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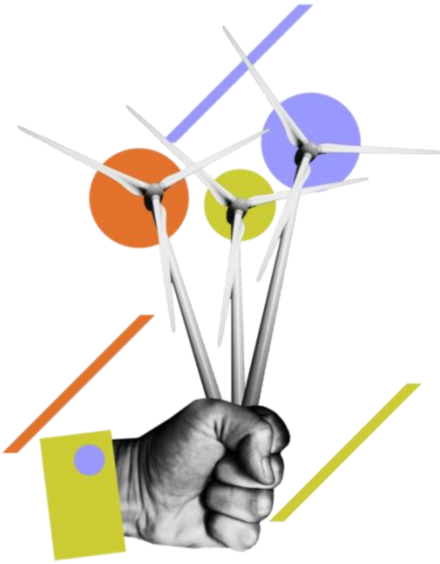
THE ITALIAN CLIMATE CHANGE THINK TANK

THE NATIONAL ENERGY AND CLIMATE PLAN

A plan for action

SECTORAL SCENARIOS

Power sector and the role of gas



SECTORAL DECARBONISATION SCENARIOS

The new version of the NECP must update national and sectoral targets on the basis of a more ambitious EU- wide greenhouse gas (GHG) reduction target of **-55% by 2030 compared to 1990 levels,** as redefined with the approval of the *"Fit for 55"* package, i.e. the set of directives and regulations that sets climate and energy objectives for Member States aligned with the climate neutrality objective in 2050.

This objective translates into the achievement of the objectives set out in the following table:

	Unit of measure	Data 2021	Fit for 55 target
Greenhouse gas reduction targets			
ETS reduction target (compared to 2005)	%	-47	-62
Effort Sharing reduction target (compared to 2005)	%	-17	-43,7
Absorption Increase Target (LULUCF)	$MtCO_{2eq}$	-27,5	-35,8
Renewable Targets			
Share of RES in gross final energy consumption	%	19	38,4%-39%
Share of RES in gross final energy consumption in transport	%	8	29%
RES share in gross final consumption for heating and cooling	%	20	29,6%-39,1%
Share of hydrogen from RES on the total used in industry	%	0	42%
Energy efficiency targets			
Primary energy consumption	Mtep	145	115 (±2.5%)
Final energy consumption	Mtep	113	94,4 (±2,5%)
Annual savings in final consumption	Mtep	1,4	73,4

Table 1 – *Objectives of the National Integrated Energy and Climate plans as identified by the Fit for 55 Package. The ETS objective is intended at EU level, while other targetsare to be seen at national level. (Source NECP 2023)*

Without considering the emissions under EU ETS which have a EU-wide reduction target[1], in line with the new objectives, national emissions by 2030 relating to the sectors included under the *Effort sharing Regulation* should fall from the current 284$MtCO_{2eq}$ to **194 $MtCO_2eq$[2],** meaning more than 30% compared to 2021 levels. It is important to underline that the reduction target is only the end point of a reduction trajectory with **binding annual targets,** so that any non-compliance in each of the years cumulates over the period 2021-2030.

[1] Equal to -62% compared to 2005, and also includes emissions from the maritime and aviation sectors.

[2] Estimated by applying a reduction of -43.7% compared to the 2005 level of 343.8 MtCO2e and as also indicated in the 2023 NECP proposal https://commission.europa.eu/system/files/2023-07/ITALY%20-%20DRAFT%20UPDATED%20NECP%202021%202030%20%281%29.pdf

In addition, **under current policies,** and taking into account the effects of measures adopted up to 2021, including those defined in the NRRP (National Recovery and Resilience Plan), an emissions gap of more than 10 $MtCO_{2eq}$ already appears in 2021. As shown in the table below, this gap, continues to grow to 52.5 $MtCO_{2eq}$ by 2030 in the absence of further measures.

	1990	2005	2021 MtCO2 eq.	2025	2030
Greenhouse gas emissions (excluding LULUCF), of which:	**523**	**594**	**418**	**373**	**350**
ETS Sectors		248	132	124	110
Effort Sharing Industries (ESR)		344	284	263	246
Effort Sharing Objectives (*)			273	241	194
Distance to ESR targets			***10,9***	***22***	***52***

Table 2 – *Historical greenhouse gas emissions and projections under current policy baseline for the ETS and non-ETS sectors. Source: ISPRA - NECP 2023*

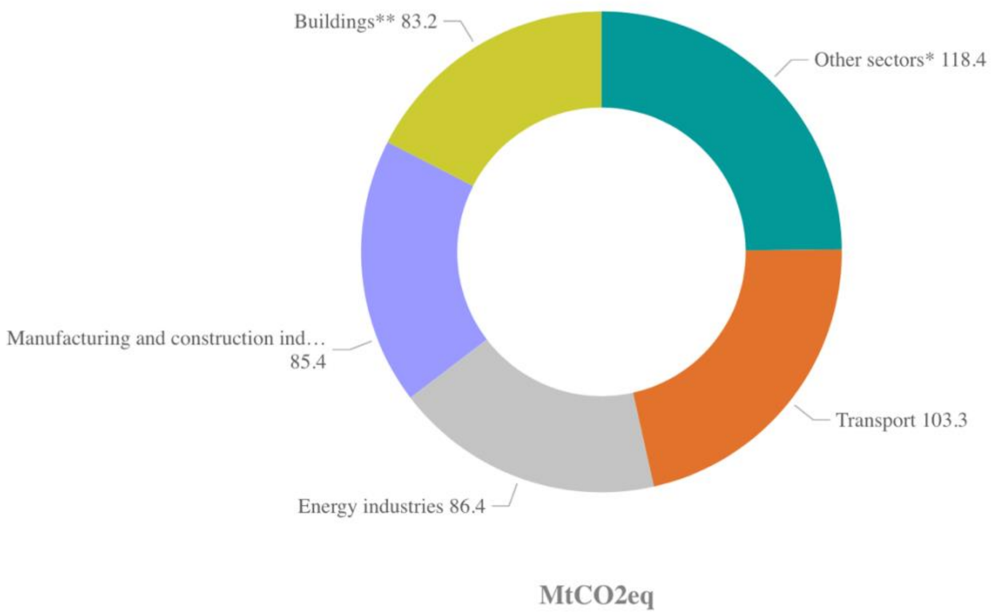


Figure 1 – *Contribution of individual sectors to total GHG emissions in 2021. Consistent with the NECP scenarios and the greenhouse gas inventory, the building sector includes emissions from Agriculture 'energy'; Other sectors include the remaining fugitive and non-energy emissions (Industrial Processes, Agriculture and Waste).*

The Effort sharing sectors, for which it is necessary to achieve annual and binding reduction targets for Italy, include the building and transport sectors, both of which are very significant in terms of emissions, accounting respectively for about 29% and 36% of the total ESR[3] sectors and the industrial sector with installed capacity of less than 20MWt (14% of the total ESR including emissions deriving from industrial processes and the use of products (IPPU)). Agriculture (only non-energy, i.e. livestock and crops, 11%) and waste (7%) are also included (Figure 1).

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[3] Source: Table 5.5 https://www.isprambiente.gov.it/files2023/pubblicazioni/rapporti/rapporto_384_2023_le-emissioni-di-gas-serra-in-italia.pdf, 2021 data

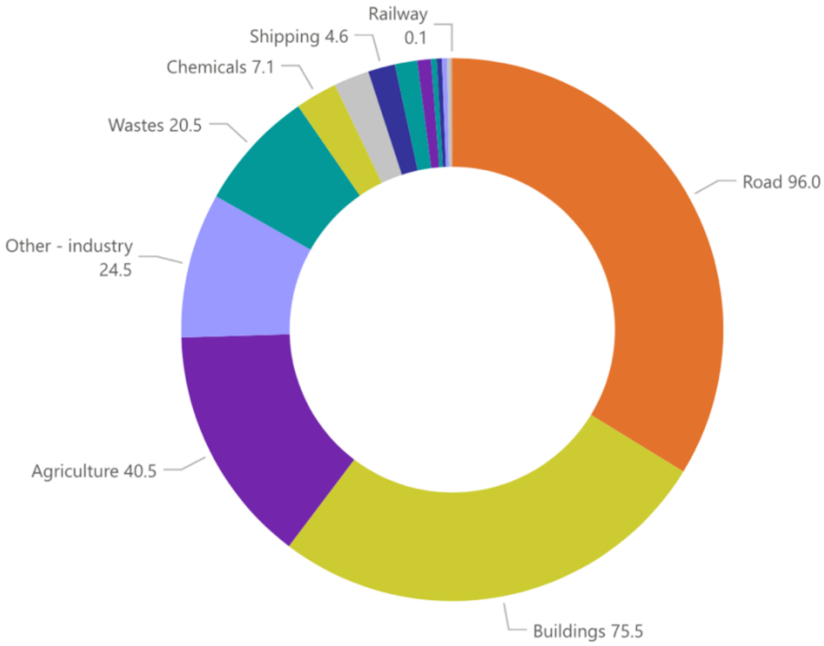

Figure 2 *– Emission contribution of the individual sectors compared to the total included in Effort Sharing. Date 2021. ECCO elaboration on ISPRA2021 data.*

In order to be able to analyse and make alternative or complementary proposals to those currently present in the NECP, a *bottom-up* 2021-2030 emissions scenario has been developed, i.e. **starting from the policies and their expected effect,** in order to highlight their risks and opportunities. The scenario, called ECCO-FF55, has been developed for the four main macro-sectors of energy production and use: power, buildings, industry and transport. These account for 76% of emissions and are the sectors with the greatest abatement potential by 2030. The work is not based on the use of a model, strictly speaking, but on a simplified **bottom-up evaluation methodology developed to associate emission reductions with the policies and measures framework, providing information on their priorities and effectiveness, investment needs and the reform framework needed to enable the transformation.**

For each sector, the following chapters will show:

1. The main characteristics of the sector, the emission share, the historical trends and the main drivers of these trends.
2. The main differences compared to the NECP2023 scenario.
3. The policies underpinning the ECCO scenario, highlighting priorities and, where possible, integrating cross-cutting dimensions, in particular the financing of measures.

