ECCO

THE ITALIAN CLIMATE CHANGE THINK TANK

THE NATIONAL ENERGY AND CLIMATE PLAN

A plan for action

TECHNICAL REPORT

December 2023

SUMMARY

Methodological note

According to the methodology adopted for the development of ECCO's research work, the the following report was built taking into account the active involvement of multiple actors during its design, discussion and definition. The various chapters could be enriched thanks to exchanges with relevant stakeholders and experts from institutions, research, businesses, and non-governmental associations to take stock of the different visions, keeping in mind the organization's mission, which is to seek transformative solutions for the climate in the public interest. The analyses and results of this work represent a starting point for further in-depth studies and exchanges, as well as for monitoring progress of climate policies in Italy.

1 KEY FINDINGS

The National Energy and Climate Plan (NECP) translates the commitments of the European Union towards the Paris Agreement into national policies and objectives. The current revision must review the commitments based on a target of reducing greenhouse gases (GHG at the EU level) by -55% by 2030 compared to 1990, as outlined by the 'Fit for 55' package.

	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
Target for Increased Absorption (LULUCF)	$MtCO_{2eq}$	-27,5	-35,8
Renewable Energy Targets			
RES Share in Gross Final Energy Consumption	%	19	38,4%-39%
RES Share 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 Energy Consumption	Mtep	1,4	73,4

Table 1 – *Targets of the Fit for 55 Package for Italy NECP 2023)*

In the absence of a national governance for climate and energy, the NECP (National Energy and Climate Plan) represents a key tool in defining the framework for implementing climate and energy policies for Italy. Its policies affect the lives of all citizens, and its time horizon – ten years – is much broader than that of economic and financial planning, as well as that of government cycles.

For this reason, the Plan must be structurally suited to its function, with a solid governance framework that makes it adaptable over time in relation to its objectives.

The NECP (National Energy and Climate Plan) proposal sent last July to Brussels declares the intention to have a realistic approach, away from the excessive optimism of the 2019 Plan.

With this work, we have attempted to define how the NECP (National Energy and Climate Plan) can become a realistic plan, meaning a plan whose declared objectives become concrete and achievable within the expected timeframe.

A realistic plan implies the ability to accompany the framework of policies and measures for achieving the objectives with a strategy for their implementation.

Policies and measures must be complemented by enabling elements, which we have referred to in our work as the cross-cutting dimensions of the plan: Governance, finance, and the social dimension. They must be accompanied by the quantification of the foreseen public expenditure and the presence of mechanisms for assessing the effectiveness of the incentives; by a financial strategy to bridge the gap in the necessary investments both through the proposal of tariff and fiscal instruments for their sustainability over time and through the activation of private investment leverage thanks to a commitment to build a legislative and regulatory environment consistent with and favourable to the objectives.

This study starts from the development of a bottom-up emissions scenario 2021-2030, **based on policies and their expected effect**, in order to highlight risks and opportunities. The scenario, called ECCO-FF55, was developed for the four main macro-sectors of energy generation and use: power, buildings, industry, and transports, which are responsible for 76% of national emissions.

During the period 2021-2030, the ECCO-FF55 scenario foresees an overall reduction of **-54.5%** in GHG (Greenhouse Gases) **emissions compared to 2005[1],** reaching a value of **270 MtCO2eq by 2030**, compared to the **312 MtCO2eq** of the NECP(National Energy and Climate Plan) 2023[2], thus meeting the reduction targets set by the Fit for 55 package, with particular reference to the national reduction target established by the Effort Sharing.

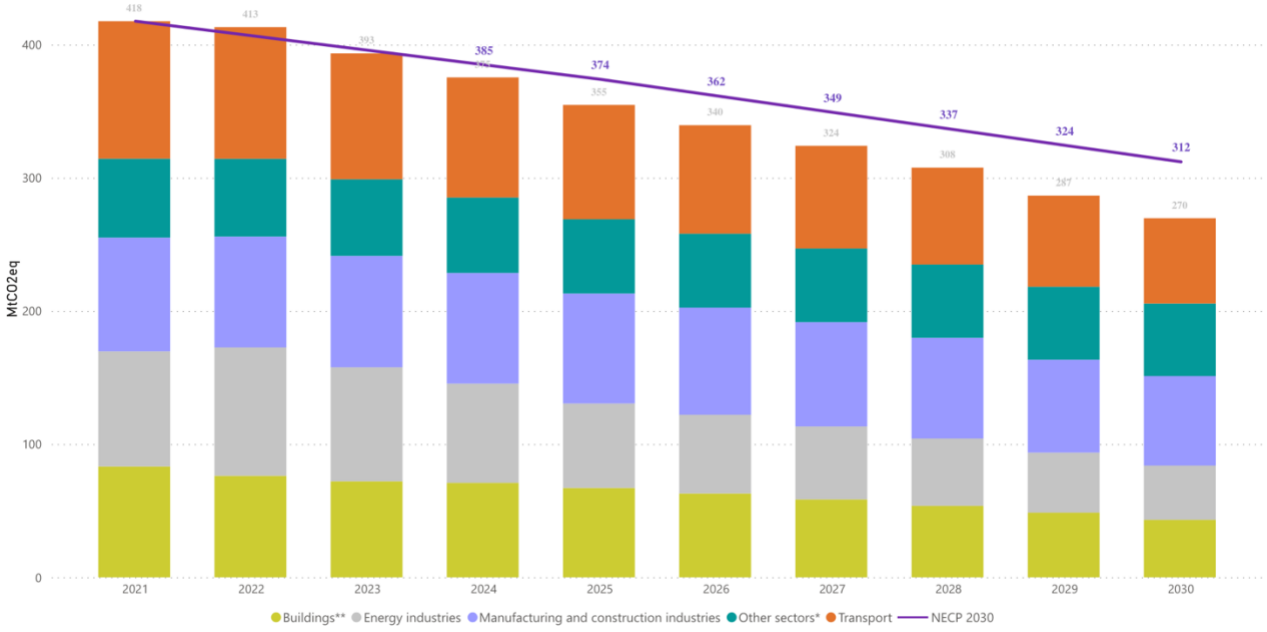


Figure 1 – *Emission scenario ECCO-FF55 for 2021-2030, excluding LULUCF, and comparison with the NECP scenario - Source: ECCO analysis [MtCO2eq]*

[1] Reference year for EU climate and energy policies. This percentage translates to 48% when compared to the emission levels of 1990, the baseline for communicating the EU's commitment to the Paris Agreement. This represents Italy's contribution to the overall contribution of the Union, which amounts to - 55% compared to the 1990 level

[2] Table 84 of the National Energy and Climate Plan (NECP)

According to the results of the ECCO-FF55 scenario:

- **Power sector** – In the ECCO-FF55 scenario, the power sector reduces its emissions by 52% compared to 2021. The ECCO-FF55 scenario foresees a contribution of renewables to the gross internal consumption of 72%, compared to 65% in the 2023 NECP, and a parallel development of energy storage systems, networks, and flexibility resources for about 4 billion euros of investments. The scenario takes into account Italy's **committment at the G7 for a fully or predominantly decarbonized power sector by 2035[3],** and is based on the evidence that the decarbonisation of all the sectors of the economy is enabled by that of the power sector. In the scenario, the increasing penetration of renewables begins to make green hydrogen available for the hard-to-abate industry around 2030, enabling the possibility of decarbonising the industrial sector. It is projected that 8 TWh of green hydrogen will be produced by 2030 to replace the current industrial demand for hydrogen produced with fossil fuels. In addition to implementing all necessary measures for permitting and market to encourage the uptake of renewables in the power sector, the measure considered as the most significant is the implementation of a monitoring mechanism for the development of renewables with the possibility of dynamic and timely adjustments of measures in case of delays. This is to monitor not only the installed capacities, and the progress in permitting procedures, but also the effectiveness of the market and policies in delivering enabling infrastructures: transmission and distribution networks, storage systems, electrolyzers, demand flexibility.
- **Manufacturing industry** – The sector reduces its energy related direct emissions by 37% compared to 2021 (compared to -24% of 2023 NECP). The main driver considered for this sector is the exploitation of the potential for **electrification** of medium and low temperature heat (<150°C), which allows for a reduction of 8.3MtCO2 by 2030. The electrification of low temperature heat in the industrial sector is not explicitly mentioned as a measure in the current version of the NECP. Additionally, the use of **biomethane** in energy-intensive sectors, the use of the potential of green hydrogen generated from the decarbonisation of the power sector to replace the current demand for **hydrogen** produced from fossils, and the initiation of the decarbonisation process of the **ex-ILVA in Taranto[4]** through replacing coal with natural gas in the DRI process with a blend of 10% hydrogen by 2030, contribute to the goal. In light of the structural complexities of decarbonisation of the manufacturing sector and its strategic relevance, it is considered essential that **the NECP provides a comprehensive contribution**, in which this sector has a dedicated space to coherently group policies both in terms of decarbonisation and impacts on the socioeconomic context of the country. In particular, there emerges the need for a strategy for low-temperature heat electrification in industrial uses, also through the enhancement and revision of current incentive tools, a focus on decarbonisation, and a correction of the levels of taxation and parafiscal charges on electricity consumption compared to natural gas. Policies for the decarbonisation of industry should act

[3] Communiqué 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 refers to 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

[4] To maintain consistency and enable comparisons in line with the emission scenarios of the NECP, emissions from the ex-ILVA in Taranto are accounted for in two sectors. A portion is counted in the energy industries sector, relating to the production of coke, and another portion in the industrial sector, pertaining to blast furnace steel production

in an integrated manner, including policies to encourage the demand for products with lower CO2 emissions (GPP, labelling) also in view of a strategy for competitiveness in the international markets of the national industry.

- **Transport –** The sector reduces its emissions by 37% compared to 2021, achieving an additional reduction of 12.8 MtCO2eq compared to the NECP targets. The proposed measures primarily focus on **reducing the demand for private transportation** through the implementation of policies outlined in the NRRP (National Recovery and Resilience Plan) and the comprehensive planning tools for sustainable mobility, which account for a reduction of 14.5 MtCO2eq (37% of the total). The increase in the number of electric BEV (Battery Electric Vehicles) in the circulating vehicle fleet – 3.5 million cars, a number lower than the 4.3 million projected in the NECP – contributes to a further reduction of 5.8 MtCO2eq (15% of the total). Additional reductions are attributed to the expected projected increase in efficiency of traditional vehicles, an initial penetration of electric vehicles in road freight transport, and the implementation of NRRP investments for the electrification of national port docks (cold ironing), as well as partial replacement of the ferry fleet for transporting people and goods to and from the islands[5]. The reduction contribution associated with the use of biofuels has been calculated based on the total consumption assumed by the NECP. For this sector, a key enabler appears to be the need for very effective governance of the Plan in **coordination with local government** levels to implement measures, ensuring that transport demand is fully met, allowing for a reduction in private transport demand and its gradual conversion towards electric mobility.
- **Building sector[6] –** The contribution of the building sector to the overall reduction is around 16%, amounting to a total of 36.2 MtCO2eq, compared to the 48 MtCO2eq projected in the NECP. In this case, the main drivers of reduction are a greater electrification of end uses due to a faster replacement of traditional heating systems with exclusively electric heat pumps and an increasing rate of renovations—from the current value of 0.37% to 4% by 2030. The key measure underlying this scenario involves targeted incentives for renovations and the replacement of heating systems, such as a proposed reform of the current eco and super bonus mechanisms for energy efficiency, which should be more aligned with decarbonisation objectives and strengthened with long-term financing mechanisms to make this measure structural. Such a measure should be accompanied by a necessary rebalancing of gas-electricity tariff systems.

