in-depth analysis of the evolution of gas demand, which can be accessed here.

2023 confirmed the trend seen in 2022, with the Italian gas demand reducing 7.2 bcm (-10.5% compared to the previous year, according to data from Snam). With the development of renewable energy sources (RES), which grew by 5.7 GW in 2023, and a notable recovery in hydroelectric production (+36% between 2022 and 2023 according to data from Terna), the withdrawal from the thermoelectric sector has fallen by 4.4 bcm, and withdrawal from local distribution networks - which include SMEs, commerce, services and above all domestic withdrawal for heating - has fallen by approximately 2.2 bcm. Larger industrial users, which are connected directly to the Snam network, have reduced their withdrawal by just around 0.5 bcm. For this latter group, the fall, which in 2022 was more than 2 bcm, seems to have stabilised. In the case of distribution networks, the most significant fall has been seen in the autumn and winter months, demonstrating how use is driven by space heating, due to an unusually warm period as well as by a more general drive for energy savings and even more widespread energy efficiency measures. Lastly, the data regarding the thermoelectric sector reflects a particularly sharp fall in gas demand balanced by higher levels of renewable energy production (+15.4% in 2023 over 2022) due to favourable weather conditions.

Aside from the progressive but still uncertain diminishing of the effects of the crisis, which makes it hard to predict the evolution of certain variables, such as GDP and temperature trends, which have in the short term a potentially significant effect on variations in demand, **certain dynamics have all the characteristics of being structural**. While on the one hand it is true that policies to combat high energy prices have not focused on stabilising any savings achieved, consequentially serving as an incentive for consumption, on the other, the penetration of RES in the electricity sector and the spread of energy efficiency will have a direct effect on gas consumption. It is therefore clear that **the trend will be for a fall in gas consumption, which will occur in a more or less rapid manner according to how quickly decarbonisation policies are implemented.**

In carrying out the study, we therefore imagined three different scenarios for domestic and European demand, which in the specific case of Italy take into consideration the variables that most affect the demand for gas in the three different areas of consumption:

- **The power sector,** where the development of RES will lead to a necessary and progressive abandonment of gas. Currently, on a national level, 50% of the electricity produced is from natural gas, but with an increase in generation from renewables, the energy mix will change substantially, leaving gas to play a marginal and residual role. Calculating that one GW-worth of new renewable systems replaces approximately 0.25 bcm of gas, according to the RES goals provided for by the new NECP, gas consumption for electricity generation will see a fall of 7 bcm by 2025, and a further 11 bcm by 2030 (compared to 2021 levels). These goals are to be considered a certain and minimal-risk variable, considering market trends and the willingness of the Government to speed up penetration of renewables, first and foremost by resolving the obstacles regarding authorisations, a process that began in the 2021-2022 period. Goals regarding the development of RES for energy systems are defined by the European Renewable Energy Directive (RED III) and are binding for Member States. Furthermore, all the scenarios assume that by 2030 the phasing out of carbon capacity will be complete, as per national goals.

- **The building sector** is showing a downward, albeit slight, trend in the use of natural gas to satisfy its energy consumption, mainly due to demands for heating and cooling. This fall will pick up pace in the medium- and long-term due to four variables: i) an increase in the energy saving goal with regards to final energy consumption as provided for by the new EU Energy Efficiency Directive (EED); ii) the progressive electrification of civil uses and the abandoning of natural gas both for space heating (500,000 heat-pump systems were installed in 2022 alone) and for cooking (induction hobs); iii) an increase in temperatures over the next thirty years that will see a fall in degree days[2], and consequentially a reduction in energy demands for heating, two factors that are positively correlated; iv) demographic forecasts that predict a progressive fall in the Italian population of more than one million by 2050 with a consequential fall in consumption.
- **The industrial sector,** which will see a slower fall in demand for gas than in the other sectors. It is, in fact, probable that the fall due to the achieving of emission goals for the sectors under the Emission Trading System (ETS), such as industry, will be compensated by a growing use of this energy source for the likely switching of the ex-ILVA plant in Taranto to DRI (Direct Reduced Iron) technology. Two of the proposed scenarios take into consideration this reconversion, which initially is set to use natural gas, probably mixed with hydrogen, to run the DRI systems, with a gradual transition to the exclusive use of green hydrogen after 2030. However, the industrial sector's gas consumption represents, on average, 17% of gas demand in the various scenarios. As a consequence, it has a minor effect on the overall expected evolution.

5.2 HYPOTHETICAL DEMAND: SCENARIOS AS OF 2030, 2040 AND 2050

The study considered three gas demand scenarios for the years 2030, 2040 and 2050. These differ in terms of the level of compliance with climate goals, and consequently foresee varying degrees of gas reduction due to the development of renewable sources, energy efficiency and electrification of consumption. The scenarios for Italy are as follows (Figure 4):

- ***Late Transition* (LT)**: this is the most conservative of the scenarios, and sees a failure to achieve medium- and long-term climate goals. It, in fact, identifies the maximum volume of gas demand that can be reached with current policies, assuming that emission reduction targets will be reached a few years later (5-10 years). In 2030 and 2040, it is in line with the corresponding *Late Transition* scenario produced jointly by Snam and Terna in July 2022, which draws on the values from the 2019 NECP, currently being updated, which were estimated in line with a Community goal – since exceeded – for a 40% reduction in CO_2 emissions by 2030. In 2040, the scenario does not predict any new climate policies, but simply the prolonging of those set for 2030. In 2050, the estimate is based on the previsions of the IEA's World Energy Outlook 2022. This is in line with an increase in global temperature of more than 2°C by 2100 and does not see the achieving of the Net-Zero goal.
- ***Fit-For-55 (FF55)***: the scenario sees policy goals updated in 2030 in accordance with the EU *Fit-For-55* package, including energy and climate policies provided for by the new NECP, the

[2] Heating Degree Days (HDD) are an indicator used to measure the thermal demand for heating homes in a determined location for a determined period (ISPRA, 2017).

draft of which was published in June 2023. For 2040, it applies the estimates from the *Distributed Energy* scenario drawn up by Snam-Terna, which sets out a non-binding and intermediate situation in 2040 in line with the achieving of Net Zero by 2050. Compared to the other scenarios by Snam-Terna, this condition provides for faster penetration of electricity carriers and a more marginal role for carbon capture and storage technology (CCS). This value is not in line with the recommendations from the European Commission (EC) regarding goals for 2040, which call for the need to reduce demand for fossil fuels by 70% of current levels. For 2050, the scenario is in line with the *Distributed Energy* scenario by TYNDP 2022, elaborated by European transmission service operator (ENTSO) associations.

- ***The G7 scenario (G7)***: this scenario forecasts full alignment of energy markets with the climate goals signed by the G7 countries at the end of 2023. ECCO has developed a scenario that guarantees a substantially decarbonised electricity system by 2035, as per the commitment signed in 2022 by the Italian Government within the context of the G7, and forecasts the strengthening of policies to promote energy efficiency and the electrification of consumption in the civil and industry sectors. Further details on the hypotheses on which this scenario is based can be seen here. By 2040, the demand for natural gas is estimated to fall by 82% compared to 2021, as per the recommendations of the EC for new goals for 2040.