Attached to the document, a table is provided with concrete examples of 'flagship measures' for each sector, which shows the information that would be necessary to be able to **accompany each measure from its design to its implementation.** Where possible, indicators for monitoring the measures have also been indicated.

The paper does not assume scenarios for process emissions from industry (7%), the LULUCF sector (Land Use, Land-Use Change and Forestry) (6% as removals), agriculture (9.6% energy and non-energy): for these sectors the scenario data have been taken as they are from NECP2023. Similarly, the production potentials of biofuels were assumed to be equal to those of the NECP and a sensitivity analysis was carried out.

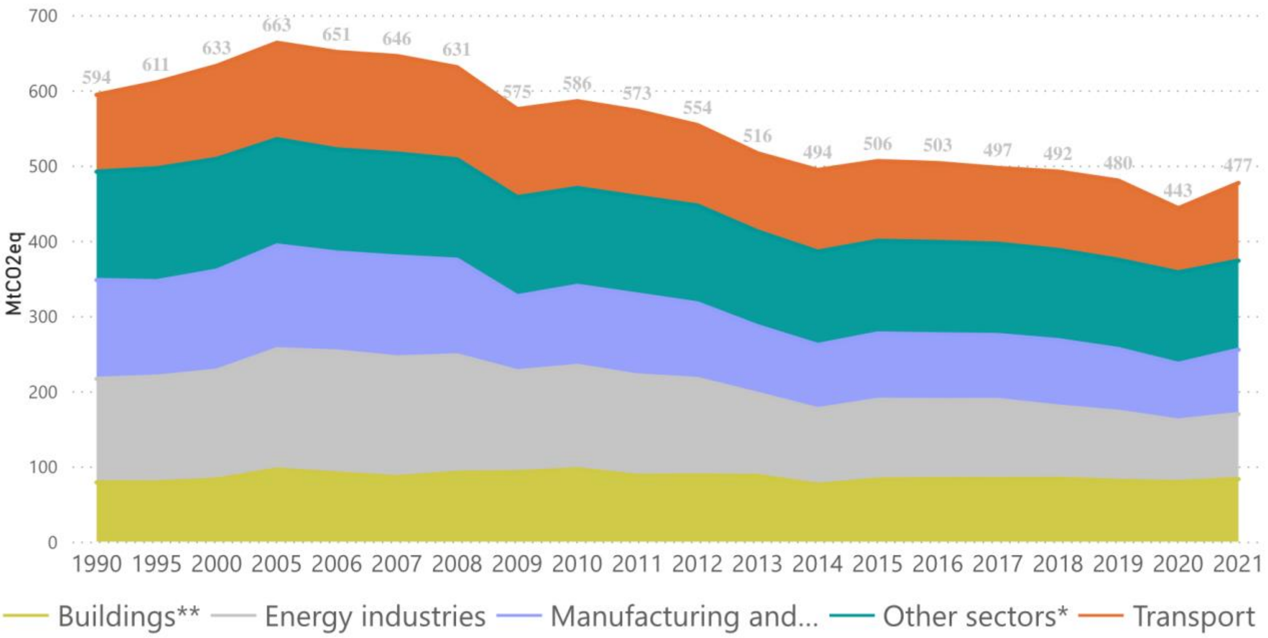

***Figure 3** – Historical evolution of GHG emissions by sector, excluding LULUCF. Other sectors* includes emissions from other energy and fugitive uses, agriculture (livestock and crops) and waste - Source: ECCO elaboration on UNFCCC data [MtCO2eq]*

The ECCO-FF55 scenario considers **Italy's commitment at the G7 towards a substantially decarbonised power system by 2035[4],** enhancing the results obtained from the dedicated modelling exercise. In addition to adhering to the commitments Italy made at the international level, this methodological choice is based on the need to **facilitate the transition across all economic sectors.** In general terms, within the energy consumption sectors, the main *drivers* of reduction are energy efficiency, the electrification of energy consumption, and the production and use of green hydrogen in hard to abate industries.

Only a competitive and decarbonised power system that guarantees stability and energy security for households and businesses can concretely enable the decarbonisation of the country 's energy consumption sectors and economic system. The ability to envision a new power system, able to effectively support the rapid uptake of renewables with appropriate and innovative solutions for stability and supply security forms, represents the foundation of a plan capable of achieving the objectives and aligning the country with the committed decarbonisation pathway.

Given the strategic relevance of the decarbonisation of the power sector, the ECCO-FF55 scenario is based on a modelling analysis explicitly developed for the power sector and fully integrates its results into the overall reduction scenario (i.e the ECCO-Artelys scenario).

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[4] Comuniqué 2023 https://www.whitehouse.gov/briefing-room/statements-releases/2023/05/20/g7-hiroshima-Leaders-communique/#:~:text=We%20reaffirm%20our%20commitment%20to,temperature%20rise%20within%20reach%20and, which recalls the communiqué of the previous year https://www.bmuv.de/fileadmin/Daten_BMU/Download_PDF/Europa_International/g7_climate_energy_environment_ministers_communique_bf.pdf

In the period 2021-2030, the ECCO-'*Fit For 55' (*ECCO-FF55) scenario envisages an overall reduction of **-54.5%** in GHG emissions **compared to 2005[5],** reaching a value of **270 MtCO2eq by 2030,** compared to **312 $MtCO_{2eq}$** in the NECP (cf. Table 84 of the NECP 2023), achieving the reduction targets set out in the 'Fit for 55' package for Italy.

According to the results of the ECCO-FF55 scenario:

- The sector contributing most significantly to the reduction is the **power sector**, which, accounts for 37% of total reductions. Here, the primary *drivers* include the robust penetration of renewables in the power system, as assumed in the [ECCO- Artelys scenario](#).
- As far as energy emissions from the **manufacturing industry** are concerned, they contribute to the reduction by 22%[6]: the primary *drivers* considered for this sector include leveraging the **electrification** potential for medium to low-temperature process heat, targeting the use of biomethane in energy-intensive sectors, exploiting **green hydrogen** generated through the decarbonisation of the power system, and initiating the decarbonisation process of the **former ILVA of Taranto plant[7].**
- The **transport** sector contributes for 20% of the reductions. The envisaged measures primarily focus on **reducing the demand for private transport** through the *implementation* of policies outlined in the NRRP (National Recovery and Resilience Plan) and various planning tools for sustainable mobility. In this context, certain proposed amendments to the NRRP (National Recovery and Resilience Plan) regarding mobility measures are critically highlighted alongside the emphasised need for highly effective *governance* of the Plan in coordination with local government levels to ensure the successful implementation of these measures. The expected **increase in the number of Battery Electric Vehicle (BEVs)** in the fleet to 3.5 million cars is lower than the NECP's projection of 4.3 millions, despite policies being more focused towards fleet electrification. Regarding the **shipping sector,** reductions are anticipated due to the implementation of the NRRP (National Recovery and Resilience Plan) investments in electrifying national port docks (i.e. cold ironing) and partially replacing the ferry fleet for shipping people and vehicles to and from the islands[8].
- In the **building sector[9],** the contribution to the overall reduction amounts to approximately 16%. The principal drivers are the **enhanced electrification** of final consumption, achieved through the accelerated replacement of traditional heating systems with (exclusively) electric heat pumps, and an increase in the rate of **renovations up to 2030** from the current value of 0.37% to 4% by 2030. This represents a significant increase compared to the rate of 1.9%

[5] Reference year for EU climate and energy policies. This translates to 48% compared to 1990 emission levels, the basis for communicating the EU's commitment to the Paris Agreement. This is Italy's contribution to the Union's total contribution, which amounts to -55% compared to 1990 levels.

[6] On the basis of ECCO calculations, it is estimated that the push for electrification contributes to a reduction in particularly in the ESR sectors, which saw emissions reduced by 38% compared to 2005.

[7] In order to be consistent and to make comparisons, in line with the emission scenarios of the NECP, the emissions relating to the former ILVA of Taranto are counted partly in the energy industries sector (for the share relating to the production of coke) and, in part, in the industrial sector (for the production of steel from blast furnaces).