As per the working methodology of ECCO, during its development, this study was enriched by contributions collected from various stakeholders involved in sectoral working groups, also addressing the cross-cutting dimensions of the Plan (governance, finance, social issues, industry, power sector, buildings, trasports).

[5] This latter contribution, initially considered under the Effort Sharing Regulation (ESR), will need to be quantified within the EU Emissions Trading System (ETS) following the sector's inclusion in the EU ETS. This change is in accordance with the latest revision of the EU ETS Directive

[6] It is noted that no specific measures have need considered regarding 'energy' emissions in the agricultural sector, which, according to the inventory classification, are 'combined' with the building sector, although the potential for reduction is quite significant (the sector emits about 7MtCO2eq). While respecting the objectives of the RED directive, it could be assumed to allocate at least part of the biofuel potential for heating and powering agricultural machinery, shifting the current Environmentally Harmful Subsidies towards the promotion of alternative fuels .

It is within this context that the importance of the **Plan's governance** emerged more clearly, that is, the need for the Plan to have a different implementation strength compared to the current version. It is important that the NECP is positioned within the legal framework at **the highest decision-making levels, such as being adopted as a resolution by the Interministerial Committee for Economic Planning and Sustainable Development (CIPESS)** following Parliamentary examination.

At the same time, the governance of the Plan should ensure the possibility of continuous **monitoring and evaluation**, with the ability to dynamically modify measures, and the factual **involvement of all actors variously involved in the implementation of the Plan in the definition** phases, with the institutionalization of procedures for multi-level dialogue.

2 EXECUTIVE SUMMARY

Introduction –what is the NECP and why is it important?

The 195 countries that joined the Paris Agreement in 2015 have committed to reducing their emissions and striving to limit the temperature increase to 1.5°C above pre-industrial levels.

However, the synthesis report by the co-facilitators on the technical dialogue of the first Global Stocktake reveals that the combined contributions of the Parties to the Agreement show gaps in both ambition and effective implementation for achieving temperature containment.

In Europe, the contribution to meeting the Agreement's objectives is determined at the Union level. The so-called 'decarbonization' process involves a stepwise approach to achieving net-zero emissions by 2050[7], with the first milestone being a 55% net emission reduction by 2030, compared to 1990 levels. Discussions are ongoing to define the 2040 reduction target, likely aligning with European Scientific Advisory Board on Climate Change recommendations for 90-95% reductions by 2040. This path is marked and, in Europe, it's established by law[8].

The common EU objective is translated into national plans through the National Integrated Energy and Climate Plans (NECP). Although conceived with a ten-year time horizon, the current plans, dating back only to 2019, need to be revised to take into account the "Fit for 55" package, as well as economic and social changes resulting from the pandemic and the energy price crisis.

The Plan is not just a list of policies for energy and climate objectives for 2030, but the **first step in the transformation of our economy** towards 2050, with significant repercussions on the economic and productive fabric and on the lives of all citizens.

The Plan also represents one of the few policy programming tools with immediate and pervasive effects on the lives of citizens, with a ten-year horizon, much broader than that of economic and financial planning, as well as government cycles. This characteristic necessitates the Plan to be structurally adequate for its function, with a solid governance structure that allows it to adapt over time in relation to its objectives.

The 2019 NECP

Despite the fact that the PNIEC2019 is in force and that at least part of its policies have been financed and implemented (e.g. policies to promote energy efficiency of buildings), Italy already does not comply with the national reduction target for the sectors *Effort Sharing* of 2021 and for more than 10MtCO2eq (Table 2).

The non-compliance with the targets has relevant implications. It determines the application of 'penalty' mechanisms, as well as infringement procedures, whereby Italy would have to compensate

[7] Countries that have legally committed to net-zero emissions by 2050, besides the EU, include Canada, Chile, Colombia, Fiji, Japan, South Korea, New Zealand, USA, and Australia. Some countries have set shorter-term commitments, like the Maldives, Guatemala, and Iran targeting 2030. https://zerotracker.net/

[8] In the EU, the commitment to net-zero emissions by 2050 is formalized through the EU Climate Law, Regulation (EU) 2021/1119. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R1119

for the excess emissions, which have a monetary value, increased by a factor established by the law[9] (equal to 8% of the excess, ed.), with a potential effect on public finances.

	1990	2005	2021	2025	2030
			$MtCO_{2eq}$		
Greenhouse gas emissions (excluding LULUCF), of which:	**523**	**594**	**418**	**389**	**359**
ETS Sectors		248	132	124	110
Effort Sharing (ESR) Industries		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 the current policy baseline for the ETS and non-ETS sectors. Source: ISPRA, PNIEC*

The existing plan declared the targets achievable, but that was not sufficient for Italy to meet them from the first year. Therefore, the existing Plan lacks the implementation force to **effectively steer policies, including public spending, in a coherent and targeted design with respect to climate objectives.**

Where we are today – the proposal of the NECP 2023

Among the first countries in the Union, Italy submitted its proposal for the update of NECP 2023 last July, but still it shows elements that undermine its potential effectiveness and ambition.

The NECP 2023 proposal declares its intention to abandon the 'unrealistic' approach of the previous version, which postulated the achievability of the targets without periodic assessments of the effects of policies. There emerges the will to start a path of improvement that leads to raising the level of ambition of the Plan until the final submission foreseen for June 2024.

Both the 2019 Plan and the latest 2023 proposal identify a very high number of policies and measures for achieving the targets, with brief descriptions and referring to subsequent implementing measures. The Plan, then, emphasizes 'what' to do.

As the goals become more challenging, however, the Plan should outline the strategy for implementing policies and provide a meaningful framework for **'how'** doing it. As highlighted in the synthesis report by the co-facilitators on the technical dialogue of the first Global Stocktake , **the ambition and the ability to implement the measures are equally important.**

From identifying objectives and proposals on paper, moving on to the implementation phase is equally crucial.

In this perspective, what are often considered as 'ancillary' dimensions of climate and energy policies become central. How to involve territories and governing bodies or all the stakeholders that should

[9] Article 9 of the Effort Sharing Regulation 'an addition to the Member State's greenhouse gas emission figure of the following year equal to the amount in tonnes of CO2 equivalent of the excess greenhouse gas emissions, multiplied by a factor of 1,08'

be? How to finance the transition? How to evaluate and manage the socioeconomic impacts of the proposed measures to maximize the benefits and minimize the risks of the transition?

The EU Court of Auditors' special report of 2023, del 2023, referring to the Italian Plan[10], indicates that **due to a lack of information at the policy level, it is difficult to assess whether the objectives can be achieved,** and that the number and type policies might not be sufficient to achieve the objectives, especially after 2022, as the measures for that period still need to be budgeted and approved.

Therefore, alongside the measures, it would always be necessary to explicitly state the elements required for their realization and subsequent assessment, with an integrated approach. In the absence of such elements, the Plan will always present an implementation gap that is difficult to resolve with contingent measures, which, by their nature, are not organic and emergency-based and, therefore, ineffective.

A possible scheme for the presentation of policies and measures of the NECP could partly follow that of the reporting model used by the Member States for policies and measures (Figure 3), in such a way as to adequately track the progress of the Plan.

Measure or policy	Source of funding	Financing instrument	Socioeconomic impact	Monitoring indicators	Governance of the measure
Synoptic description of the measure	% public-% private	Taxation, public debt, incentive?	Scope and assumption within which the measure is defined	For both the main dimension and the 'enabling' ones	Who does what - relevant bodies and stakeholders and methods of involvement
(...)					

Figure 2 – *Possible scheme of supplementary information for the measures and policies of the NECP*

PAM number	Name of policy or measure	Sector(s) affected[a]	GHG(s) affected[b]	Objective[c]	Quantified objective[d]	Short description[e]	Type of policy instrument[f]	Union policy which resulted in the implementation of the PAM		Status of implementation[i]	Implementation period		Projections scenario in which the PAM is included	Entities responsible for implementing the policy [j]		Indicators used to monitor and evaluate progress over time					Reference to assessments and underpinning technical reports	General comments
								Union policy[g]	Other[h]		Start	Finish		Type	name	Description	Values [k] [Year]	[Year]	[Year]	[Year]		

Figure 3 – *Model for the communication of information relating to the policies and measures of the Member States (Source, ECA 2023)*

[10] Table in Annex IV of the report

An 'implementation-oriented' approach for the National Energy and Climate Plan 2024

With the aim of contributing to the process of defining the final version of the Plan, due by June 2024, this work outlines the lines of an alternative approach, with ideas and concrete proposals so that the final Plan can be more ambitious and effective.

To this end, a simplified bottom-up emission scenario for 2021-2030 was developed, starting from the policies and their expected effect, in such a way as to highlight their risks and opportunities.

The scenario, called ECCO-FF55, was developed for the four main macro-sectors of energy production and use, i.e. the power sector, buildings, industry, and transport. This is not a modeling work, strictly speaking, but a **tool developed to focus on the priorities of the policy and measures framework, the investment needs, and the reform framework necessary to enable the transformation.**

For each sector, the main levers of action to be activated to achieve the objectives were analysed, the differences compared to the NECP2023 scenario and the list of sectoral policies that are considered to be priorities[11].

The ECCO-FF55 scenario takes into account **Italy's commitment at the G7 to a substantially decarbonised electricity system by 2035,**[12] enhancing the results achieved by the ECCO-Artelys scenario.

During the period 2021-2030, the ECCO-FF55 scenario leads to a total reduction of **-54.5%** in GHG emissions **compared to 2005**, reaching a value of **270 $MtCO_{2eq}$ by 2030,** compared to the **312 $MtCO_{2eq}$** of the NECP (see Table 84 of NECP 2023).

The ECCO-FF55 scenario meets Italy's Effort Sharing Regulation reduction targets for 2030, with a reduction of about 44.1% compared to 2005[13], and also implies significant reductions in the ETS sectors, by about 69% compared to 2005, due to the more accelerated decarbonization of the power sector (with 72% of final electrical consumption from RES against 65% of the NECP).

For each sector, the considered policies are detailed and developed as far as possible. These are very targeted policies, given the tight timeframes and very challenging objectives. So called 'enabling reforms' are also identified, which can facilitate the adoption of decarbonization solutions, such as a comprehensive reform of the tariff structure in order to rebalance electricity and gas prices for the building sector or a reform of taxation for cars.

---

[11] For some sectors for which sufficient data were not available for independent modelling, the same as those of the PNIEC were assumed, such as potential biofuels, process emissions for industry, agriculture or LULUCF

[12] Communicated 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

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

	2005	2030	
		NECP	ECCO-FF55
		MtCO2eq	
From ENERGY USES, of which:	**488**	**232**	**189**
Energy industry	160	51	41
Industry (including ILVA)	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)*

Furthermore, consistently with the analyses carried out on the NECP 2019, the so-called cross-cutting dimensions have been developed, namely finance and the assessment of the socioeconomic implications of policies, since these should **guide** the development and evaluation of policies. For each sector, the **investment needs linked to the framework of the proposed policies have been assessed,** and examples are shown – in dedicated boxes – of how a lack of evaluation of the socio-economic impacts of measures, both regarding consumption and industrial policies, can undermine their effectiveness (e.g. Boxes on Wind energy, Superbonus and ILVA).