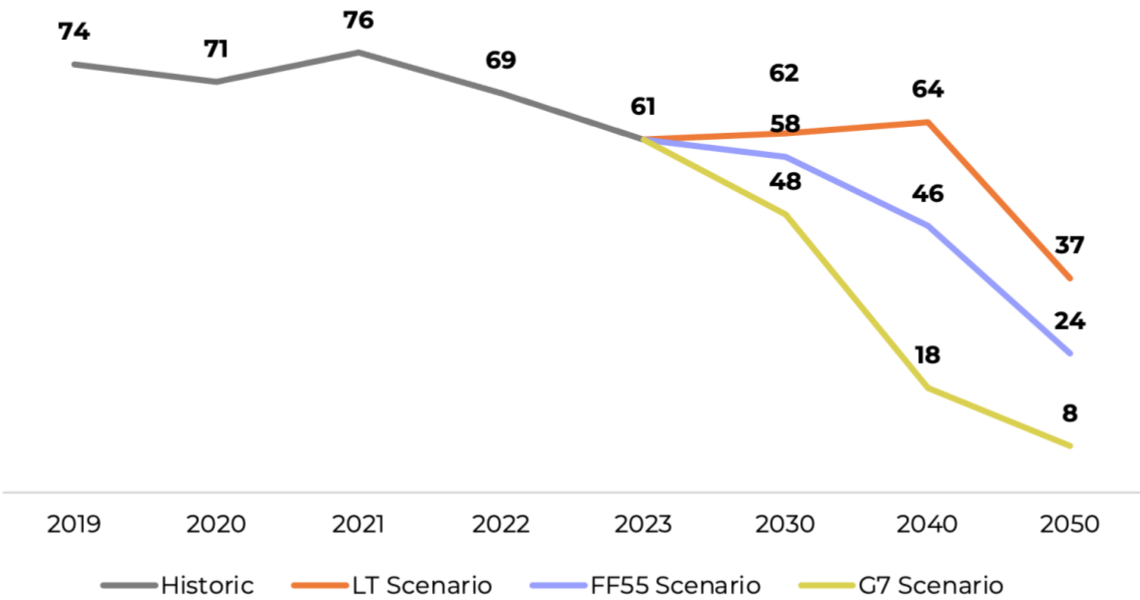

Figure 4 – *Italian demand for gas in 2019, 2020, 2021, 2022 and 2023, and scenarios for evolution in 2030, 2040 and 2050 [bcm/year]. Source: MASE, Snam and processing by ECCO*

The three scenarios are conservative in comparison both to the structural nature of the gas reduction seen of 2022-2023, assuming a post-crisis recovery in demand for gas that will bring volume back up to the levels seen in recent years, and to a potential "temperature effect". They do not, in fact, take into consideration the increase in global temperature that currently represents a fundamental variable in determining winter demand and daily peaks. Even by imagining, on the contrary, weather conditions that are particularly harsh, a probability that is becoming ever more remote due to the effects of climate change, despite remaining a possibility, demand for gas would still only increase by less than 2 bcm.

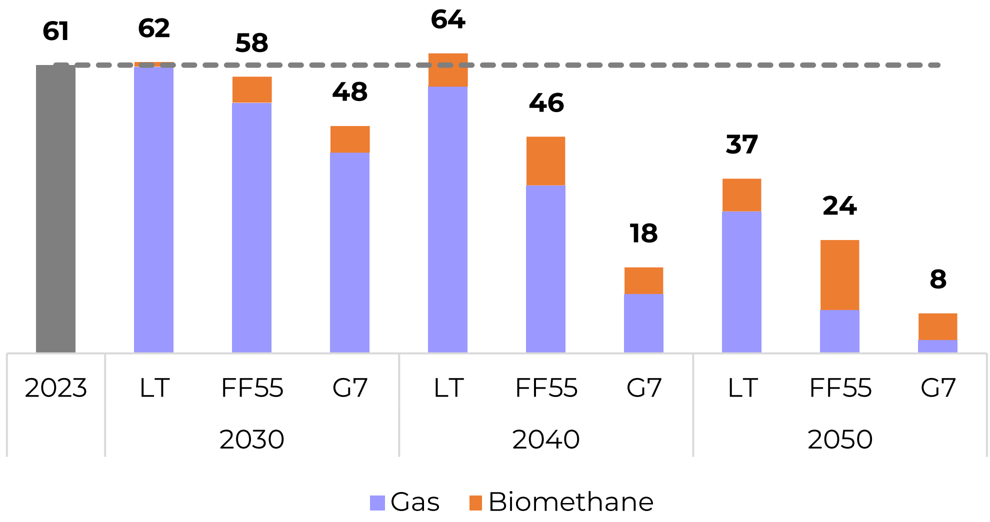

Figure 5 – *Comparison between the scenarios for gas demand (natural gas and biomethane) for 2030, 2040 and 2050 and the demand seen for Italy in 2023 [bcm/year]. Source: Snam and processing by ECCO. This demonstrates how estimates for 2030 and 2040 in the LT scenario are higher than levels for 2023.*

To guarantee the energy security of the gas infrastructure, it is also important to assess coverage of the winter peak in estimated daily gas demand under exceptional conditions[3]. This is analysed within the 2030 horizon, which for the volume of demand, is the most critical. **Each scenario for annual consumption has associated a daily peak demand level:**

- *Late Transition*: 412 mcm/day as per the *Late Transition* scenario drawn up by Snam-Terna (July 2022)
- *Fit-For-55*: 425 mcm/day as per the NECP POLICY[4] scenario drawn up by Snam-Terna (2023)
- *G7*: 350 mcm/day (estimate by ECCO).

Lastly, three scenarios for European gas demand were also drawn up, each associated to the corresponding Italian scenario (Figure 6), in order to have a picture as complete as possible and to allow the model to provide for flows between the various countries. The gas demand in the 27 European countries, in the United Kingdom and Switzerland was also simulated, assuming evolution in line with the average evolution in the three different scenarios. More specifically:

- For the *Late Transition*, consideration was made of the *National Trend* scenarios from the TYNDP 2022 Scenario Report. These take into account national energy and climate policies derived from past European objectives and included in the relative NECPs in 2019.
- For the *Fit-For-55*, consideration was made of the *Distributed Energy* scenarios from the TYNDP 2022 Scenario Report.
- For the *G7*, reference was made to the study by the German think tank Agora-Energiewende (2023), which provides natural gas demand on an aggregated EU27 level in line with an accelerated phasing-out of fossil gas.

[3] Snam makes reference to a winter with a probability of occurrence of once every 20 years.
[4] Scenario aligned with the 2023 NECP.

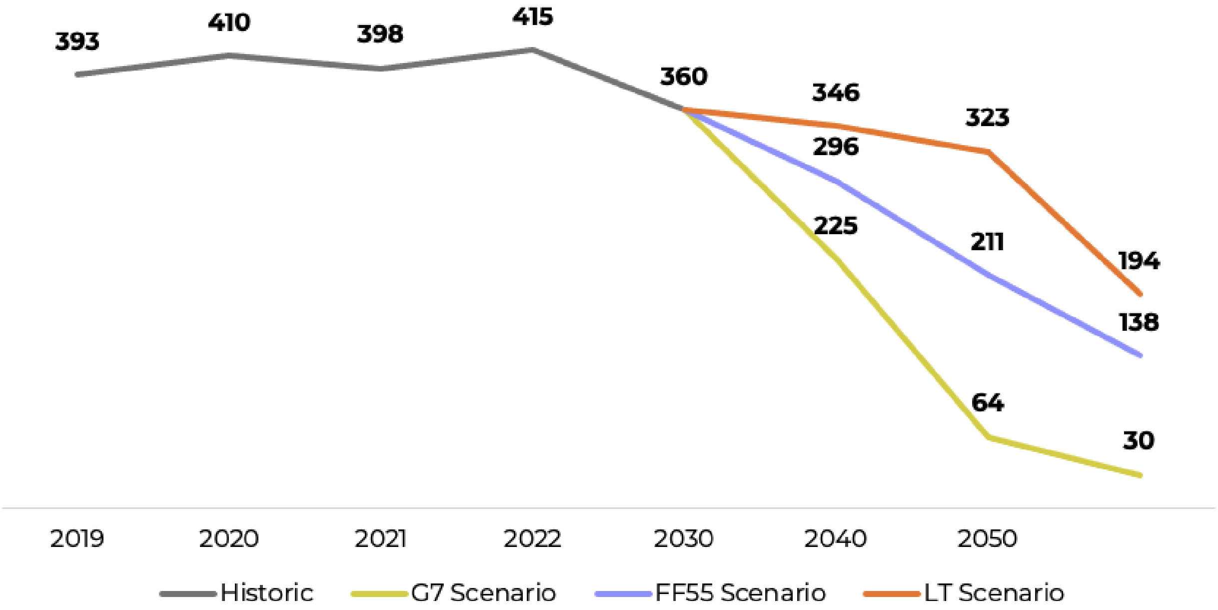

Figure 6 – *Past European gas demand and scenarios for 2030, 2040 and 2050 [bcm/year]. Source: Eurostat and ECCO processing.*