[8] This last contribution, considered in ESR, will have to be quantified as an ETS following the inclusion of the sector in the EU ETS, as provided for in the last revision of the Directive.

[9] It should be noted that, with regard to the 'energy' emissions of the agricultural sector which, following the classification of the inventory, are 'merged' with the civil sector, no specific measures have been envisaged, although the potential for reduction is quite significant (the sector emits about 7MtCO2eq). While respecting the objectives of the RED Directive, it could be envisaged to allocate at least part of the potential biofuels for heating and traction of agricultural machinery, moving the current SADs for the promotion of alternative fuels.

assumed in the NECP for the period 2021 to 2030. The measures supporting this scenario include targeted incentives for deep renovations and replacement of heating systems, based on a reform hypothesis for the current eco and superbonus mechanisms promoting energy efficiency.

The scenario accounts for the emission trends and the historical inertia observed within individual sectors, whilst identifying a framework of priority measures. These measures are distinctly aimed at bridging the emissions *gap* identified in the NECP, especially for the *Effort sharing* sectors, notably in transport, building and industry.

	2005	2030	
		NECP	ECCO-FF55
	MtCO2eq		
From ENERGY USES, of which:	**488**	**232**	**189**
Energy Industries	160	51	41
Industry (including manufacturing other comb.)	92	41	34
Transport	128	77	64
Building sector	96	56	43
Of which agriculture*	9,2	7	7
Other energetic and fugitive uses	12	7	7
From OTHER SOURCES, of which:	**106**	**81**	**81**
Industrial Processes	46	33	33
Agriculture (cultivation and livestock)	35	32	32
Waste	24	16	16
Total (excluding LULUCF)	**594**	**312**	**270**
LULUCF	-36	-35	-35
Of which ESR	**344**	**216-223**	**193**
Distance to ESR targets		**22-29,1**	**-1**

Table 3 – *Historical evolution of GHG emissions by sector (source: ISPRA) and emission scenario for 2021-2030 (source: ECCO elaboration)*

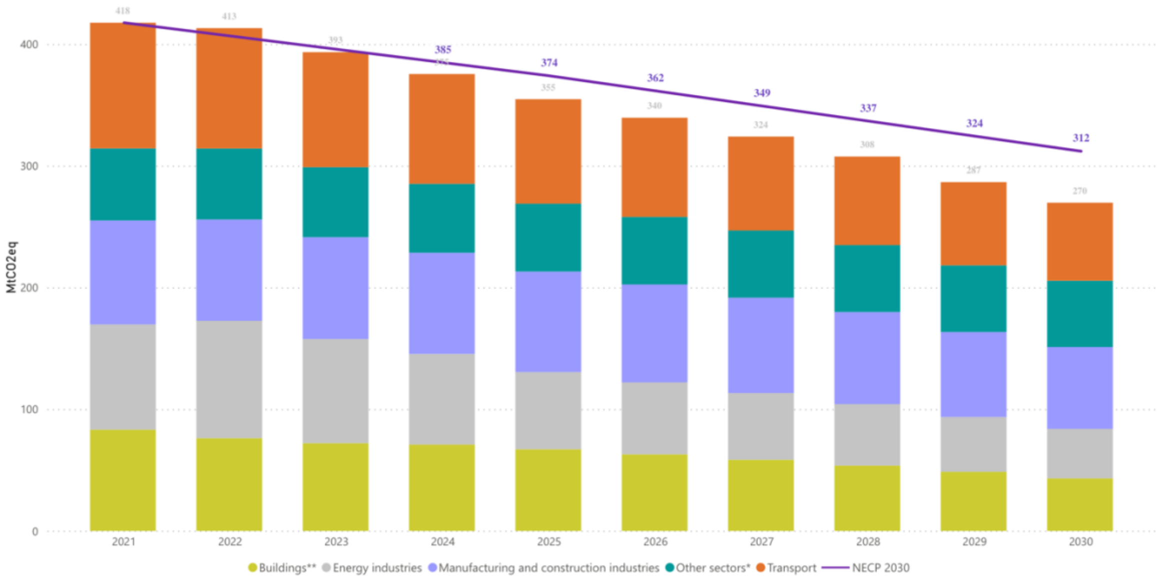

Figure 4 – *ECCO-FF55 emission scenario for 2021-2030, excluding LULUCF, and comparison with NECP scenario - Source: ECCO elaboration [MtCO2eq]*

POWER SECTOR AND THE ROLE OF GAS

The main characteristics of the power sector

- Italy's power sector remains significantly reliant on fossil fuels. In 2022, fossil fuels – natural gas, coal, and petroleum products – were responsible for 60% of gross electricity generation.
- **The demand of electricity in Italy in 2022 was 316.8 TWh, marking a 1% decrease compared to 2021.** Renewable energy sources contributed 35.6% to electricity production, with the balance provided by fossil-based energy sources. The net external balance stood at almost 43 TWh.
- Total generation capacity installed at the end of 2022 reached 120.9 GW. Of this, thermal power plants accounted for 60.4 GW, with 77% natural gas fired. Hydropower accounted for 22.9 GW, wind power 11.8 GW, and solar power 25.1 GW

The emission reduction scenario developed by ECCO and Artelys

- The ECCO-FF55 scenario has simulated a decarbonised power sector in 2035, aligning with the commitments[10] made by Italy within the G7 framework in 2022 and reaffirmed in 2023. It bases its projections on the findings of the ECCO-Artelys study.
- The evolution of the sector is based on the extensive use of renewable sources, illustrating thepotential to reduce CO2 emissions from 86 MtCO2eq (in 2021) to 41 MtCO2 in 2030. It entails a 70% decrease compared to 1990 (-74% vs 2005 and -52% vs 2021), facilitated by the phase-out of coal by 2025 and the gradual phase-out of all other fossil fuels. The reliance on natural gas for power production is projected to reduce significantly by 2030 (with an anticipated residual production of 54 TWh/year).
- In contrast to the NECP, which predicts a renewable energy source (RES) capacity of 131 GW by 2030, the ECCO-FF55 scenario assumes over 148 GW renewable capacity by the same year, including 96 GW from photovoltaics and 32 GW from wind energy (6 GW attributed to offshore sources).
- By 2030, the scenario foresees 10 TWh/year of **green hydrogen manufactured** for industrial use, supported by 14 TWh of overgeneration from renewable sources. The integration of electrochemical storage, demand side response technologies, and green hydrogen (with a focus on development mainly between 2030 and 2035) is expected to enhance the flexibility and security of the electricity grid, so dismissing the role of natural gas progressively.

  The ECCO-FF55 scenario does not include CO2 capture and storage technologies nor nuclear power plants, due to high costs and challenges associated with deploying these technologies by 2035.

Which policies for decarbonization

- Facilitated development of renewable sources and complementary technologies (improved **governance of permitting, evolution of the mechanisms for long-term price stabilisation,** innovative storage, demand response).

[10] The outcome text of the G7 in Japan in 2023 reads "Recognizing the need to *urgently curtail greenhouse gas emissions in this critical decade, we recall the 2022 G7 Leader's Communiqué and reaffirm our commitment to achieving a fully or predominantly decarbonised power sector by 2035*"

- **Elimination of public incentives** (within the tax system or regulated bills) to gas infrastructures. Such incentives on the one hand drain significant economic resources, on the other hand hinder the transition by making fossil fuels artificially cheaper and by fueling a persistence of policies favorable to them.
- **Progressively phase out all fossil fuels subsidies.**
- **Revision of the capacity market,** whose design is obsolete with respect to the objectives of the transition and the market trends (decline in gas consumption in Italy and Europe)

In 2022, Italian electricity demand was 316.8 TWh, down 1% compared to 2021 (319.9 TWh)[11]. The decline was caused by the energy crisis and the measures implemented by citizens and businesses to moderate electricity consumption. 86.4% of demand was met by domestic production and the remainder (13.6%) by the balance of energy exchanged with foreign countries. Net domestic production (276.4 TWh) decreased by 1.3% compared to 2021. Photovoltaic (+11.8%) and thermoelectric (+6.1%) sources grew, in particular coal-fired (+61.4%) as a result of the Government's decision to maximise it in order to moderate gas consumption. Hydroelectric (-37.7%), wind (-1.8%) and geothermal (-1.6%) sources decreased. Overall, in 2022, production from renewables contributed 35.6% to total net production, down from 40.4% in 2021.

Net generation capacity installed in Italy at the end of 2022 was 120.9 GW. Thermoelectric power plants account for 50% (60.4 GW), 77% of which fueled by natural gas, 10% by coal, 6% by bioenergy and 7% by oil products or other fuels. Hydroelectric power plants had a net capacity of 22.9 GW, wind power plants 11.8 GW, and photovoltaic plants 25.1 GW. **As a result of the energy prices crisis, the development of renewables accelerated, growing by more than 3 GW in 2022, which is double the figure of 2021 (1.3 GW), which more than doubled again in 2023.**

In 2021, the energy industries – which, according to the categorization used by UNFCCC (United Nations Framework Convention on Climate Change) include the production of electricity and heat from cogeneration plants, as well as emissions from refineries and the ILVA coking plant of Taranto – emitted 86.4 MtCO2eq for energy uses.