In the text sent to Brussels, the assessments of financing needs and socioeconomic impacts are aggregated and not yet sufficient to **focus the strategy to achieve the challenging goals of the Plan.** For this reason, for some 'flagship' measures, a table is shown below in this document, which alongside the measures, provides for the minimum set of information which would be necessary to **accompany each measure from its design to its implementation.**

A complex framework like the one described cannot stand without a solid governance structure that is both embedded in an implementing regulatory framework and, at the same time, **ensures the possibility of dynamically adjust policies to the targets over time.**

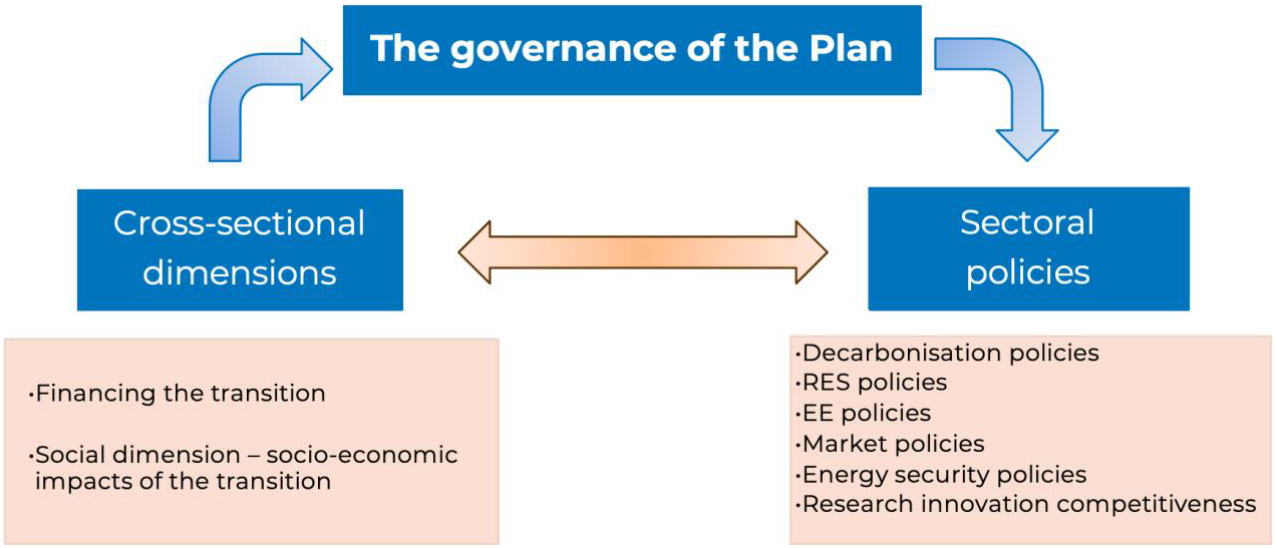


Figure 4 – *Simplified scheme of the integration of the dimensions of the National Energy and Climate Plan*

Following the described approach, **the inclusion of a chapter and a dedicated strategy for the manufacturing sector is key.** The industrial sector catalyzes the abovementioned issues, requiring comprehensive policies to accompany the transition and sectoral assessments of the socio-economic impacts of industrial transformation, over a long-term horizon, which is the horizon where the challenge of the competitiveness of the national industry is at stake.

Summary of conclusions and recommendations

The effects of climate change are evident. The recommendations of science on the strategies to be implemented to mitigate the increase of the global average temperature are known, and in Europe, they have legal force[14]. The challenge is increasingly complex, and reductions must be delivered in a very short timeframe[15]. The regulatory tool that translates all this for Italy is the National Integrated Energy and Climate Plan, and ensuring that this is **ambitious** and **effective** must be a priority.

Accompanying the measures of the Plan with strategies for their implementation appears to be a necessary step to show a concrete path of decarbonization and a vision of the country's development, in the shorter and longer term perspectives, to seize the opportunities of a NECP that is, actually, to the advantage of all citizens.

The objectives of the Plan and its coherence will determine the framework for major public and private investments, in a long-term perspective, and will also affect the consumption choices of individual citizens. How can we make our homes more efficient? How will we commute or travel? Which path must our manufacturing industry take to not lose competitiveness and re-orient towards decarbonized productions, investing in its transformation?

The challenge risks being lost from the start if one is not able to mobilize participation, to ensure breadth, vision, and transparency in the writing of the Plan's revision.

---

[14] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32021R1119 Regulation (EU) 2021/1119
[15] https://www.ipcc.ch/report/ar6/syr/

1. With this spirit, the analyses of this study were conducted and their conclusions, in view of the drafting of the final Plan in June 2024, lead to the definition of the following recommendations:
2. **The *governance* of the Plan is the essential element for its implementation.** The NECP should be approved through an implementing regulatory instrument, e.g., a deliberation by the Interministerial Committee for Economic Planning and Sustainable Development (CIPESS). The coordination and implementation body should be placed at the highest decision-making levels and establish a close dialogue with the various levels of government, both central and local. This steering committee should also coordinate with all stakeholders involved in the implementation of the Plan and assess and adjust the policies and measures to the objectives over time.
3. **The measures of the NECP should be accompanied by strategies for their implementation.** The NECP should clearly identify the priority sectoral policies, based on an explicit assessment of the effects achieved so far and the strategic objectives to be pursued. For each measure, alongside effectiveness in reducing emissions or in the spread of renewables, the Plan should report the necessary financial requirements and how these are met, as well as the expected socio-economic impacts, at least in terms of costs and benefits, and clearly identify the stakeholders and the authorities responsible for implementing the measures and how these are included in the decision-making process.
4. **The NECP should include a sectoral chapter dedicated to the manufacturing industry.** Due to the strategic relevance of the manufacturing sector in the country's economy and the technological, economic, and social challenge implied by its transformation, it is considered fundamental that the NECP explicitly states in a dedicated chapter the decarbonization strategy for the manufacturing industry, which, as much as possible, deepens specific sectoral analyses that highlight the risks and opportunities offered by the acceleration towards innovation of the supply chains imposed by the decarbonization of the economy.

3 CROSS-CUTTING DIMENSIONS OF THE PLAN

Both the 2019 Plan and the latest 2023 proposal identify a very large number of policies and measures to achieve the objectives, with brief descriptions and few further details. The Plan therefore places the emphasis on **'what'** to do.

As the climate and energy targets become more challenging and lower-cost, higher-impact decarbonization solutions are exhausted, the Plan should increasingly serve as a **place of synthesis** of various dimensions and provide a strategic framework for **'how'** to implement policies. Which policies and what are the elements needed to achieve the transition? From identifying objectives and proposals on paper, moving on to the implementation phase is anything but trivial. With this in mind, those that are often dismissed as 'ancillary' dimensions of climate and energy policies become central. How to effectively involve the territories and all the actors that should be involved (*governance*)? How to finance the transition? How to assess and govern the socio-economic impacts of the proposed measures to maximise the benefits and minimise the risks of the transition (social dimension)?

The tables of the NECP (National Energy and Climate Plan) should always include explanations of the elements necessary for their implementation, in addition to listing the measures. Without these elements, the Plan will inevitably suffer of an implementation gap which cannot be addressed solely with contingent measures. Such measures, by their nature, are non-organic and emergency-based, and therefore ineffective.

Integrating cross-cutting dimensions with sectoral policies can enable:

1. to **prioritise** actions with respect to effectiveness criteria (e.g. effectiveness towards the objectives of the Plan, effectiveness of public spending, etc.)
2. to clearly identify, alongside the **objectives,** the **strategy** to achieve them.
3. to **reduce** the risk of **inconsistency** within the overall framework in relation to individual measures.

These cross-cutting dimensions are described below, i.e. the financing strategy, the assessment and socio-economic impacts, and the dimension on which all these elements should be based in order to be effective, meaning the governance of the Plan.

3.1 WHAT GOVERNANCE FOR AN EFFECTIVE PLAN

Italy failed to meet the 2021 reduction target for *Effort Sharing* sectors by more than 10MtCO$_{2eq}$, despite the NECP 2019 being in force and various of its measures financed and implemented.

For instance, in the building sector, incentives for energy efficiency have resulted in only 1% reduction in emissions, despite significant public investments from the NRRP (National Recovery and Resilience Plan). Subsidies for utility bills were not based on efficiency or income-related criteria, while permitting procedures for renewables have seen limited progress, despite numerous legislative interventions.

There is a clear lack of a coherent regulatory and implementation framework, able to guide policies towards energy and climate objectives. Other countries around the world have filled this

gap through framework climate laws. In the absence of such a tool, the Italian NECP (National Energy and Climate Plan) should be able to fill this gap, and its governance framework becomes crucial for its implementation. This framework should consider:

1. The legal force of the Plan, granting for clarity in terms of implementation and enforcement of the text.
2. A governance mechanism to **design, monitor, evaluate, and promptly adjust ineffective policies,** through an ongoing dialogue with institutions and actors at various levels involved in the Plan implementation.

The Plan legal form and its inclusion *in the economic planning cycle*

The NECP (National Energy and Climate Plan) is the European Regulation 2018/1999 implementing tool and some of its chapters put other EU Regulations into effect (e.g. the *Effort Sharing* and LULUCF – Land Use, Land-Use Change and Forestry – Regulations). While the Treaties establish that regulations have immediate applicability in Member States (Art. 288), this does not automatically guarantee the effectiveness of the regulatory instrument adopted in national law.

The Plan therefore needs a legal form appropriate to the importance of its measures and commensurate to the effects of their implementation.

This is also true in light of the recent Constitutional reform, which introduces environmental protection among the fundamental principles of the Constitution, in the interest of future generations[16] (Art. 9) and binding economic initiative to potential health and environmental damage (Art. 41).

Therefore, the NECP (National Energy and Climate Plan) should at least be approved by means of a **regulatory tool** and grounded into the highest levels of decision-making institutions. One such tool could be a deliberation of the Interministerial Committee for Economic Planning and Sustainable Development (CIPESS) following parliamentary examination. A similar procedure was undertaken with the Emission Reduction National Plans, approved by the then CIPE[17] (Interministerial Committee for Economic Planning). The Italian central Government would thus take on the responsibility for NECP effective approval and implementation.

Moreover, it's essential to better explain role and contribution of climate and energy policies within the Government's **planning on economic and budgetary policies** (i.e. **the budget law**). Given the magnitude of investments required by the decarbonization process (over € 100 billion/year) and the role of public spending as a lever for private investment (see the Plan Investments and Finance section), the budget should identify tools to make spending more efficient. Currently, there is only an annual report on the state of emissions[18] as an annex to the EFD (Economic and Financial Document). Public spending implications of climate and energy policies should be more explicit on

[16] Through the Committee for the Evaluation of the Generational Impact of Public Policies (COVIGE), "Guidelines for assessing the generational impact of public policies", drafted and published in July 2022 https://www.politichegiovanili.gov.it/comunicazione/news/2022/6/linneguidaimpattogen

[17] https://www.mase.gov.it/pagina/piano-nazionale-di-riduzione-dei-gas-serra-0

[18] Law 39/2011, art. 2, c. 9

expenditure forecasts and the economic and social impacts of policies. In this sense, it would be necessary to:

1. Ensure ex-ante assessment of expected impacts of new legislation on climate objectives.
2. Introduce explicit references to public expenditure in relation to climate objectives.
3. Highlight how the proposals in in the Economic and Financial Document can contribute to achieving climate objectives.

A dynamic, multi-level governance and the participatory plan

In addition to an appropriate legal framework, a **participatory** and **dynamic** mechanism is needed to define, monitor, evaluate and possibly adjust policies and measures.