5.3 HYPOTHETICAL SUPPLY AS OF 2030, 2040 AND 2050

The analysis compares the three demand scenarios with various hypothetical supplies that take into account both different levels of gas infrastructure capacity and different contractual conditions for import volumes in 2030, 2040 and 2050.

In terms of gas capacity, an initial hypothesis was drawn up that exclusively focuses on projects that are either already in the implementation phase or that have been authorised (positive FID). This hypothesis was then extended to also include projects that are uncertain and are still in the discussion phase (pre-FID).

With regards to import contracts, the LT scenario is based on increased availability of exports from Algeria and Azerbaijan due to a continuation of gas production volume in these countries, driven by Europe's need to satisfy higher internal demand and consequently its desire to maintain or stipulate new long-term contracts for the purchase of gas. On the contrary, with lower-demand scenarios (FF55 and G7), the propensity of Europe to sign long-term contracts sufficient to support production in the exporting countries, is estimated to wane. For this reason, the full doubling of the TAP is assumed to take place in the LT scenario only. In this case, potential imports from Azerbaijan rise to 20 bcm/year by 2030 and 2040, and those from Algeria to 22 bcm/year by 2040 (Figure 7).

Table 3 summarises the various hypotheses for supply.

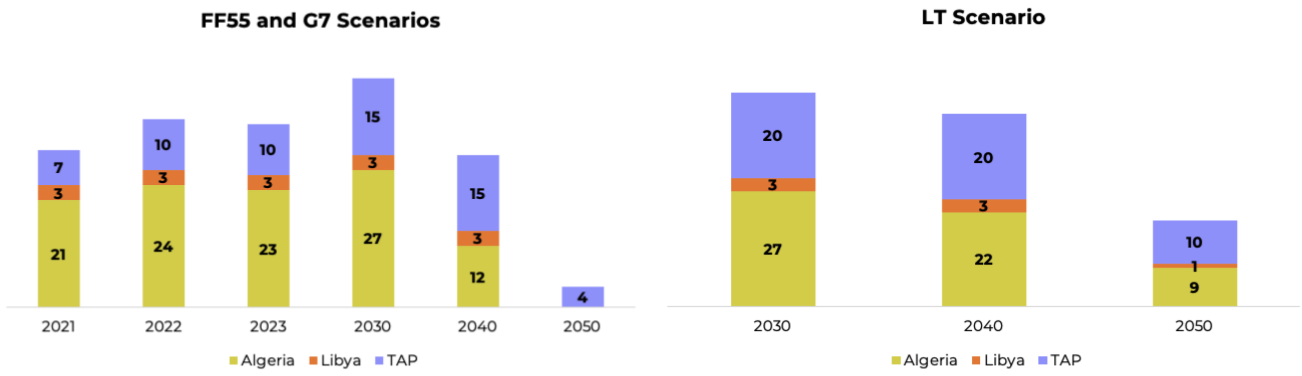

Figure 7 ***–*** *Potential supply via pipeline from Algeria, Libya and Azerbaijan (TAP) - past importation and scenarios for 2030, 2040 and 2050 [bcm/year]*

<table>
<tr><th>Gas demand scenario</th><th>New gas infrastructure already authorised</th><th>Importation contracts</th><th>Extension of infrastructure (new pre-FID capacity)</th><th>Current perimeter projected to 2030</th></tr>
<tr><td>LT</td><td rowspan="3">IT: two new FSRU terminals in Piombino (in future Vado Ligure) and Ravenna; Adriatic backbone; an increase of 5 bcm/year from the TAP.
EU: regasification capacity achieved in 2022-2023 and capacity already authorised for an additional volume of 90.7 bcm/year</td><td>Volume sas per LT Scenarioin Figure 4</td><td rowspan="3">IT: two new onshore terminals in Gioia Tauro and Porto Empedocle; the Poseidon-Eastmed pipeline
EU: pre-FID regasification capacity for an additional volume of 95.2 bcm/year</td><td rowspan="3">IT: the current infrastructure with the sole addition of the new terminal in Ravenna</td></tr>
<tr><td>FF55</td><td rowspan="2">Volume sas per the FF55 and G7 Scenarios in Figure 4</td></tr>
<tr><td>G7</td></tr>
</table>

Table 3 ***–*** *Summary of the hypotheses for gas supply analysed.*

6. THE BALANCE BETWEEN SUPPLY AND DEMAND: MODEL SIMULATIONS

On the basis of the elements presented above (supply infrastructure, internal interconnection lines, demand for gas), and introducing further hypotheses regarding contracts for importing gas and LNG, costs for transportation and for the various supplies, the optimisation model simulates the market balance with daily granularity as of 2030, 2040 and 2050. The simulated perimeter, which includes EU member states with the exception of Cyprus and Malta while considering Switzerland and the United Kingdom, is aggregated by market macro-areas, and the demand for gas is satisfied (and optimised) at the lowest available cost. On the basis of the simulation results, it is possible to calculate by market area, and specifically for Italy:

- the average annual rate of use of the various forms of supply infrastructure, in particular LNG terminals
- flow towards other countries
- any excess in supply and any demand not met.

For each scenario, the price of supply via gas pipeline (from North Africa, from the TAP and from Norway) is assumed to be lower than that of shipped liquefied gas[5].

Late Transition Scenario (LT)

In the LT scenario, by 2030 Italy satisfies its internal demand of 62 bcm/year (61 bcm of natural gas and 1 bcm of biomethane) - a higher, albeit slightly, volume than in 2023 - with imports from the South, taking maximum advantage of capacity, on the basis of the model assumptions that prioritise pipeline supplies, and with 18.2 bcm/year of LNG. In addition, it is estimated to export of 9.2 bcm/year: 6.6 bcm to Austria and Slovakia, and 1.6 bcm to Slovenia and Croatia, which in turn is set to export respectively 3 bcm and 1.1 bcm to Hungary; and 1 bcm to Switzerland, which, as well as covering its own internal demand, is set to export a limited quantity to Germany. These flows are an indication that, without a reduction in demand, Northern Europe needs gas from the south, albeit in limited quantity. In 2040, the simulation is almost identical, with demand for natural gas falling to just 4.1 bcm/year, and for biomethane rising to 6 bcm/year, assumed again to be satisfied by domestic production. Imports of LNG are estimated to increase by 2 bcm/year, with a reduction in supplies from Algeria of 5 bcm/year, again in this case due to the underlying hypotheses (Figure 8).

[5] The simulations do not incorporate a cost for importations based on price forecasts, rather they considered the ranking expected for the gas supplies. The increasing order is: domestic production < imports by pipeline < imports of LNG. Consideration was also made of transition costs between one country and another. For Italy, imports from other countries prove to be more expensive than direct imports (where possible) by gas pipeline or LNG.