[11] https://www.terna.it/it/sistema-elettrico/statistiche/pubblicazioni-statistiche

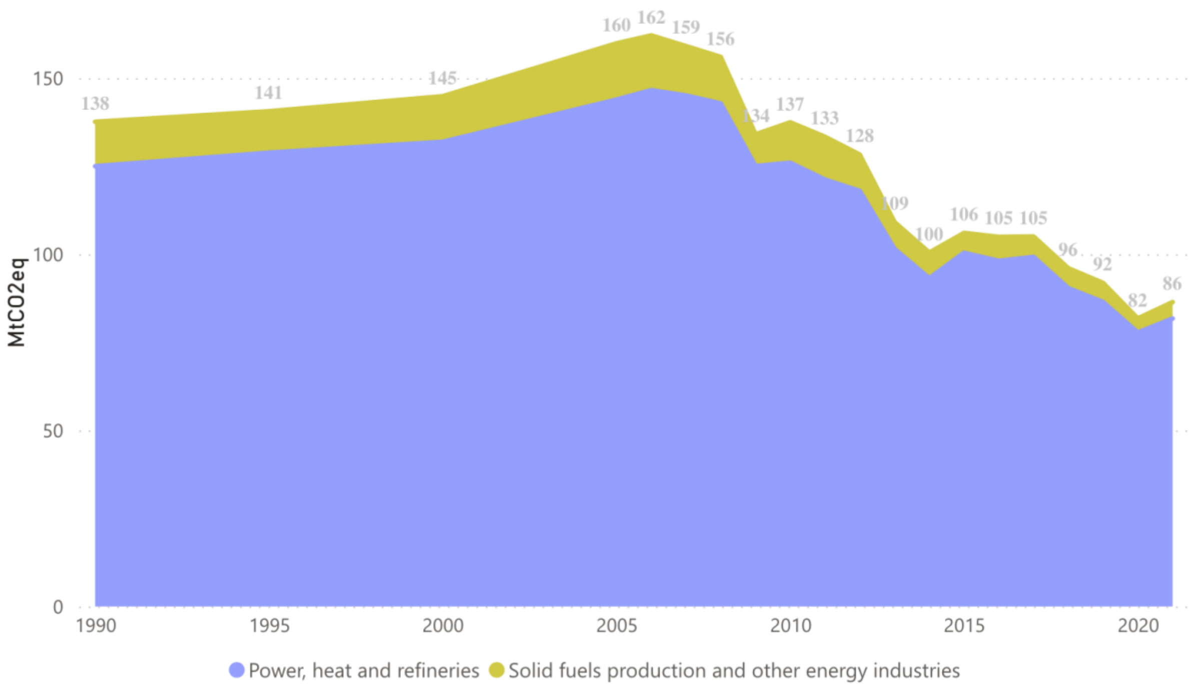

Figure 5 *– Trends in CO2eq emissions from energy industries from 1990 to 2021*[12].

DESCRIPTION OF THE ECCO.FF55 SCENARIO

For the electricity production sector, the ECCO-FF55 scenario is based on the assumptions and results of the work carried out jointly by Artelys and ECCO in the first half of 2023[13], whose aim is analysing the pathway towards a decarbonized power system in 2035, and developing a scenario consistent with Italy's commitment within the G7.

The decarbonisation of the power system is essential to support the decarbonisation of the entire economy. Decarbonising electricity supplies enables the comprehensive decarbonisation of all consumption intended for the electrification of consumption in the building, transport and, where possible, industrial heat sectors. The related production of green hydrogen will facilitate the decarbonisation of all those industrial uses currently based on hydrogen, as well as enable the expansion of its use for high-temperature heat and industrial processes in the so-called *hard-to-abate* sectors.

The energy industries sector, which includes electricity production, has historically shown the most significant GHG reductions (-46%), transitioning from being the primary national emission sector in 2005, the year the EU-ETS was first implemented, to its current emission levels (Figure 4). This reduction was particularly driven by the increase in the penetration of renewables in the electricity production and a decreased reliance on coal and fuel oil, resulting in a 44% decrease from 116MtCO2eq to the current 65MtCO2eq.

Based on ECCO-Artelys simulations, renewable energy production is expected to reach 156 TWh in 2025, nearly double the amount in 2022, and 266 TWh in 2030. The consistent increase in renewables

[12] The 2022 emissions were calculated on the basis of Terna's 2022 production data and not from scenario data.
[13] Study commissioned by Greenpeace Italy, Legambiente and WWF Italy.

penetration within the sector will enable these sources to account for 53% of production by 2025, 73% by 2030 (compared to 67.5% in the NECP) and 99% by 2035, compared to 35% in 2022 (Figure 6). All coal-fired capacity is scheduled to be decommissioned by 2025, according to the NECP 2019 plan.

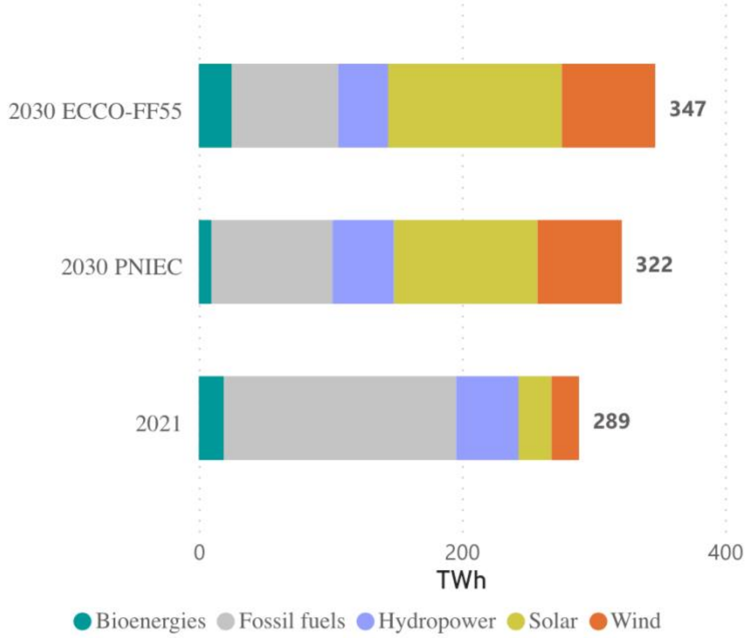

Figure 6 – *Gross electricity production from fossil and renewable sources in 2021 and in the NECP and ECCO-FF55 scenarios to 2030. In 2030, part of the renewable production used to make green hydrogen.*

Installed Capacity (GW)	2021	2025		2030	
		NECP	ECCO-FF55	NECP	ECCO-FF55
Water	19,1	19,1	15,5	19,1	15,9
Wind	11,3	17,3	15,3	28,1	32,3
Of which offshore	0	0,3	0,8	2,1	6,0
Bioenergy	4,1	3,8	3,7	3,0	3,7
Solar	21,6	44,8	39,3	79,9	96,4
Of which distributed	5,1	-	17,9	-	30,9
Total	**56**	**86**	**68**	**131**	**142**

Table 4 – *Installed capacity from renewable energy sources (RES) in 2021 (historical data), 2025 and 2030 in the NECP and ECCO-FF55 scenario.*

Under this scenario, **solar** energy, particularly at **utility-scale,** is expected to make the most significant contribution in the decarbonisation of the sector. Total solar capacity is expected to rise from 25.1 GW (in 2022) to 96 GW by 2030 (with utility-scale installations accounting for 65 GW and distributed systems for 31 GW). Solar will constitute over 50% of the electricity mix in terms of installed capacity.

Wind energy, both onshore and offshore, will emerge as the second most crucial renewable source within the sector, achieving an installed capacity of 32 GW by 2030. While the onshore wind will be providing the bulk of this capacity, a significant expansion in offshore is necessary, increasing from 0 GW today to 6 GW by 2030. Achieving these goals requires an **installation rate that will need to be multiplied by 7 by 2030.** On average, over the period 2025-2035, installation rates are expected to reach 11.5 GW per year for utility-scale solar, 1.4 GW per year for distributed, 2.6 GW per year for onshore wind, and 0.9 GW for offshore wind.