Public administrations and authorities responsible for implementing the NECP (National Energy and Climate Plan) should:

a) Constantly **promote** information and close coordination, both horizontally - between Ministries – and vertically – between them and local authorities – to achieve shared responsibility on climate and energy objectives implementation. Coordination mechanisms cannot be separated from involving territories, civil society and businesses, and implementing the **multi-level dialogue for climate and energy** (as required by the European legislation).
b) **Encourage continuous action** through the definition, implementation, monitoring and evaluation of policies. This would allow dynamic adjustments for developing effective paths to achieving climate and energy objectives, in line with the Plan progress evaluation at EU level.
c) **Base** its decisions on shared and up-to-date **scientific criteria and evidence.**

Given the breadth of the subjects covered in the NECP (National Energy and Climate Plan) and the potential repercussions of its policies on public spending as well as on the productive and entrepreneurial fabric of the country and on citizens lives, responsibility for NECP coordination and implementation **should be placed at the highest decision-making levels of the central government.** The Presidency of the Council of Ministers, or offices directly dependent on it, would ensure fair representation of all the Ministries and Bodies involved, including agencies, gas and electricity distribution network operators, Regions and Municipalities. This setting would also ensure close coordination with the **structures entrusted with implementation of the NRRP,** also based in the Prime Minister's Office.

If what is outlined above cannot be achieved, the structure responsible for the Plan coordination and implementation should provide for at least the presence of a **Coordination Unit,** hinged, for example, on the MEES (Ministry of Environment and Energy Security) as the lead administration. The Unit would be made up of MEES's representatives, together with representatives from public research institutes that the Ministry relies on for the definition of technical-economic scenarios and development of the Plan policies and measures(ISPRA, Higher Institute for Environmental Protection and Research, RSE, ESM Energy Services Manager, ENEA, Italian National Agency for New Technologies, etc.). The Unit should act in close **coordination** with at least two other clusters of representative bodies: one that include the other Ministries and Agencies closely impacted by the Plan and the other representative of **regional and local government levels** (Regions and Autonomous Provinces, Metropolitan Cities, ANCI).

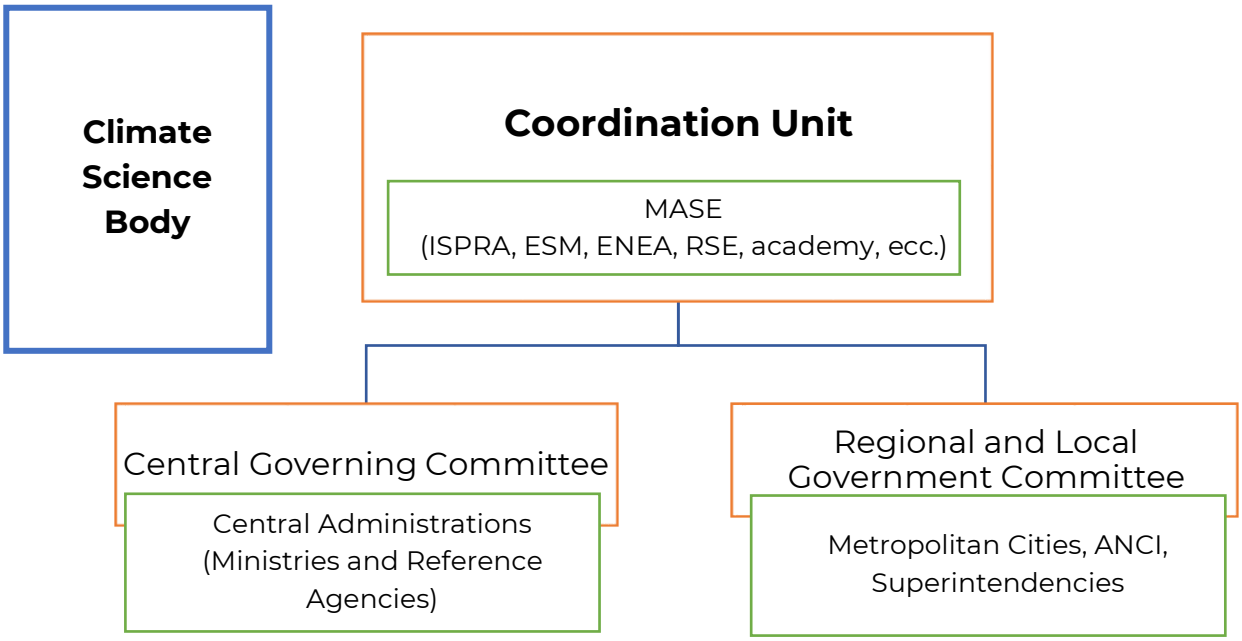


Figure 5 – *Possible hypothesis of a coordination structure for the implementation of the Plan – The independent scientific body contributes to the coordination structure, ensuring timely and constant dialogue between politics and the most recent scientific evidence on climate and energy.*

This structure should be the framework for defining the Plan's content and for drafting, implementing, monitoring and evaluating its policies.

The approach outlined in the current Plan proposal somehow recognises the need to *strengthen both coordination and monitoring activities*.

For what concerns coordination between central and local government structures, the Plan does not propose an organic solution, but, as a good practice, refers exclusively to the so-called *Burden Sharing* Decree (Ministerial Decree of 15 March 2012) which sets Regions and Autonomous Provinces contributions for the purpose of achieving the national renewable energy target by 2020.

This approach is inadequate both with respect to the identification of decision-making levels competence boundaries, and in light of the breadth and scope of the policies dealt with in the NECP (National Energy and Climate Plan). These, in addition to achieving renewable energy objectives, should also look at policies for emission reduction in the civil, transport and agriculture sectors.

As a matter of fact, the current institutional set-up entails significant implementation issues that may slow down the needed increase of electricity from renewable sources, in line with European legislation.

Allocation of competences between State and Regions is provided by art.117 of the Constitution, which triggered abundant production of norms[19]. Competences and norms regarding production, transport and national distribution of energy are particularly relevant and controversial. Although the central Government retains exclusive competence in the field of environmental protection (e.g. Costitutional Court judgment 199/2014), this clash with Regions' competences in the protection of

[19] https://www.cortecostituzionale.it/documenti/convegni_seminari/stu_281.pdf

landscape and territory, protection of historical-cultural sites, protection of biodiversity and agri-food production.

Considering the difficulty and the time required to achieve an organic reorganization of the State-Regions competences in the field of energy, it is necessary to at least ensure that the **dialogue between central and local governments** (Regions, Metropolitan Cities and Municipalities) **is established from the drafting of the Plan, including definition and sharing of objectives and policies to achieve them. The dialogue should continue during Plan implementation through a multi-level dialogue able to deliver effectively on its objectives[20]. Multi-level participation and dialogue would ensure that NECP policies and measures would be effective and implementable. Furthermore,** these must be shaped according to the various levels of responsibility that stakeholders have with regards to Plan drafting and implementation. Stakeholders encompass local authorities, industrial, productive and civil society associations and individual citizens. Thus, the NECP could represent multiple visions, becoming recognized and recognizable by those who contributed to its construction, through ownership of its structure, its contents and its broader objectives.

Decision-making and coordinating bodies should therefore act as a means of establishing an appropriate **multi-level dialogue** between stakeholders and the authorities implementing the Plan (cf. Strategy for public participation and multi-level dialogue in the NECP). **Ideally, each policy of the Plan should clearly identify the actors to be involved in the definition, monitoring, evaluation and possible modification phases and how such involvement needs to happen.**

In this way, policies could be gradually adapted according to their effectiveness in relation to the objectives to be achieved, as shown in the following simplified diagram.

Figure 6 – *Diagram of the functioning of the phases of definition, implementation, monitoring, evaluation and dynamic adjustment of policies, read on the basis of the timing of the moments of evaluation of the Italian Plan by the Commission (the diagram shows the main moments that derive from the combination of the Effort Sharing Regulation and the Governance Regulation).*

[20] Article 11 of Regulation (EU) 2018/1999 https://eur-lex.europa.eu/legal-content/IT/TXT/PDF/?uri=CELEX:02018R1999-20210729

A **strategy of multi-level participation and dialogue** (cf. Strategy for Public Participation and Multi-Level Dialogue in the NECP) should be **embedded in the governance of the Plan** itself, becoming one of its integral and substantial part.

Finally, this organisational structure should base its decisions on the latest scientific evidence. To this end, an **independent Scientific Council** should be set up along the lines of the proposal signed by the political forces on the eve of the elections. Such a body, operating in complete autonomy and with independence of judgment and evaluation, could provide its opinion to the coordinating body for the Plan implementation. Its general function could be to assess the design and implementation of climate policies and guidance with respect to the
coordination and monitoring of their consistency with the objectives, as well as an external evaluation of the objectives themselves, as is the case in Germany and the United Kingdom (see also the report A governance for the climate in Italy).

In conclusion, it is necessary **to restore a framework of meaning to energy and climate policies in Italy and to the Plan itself, which is appropriate to the role and breadth of the issue and its economic, social and environmental implications. The governance of the Plan is an essential element of this framework.** Only the clarity of the regulatory framework and the final objectives, accompanied by the dynamic monitoring and adjustment of policies in a constant multi-level dialogue between the institutions and the subjects involved in its implementation in various capacities, can deliver 2030's objectives and the subsequent ones on the path to climate neutrality in 2050.

3.2 FINANCE AND INVESTMENTS IN THE PLAN

The NECP estimates the amount of investment needed to achieve the decarbonisation targets at € 830 billion cumulatively, between 2023 and 2030 (i.e. € 119 billion on average per year). This value, although underestimated compared to the estimate developed by ECCO, confirms the extraordinary importance of the financial effort necessary for Italy to achieve the decarbonisation objectives defined at European level. This means that approximately 25% to 30% of the national overall investments, totaling around € 400 billion/year[21] should be redirected towards transition. It should be noted that this this total value fails to adequately consider the socio-economic dimension of the Plan and its implications (see also Chapter 3.3).

It's clear that this significant economic and financial commitment cannot solely rely on public resources from the NRRP (National Recovery and Resilience Plan) and REPowerEU[22].**Therefore, any**

[21] ISTAT 2022 data, National Accounts

[22] The Italian government has recently updated and amended the National Recovery and Resilience Plan (NRRP) to incorporate the new objectives arising from REPowerEU: the total funds of the plan are equal to € 194.86bn. The additional chapter, stemming from REPowerEU, has a budget of € 19.2 billion. The resources for this chapter come from the reallocation of funds from other measures of the plan totaling € 15.9 billion and additional EU resources. Specifically, out of the approximately €5 billion additional funds from REPowerEU, €2.7 billion are non-repayable grants, €3 billion come from Cohesion Funds, and €0.15 billion stem from changes in GDP. Analyzing individual expenditure items reveals an increase in green spending within the PNRR (primarily Missions 2 and 3), rising from 16% in 2021 to 22% in 2023. It is estimated that 70% of the new funds will have a highly positive climate impact, while 50% of the defunded projects would have had marginal mitigation effects. Cf. "A Year of REpowerEU: Effects on the Italian NRRP" ECCO (September 2023)

strategy for the transitioning of the economy cannot exclude a concrete and independent financial strategy acting as a lever within an enabling regulatory environment that allows the achievement of European objectives[23].

In addition to the overarching financial strategy, it is crucial to adopt a detailed approach, **delving into specific financial instruments suitable for supporting each individual policy and measure.**

This strategy should be integrated in the NECP itself and must be meticulously structured with a high level of specificity for each identified measure and policy outlined in the Plan. This involves establishing a well-structured *governance*, creating a coherent and supportive legislative framework, clearly defining roles and responsibilities, as well as primary and secondary funding sources.

Outlined below are the main public and private finance policies that could serve as the foundation for developing a strategy to facilitate the financing of the transition and the NECP measures.

The Role of Public Finance and National Promotional Banks[24]

The public sector plays a pivotal role, mainly through direct investments in enabling infrastructures, in supporting innovation, as well as through tax and financial incentives that crowd-in private investments toward the desired direction.