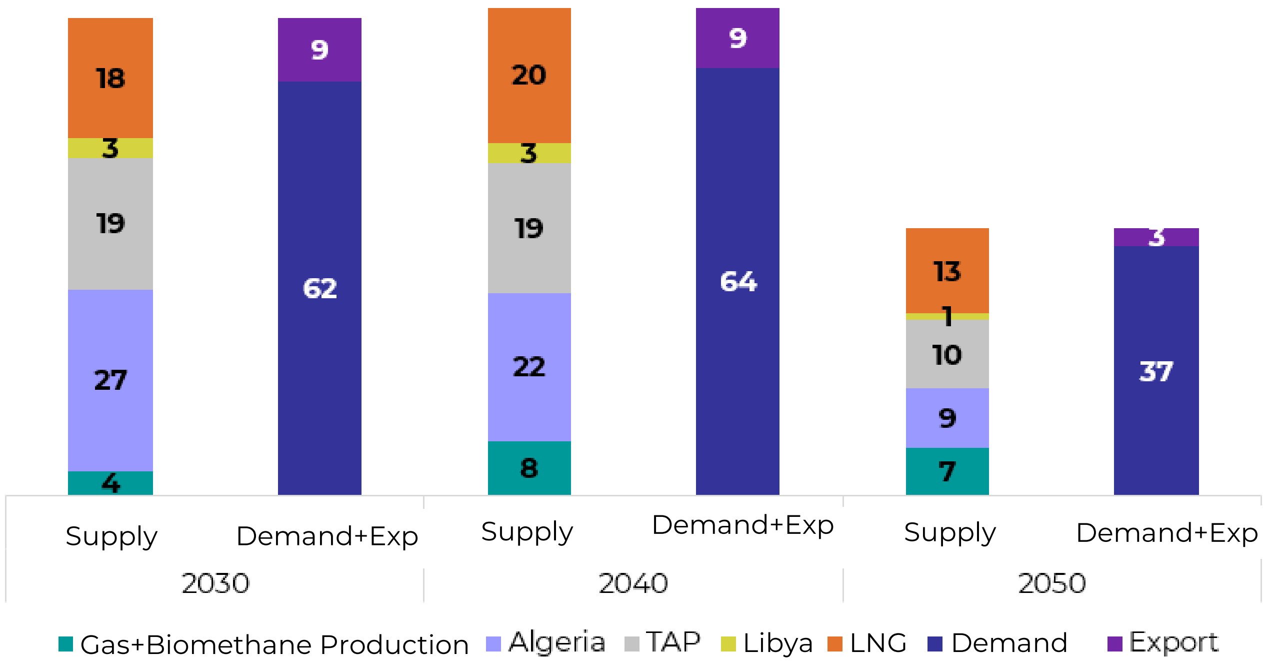

Figure 8 *– Balance between gas supply and demand for Italy as of 2030, 2040 and 2050 in the Late Transition scenario [bnm³/year]*

The rate of use of Italian regasification capacity, assumed to be 90% of maximum potential capacity, proves to be 77% in 2030, 86% in 2040 and 55% in 2050, with a European average of 64% in 2030 and 2040, and 38% in 2050 (Figure 9).

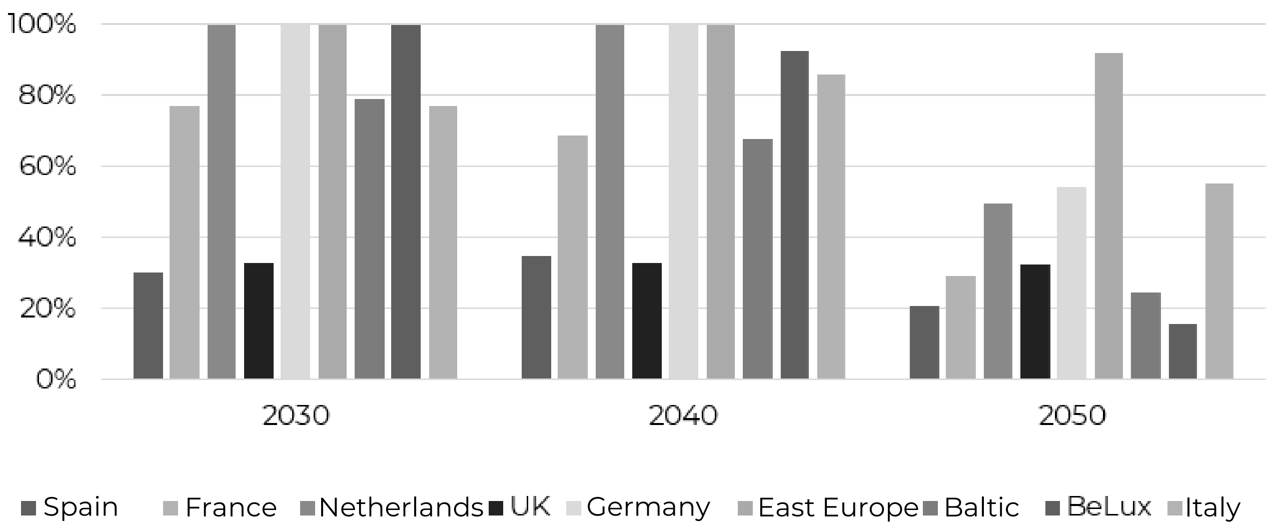

Figure 9 *– Rate of use of regasification capacity in the principal market areas simulated for 2030, 2040 and 2050 in the Late Transition scenario.*

Fit-For-55 Scenario (FF55)

In the intermediate demand scenario, where natural gas consumption will reach 53 bcm/year and consumption of biomethane 5.5 bcm/year in 2030, the import capacity from the south is set to be fully used (27 bcm/year from Algeria, 3.0 bcm/year from Libya, and 15 bcm/year from Azerbaijan), while the rate of use of the regasification terminals is estimated 56% (12.9 bcm/year). This latter figure falls to 29% and 25% in 2040 and 2050 respectively, due to a decisive reduction in domestic demand for natural gas. In 2030, export flows are set to fall to 7.4 bcm/year, and are almost entirely to cover domestic demand in Austria and Slovakia (Figure 10). This volumes are expected to fall significantly by 2040 to just 2 bcm/year, due to demand in these countries falling over the 2030-2040 period in line with the European average (-46%).

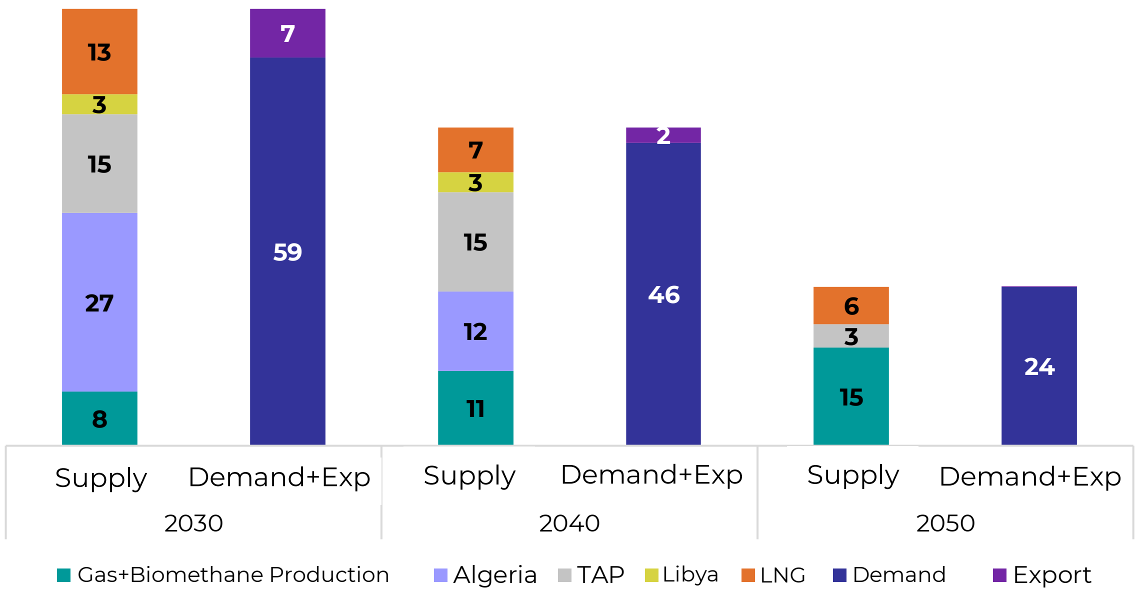

***Figure 10** – Balance between gas supply and demand for Italy as of 2030, 2040 and 2050 in the Fit-For-55 scenario [bnm^3/year]*