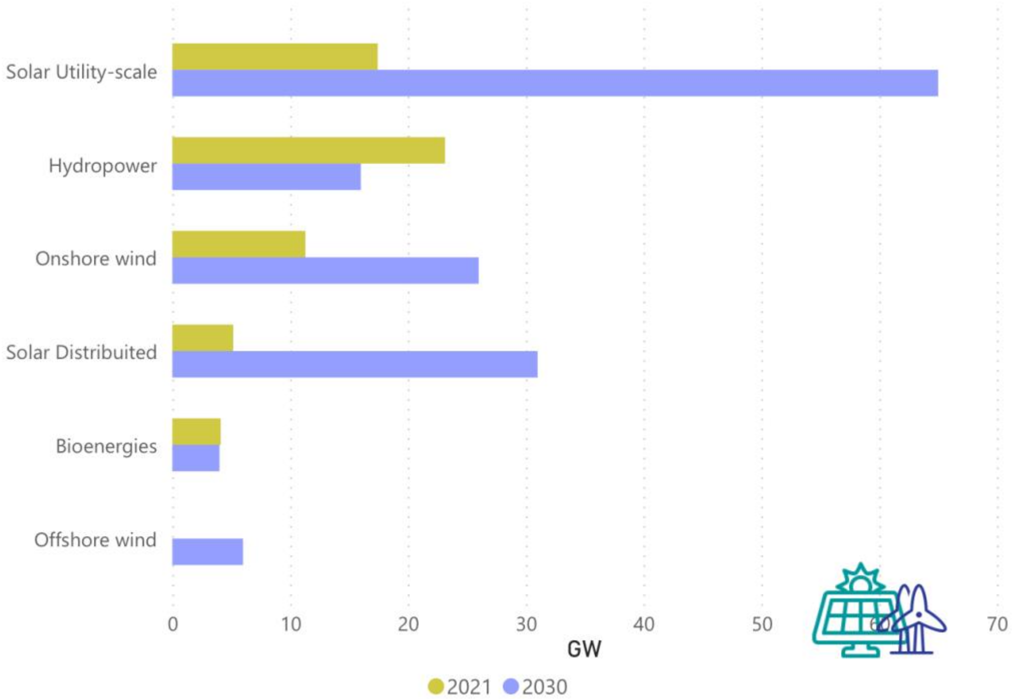

Figure 7 – *Installed capacity of renewables (MW) in the ECCO-FF55 scenario, compared with the installed capacity in 2021 (Source: ECCO-Artelys scenario)*

The scenario envisages that other renewable sources, including hydropower and bioenergy, will persist in contributing towards the 2035 decarbonisation target. Their installed capacities remain relatively constant up to 2030 with hydropower at 16 GW and bioenergy at 4 GW.

Based on the extensive use of renewable sources, this scenario reduces CO2 emissions from the current 86 MtCO2eq (in 2021) to 41 MtCO2 in 2030, achieving a decrease of 70% compared to 1990 (-74% vs 2005 and-52% vs 2021) (Figure 3). This reduction is supported by the complete phase-out of coal by 2025 as a source of electricity generation and the gradual reduction of the other fossil fuels. Consequently, the share of natural gas in the electricity production mix is projected to decrease to 18% in 2030 down from 50% in 2022.

The revised draft of the NECP no longer plans for a complete coal phase-out by 2025, as initially envisaged by 2019 version, but it postpones it to 2028 in Sardinia (Fiumesanto for 534 MW and Sulcis for 432 MW). Such measure is justified by the need to complete the Tyrrhenian Link between the peninsula and the two islands of Sardinia and Sicily, expected for 2028. However, the NECP retains the option for further development of gas capacity "where the closure of coal-fired capacity will necessitate it"[14], without taking into account the capacity already secured by Terna through the market.

[14] Page 260 of the NECP

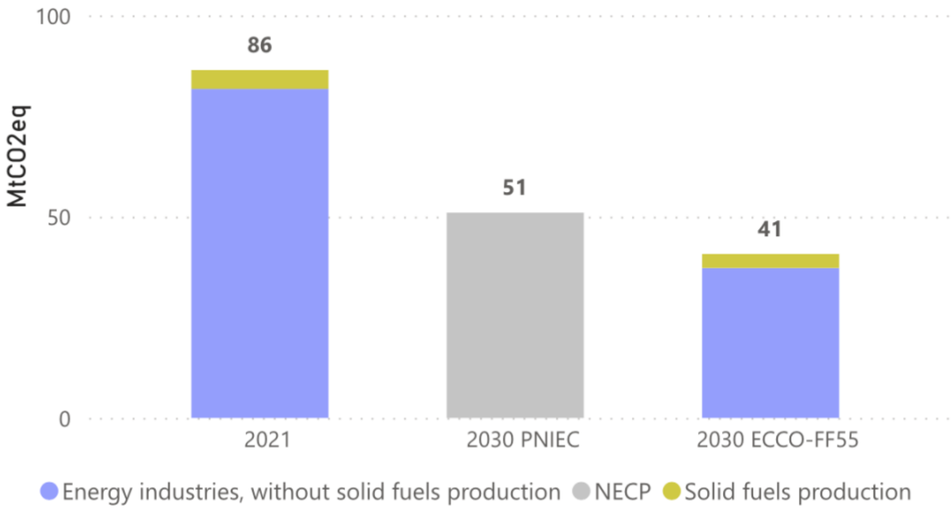

***Figure 8 –** Comparison of CO_{2eq} emissions of energy industry in 2030 in the ECCO-FF55[15] scenario.*

The gradual increase in electricity production from renewable sources, particularly solar and wind, must be complemented by a consistent development of flexibility services.

The historical role of gas-fired power plants in providing flexibility will progressively diminish, giving way to new sources of flexibility. These include shiftable demand, storage solutions such as batteries, and seasonal storage by hydrogen, alongside the import/export of energy.

Consequently, to continue ensuring the security and flexibility of the grid, it will be necessary to enhance demand response services and promote a system that encourages the use of electrolysers.

The flexibility of the system will be ensured through demand-response in two forms: load-shedding and load-shifting. These demand management strategies, based on price signals, incentivise consumers to alter their usage patterns. Under the ECCO-Artelys scenario, it is projected that consumers could forego a demand of 2.9 GW (load-shedding) when electricity prices exceed 250 €/MW. Similarly, the capacity for demand to be shifted (load-shifting) is expected to reach 3 GW by 2030 and 4.4 GW by 2035. The NECP further aims to enhance the active role of demand to better integrate renewable sources, especially distributed ones, by modifying market rules and increasing end-user participation (facilitated by the emergence of aggregators) in dispatching services. However, **a quantitative estimation of the contribution that demand response technologies can make to the grid's flexibility and adequacy is lacking,** as the identification of even indicative development goals. Such omission in the NECP scenarios means that only the services provided by gas-fired thermal power plants are considered necessary.

Hydrogen production is primarily anticipated to ramp up between 2030 and 2035. According to the ECCO- FF55 scenario, there will be a capacity of 4.5 GW of electrolysers by 2030, which is expected to increase to 30 GW by 2035. These installations will generate renewable hydrogen for 10 TWh/year by 2030 (equivalent to 0.25 million tonnes/year) and 64 TWh/year by 2035. The role of hydrogen production extends beyond stabilising the system; it will also meet the rising demand for non-electric end-uses, notably within industry and transport. The projected hydrogen aligns with the NECP's

[15] 2022 emissions were calculated based on 2022 production data by Terna, and not based on data from a scenario.

target for 2030, with 80% of hydrogen produced domestically through 3 GW of electrolysers[16]. Similar to the ECCO-FF55 scenario, by 2030, renewable hydrogen is intended for direct use in specific end-use sectors (industry and transport). However, the NECP does not provide detailed qualitative or quantitative insights into hydrogen's contribution to the electricity grid's security.

Batteries are set to play a crucial role, particularly in maintaining daily flexibility. By 2025, our scenario forecasts an installed capacity of 3 GW for lithium batteries, which is expected to increase to 15 GW by 2030 and to 17 GW by 2035. This capacity aligns with the projections set out in the NECP, which, for new electricity storage capacity (both utility scale and distributed), references the forecasts prepared by Terna in its Development Plan: for 2030, it anticipates a new storage capacity of 15 GW, including 4 GW of distributed storage. The NECP allocates approximately €6 billion for the development of storage solutions, which is €2 billion more than the allocation in its 2019 version.

Our scenario additionally sets a limit on annual electricity imports from neighbouring or bordering countries to Italy, namely Austria, Switzerland, France, Greece, Montenegro, Malta and Slovenia. This cap, established at 40 TWh per year by 2035 aims to ensure a degree of independence for the Italian electricity sector from external sources. Concurrently, the NECP projects a specific volume of net electricity imports from abroad: 3,712 ktoe by 2025 and 2,906 ktoe by 2030, which is equate to approximately 43 TWh/year and 33 TWh/year respectively.

[16] Page 88 of the NECP

BOX – ASSESSMENT OF THE SOCIO-ECONOMIC IMPACTS OF THE TRANSITION – DEVELOPMENT OF WIND POWER IN ITALY

The NECP's projections for the expansion of offshore wind power in Italy anticipate the installation of 2.1 GW by 2030. This figure stands in contrast to the 50 GW planned in the United Kingdom and 30 GW in Germany, despite estimates suggesting a potential for up to 200 GW of offshore wind power in Italy.

Although modest in scale, the initiation of offshore wind power in Italy is expected to facilitate the development of a comprehensive manufacturing and infrastructure network, leading to significant economic benefits (see also the chapter "The Plan and the manufacturing industry" and 'The socioeconomic dimension of the Plan' for further details). The potential for growth in relation to demand scenarios are considerable. At the European level Wind Europe has identified a need to triple the current production capacities of nacelles, turbines, foundations, and substations. In this context, the Global Wind Energy Council has forecasted the emergence of supply-side bottlenecks starting from 2026.