Private finance has traditionally been driven solely by the principles of risk and return, which often do not naturally incentivize the advancement of decarbonization within the country's system and the attainment of European climate objectives. Consequently, public finance should step in to bridge this gap between public objectives and private financial incentives. This can be achieved through two main instruments: **guarantees and tax incentives.** Guarantees can reduce risk for private investors interested in *green* projects (consequently reducing interest rates), while tax incentives (e.g. tax credits, tax breaks on returns) can make investments in activities with low environmental impact more attractive.

To speed up the process of re-directing investments toward the objectives of the NECP, tax incentives and guarantees must be carefully developed and integrated into well-defined policies for each financial instrument. These policies should favor the use of green financial instruments, incentivising private finance to align with the public sector direction, i.e. decarbonisation.

In fact, it is possible to envision **the implementation of a tailored tax incentive system linked to certain instruments already established in our legal framework[25]**, provided that they finance investments in sectors and/or projects aimed at the energy and ecological transition: for example, the reduction of withholding tax on Green bonds, Minibonds, Basket bonds, Individual Savings Plans (PIR), European Long-Term Investment Funds (ELTIF), Sustainability-Linked Bonds, Sustainability-Linked Loans, Energy Efficiency Mortgages, securitisations, etc.

---

[23] ECCO Policy Brief, "Quale strategia finanziaria per la transizione climatica in Italia?" (21/9/2023), https://eccoclimate.org/it/quale-strategia-finanziaria-per-la-transizione-climatica-in-italia/

[24] See also "Il ruolo delle banche del clima nella strategia del Green Deal europeo" (November 2021), https://eccoclimate.org/wp-content/uploads/2021/12/Il-ruolo-delle-banche-del-clima_Rapporto.pdf

[25] See ECCO, "Mappatura degli strumenti finanziari per la transizione green" (October 2023).

In this context, the official designation of Climate Banks to Italian NPBs (National Promotional Banks) and ECAs (Export Credit Agencies) like CDP, SACE, Invitalia, plays a pivotal role in the financial strategy of the NECP. Through their primary activities (granting guarantees, direct financing, loans, equity, etc.) and supported, as mentioned, by a coherent regulatory incentive framework, they would be able to effectively channeling financial resources towards the achievement of the objectives of the European Union.

The activities of the Italian NPBs must therefore be officially conditioned to the pursuit of the national and European climate targets:

- ***Mission-oriented*:** SACE, CDP and Invitalia should adopt a perspective focused on pursuing clearly defined long-term climate objectives clearly that align with Italy's and Europe's strategic priorities. This approach is essential for effectively addressing climate challenges and supporting the transition.
- **Sustainability Criteria:** NPBs should adopt criteria and methods for selecting investments and projects that are consistent with this climate mission, i.e. consistent with the decarbonisation strategy of the NECP. These criteria may include instruments of environmental sustainability, the impact on climate change, and the promotion of low-carbon technologies and practices. It should be a key element in the evaluation of any proposal or investment.
- **Impact assessment:** Institutions should focus on the ultimate impacts of their activities. This entails assessing not only the financial aspects of their exposures but also the environmental (and social) impacts. The effectiveness of initiatives should be measured not only in terms of financial returns but also in terms of greenhouse gas emissions reduction, promotion of renewable energies, industrial efficiency improvements, etc.

A valuable regulatory perimeter for outlining the prerequisites necessary for Italian NBPs to become the focal point of the NECP's financial strategy can be drawn from the technical experience gained during the efforts to combat the economic and financial impacts of the pandemic crisis:
D.L. "Liquidità" no.23/2020 and D.L. "Semplificazioni" n.76/2020 for SACE and MCC public guarantees; D.L. "Rilancio" no. 24/2020 and D.L. no. 26/2021 for the "Patrimonio Destinato" entrusted to CDP[26].

Given this conditionality, the formal recognition of the role of Italian NPBs (National Promotional Banks) and ECAs (Export Credit Agencies) as Climate Banks offers numerous and diverse benefits:

- **reducing the cost of capital for private investors through guarantees and risk-sharing**
- pursue **long-term investment strategies** through a variety of financial instruments, along side guarantees (*investment platforms*, *European Long-Term Investment Funds*, equity investments or guarantees on the securitisation of loans to businesses)
- **enhance the "leverage" effect** by implementing a cumulative multiplication process onto the resources distributed by different European funds, not only direct sources from EU funds or through EIB, but also indirectly, through the guarantees that each individual State can grant to NPBs (*national cofinancing*)

[26] See ECCO, "Cassa Depositi e Prestiti: National Promotional Bank del Clima?" (January 2022), https://eccoclimate.org/wp-content/uploads/2022/01/CDP_20220110.pdf ; ECCO, "SACE: Export Credit Agency of the Climate?" (January 2022), https://eccoclimate.org/wp-content/uploads/2022/01/SACE20220110.pdf ; ECCO, "Invitalia-MCC: Regional Development Financial Institutions of Climate?" (January 2022), https://eccoclimate.org/wp-content/uploads/2022/01/SACE_20220110.pdf

- **ensure that funding is tied** to the pursuit of specific objectives and monitor the progress of the financed projects
- **focus investments** towards initiatives that the market would typically overlook (such as financing of SMEs (Small and Medium Enterprises), thereby stimulating positive emulation by private capital
- **provide assistance** to beneficiaries during both the preliminary phases of the projects and subsequent implementation stages.

Directing private financial resources

The European Commission has already developed Directives, Regulations and voluntary tools to improve (at European level) the reporting of ESG (Environmental, Social and Governance) data, establishing common criteria and aiming for an adequate granularity of data and information. Starting from the assumption that exhaustive information is needed on the actual compliance of investments with sustainability criteria, theultimate goal of this "regulatory package" is the reorientation of private financial flows towards technologies, processes, and activities aimed at decarbonisation. **It is therefore necessary for the NECP to be consistent with the European strategy, acknowledging these instruments, both mandatory and voluntary, as tools to support financial market players to mobilising and guiding private investment towards the *net-zero objectives* by 2050.**

Indeed, to facilitate the shift of private portfolios towards sustainable finance, the EU *Green Deal*[27] strategy defines three main objectives: (1) to redirect capital flows towards a more sustainable economy; (2) promote transparency and long-term vision; (3) foster a broad adoption of sustainability criteria in the investment and risk management practices of intermediaries.

Some of the Directives and Regulations of particular interest include: **CSRD**[28] (Corporate Sustainability Reporting Directive - a new European Directive aimed at reporting ESG information of companies, which significantly broadens the scope of application compared to the current Non-Financial Reporting Directive (NFRD), encompassing a wider range of companies required to disclose their non-financial information); the **EU Taxonomy** Regulation[29] (a regulation aimed at classifying economic activities with sustainability criteria for each specific sectors); **SFDR**[30] (Sustainability Finance Disclosure Regulation requiring financial market participants, such as asset managers and insurance companies, to report ESG risks and impacts at entity and product levels) and **CSDDD**[31] (Corporate Sustainability Due Diligence Directive – a not yet in force Directive which mandates European companies to adopt due diligence procedures aimed at promoting sustainable business practices that prioritize environmental protection and human rights across their entire value chain.

---

[27] See European Commission (2021), "Strategy for Financing the Transition to a Sustainable Economy", COM (2021) 390 final and SWD (2021) 180 final (6.7.2021). https://finance.ec.europa.eu/publications/strategy-financing-transition-sustainable-economy_en

[28] Corporate Sustainability Reporting Directive - Directive (EU) 2022/2464

[29] Regulation (EU) 2020/852

[30] Sustainability Finance Disclosure Regulation – Regulation (EU) 2019/2088

[31] Corporate Sustainability Due Diligence Directive (amendment to Directive (EU) 2019/1937)

To guide the development of a financial strategy aligned with European objectives, the NECP should:

a) **Adopt the objectives set out in the European *frameworks* and regulations, creating coherence between national and European policies.** For example, the EU Taxonomy defines criteria for assessing the sustainability level of an economic activity, providing investors clear guidance on which projects and activities to support to contribute to net zero emission targets. The EU Taxonomy acknowledges that transitioning to a sustainable economy requires allocating financial resources for both initial investments (CapEx - as the creation of low-carbon infrastructure), and operating costs (OpEX - as maintaining and operating this infrastructure), requiring reporting of both associated KPIs: the percentage of CapEX and OpEX aligned with EU Taxonomy targets. Consequently, the NECP's financial strategy **must consider financing both CapEx and OpEX** associated with the transition to a low-carbon economy. Integrating this perspective into the NECP's financial strategy enables a more accurate assessment of the financial needs linked to the transition and ensures an appropriate resource allocation. Reporting both CapEX and OpEX facilitates also monitoring and evaluating the efficacy of investments in achieving net zero emission targets. Furthermore, it aids in comprehending the long-term costs of decarbonization, allowing for more accurate planning of sustainability initiative financing.
b) **explicitly recognize and encourage the adoption of tools such as the Science-Based Targets** (SBTs)[32], **the TPT Disclosure Framework** (*Transition Plan Taskforce*)[33], **the TCFD (Ta*sk Force on Climate-related Financial Disclosure*)[34]** and the **Green Bond Standard[35].** These tools, currently voluntary but internationally recognized, can guide companies, investors and NPBs towards effective decarbonization investments. The National Plan should mandate to all market actors (including companies and the financial entities) to disclose information related to transition plans based on reliable criteria such as those defined by the SBT[36] and the TPT. These plans could be audited by an independent third party and include commitments from investors and boards of directors to facilitate emission reduction strategies. They could also be used by investors, as well as NPBs, as criteria for the preliminary assessment of a *"green"* investment. Similarly, the NECP could require companies, investors and NPBs to report in accordance with the *TCFD Framework*, i.e. **disclosing information on the assessment and management of climate risks and opportunities, such as 1) efficiency and cost reduction, 2) enhanced competitiveness through exploring new markets and products, 3) improved stakeholder engagement (including investors, employees, and customers) facilitated by transition policies.** This approach would incentives private investments in sectors and projects that exhibit improved management of climate risks and greater resilience to environmental challenges.[37] Ultimately, **incorporating the European Green Bond Standard into the NECP as an official instrument for green bond issuance** and, consequently, for defining the essential criteria for labeling a project as "green," would guarantee that financing is directed towards technologies that play a significant role in the

[32] https://sciencebasedtargets.org/
[33] https://transitiontaskforce.net/disclosure-framework/
[34] https://www.fsb-tcfd.org/
[35] https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/european-green-bond-standard_en
[36] Targets are considered "science-based" if they are in line with the goals of the Paris Climate Agreement, which are to limit global warming to well below 2°C above pre-industrial levels and to pursue efforts to limit warming to 1.5 degrees.
[37] For example, the Bank of England and the UK Government believe that climate financial disclosures are key to enabling consumers, businesses, financial firms, investors, policymakers and other stakeholders to make informed decisions. Such reporting is important not only for transparency and risk management, but also as a way to enable the flow of capital towards investments consistent with an orderly transition to net-zero emissions.

country's decarbonization efforts, without compromising efforts to effectively address climate change (i.e. avoid the "*green washing*").

c) The TESG on SME (Technical Expert Stakeholder Group on Small and Medium Enterprises) has underlined[38] the need for European and national policies to support and collaborate with European small and medium enterprises in the communication of ESG information aimed at addressing and mobilising financial resources. This need is particularly relevant if we refer to the Italian landscape, characterized by a high number of micro and **SMEs** that represent 57% of the added value generated[39]. It is therefore relevant that the National Plan remains aligned, once again, with European directives and takes into account the significant presence of SMEs in the Italian industrial market. Developing a financial strategy that considers the specificities and needs of these enterprises is crucial. This may involve **establishing financial incentives, facilitating access to funding for sustainable projects, and promoting partnerships between SMEs and financial sector actors. Alternatively, a support program could be established to offer resources, reporting models, and training to help SMEs understand requirements and adopt sustainable practices.**

3.3 THE SOCIO-ECONOMIC DIMENSION OF THE PLAN

The path towards net-zero by 2050 will be extremely complex and it will involve deep economic and social transformations. Such transformations can create or exacerbate existing inequalities; therefore, it is of paramount importance that decarbonization policies and measures are designed and implemented according to principles of justice, equity and inclusion. This approach is essential to ensure social acceptance of decarbonisation policies and to ensure that no one is left behind. Thus, climate policies cannot provide "niche" solutions or undermine the well-being of social groups, territories and communities. On the contrary, the ecological transition should be the basis of a new model of development, one that integrates principles of social justice in its implementation.