In this scenario, Eastern European countries such as Poland, the Czech Republic and Hungary will import gas flows from the Baltic States, where no increase in the capacity for regasification is assumed, Norway/Denmark via the *Baltic pipeline*, from Germany, and the market macro area that includes Greece, Romania and Bulgaria, where the rate of use of LNG terminals of 36% in 2030 is in line with the European average (Figure 11).

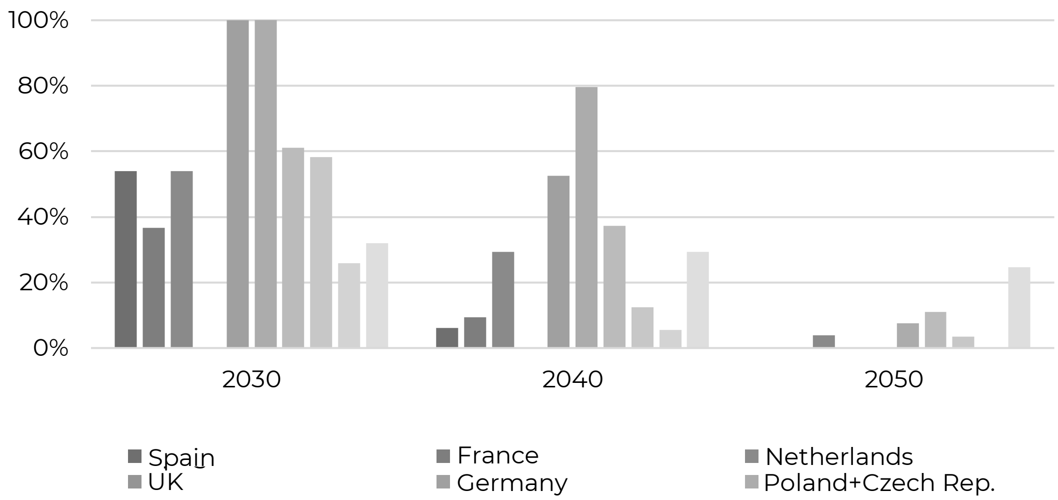

***Figure 11** – Rate of use of regasification capacity in the principal market areas simulated for 2030, 2040 and 2050 in the Fit-For-55 scenario*

The simulation shows how Italy's increased exportation capacity is in fact in competition with the export capacity of Northern and Eastern European countries (the Baltic States, Germany, the Netherlands, Belgium, Poland, Greece and Bulgaria), which have also turned to new LNG terminals in response to a sharp fall in Russian flows. Compared to past figures for exportation, amounting to approximately 3 bcm/year, in this demand scenario, exports from the Italian peninsula to Europe, and in particular to Eastern European countries, will see an increase only in 2030, and for a value of just over 4 bcm/year.

G7 Scenario

In the third and final G7 scenario, the reduced values of demand in both Italy and Europe have an impact, first of all, on Italian imports of LNG, which is expected to fall in 2030 to 3 bcm/year, and secondly on exports, which are set to fall to almost zero by 2040 (0.8 bcm/year). The export from Italy is directed, again, towards Austria, Slovakia and Switzerland, to cover domestic demand. As of 2030, imports from the south are estimated to be used at maximum capacity (45 bcm/year), but by 2040 they are set to fall to 12 bcm/year against a potential of more than double this amount (Figure 12).

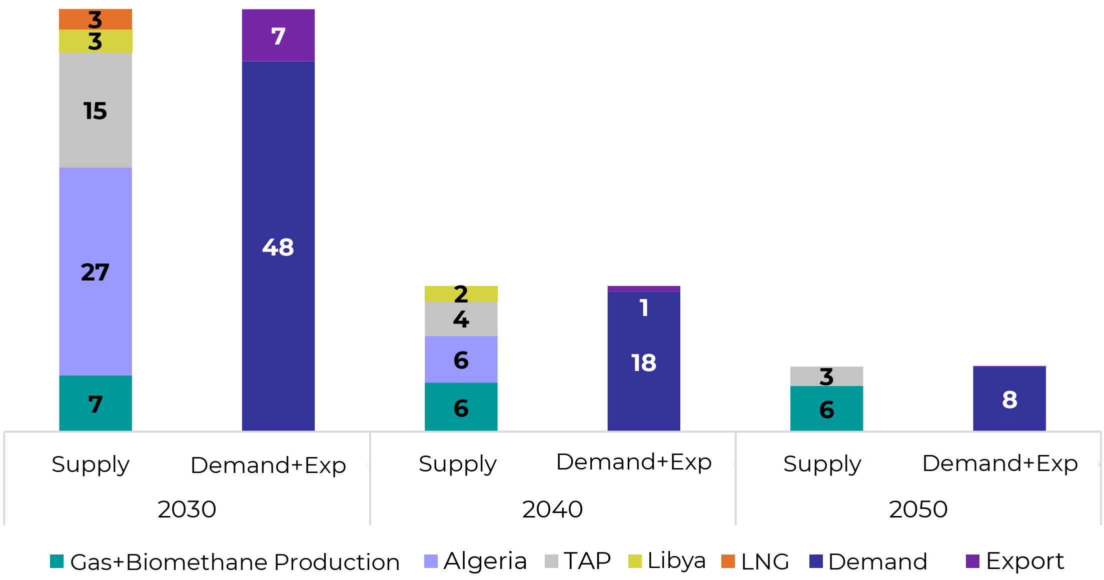

Figure 12 – *Balance between gas supply and demand for Italy as of 2030, 2040 and 2050 in the G7 scenario [bcm/year]*

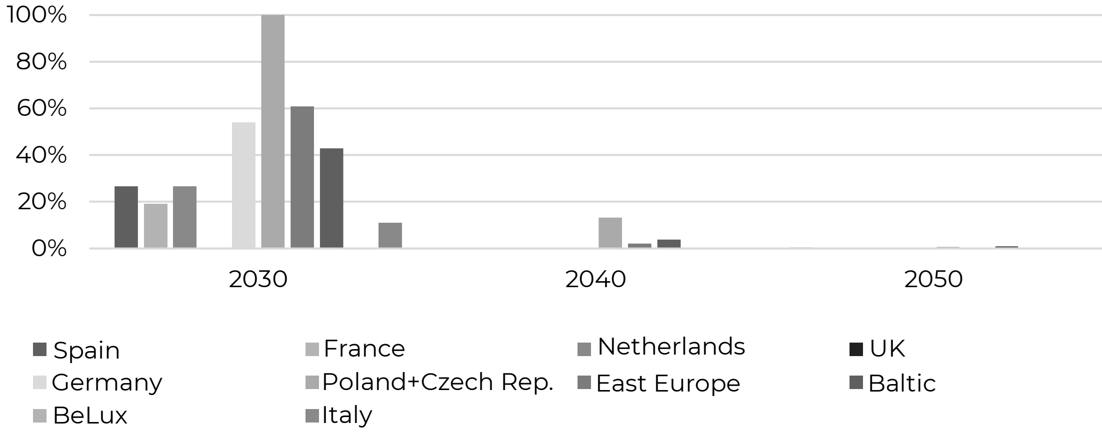

***Figure 13** – Rate of use of regasification capacity in the principal market areas simulated for 2030, 2040 and 2050 in the Fit-For-55 scenario*

This simulation illustrates that **the reduction in Italian and European demand does not create the conditions for significant flows of gas from North Africa or Azerbaijan towards Europe.** Again, by 2030, supplies on a European level of LNG, corresponding to 53 bcm/year (Figure 14), are already shown to be at a level similar to that currently provided for with existing long-term contracts. This shows that with energy and climate policies further directed towards reducing dependence on fossil fuels, new gas infrastructure or new purchase contracts are at considerable risk of proving redundant and unused.