Italy lacks significant production specialisation in the wind power sector, including onshore wind. In Europe, the supply chain has primarily developed in Denmark, Germany and Spain. None of the major European *original equipment manufacturers* (OEMs) – such as Vestas, Siemens Gamesa, Nordex – are Italian. The most notable production centre for wind power components in Italy is located in Taranto employing (800 staff) and specialising in the production of onshore blades. In the period from 2020 to 2022, Germany, Denmark and Spain were ranked the first, second and fourth largest exporters of wind components globally, whereas Italy has largely remained an importer. According to Eurostat data from 2022, Italian imports of wind power components amounted to 94 million euros versus its national production, which accounted for only 1.4 million euros. Without an adequate development strategy of a domestic supply chain, the expansion of domestic offshore wind is likely to benefit foreign producers.

Nevertheless, the unique technical characteristics of offshore wind present an opportunity for the Italian industry to assume a pivotal role in the European supply chain. Italy used to have a good competitive positioning in steel production and its transformation into structures, crucial components in the construction of offshore foundations and substations (comprising about 90% of turbine's material composition). Moreover, the development of wind farms needs specialised shipping vessels, a domain where the Italian shipbuilding industry could further expand, being among the largest and most technologically advanced in Europe with the lead of Fincantieri. For the installation of wind farms, there exists potential for leveraging the expertise of a major oil and gas like Saipem to adopt a new role in this emerging sector.

At the same time, the necessity for developing suitable port infrastructure could stimulate the creation of an ecosystem that supports further expansions in turbine components production. This development could significantly benefit regions in southern Italy and the islands (Puglia, Sicily and Sardinia). However, only a national offshore wind installation strategy possibly encompassing direct supply-side measures (for example, incorporating local content requirements in allocation auctions) could favour the settlement of production capacities by the OEMs in such regions.

Permitting process for renewable energy generation plants

The subsidiarity of powers for energy production between the central State and the Regions tends to slow down permitting procedures. On the other hand, the State clearly bears the ultimate responsibility for achieving climate policy goals. Therefore, it must implement cascading accountability mechanisms for the Regions and
local authorities as well[17].

Currently, neither permitting process nor climate *governance* incorporate mechanisms for monitoring permits or corrective actions to ensure alignment with targets.

Given the lack of significant acceleration in the permitting process, *'default'* systems become essential to ensure the desired outcomes. For instance, increasing incentives, including financial ones, for the deployment and connection of distributed systems like rooftop solar photovoltaics, storage, efficiency improvements, and electrification devices could bypass the lengthy permitting procedures for plants subject to central or regional approval processes. Indeed, as ISPRA (Italian Institute for Environmental Protection and Research) underlines in its recent report on land use, Italy's rooftops could accommodate photovoltaic capacity ranging from 70 to 92 GW. "This capacity is more than enough to meet the total projected increase in renewable energy stipulated by the NECP by 2030", thereby mitigating environmental and ecosystem concerns associated with land use.

Logistics and large-scale distribution are significant contributors to the increase in land consumption in Italy, with over 7,000 hectares nationwide being covered between 2021 and 2022. This space could facilitate the installation of about 6GW of renewable energy plants. Clearly, there is a pressing need to significantly reduce land use, as well as optimise the utilisation of converted areas for renewable energy projects. This could be encouraged through fiscal incentives, such as concessions on the Municipal Property Tax (MPT), or even through mandatory easements on warehouses, industrial, and production sites, potentially supported by a public fund.

Peritting monitoring systems and mechanisms for the dynamic correction of measures to favour them are essential (refer to the dedicated section for more details). For example, where the permitting process fails on a local scale, it is imperative to consider corrective mechanisms that can address such inefficiencies. One potential solution could be to promote an increase in distributed generation through economic bonuses or tax incentives.

Public Auctions for Contracts for Differences (CfD) for Renewable Generation

The NECP does not specify the instruments intended for achieving the proposed objectives for renewable energy deployment, nor does it indicate, even broadly, the expected proportion of development between *grid- connected* plants and distributed plants. This distribution is crucial as the two types of plants operate in different markets, face various barriers, undergo distinct permitting processes, and cater to different end-users. Accordingly, they necessitate tailored policies. Specifically, for *grid connected* plants, the Government's recent adoption of CfD auctions for renewable plants nearing economic competitiveness represents a strategy that should be

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[17] See also Chapter 3.1

incorporated into the NECP. The auction mechanism requires bolstering with robust monitoring and corrective measures to address potential supply shortages resulting from delays in permitting. This approach is crucial to ensuring that the auctions remain competitive and do not inadvertently support anti-competitive practices.

Retail PPAs and 'prosumer' PPAs

The 2022 crisis has underscored the challenges posed not only by the price levels of fossil fuels but also their volatility. This volatility is likely to persist as long as there is a significant reliance on gas. Currently, the only method for an electricity customer to completely insulate themselves from the volatility associated with gas is to disconnect from the grid, opting instead for a combination of photovoltaics and storage systems. While this approach is viable for those who have access adequate outdoor space, it incurs high costs due to the inefficiencies of bypassing the existing electricity network.

The absence of virtual solutions enabling retail electricity customers to fully dissociate from the gas price component represents, in our opinion, a market failure. Ideally, by covering the necessary costs, customers should be able to secure energy supply characterized by fixed costs and modulation capacity based on storage solutions rather than peak fossil fuel plants, through contractual, including financial, instruments. This would entail the seller contracting adequate portions of wholesale Power Purchase Agreements (PPAs) with renewable energy capacity.

From this perspective, it is logical for institutions to mitigate the risks associated with entering wholesale PPAs for renewable energy. Additionally, it should be feasible for energy retailers – even those not vertically integrated with generation – to guarantee their sales supplies with portions covered by wholesale PPAs. This approach would enable the provision of tariffs truly independent from gas costs. Such offerings would necessitate:

- A retail system for the allocation of rights on PPAs contracted by the national auctioneer to electricity retailers.
- Amendments to the regulations governing sales to retail customers, enabling the inclusion of reasonable exit fees for customers who enter into "prosumer" agreements. These contracts would be based on the average costs of renewable sources, rather than the fluctuating spot price of energy.

On light of existing regulations that require energy sellers in Italy to offer specific tariff structures, it is prudent to introduce tariff options that are entirely independent of spot prices (typically influenced by gas prices). This approach would, in turn, encourage the development of wholesale financial instruments designed to mitigate associated risks.

Capacity Market Upgrade

The anticipated increase in renewable energy penetration, as outlined in the NECP, necessitates a revision of the current design of the *capacity market* mechanism. The Italian *capacity market,* in its present form, does not align with the objectives of the European Commission's reform, nor with the goals of ARERA (the integration of all resources based on their technical capabilities) upon which the IEDA (Integrated Electricity Dispatching Act) reform is predicated. Furthermore, it falls short of meeting the decarbonisation targets set out in the -55% scenario and the ambition for near-zero electricity by 2035.

In fact:

- The mechanism currently for the participation of demand resources only in a " negative" capacity, meaning it excludes them from receiving payments for the costs associated with the *capacity market* itself, rather than offering compensation for investments made to provide services to the network.
- It disqualifies entities that benefit from other incentives such as those for renewable energy sources (RES), even though these incentives are intended to compensate externalities unrelated to the network services. It remains unclear why a plant that contributes positively to the environment and is capable – under the necessary parameters – of providing reliable capacity services, should be barred from selling these services on the *capacity market*, unlike other sources.
- The system enforces a significant disparity between existing plants, which receive remuneration for only one year (1-year remuneration), and new ones, which are eligible for contracts (up to 15 years). In the auctions conducted so far, the latter have received payments comparable to the capital expenditure (CapEX) for the construction of the new plant. This arrangement has favoured the development of new gas-fired combined-cycle power plants, which are now likely to hasten the market exit of older generation plants. These older plants are only marginally less efficient, but equally flexible and already substantially depreciated. This issue de facto serves to justify the perceived need for new capacity market auctions.

The capacity market, under its current regulations, should not be merely extended but ought to be superseded by auctions designed specifically for the procurement of electricity storage capacity and *demand response* infrastructure.

Furthermore, existing contracts, where they allow for acceptable forms of renegotiation, should undergo modifications, notably:

- Enabling the **direct involvement of Demand Response (DR)** entities, (with direct remuneration and, for new capacities, contracts durations matching those awarded for new electricity capacities).
- In light of the revised renewable energy targets, it is imperative to enforce **a zero-emission requirement for new installations,** or at least to impose limits that align with the emission reduction *trajectory* towards the 2030 objectives. Should there be changes in the energy landscape, provisions should be made to convert the amount of fossil fuel capacity currently compensated into an equivalent volume of storage capacity.
- **Abolishing the existing rule that renders renewable energy subsidies incompatible with payments from the capacity market** (it is crucial to recognise that these two aspects – decarbonisation and system security – are distinct and both warrant long-term compensation).