The Commission Guidlines[40] require the Plan to be accompanied by an assessment of its impacts on macroeconomic (e.g. income, employment) and socio-economic variables (e.g. health, quality of employment, education, skills). These guidelines have barely been updated in the new Plan proposal, where instead is recommended an input-output analysis[41] based on sectoral interdependencies matrices published by the National Institute of Statistics. However, more recent publications and

[38] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions empty - Strategy for Financing the Transition to a Sustainable Economy, 2021

[39] ISTAT data 2019 Industry in the strict sense

[40] See Annex 1 of the Governance Regulation https://eur-lex.europa.eu/legal-content/IT/TXT/PDF/?uri=CELEX:02018R1999-20210729

[41] The NECP scenario can be analysed from the point of view of its macroeconomic impacts compared to the current policy scenario. This analysis was carried out using a standard input/output model based on the matrices of sectoral interdependencies published by the National Institute of Statistics (ESM calculations). These matrices represent an accounting framework that schematizes the economic structure of a country over a given period of time, highlighting in a concise and immediate way the interdependencies between the different sectors that make up the economy. The matrices, suitably transformed through specific procedures, make it possible to estimate the macroeconomic impacts (added value, employment) due to changes in final demand in a given sector in a given year. The matrices are constructed from the tables of resources and uses published by the National Institute of Statistics (ISTAT) on an annual basis. The latest tables, available at the time of writing, refer to the year 2019 and are disaggregated into 63 economic sectors. (NECP 2023)

methodologies could be taken into consideration[42] to **expand the impact analysis on macroeconomic and socioeconomic variables.**

The Plan social sustainability should therefore consider policy impacts on vulnerable groups and dedicate specific space and tools to allow climate policies to become an opportunity of well-being for everyone. It should also couple incentive tools with an **efficient allocation of resources,** so that the stakeholders involved are urged to achieving objectives desired **both by society** (i.e. the reduction of greenhouse gas emissions) **and by the private sector (i.e. implementation of a given project at the minimum cost).** As a matter of fact, action against climate change can be effective and transformative if solutions and technologies for its implementation are desirable and accessible to the majority of citizens, as well as to the most vulnerable social groups. **Assessment of the socio-economic sustainability of the transition is an enabling element for the full implementation of decarbonisation policies.**

The NECP and its policies need to adequately consider what tools should accompany the social sustainability of the transition, to comprehensively intervene on employment issues, public spending, taxation, and poverty (beyond energy-related aspects). This means matching policies and measures with indicators capable of directing public investment towards the industry sector and the labour force. This will in turn allow a just transition for workers, demand-side selective incentives, diffusion of new technologies, weighting risks, invest in workers up-skilling and re-skilling, protecting and providing straightforward and beneficial solutions to disadvantaged social classes.

Furthermore, to enhance efficiency in public spending, the Plan should include **a strategic framework for assessing social sustainability,** beyond energy poverty. The prerequisites for such an evaluation and the fundamental methodologies for its implementation should be outlined and cover at least two key areas:

1. **Consumption policies** assumptions and objectives (for instance, selective demand incentives in transport and civil-buildings) with reference to different social dimensions[43]. This should be accompanied by specific public finance measures and evaluation criteria to weight their effectiveness, distributional implications and the need for compensatory measures.
2. Impact assessment methodologies **to evaluate effects of the Plan's policies on the country's productive fabric from a socio-economic point of view.** This includes effects on employment and effects (positive or negative) on supply chains transformation or creation of new ones.

With such a framework, the Plan could fulfill EU Commission requests concerning identification of **principles for the Social Climate Plans and to achieve concrete integration of the Territorial Just Transition Plans,** both missing in the current version.

---

[42] Examples of existing analyses, such as "Green Transition and the Italian Labour Market " (Oct 2023) Or the exercise done, with a different methodology on the NRRP: BdL: “Employment activated by the NRRP and its characteristics” (Feb 2023) or "Employment activated by the NRRP in the construction sector at the regional level" (Jun 2023), https://www.bancaditalia.it/pubblicazioni/qef/2023-0775/index.html

[43] As methodological examples, the BdI exercises on the cost-benefit impacts (through the SCC methodology) of some key measures of the NRRP such as superbonus, renewables, hydrogen, grid and mobility are useful here. See BdI "Costs and Benefits of the Green Transition Envisaged in the Italian NRRP" (Oct 2022), https://www.bancaditalia.it/pubblicazioni/qef/2022-0720/index.html

Consumer Policies: Distributional Effects and Effectiveness of Public Spending

In addition to macroeconomic assessments, currently lacking in the Italian Plan[44], each policy should be accompanied by implementation tools, including those assessing socio-economic impacts. This means identifying within the Plan the **prerequisites for tracking and monitoring the effectiveness of public spending, in line with climate policy objectives[45].**

These tools would make it possible to highlight the **economic and social opportunities** arising from the transition, but also the risks stemming from an accelerated deployment of new technologies. This analysis could help identifying the most effective spending tools, such as selective demand incentives with reference to multiplier effects or the learning curve necessary for upscaling new technologies diffusion.

There is a need to use methodologies that can support a socio-economic impact assessment of the Plan's measures, which could quantitatively assess and explain their social and private rate of return[46]. Plausible methods are cost-benefit analyses, however, they might ignore indirect social impact and should, therefore, be integrated with specific social indicators.[47] Another possible method is the Social Return on Investments or SROI, which measures the value of an intervention, net of resources invested. Within the cost-benefit analysis, SROI is used to quantify the social, environmental, and economic return on investments[48]. Several indicators could be added together or taken into account in this exercise. Some countries, including the UK, employ the "*Healthy Street Approach*"[49] for evaluation of transport and mobility policies. Centered on 10 evidence-based indicators, it represents a methodology that incorporates public health considerations into transport and urban planning decisions.

NECP measures, whether within the Plan or influenced by it, should have a more systematic and clear assessment of socio-economic impacts, like any public policy. This assessment would draw synergies within policies linked to certain objectives, in a design coherent and effective from a public spending point of view, as well as for the benefit of climate and society.

Climate and energy policies impacts on the productive sector

The new NECP should also identify the methodologies used to assess **positive and negative socio-economic effects that the Plan's measures will have on the national production sector.** Decarbonisation strategies – including those in sectors beyond industry like electricity or transport – are closely tied to the responsiveness of the production system and material supply chains. Allowing

---

[44] The Spanish Plan, for example, uses the model as the DENIO model, DENIO is a dynamic input-output econometric model of the Spanish economy, which has its origin in the FIDELIO model of the Joint Research Centre (JRC) of the European Commission. The model was developed by the Basque Centre for Climate Change (BC3) in collaboration with the Centre for Economic Scenario Analysis and Research (CESAR). This model makes it possible to simulate the effect of a wide range of economic, fiscal, energy or environmental policies. https://energy.ec.europa.eu/system/files/2020-06/es_final_necp_main_en_0.pdf

[45] Here is a useful reference to what has been achieved by the Inequalities and Diversity Forum (IDF) on the NRRP https://www.forumdisuguaglianzediversita.org/monitoraggio-pnrr/

[46] By way of example: https://www.uniroma1.it/sites/default/files/allegati/AIR_Def_11.11.13senza_citazione_Obiettivo1-1.pdf%3B https://www.funzionepubblica.gov.it/sites/funzionepubblica.gov.it/files/16897.pdf

[47] https://www.lse.ac.uk/cities/research/cities-space-and-society/Measuring-impact-beyond-financial-return

[48] https://edizionicafoscari.unive.it/media/pdf/books/978-88-6969-409-7/978-88-6969-409-7-ch-04.pdf

[49] https://www.healthystreets.com/what-is-healthy-streets

these supply chains and their competences[50] to relocate nationally or abroad, it's not a positive achievement. The Plan should therefore develop more complex scenarios, which highlight the social and economic impacts of the transition on the production system and show links between different industrial supply chains. In this regard, input-output simulations that consider different propensities to import on different production chains, would be highly valuable. This is true both **for existing and developing supply chains, the latter being functional to decarbonising the former** (as explained in the next chapter).

Regarding existing supply chains, it is necessary to assess how their transformation can turn certain tasks obsolete or even result in closure of entire production sectors. Simultaneously, positive impact of creating new jobs and skills should be assessed, within a framework of existing policies, possibly supplemented with additional support measures.

The repercussions of this transformation will not be neutral, nor will they be uniform. Not all new jobs will automatically be able to compensate for the obsolescence generated by the transition; The net result could be negative within the same sub-fund. The *automotive* sector has similar characteristics, since the work intensity of the electric motor is lower than that of the endothermic motor.[51] At the same time, there are problems of skills transferability: the technical knowledge embodied in workers of a sector is not always perfectly transferable to the new activity but requires deep and structural retraining[52].

Additionally, some productions that could be downsized are concentrated in specific geographical areas, where the social impacts of employment collapse would be more pronounced. This issue is addressed by the Territorial Just Transition Plans (TJTP) of Taranto and Sulcis, but these cannot be the only industrial areas taken into account, nor are these areas undergoing climate transition induced transformations. Alongside these areas, characterized by an history of industrial crisis, it would be necessary to focus on **new transformations,** which means on those territories that never experienced and industrial crisis[53]. Therefore, the Plan must at least acknowledge, if not already identify a method for mapping potential areas of crisis[54] and intervening for redevelopment and economic diversification of those areas, tailored to the technological and industrial specificities of the activities involved.

Regarding the supply chains that will have to be created or developed, the NECP should include a comprehensive estimate of the positive impacts that these may entail, in terms of direct and indirect creation of new jobs, induced investments, savings in electricity consumption, reduction of emissions and more. A specific example, probably too detailed for the purposes of the Plan, but certainly

---

[50] To give an example, the desired decarbonisation of final consumption in the residential sector is linked to the development and production capacity of electric heat pumps, but not only. It also depends on the presence and preparation of manpower and designers who are able to adopt a preferable technological solution to the current one.