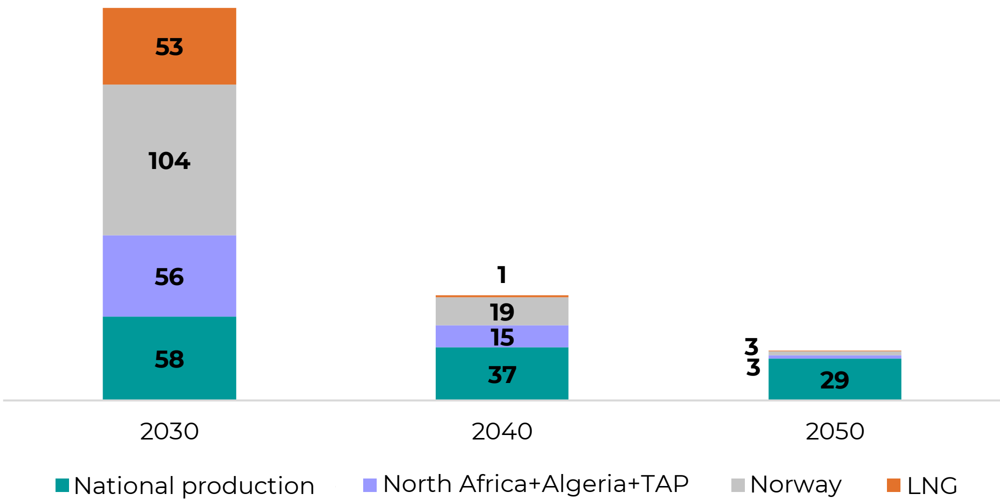

***Figura 14** – Volume of European demand as of 2030, 2040 and 2050 covered by domestic production in the various countries, imports via gas pipeline from the south, Norwegian production and imports of LNG in the G7 scenario [bcm/year]*

7. ANALYSIS OF RESULTS

New investments in gas – the two new LNG terminals, the Adriatic Line and the partial expansion of the TAP capacity – are shown to be necessary for Italian and European security of supply exclusively in the *Late Transition* scenario, above all to cover gas demand from Austria, Slovakia and Switzerland. Specifically, the Adriatic Line is fundamental in allowing imports from the south of almost 50 bcm/year, a volume that is never reached in the other scenarios. Simulated gas infrastructure proves to be of particular importance not so much for covering domestic demand, which could be satisfied by the regasification terminal in Ravenna alone and with imports from the north of 2.9 bcm/year, but for supporting exports to Eastern-European countries, which remain high, at approximately 9 bcm/year, as of 2040. This is in the face of a demand that is not aligned with new 2030 goals and not able to achieve Net Zero by 2050. Demand is similar to the 2023 level and does not take into account the structural dynamics that have emerged over the last two years. On the contrary, variables such as renewable energy sources and energy efficiency are unlikely to see a decisive downturn over the next seven years.

The demand evolution, both on an Italian and a European level, is confirmed as the main driver in determining the need for new infrastructure capacity. Without the new options, such as the expansion of the TAP, the Adriatic Line and the LNG terminal in Vado Ligure, domestic production, imports from the south (27 bcm/y from Algeria, 10 bcm/y from Azerbaijan and 3 bcm/y from Libya) and the full use of regasification capacity (amounting to 19 bcm/y including the terminal in Ravenna, deemed to be certain considering the more than 20 years' authorisation) would be sufficient for covering both national demand and export requirements in the FF55 scenario and to a larger extent in the G7 scenario. Of course, as of 2030, this would require the infrastructure to be used at full capacity, meaning that the system would have practically no margin for reserves, but this is countered by the hypothesis that flows from Tarvisio remain at zero, and that Austrian and Slovakian demand is not satisfied by an increase in exports from Northern or Eastern Europe, where, in the simulation, only the LGN terminals in Germany and Poland are used at full capacity. By 2040, export demand fall from 7.4 bcm/year to 2.4 bcm/year, determining the fact that current gas infrastructure (including the terminal in Ravenna) will be able to guarantee energy security without any criticality. Analysis of last year is the evidence of this. Existing infrastructure proved to be sufficient in covering more than 63 bcm/year of national demand: 2.8 bcm from domestic production, 23 bcm from Mazara del Vallo (Algeria), 2.5 bcm from Gela (Libya), 2.5 bcm from Tarvisio (Russia), 6.4 bcm from Passo Gries (Northern Europe), 9.8 bcm from the TAP (Azerbaijan) and 16.2 bcm from LNG terminals (of which only 1.1 bcm from Piombino). In comparison to 2023, the FF55 scenario does not include imports from Tarvisio and Passo Gries, with the latter less economical than other options, but these absent flows are compensated by the new 5 bcm/year LGN terminal in Ravenna and an increase in imports from Algeria of 4 bcm/year and from Libya of 0.5 bcm/year. These increases would be sufficient to cover a demand for natural gas of 60.3 bcm/year: 53.2 bcm/year of domestic demand and 7.1 bcm/year of export.

In assessing the security of supplies and the adequacy of the infrastructure system, it is also necessary to analyse coverage of peak demand, i.e., winter peak demand in exceptional conditions. For this, the N-1 criterion is required, as it examines the capacity of the system to compensate for an interruption in the main source of supply; here, once again, the determination of daily peak demand is of prime importance. The greatest criticalities only emerge in 2030, and in particular in the FF55 demand scenario, which sees the highest daily peak. With the current infrastructure (that includes the LNG terminal in Ravenna), considering the nominal import capacity and excluding gas flows from Tarvisio, the N-1 criterion is shown to be satisfied by 108%. This is without the Adriatic Line, the expansion of the TAP and the regasification terminal in Vado Ligure. In considering available flows, i.e., pastgas flows, the N-1 criterion falls to 102%, with a useful peak supply of 432 mcm/day.