Demand response

An essential update to the regulatory framework governing the electricity sector, affecting critical markets such as reserves and balancing, is embodied in the IEDA (Integrated Electricity Dispatching Act). This initiative, introduced in the ARERA 685/22 summary note, focuses on the goal of facilitating wider **participation in the balancing resources of the electricity system. The underlying principle**

is to enable each participant to contribute to balancing efforts "as they can", initiating this process with a question[18].

This process necessitates the establishment of a more open environment in Italy for flexibility service providers, particularly, (*Balancing Service Providers*), and thus for **aggregators.** These are operators specialised in engaging customers capable of providing balancing capacity (enhanced by technological innovations in their consumer appliances) that can be marketed to the Transmission System Operator (TSO). Subsequently, the energy adjusted and a portion of the compensation for the actual flexibility are passed back to the end customer via the Balancing Responsible Party (BRP). This differentiation, (while not immediately apparent), is crucial for the system's efficiency.

The draft NECP acknowledges *demand response* but falls short of specifying the detailed policies or investments needed to promote it effectively. While it references market integration and smart meters, the document contains only a vague reference to dynamic pricing, despite its potential benefits. The text stresses the need for "further research", yet there is an immediate necessity to implement relevant European regulations and directives and to draw lessons from other markets where distributed resources increasingly contribute to electrical safety services. Although experimental initiatives for flexibility markets in local networks are being introduced (with the Areti project in Rome being a positive example). The NECP ought to adopt a more decisive approach in fostering these markets. This includes potentially moderating the role of the Transmission System Operator (TSO) as the orchestrator in this domain.

Elimination of the 'essential plants' regime

The regime for "essential plants" (mostly thermal and large hydroelectric installations) are currently compensated through various cost reimbursement mechanisms. These mechanisms are marked (to varying degrees) by a lack of transparency and insufficient integration with the *capacity market*. Maintaining any form of regulation that creates a "special island" of this nature runs counter to the principles of contestability and inclusion of all services, especially those that are the most innovative and distributed.

In a cohesive strategy, the regime of essential installations ought to be discontinued and integrated into the other markets that deal with spot and forward supply of energy availability and electricity generation capacity.

Corrective measures for aid mechanisms in response to high bill prices

High energy prices have seen more than € 100 billion spent on mitigating energy bills indiscriminately up to the end of the first quarter of 2023 in terms of commitment to energy efficiency or savings and also with respect to the actual needs of the recipients, with the energy bonus for domestic customers being the only exception.

In revising these mechanisms, particularly in anticipation of any temporary surges in energy prices, it is crucial to ensure that they do not promote behaviours contrary to decarbonisation and energy consumption efficiency goals. To this end, they should align with the following objectives:

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[18] "To preserve the right to turn on the light at will, we must build a new world in which turning it off is an opportunity," ARERA writes very appropriately.

- **Aid should be based on a proportion of consumption that is lower than the historical average, or at the Best Available Techniques (BAT)** for an entity with similar needs (for instance: in cases of air conditioning consumption, reference should be made to the climate zone, potentially the energy class, and the size of the building – in this regard, the recent introduction of a fixed quota contribution, differentiated by climate zone to final consumers of heating gas, is a step in the right direction. Conversely, for consumption related to manufacturing processes, reference should be made to product/technology specific tables, similar to those already used in the calculation of efficiency for the issuance of "white certificates", i.e. emission performance levels aligned with the EU Emission Trading System (ETS) sectoral benchmarks).
- Aid for companies should be based on their exposure to competitors with access to energy supplies in areas where prices are poorly correlated with those of the domestic market. Additionally, the modulation of aid should consider any compensation received through the Energy Transition Fund in the industrial sector. This approach must take into account the cumulative impact of various factors and the exposure of companies to competitive risk based on their reference market. It should assess whether higher energy costs can be transferred downstream without affecting profit margins. In scenarios where this is feasible, the focus shifts to safeguarding the final consumer from inflation.

Hydrogen's role in balancing the electricity system and industry

Within the context of the ECCO-Artelys study, the potential of hydrogen (via electrolysers + thermal machines for converting back into electricity) has been evaluated for its utility in both seasonal and short-term electricity storage. This assessment also considers the potential relevance of producing green hydrogen production for the decarbonisation of hard-to-abate industrial sectors.

Green hydrogen production, storage, and transportation (mostly at a national level) are crucial for the decarbonation of both the electricity system and industrial sectors with significant greenhouse gas emissions that are not easily electrified.

A certification system for hydrogen from renewable sources will be necessary for the correct computation, among other considerations, of climate-changing emissions from hydrogen-powered thermal engines.

INVESTMENT NEEDS

Given the ECCO-Artelys scenario which aligns with the FF55 objectives for 2030 and targets the predominantly decarbonized power system by 2035, a commitment made by Italy at the G7, investments in the required technological asset portfolio for the 2030 target are anticipated to reach around € 85 billion (a figure subject to fluctuations due to interest rate volatility) are expected to be divided as shown in the table below. For the period between 2025 and 2030, total investments are expected to exceed € 70 billion. This investment will be distributed across electricity generation plants, storage facilities, and networks. Generation plants typically operate under the merchant regime and are compensated over a long-term via the capacity market. Storage facilities (storage), also merchant, are likely to be acquired through regulated auctions, while the network investments, covering both capital and operational expenditures, are compensated within the regulated portion of the electricity tariffs, following criteria set by law and enforced by ARERA. In all cases, in the current framework, these costs are covered through the value and charges on electricity bills.

Technology	2025 - 2030	2030 - 2035
Hydrogen turbines	0,07	1,22
Batteries	2,05	0,24
Solar utility-scale	3,15	4,73
Small-scale solar	2,02	0,19
Offshore wind	1,90	1,30
Onshore wind	2,98	3,38
Electrolysers	0,27	1,53
Hydroelectric	0,21	0,00
Pumping	1,29	0,00
Internal transmission network	0,32	0,63
Interconnections with foreign countries	0,01	0,15

Table 5 *– Estimated average annual investment costs (overnight costs) for 2025-2030 and 2030-2035 (billion euro/year). Source: ECCO-Artelys scenario.*

MONITORING INDICATORS

The establishment of a monitoring system to track the progress and efficacy of interventions towards energy and emission targets is crucial to implement any necessary adjustments to the existing measures. The ECCO scenario outlines a range of indicators, some of which are already available publicly, while others need to be developed. These indicators should be assessed at least on an annual basis.

Primary indicators:

- Greenhouse gas emissions from electricity production (ISPRA/TERNA)
- Electricity generation by source. Source: TERNA
- GW installed by source (including green hydrogen storage and production capacity): ESM/TERNA
- Market Prices
- Accumulations

Secondary indicators (useful for assessing the progress of the measures enabling the decarbonisation of the sector):

- Monitoring of network development (both transmission and distribution)
- Monitoring of authorisation issues (MEES, Regions)
- Flexibility management monitoring: A comprehensive indicator that encompasses a variety of aspects, from the installation of distributed storage capacity to the deployment of *smart meters,* etc.
- Connection times

THE ROLE OF GAS IN THE TRANSITION

One of the most complex elements of the proposed Plan remains Italy's strategy for the gradual phase-out of fossil fuels, including the milestones and basic criteria (e.g. for which sectors a faster exit is expected and which less and why) and the role of natural gas within this overall strategy.

In Italy, gas demand peaked in 2005, reaching 86 billion cubic meters. Since that peak year, gas consumption has shown an overall downward trajectory, reaching a volume of 75.3 billion cubic meters in 2021, marking a decrease of -12% from the 2005 peak. As a result of the energy crisis, which began at the end of 2021 and was intensified by the Russian invasion of Ukraine, gas consumption fell by 9% in 2022 compared to the year prior, reaching a volume of 68.7 billion cubic meters. This reduction was primarily observed in the civil sector, where demand fell by 21% from September 2022 to February 2023, compared to the same timeframe of the preceding year, followed by the industrial sector with a decrease of -20% and, finally, a reduction of -16% in the thermoelectric sector.

The decrease in gas demand derives both from immediate, emergency savings measures, and longer-term structural changes. Initiatives aimed at savings, enhancing energy efficiency, and expanding renewable energy sources have significantly bolstered the security of Italy’s gas system amid the reduction of Russian gas flows, which have now nearly ceased through Tarvisio. Consequently, these efforts have contributed to the reduction of gas prices on wholesale markets, with prices in the second half of 2023 approached levels around € 40/MWh.

In the civil and industrial sector, a minor increase in gas consumption is likely to be anticipated, though a further decrease in demand in 2023[19]. However, the downward trend in gas demand is expected to be more pronounced in the years ahead, driven by firm commitments to decarbonise energy systems. At national level, gas as a transitional fuel, is unlikely to see any growth, except possibly in the primary steel sector where it could replace more polluting fuels. The expansion of renewable energy sources in the electricity sector and improvements in energy efficiency will contribute to a decline in gas demand. Thus, the transition of gas in Italy is therefore set to follow a path of progressively decreasing consumption.

This declining trend is projected to extend across European demand, with variations among the different Member States. From a total demand of 414 billion cubic meters in 2021, the Commission forecasts a reduction of 42% by 2030 and 68% by 2040.