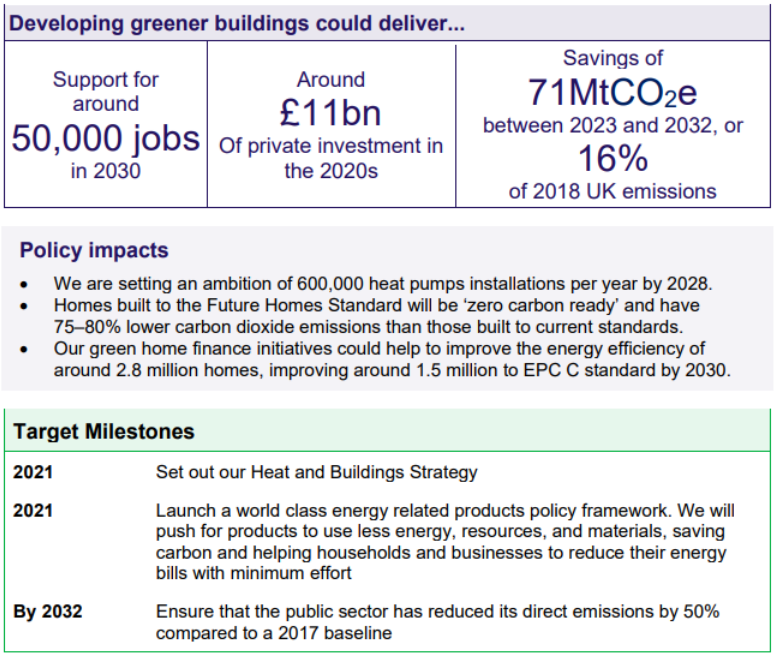
[51] Brown, D., Flickenschild, M., Mazzi, C., Gasparotti, A., Panagiotidou, Z., Dingemanse, J., & Bratzel, S., (2021). *The Future of the EU Automotive Sector. Policy Department for Economic, Scientific and Quality of Life Policies,* European Parliament

[52] Cetrulo, A., Dosi, G., Moro, A., Nelli, L., & Virgillito, M., E., (2023). *Automation, digitalization and decarbonization in the European automotive industry: a roadmap towards a just transition* (No. 2023/36). Laboratory of Economics and Management (LEM), Sant'Anna School of Advanced Studies, Pisa, Italy.

[53] As in those territories of the centre-north where the main companies in the components sector are located. the *automotive sector* related to the endothermic engine.

[54] Also in relation to what is already present in the NECP in relation to the phase out of coal.

illustrative, is shown below in Figure 7 with reference to the UK government's policy for the decarbonisation of buildings.



Developing greener buildings could deliver...

Support for around **50,000 jobs** in 2030	Around **£11bn** Of private investment in the 2020s	Savings of **71MtCO$_2$e** between 2023 and 2032, or **16%** of 2018 UK emissions

Policy impacts

- We are setting an ambition of 600,000 heat pumps installations per year by 2028.
- Homes built to the Future Homes Standard will be 'zero carbon ready' and have 75–80% lower carbon dioxide emissions than those built to current standards.
- Our green home finance initiatives could help to improve the energy efficiency of around 2.8 million homes, improving around 1.5 million to EPC C standard by 2030.

Target Milestones

2021	Set out our Heat and Buildings Strategy
2021	Launch a world class energy related products policy framework. We will push for products to use less energy, resources, and materials, saving carbon and helping households and businesses to reduce their energy bills with minimum effort
By 2032	Ensure that the public sector has reduced its direct emissions by 50% compared to a 2017 baseline

Figure 7 – *Extract from The Ten Point Plan for a Green Industrial Revolution, UK Gov. 2020*[55].

Such detailed work must therefore provide adequate space for an evaluation methodology integrated with public policies, both industrial and in support of employment and training.

[55] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/936567/10_POINT_P LAN_BOOKLET.pdf

4 THE PLAN AND THE MANUFACTURING INDUSTRY

Manufacturing holds a pivotal position in the transition for several reasons. Firstly, there is a pressing need to decarbonise production processes, which often involve intricate and currently uneconomical technological solutions. Secondly, manufacturing generates technologies that have a broad impact across various sectors, including transportation, residential living, and electricity production. For instance, which industries contribute to electric mobility, energy-efficient buildings, and the widespread adoption of renewable energy sources? The Plan should allocate a specific chapter to the manufacturing sector, where critical supply chains for decarbonisation can be identified and linked with specific policies. In essence, the Plan should not only serve as a tool to identify direct emission reductions in the industrial sector but also steer the country's development towards products and services within decarbonised markets. This is crucial considering the escalating competitiveness of these markets, especially given the significant transformations in finance.

The regulatory framework[56] suggests that the industrial transformation pathway is inevitable. Therefore, instead of dwelling on the possibility of this transformation, the focus should shift to assessing its costs and opportunities. If the aim is global decarbonisation of processes and products, relocating production to countries with less ambitious environmental goals is not a favourable option. Consequently, the decarbonisation pathway should align national CO2 targets with competitiveness in global markets. Achieving this alignment will require diplomatic efforts, including within the G7, aimed not at protectionism but at steering global markets towards low-carbon goods and services, with aspirations for competitiveness in mind.

The manufacturing sector remains the backbone of the Italian economic system. Before the pandemic[57], it was populated by around 360 thousand companies, accounting for 250 billion euros of added value, 33.5 billion euros fixed investments and 3.8 million employees. Measured in terms of value added at constant prices, the Italian manufacturing sector ranks **second in the European Union and eighth in the world[58].**

Over the past thirty years, our country has undergone a significant transformation process, with the manufacturing sector's share of GDP (Gross Domestic Product) falling from 20.1% in 1990 to 14.9% in 2021[59]. In the same period, there has been a worrying loss of competitiveness. Italy currently ranks eleventh in the world in UNIDO's Competitive Industrial Performance Index (CIP), marking a decline from its fourth-place position in 1990.

Part of this trend can be attributed to the gradual fragmentation of the Italian productive sector, which began with the industrial restructuring of the 1970s[60]. This sector is now largely dominated by small and medium-sized enterprises (see box below). Simultaneously, the Italian economy has

[56] Particularly the CSRD, the Taxonomy Regulation, the revision of the ETS Directive, the CBAM Regulation, the use of ESRS standards

[57] The last significant figure reported by ISTAT is 2019.

[58] UNIDO data for 2022, measured in US dollars at constant 2015 prices.

[59] In terms of this parameter, Italian manufacturing falls to 10th place in the EU, trailing behind countries such as Czechia (21.1%), Germany (18.9%), Poland (16.7%), and others

[60] This is a central theme in the literature on the history of Italian industry. See: Graziani, A. (2000). The Development of the Italian Economy, Bollati Boringhieri; Barca, F. (1997). History of Italian Capitalism, Donzelli; Bianchi, P. (2013). The braked run-up, the Mill

experienced the decline and downsizing of its large high-tech manufacturing sector. This sector was once represented by prominent companies such as Fiat, Montedison, Pirelli, Olivetti, Italcementi, Ansaldo, and others, which were the only ones capable of competing on a global level.

Italy must confront the challenge of industrial transformation with an awareness of its strengths and weaknesses. Decarbonisation presents **both a challenge and an opportunity.** These two factors are intrinsically linked and must be considered as synergic within the Plan.

BOX 1 – THE WEIGHT OF SMALL AND MEDIUM-SIZED INDUSTRY IN THE ITALIAN MANUFACTURING SECTOR

The national manufacturing system is characterised by a high degree of fragmentation, dictated by the significant weight of small, medium and micro-enterprises (SMEs), in terms of number, value added and employees (Figure 8). Figures reported by the OECD for 2019 shows that Italy's manufacturing companies with 1 to 9 employees accounted for 21.2% of the total number of employees in the manufacturing sector, compared to 10.3% in France and 5.9% in Germany. Meanwhile, the share of employees in manufacturing companies with more than 250 employees was only 27.7% of the total in Italy compared to about 61% in France and Germany.

The chronically small size of Italian firms can present both obstacles and opportunities for innovation in the context of decarbonisation. SMEs are characterised by a high degree of flexibility and product specialisation, but they often encounter structural difficulties in accessing credit to finance the necessary investments for their growth and innovation.

If properly supported, SMEs can be a key source of emissions reduction. Despite being largely concentrated in non-ETS sectors, SMEs have the potential to respond quickly to market challenges, thanks to the decentralised energy solutions they can provide and to their contribution to the circular economy. The Cerved SMEs Report[61] confirms that the transition process requires significant investments, but also indicates that SMEs, with sufficient support from the banking system, are generally capable of accommodating them.

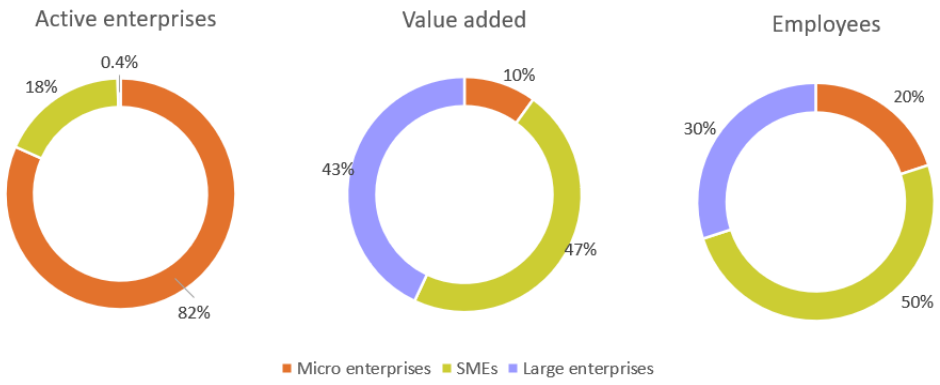


Figure 8 – *Characterisation of the Italian manufacturing industry. ECCO elaboration based on ISTAT 2019 figures.*

[61] "Cerved SMEs Report", Cerved, 2022

The manufacturing industry is responsible for about 22% of national greenhouse gas emissions[62] (31% when including emissions from electricity use[63]). The sector is characterised by high levels of process emissions (chemicals, cement, steel) and their energy uses, which are significantly dependent on natural gas[64]. As shown in Figure 5 below, the industrial sectors with the highest share of natural gas consumption are non-metallic minerals (21% of natural gas consumed by industry in 2021), chemicals (19%), paper and printing (15%)[65].

In addition, the projections of the 2030 reference scenario[66] indicate that the manufacturing sector will still be the second largest emitter after transport, with a share of 21% of the national total, accounting for 21% of the national total, a figure essentially unchanged from the present day.

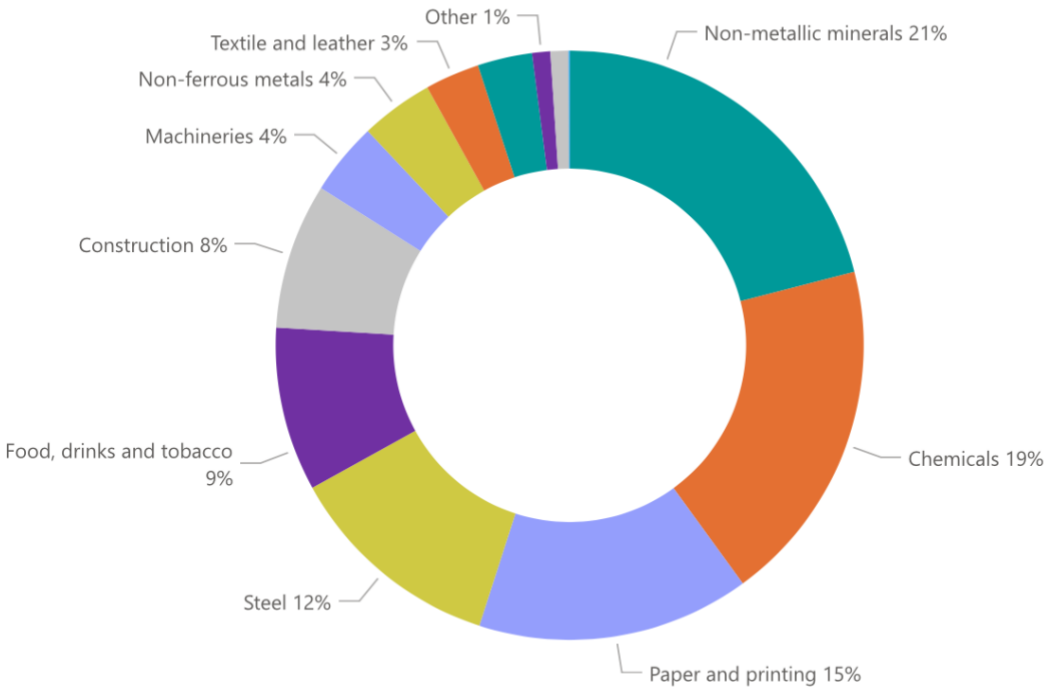


Figure 9 – *Breakdown of natural gas consumption by industrial sub-sectors in 2021. Total: 8.9 Mtoe*[67]