If gas flows from Algeria, which is currently the main supplier, are excluded, and considering available flows, at this point criticalities emerge. In this case, which sees the lack of two gas flows (criterion N-2), estimates are of a useful peak supply of 366.9 mcm/day, with a shortfall of 58.1 mcm/day to cover. The discussed new infrastructures would allow for an increase in peak supply of up to 473.8 mcm/day, with an individual volume contribution as follows (Table 4):

- Expansion of the TAP: a maximum contribution of 88 mcm/day in the case of a complete doubling (58 mcm/day in the case of an increase of +5 bcm/year)
- The Adriatic Line: without gas from Algeria, the Adriatic Line would not make any contribution as the flows from the south would amount at most to 104 mcm/day. The maximum south-north transportation capacity of almost 150 bcm/day would only be achieved with the addition of the two onshore terminals in Gioia Tauro and Porto Empedocle
- The regasification terminal in Vado Ligure: a contribution of 20 mcm/day

mcm/day	Supply with current capacity + the terminal in Ravenna	Supply with new capacity (TAP, LNG terminal in Vado Ligure, Adriatic Line)	Supply with the doubling of the TAP + 2 onshore terminals
Peak demand	**425**		
Imports	**98.1**	**112.1**	**182.1**
Max. transported from the south	57.1	74.1	144.1
Mazara	0.0 (88.4)	0.0 (88.4)	0.0 (88.4)
Gela	16.1	16.1	16.1
Melendugno	44.0	58.0	88.0
Tarvisio	0.0 (20.0)	0.0 (20.0)	0.0 (20.0)
Passo Gries	38.0	38.0	38.0
Gorizia	0.0	0.0	0.0
Domestic production	**23.4**	**23.4**	**23.4**
Storage	**174.0**	**174.0**	**174.0**
LNG	**74.4**	**94.4**	**94.4**
Panigaglia	13.0	13.0	13.0
Livorno	15.0	15.0	15.0
Cavarzere	26.4	26.4	26.4
Vado Ligure	0.0	20.0	20.0
Ravenna	20.0	20.0	20.0
Gioia Tauro + Porto Empedocle	0.0	0.0	20.0 + 20.0 (included in the max. transported from the south)
N-1 % (without Russia) = available supply / peak supply	**102%**	**113%**	**113%** *
N-2 % (without Russia or Algeria) = available supply / peak supply	**86%**	**95%**	**111%**
Useful peak supply (N-2)	**366.9**	**403.9**	**473,8**
Interruptibility	12.0	12.0	12.0
Max peak demand with interruptibility (N-2 %)	**413 (90%)**	**413 (98%)**	**413 (115%)**

Table 4 *– Analysis of the N-2 criterion (without Russian or Algerian flows), considering the maximum peak demand from the FF55 scenario and the various supply hypotheses. Source: MASE, Snam and processing by ECCO. * In this case, the capacity of the regasification terminals in Gioia Tauro and Porto Empedocle would not be used, as the maximum south-north transportation capacity is already saturated.*

However, while justified by a supply security criterion, these investments are to be assessed **in light of the possible alternatives in accordance with a least-regret approach, which involves choosing the option that minimises disappointment for the policy maker.** The need for the discussed solutions responds to the logic behind criterion N-1, which in this case becomes N-2, with a significantly remote chance of occurrence considering the interest that Italy and Europe are showing towards the African continent. All of this to respond to a peak daily demand that, according to records, has only been seen in 2010, 2012 and 2017. If these options are only shown to be necessary in 2030 (in 2040 peak demand is lower than useful supply in all scenarios), for a few hours per year and in the event of exceptional conditions (in terms of demand, particularly intense cold, and in terms of supply, the interruption of flows from the two traditionally main suppliers), it would also be worth considering alternative options, such as interruption of services, which have been quantified for the 2023/2024 year at 12 mcm/day, or an increased focus on renewable energy sources, energy efficiency and the electrification of consumption, actions that are already provided for by the decarbonisation policy. **It would probably also be necessary to review the method with which the Italian TSO establishes peak demand**, which appears excessive in light of an annual demand for gas of 58.7 bcm (Figure 15). Snam itself highlights the need for further study on the effect of renewable development into the power generation sector, considering their location and the resilience of the networks, and in fact it introduces a margin of error of 30 mcm/day. Even when examining the various versions of the Snam documentation, "Description of Scenarios", the reasoning behind the determination of peak demand, which always oscillates by approximately 50-60 mcm/day between minimum and maximum figures, does not appear particularly clear. It is worth noting that in the LT scenario, which provides for higher annual consumption, the estimate for peak demand is lower than in the FF55 scenario. Furthermore, with reasoning in line with the least-regret approach, this estimate needs to include an analysis on the effects of the average increase in temperature, which over the last two years has seen uncommon daily temperatures and a late start to the winter season. In light of a progressive reduction in gas demand, it is worth asking whether there should be a rethinking of the definition of energy security, in order to place increased focus on the alignment with the decarbonisation process and on the compatibility with climate goals.

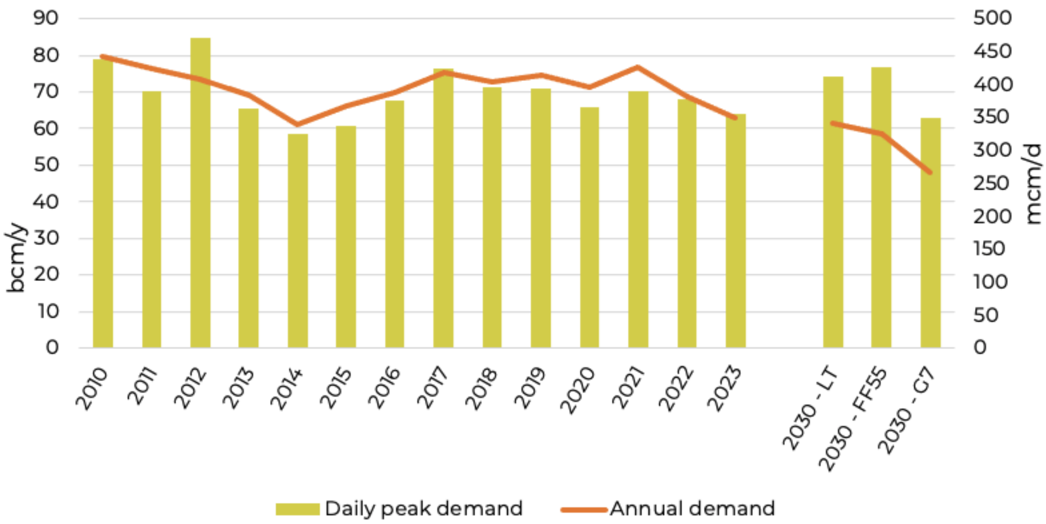

***Figure 15** – Annual and daily peak demand with the three different scenarios for 2030. Source: Snam and ECCO processing.*

The idea to turn Italy into a gas hub for Europe is also particularly driven by the expansion of import capacity (LNG terminals), which will be developed by Northern European countries. Development of regasification capacity in Germany and Poland will reduce volume exported from Italy. The hypothesis of full development of the investments in infrastructure under discussion (the pre-FID projects for Europe and the terminals in Gioia Tauro and Porto Empedocle, as well as the *Poseidon-Eastmed project*, for Italy), shows how demand in these countries is more easily covered by imports from the North, thus creating less need for exports to Austria, Slovakia and Switzerland. Even with an increase in the Italian import capacity, Italian exports are the highest in the LT case, at a volume of 9.2 bcm; furthermore, a passage to higher infrastructure capacity leads to a fall in flows out of Italy in all demand scenarios with the exception of FF55 in 2040. This is due to the assumed hypotheses on prices; the gas travelling along the *Poseidon-Eastmed pipeline*, which is more competitive than LNG, is used primarily by the model to reduce imports of LNG, and then, if possible, to export abroad. At the same time, Gioia Tauro and Porto Empedocle are unused in all of the hypothetical scenarios, demonstrating that if new investment in gas infrastructure is defined as "strategic, non-deferrable and urgent", infrastructure that is, furthermore, onshore and therefore impossible to transfer to other places/countries (article 2 of the Energy Security Decree), this definition needs to be backed up by quantitative analysis that justifies the stated necessity.

Below are three summary tables with the results of the simulations.