The evolution of gas demand in Italy in the ECCO-FF55 scenario

In the ECCO-FF55 scenario, gas demand falls to 40 billion cubic meters by 2030. This evolution is driven by:

- The **power sector,** where the development of renewable energy sources will lead to a necessary gradual exit from the use of gas. Today, 50% of the country's electricity production comes from natural gas, but with the increase in renewable generation, the energy mix will change substantially, leaving gas with a marginal and residual role. Calculating, in fact, that one GW of new renewable plants replaces about 0.25 billion cubic meters of gas, according to

[19] Between January and September 2023, domestic gas consumption decreased by 13.8% compared to the same period in 2022 (MEES gas balance data).

the RES objectives set by the new NECP, gas consumption for electricity generation will decrease by -7 billion cubic meters by 2025 and a further -11 billion by 2030 (compared to 2021). These objectives are to be considered a variable with minimal risk, given market trends and the Government's desire to accelerate the development of renewables starting with a resolution of the problem of authorization blocks, already started in the two-year period 2021-2022. The development targets for renewable sources in energy systems are mandated by the European Renewable Energy Directive (RED III) and are binding for all Member States.

- The **building sector,** which, although slight, shows a tendency to reduce the use of natural gas to meet its energy consumption, mainly due to heating and cooling needs. This decline will accelerate in the medium to long term as a result of four variables: i) an enhancement in the energy savings target for final energy consumption under the new EU Energy Efficiency Directive (EED); (ii) an increase in the energy savings target for final energy consumption, as set out in the new EU Energy Efficiency Directive (EED); the Progressive electrification of heating for buildings and the gradual reduction of natural gas use for heating (use of heat pumps, 500,000 units were installed in 2022 alone) and for kitchen use (induction cooker); iii) an increase in temperatures over the next thirty years such as to lead to a decrease in degree days and consequently a reduction in the need for energy for heating, between which there is a positive correlation; iv) demographic forecasts that estimate a progressive decline in the Italian population of over one million individuals by 2050, with a consequent decline in consumption.
- The **industrial sector,** where the reduction in gas demand will be slower than in other sectors. In fact, it is likely that the decrease due to the achievement of the emission targets for the sectors subject to the EU ETS system, including industry, will be offset by an increasing use of this source, in the event that the conversion of the former Ilva steel plant in Taranto will take place through a transition to DRI (*Direct Reduced Iron*) technology. The ECCO-FF55 scenario takes into account this conversion, which initially involves the use of natural gas, blended with 10% hydrogen as initially planned, to power DRI plants, with a gradual transition to the exclusive use of green hydrogen post-2030. However, gas consumption in the industrial sector represents an average of 17% of gas demand in the various scenarios, with a smaller impact on the total expected evolution.

Compared to the NECP, it is precisely the power sector that is driving the decline in domestic gas demand, which in the ECCO scenario to 2030 will contribute less than 15% to covering consumption. This is followed by the building sector, for which greater electrification of heat consumption is expected.

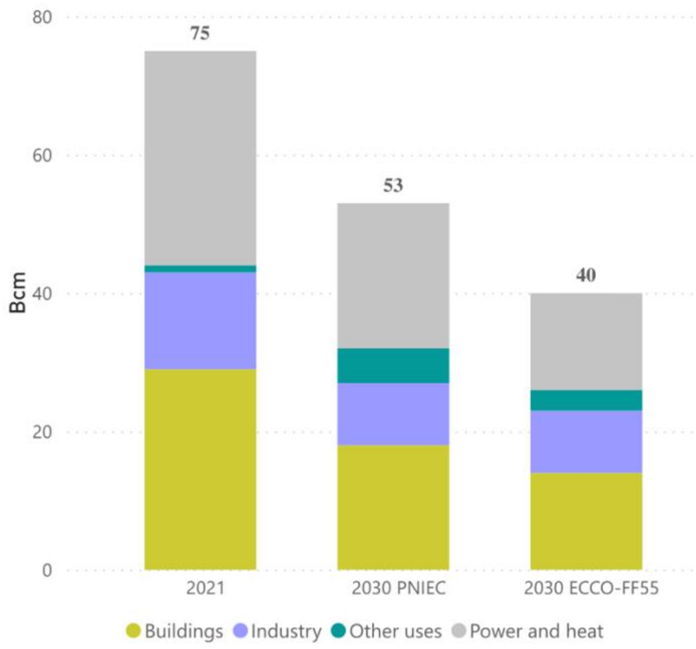

***Figure 9 –** Comparison of Italian natural gas demand (billion cubic meters) in 2021 (historical data) and 2030 (NECP and ECCO-FF55 scenario).*

Gas supply analysis and supply capacity

On the **supply** side, the adequacy and security of the system depend on the following variables:

- The **infrastructure capacity of the system,** which today consists of five gas pipelines with six entry points into the national network and three regasification terminals that together guarantee a nominal import capacity of about 130 billion cubic meters per year – double the gas demand expected by 2025 in the ECCO-FF55 scenario. **Assuming that Russian revenues are totally excluded from the Tarvisio point, nominal import capacity would remain 40% higher than the estimated gas demand in 2025.** Despite the decline in Russian revenues following the conflict in Ukraine, Italy has passed the '21-'22 and '22-'23 thermal seasons without the need to cut consumption or activate disruptive measures and without the support of new FSRU units. In fact, the new unit in Piombino only started operations in May 2023, not contributing to the coverage of consumption in the winter period November '22 - March '23. In addition to the Piombino vessel, for which a temporary use of no more than three years is established, the Ministry of the Environment and Energy Security had asked Snam to purchase a second FSRU to be connected to Ravenna on 22 March 2022. The combined capacity of the two regasification terminals corresponds to 10 billion cubic meters per year (5 billion cubic meters each). With the Ravenna unit, already authorized, and without the Piombino FSRU, Italy's regasification capacity would rise to **over 20 billion cubic meters, capable of covering more than a third of the demand expected by 2026.** Italy has also started talks to double the transport capacity of the TAP pipeline, which would increase to a capacity of 20 billion cubic meters per year. With the Ravenna unit and the doubling of the TAP, Italy's nominal infrastructure capacity would rise to 145 billion cubic meters per year. **Even without Russian gas from Tarvisio, therefore, infrastructure capacity would be 60% higher than the estimated demand by 2026.**
- The characteristics of **gas supply contracts** signed with exporting countries, such as duration, indexation, the presence of *take-or-pay* clauses, the possibility of periodic revision of contractual conditions. On these, the information available is mostly comprehensive but brief,

lacking details and transparency. According to ARERA's annual survey on energy systems, the structure of import contracts (annual and multi-year) shortened in 2022 compared to 2021: both the share of long-term contracts with a full duration of more than 20 years and that of medium-term contracts (5-20 years) decreased, while the incidence of short-term imports increased, i.e. those with a duration of less than five years. The higher inflow of LNG, replacing the shortfall of Russian gas via pipe, led to an increase in short-term spot imports, which rose by 7 percentage points between 2021 and 2022. However, with the gas demand expected in 2026, LNG supplies from the current regasification terminals (without the two FSRUs in Ravenna and Piombino) will be able to cover 25% of national consumption in the ECCO-FF55 demand scenario.

- **Storage** and the ability of the system to cover demand at times of greatest need, when it reaches its daily peak, which historically occurs in the winter period. In addition to imports, stocks provide security and flexibility to the system, allowing it to cope with critical situations and balance supply and demand. **After Germany, Italy has the largest storage capacity in Europe, with 18 billion cubic meters, of which 4.6 billion cubic meters are destined for strategic storage.** In the scenario drawn up by the TSOs (Snam-Terna), the most conservative, a drop in peak demand is expected, mainly due to the reduction in gas consumption in the civil sector. This, combined with the strengthening of the Adriatic backbone between North and South, increases the resilience of the gas network and leads to a reduction in risks related to the adequacy and security of the system at peak times. According to the ECCO-FF55 scenario, **storage will be able to cover on average more than 30% of winter gas demand by 2026.**

The dynamics of Italian and European demand fuel doubts about the technical and economic soundness of new investments in infrastructure capacity, which must be carefully assessed taking into account criteria of economic and climate sustainability.

In fact, from the analysis of both the ECCO scenario and that of the NECP scenario, natural gas demand by 2030 is projected to fall significantly from a minimum of 32% in the NECP and up to a maximum of 44% in the NECP scenario, driven in particular by the drop in gas use for power generation and the building sector. A further development of infrastructure appears redundant with respect to needs, and should, therefore, be carefully assessed in relation to the evolution of demand, the legitimate energy security needs of the country, but also the risk of generating stranded assets and the repercussions of this risk on the community. In addition, it would be necessary to assess what lack of infrastructural capacity in the rest of Europe Italy could theoretically fill and where this is generated. Moreover, the price differentials between the TTF index (*Dutch hub*) and the index relating to the Italian virtual market PSV are historically unfavourable to Italian exports abroad (GME data), highlighting Italy's historical role as an importing country.

THE ITALIAN CLIMATE CHANGE THINK TANK

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