Supply hypothesis: FSRU in Vado Ligure and Ravenna, expansion of the TAP, the Adriatic Line

	Energy security	Peak coverage in case N-2 (peak demand; N-2 %)	Load factor capacità di rigassificazione [%]	Exportation flow [bcm/year]	Conformity with climate goals
LT Scenario	✓	✓ (412)	2030: 77% 2040: 86% 2050: 55%	2030: 9.2 2040: 8.9 2050: 2.8	×
FF55 Scenario	✓	- (425; 98%)	2030: 56% 2940: 29% 2050: 25%	2030: 7.4 2040: 2.4 2050: 0.0	-
G7 Scenario	✓	✓ (365)	2030: 11% 2040: 0% 2050: 0%	2030: 6.8 2040: 0.8 2050: 0.0	✓

***Table 5** – Summary of the results with the supply hypothesis that includes, for Italy, the two FSRU in Vado Ligure and Ravenna, the expansion of the TAP and the Adriatic line.*
For peak coverage, consideration is also made of interruption of services amounting to 12 bcm/day: ✓indicates full satisfaction (≥ 100%) of criterion N-2; – indicates an error of 10% (≥ 90%);
× indicates an error of more than 10% (<90%).
For conformity with climate goals, the FF55 scenario is deemed to not be fully satisfactory (–) as the 2023 NECP draft does not reach the goals set in non-ETS sectors, including the civil sector.

Supply hypothesis: with in addition the onshore terminals in Gioia Tauro and Porto Empedocle; doubling of the TAP; *Poseidon-Eastmed*

	Energy security	Peak coverage in case N-2 (peak demand; N-2 %)	Load factor for regasification capacity [%]	Exportation flows [bcm/year]	Conformity with climate goals
LT Scenario	✓	✓ (412)	2030: 29% 2040: 27% 2050: 17%	2030: 7.5 2040: 6.0 2050: 2.4	×
FF55 Scenario	✓	✓ (425)	2030: 18% 2940: 7% 2050: 2%	2030: 7.0 2040: 3.3 2050: 0.0	-
G7 Scenario	✓	✓ (365)	Not available	Not available	✓

Table 6 – *Summary of the results with the supply hypotheses that include, for Italy, the two FSRU in Vado Ligure and Ravenna, the doubling of the TAP, the Adriatic Line and the onshore terminals in Gioia Tauro and Porto Empedocle, and the Poseidon-Eastmed pipeline.*
The G7 demand scenario has not been modelled with these supply hypotheses as the new capacity would not have made any relevant changes to the results.

Supply hypothesis: existing infrastructure including the new FSRU in Ravenna

	Energy security	Peak coverage in case N-2 (peak demand; N-2 %)	Load factor for regasification capacity [%]	Exportation flow [bcm/year]	Conformity with climate goals
LT Scenario	-	- (412; 92%)	2030: 100% 2040: 100% 2050: 67%	2030: 4.1 2040: 2.3 2050: 2.7	×
FF55 Scenario	✓	- (425; 90%)	2030: 92% 2940: 59% 2050: 30%	2030: 7.1 2040: 1.8 2050: 0.0	-
G7 Scenario	✓	✓ (365)	2030: 37% 2040: 0% 2050: 0%	2030: 6.4 2040: 0.8 2050: 0.0	✓

Table 7 – *Summary of the results with the supply hypotheses that include, for Italy, only the FSRU in Ravenna in addition to the current infrastructure.*
In the LT scenario, energy security is satisfied in terms of annual volume, but with almost zero margin for reserves, considering that the load factor for regasification terminals in many European countries is at 100% (EU average 70%), which is why it has been assessed as not fully satisfying the "Energy security" criterion.

8. CONCLUSIONS

The simulations show how **possible new investments in gas capacity** (the repositioning of the LNG terminal from Piombino to Vado Ligure, the Adriatic Line, the expansion of the TAP, the onshore terminals in Gioia Tauro and Porto Empedocle and the *Poseidon-Eastmed* project) **are necessary for supply security only when national demand is set to remain high, with volumes that are in line neither with national and European climate goals for 2030 nor with the international commitments under the Paris Agreement.** With a fall in consumption, the new capacity proves to be useful in 2030 only, as coverage for peak daily demand. These levels, which were determined by Snam in its own development plan, appear excessively high in comparison to estimates for annual demand, not only considering no import from Russia, but even from Algeria.

With a view to the efforts for energy security, in light of the decarbonisation process and the relative economic and financial risks (for example the risk of stranded assets), **alternative options must also be considered, such as load disconnection services or the promotion of technological solutions that accelerate the abandonment of natural gas (renewables, efficiency, electrification of domestic consumption), which do not divert capital from energy transition.** This is an even more valid consideration considering that these investments would be activated for just a few hours a year, and under conditions that are defined as exceptional.

The contribution of new capacity is also limited with regards to the dominant narrative that sees Italy becoming a gas hub. Export volumes are estimated to increase by a maximum of 6 bcm/year by 2030 (over 2023), and would require investments of approximately EUR 4.7 billion, partially financed with European resources (EUR 700 mn from the NRRP for the Adriatic Line) and the rest regulated, i.e., covered by gas charges and therefore paid for by the final consumer. Furthermore, these volumes are not certain, but rather depend on the evolution of national and European gas demand. If this falls, as policies and climate goals assume, it would render the new investments even more redundant and less useful, since exports in 2040 are set to plummet to 0.8-2.4 bcm from 6.8 and 7.4 bcm in 2030.

For Italy, achieving the commitment signed in 2022 and underscored in 2023 during the G7 for a "substantially" zero net emission electrical system by 2035, and accelerating the decarbonisation of sectors not included in the European Emission Trading System (ETS), i.e., the civil and transportation sectors, would result in a national demand by 2030 of 48 bcm in natural gas and biomethane, meaning a reduction of almost 30% compared to 2022. With this drop on both Italian and European demand, and with a regasification capacity bolstered with only the new terminal in Ravenna, by 2030 Italy would in any case be able to export 6.8 bcm of LNG and guarantee its own supply security even with the break from Russian gas. By taking full advantage of the regasification capacity, Italy could export a further 4 bcm, and approach the idea of the gas hub, which has regained popularity with the crisis, without the need for further infrastructure.

Another element of uncertainty is the expansion of regasification capacity in the rest of Europe, particularly in the North (Germany and Poland), which would be in competition with Italy. In the event that all the various Member States increase their importation capacity, there would no longer be any need for south-north flows, and Italy would no longer have a role as an exporter. Italy would find itself investing in new capacity, socialising the cost, with the aim of exporting volume abroad to guarantee European energy security, facing losses when this role loses value due to a sharp fall in demand or to the availability of gas from elsewhere. **In an interconnected system that is increasingly free of fossil fuel supplies, it is now necessary to redefine the concept of energy security from a European and climatic point of view,** thus assessing the various options on a Community level within a scenario that sees a fall in demand for gas in the near future. This also means considering sharing the relative costs and risks on a European level. Germany, Austria, and now Italy, are all, in a certain sense, moving in this direction. They have decided to repay the costs for last-resort purchases of gas stored in 2022 (for Italy, estimated to be approximately EUR 4 bn) with an increase in transportation gas prices at exit points, thus requiring economic effort from foreign markets that benefit from the availability of gas from these countries. The underlying logic is in line with the idea that these efforts contribute to ensuring security for the entire integrated EU market.

In the end, there appears to be no advantage for the consumer in setting up the gas hub with new infrastructure. As the IEA itself states, the energy crisis has led to an increase in prices that seem to be structural, on the one hand due to the uncertain and volatile nature of prices, which remains high, and on the other due to the shifting of the "new" gas market to LNG, which is generally more expensive. The only scenario in which LNG is not a marginal source, and thus able to determine the gross price in the relative hub (the PSV - Virtual Exchange Point - for Italy) is the G7, once again demonstrating that the only solution that can simultaneously provide supply security, meet climate goals and be economical is a reduction in consumption. Becoming a gas hub, and therefore having LNG to export abroad, does not necessarily mean a reduction in price for consumers; on the contrary, it would only result in a positive economic margin for the export companies.

THE ITALIAN CLIMATE CHANGE THINK TANK

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