The national manufacturing industry is composed by a heterogeneous set of sub-sectors, each characterised by distinct processes and products. These sub-sectors are interconnected through distributed and intricate supply chains. However, **in the current proposal for the Plan, the manufacturing sector is categorised simply as an "industry", lacking further sub-sectoral specifications.** There is a deficiency in specific sectoral analyses dedicated to better understanding their potential contribution to the decarbonization and development of the country. The industry seems to be treated as an ancillary element in comparison to energy policies and is sporadically

[62] ECCO elaboration based on ISPRA figures.
[63] ECCO elaboration based on ISPRA and Eurostat figures.
[64] 35% of the energy demand of the industrial sector is met by natural gas (ECCO elaboration from Eurostat figures)
[65] "Simplified energy balance", EUROSTAT.
[66] After the transport sector with 26%
https://www.isprambiente.gov.it/files2023/pubblicazioni/rapporti/rapporto_384_2023_le-emissioni-di-gas-serra-in-italia.pdf
[67] ECCO elaboration based on EUROSTAT data.

referenced in the chapter on 'Research, Innovation, Competitiveness'. Once more, there is a failure to conduct impact analysis on both the policies already in place and those planned for implementation. Furthermore, there is a lack of prioritisation of interventions based on their anticipated effects.

The complexity of the industrial transformation challenge underscores the importance of formulating policies with greater sectoral specificity to ensure their efficacy in both the short term (by 2030) and the long term (by 2050). This requires policies to be customized and categorized according to reference sectors, taking into account their projected direct or indirect impacts over both time frames.

As far as the current NECP is concerned, the following aspects could be considered:

i) **Enhancing energy efficiency and decarbonisation in industry:** reducing emissions from direct (and indirect) consumption of fossil fuels for industrial energy usage.

ii) **Transitioning *hard-to-abate* sectors:** reducing direct emissions from *hard-to-abate* industrial processes through the formulation of innovation policies with medium to long-term effects.

iii) **Developing strategic supply chains for decarbonization:** identifying strategic manufacturing supply chains for decarbonisation technologies, namely industrial supply chains enabling decarbonisation while not significantly impacting emissions which require a favourable legislative, regulatory and financial environment.

The development of the decarbonisation industry aims to capitalise on opportunities in new markets and reduce dependence on foreign countries. It also seeks to generate positive spillovers in terms of direct and indirect employment, as well as complementary investments.

The Plan should be looking at: (i) assessing the energy requirements and security of supply of the manufacturing industry; (ii) identifying opportunities for investing in technological solutions for decarbonisation in the medium and long term; and (iii) exploring opportunities for creating and enhancing new or existing industrial supply chains.

The regulatory framework should not rigidly dictate the approach that needs to be pursued. A strategy for the manufacturing industry in the Plan can be effective if it guides industrial operators and provides financial support towards defined objectives, with reduced uncertainty through the long-term commitment of the public counterpart[68].

i. Enhancing energy efficiency and decarbonisation in industry

A strategy to decarbonise the manufacturing industry should begin with an analysis of its energy needs. It should also address the specific requirements of its sub-sectors. In particular, the Plan should include:

- A strategy for how to decarbonize the power sector[69] through the installation of large renewable plants serving production plants. The decarbonisation of the electricity sector is

[68] See also paragraph 3.2

[69] The measures currently included in the REPowerEU move in this direction. https://eccoclimate.org/it/un-anno-di-repowereu-gli-effetti-sul-pnrr-italiano/

pivotal for all other sectors. The manufacturing sector appears to be key to its realisation, given the scale of the projects and the scale of investments.

- A strategy for the usage of natural gas and its substitutes, prioritising industrial applications requiring high- temperature heat that cannot readily substitute it in the shorter term.
- A set of measures to enhance the energy efficiency of industrial processes as well as foresees electrification of low temperature process heat to reduce emissions. As described in the subsequent dedicated sectoral chapter, a preliminary analysis highlights how exploiting the potential of electrification of low- temperature heat in industrial processes[70], particularly in non-ETS sectors, can contribute to the national reduction target.

ii. The transition of hard-to-abate sectors

In *hard-to-abate* sectors, CO_2 emissions derive from energy-intensive activities, such as the use of high-temperature heat, or from industrial processes in which the production of greenhouse gases is directly linked to the chemical reactions intrinsic to the production process. Technological solutions, where available, are often far from commercialisation at an industrial scale.

The Plan should identify the technological solutions that can be considered strategic and in which it intends to invest, highlighting opportunities and risks involved. For example, the current Plan calls for the use of CCS (Carbon Capture and Storage) (see also the dedicated Box). However, given the technological and economic sustainability uncertainties of this technology, it would be important to consider the feasibility of its use from several points of view. In addition to its legal feasibility, it would be important to deploy this technology where it could be most effective. For example, on process emissions from *hard- to-abate* sectors.

Secondly, the Plan should include a survey of the available financial instruments and funds for financing these technologies, so as to provide a medium to long-term orientation to investors. Such instruments should consider the uncertainty regarding the economic return on investments, as well as the potentially higher operational costs associated with implementing such technologies (see also Chapter 3.2).

iii. Development of strategic supply chains for decarbonisation

The Plan should delineate the manufacturing industry's contribution to fulfilling domestic production needs for technologies essential to decarbonization, considering variations in propensity to import across different production chains.

In particular, the Plan should specify how the country intends to **strengthen its manufacturing capacity** in what the European Union – in its Net-Zero Industry Act – defines as ***'strategic net- zero technologies'.*** These include, for example, the production of solar panels, wind turbines, batteries, electrolysers and heat pumps. More broadly, the industrial strategy outlined in the NECP should encompass all technologies and products essential for decarbonisation, which could be categorised as 'net zero' products. This includes materials or technologies for enhancing the energy efficiency of buildings, such as the production of flat glass or windows, insulation materials, as well as

[70] In particular, in sectors which are, at least in part, not covered by the ETS and for which the emissions reduction by 2030, could bring significant benefits for Italy in achieving the Effort Sharing objectives.

technologies aimed at expediting the electrification of the automotive fleet, such as electric motor components.

Without delving into the specifics of each individual supply chain, which should be developed separately, the Plan should outline a set of national objectives regarding the **need for scaling up production.** The Plan should detail how these initiatives will contribute to the broader decarbonisation goals, providing insight into the policies for different strategic supply chains. These policies should be differentiated between indirect and direct measures influencing demand or supply aspects. This approach, preceded by an analysis of the technical and market characteristics of the supply chain (with reference to Italian specialisation), enables the identification of the most suitable measures to achieve the objectives of enhancing national production capacity within that specific value chain.

An example of how these industrial strategies can be conceptualised for the various supply chains considered strategic is shown in Table 4.

	Direct (policies that directly affect investment in decarbonisation products/technologies)	Indirect (policies that provide for the investment of producers of decarbonisation products/technologies)
Supply	• Tax credit or other incentives for manufacturing in one or more segments of the 'net zero product' value chain e.g. heat pumps, batteries • Capital transfers and/or subsidized financing to companies for investments conditional on increasing the manufacturing capacity of 'net zero products' (provided that this is in line with decarbonisation objectives) • Prizes for technological innovation (incremental and radical) on net zero products • Tax relief for the recruitment of highly qualified research staff in net zero product supply chains • Guarantees and preferential credit for exporters of *net zero* products • Tariff reductions and monetary incentives for companies importing raw materials and machinery that are essential to the manufacturing process of net zero products	• Investments in enabling infrastructure and logistics to promote the distribution of net zero products (ports, rail freight transport, specialized shipbuilding, etc.) • School curricula and vocational training schemes specific to net zero products • Establishment of environmental standards for imported technologies and products • Conditional tax relief for the decarbonisation of production processes, when these imply the adoption of enabling technologies produced in Italy • Measures restricting imports of competing finished products that do not reflect pre- established environmental or social criteria
Demand	Policies that can stimulate demand for Net Zero Products: • Adoption of standards for the definition of net-zero products and requirements to identify when and which critical elements of the supply chain are developed at the domestic level • Public procurement oriented towards favouring *net zero* products, particularly linked to domestic production chains • Auctions for the installation of renewable energy infrastructure, with more favourable requirements for the use of 'net zero' products linked to domestic production chains	Policies that can stimulate demand for Net Zero Products: • Preferential financing for investments requiring the adoption of net zero products from domestic supply chains • Selective incentives for firms and households adopting net-zero technologies from domestic supply chains • Labelling systems that highlight 'net zero' products, with particular emphasis on those from domestic supply chains

Table 4 – *Matrix of industrial policy measures for the development of manufacturing supply chains in net zero technologies considered strategic for decarbonisation. This scheme, borrowed from IEA 2022, must be adapted to the technical and market characteristics of the specific supply chain, considering the existing Italian specialisation in the various segments of the value chain.*

5 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 5 – *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[71], 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 $MtCO_2eq$[72],** 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.

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

[72] 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	2025	2030
			MtCO2 eq.		
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 6 – *Historical greenhouse gas emissions and projections under current policy baseline for the ETS and non-ETS sectors. Source: ISPRA - NECP 2023*

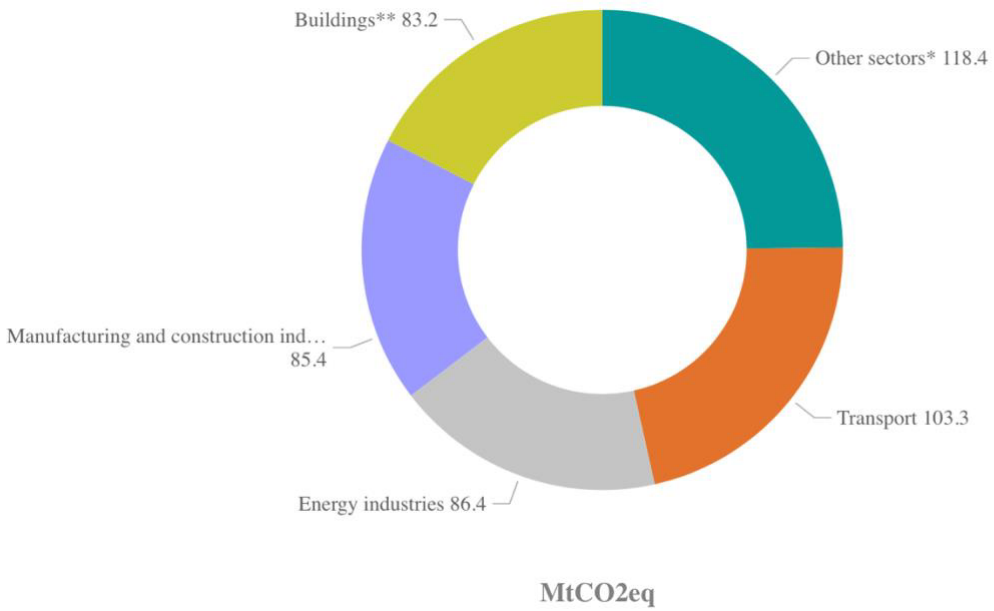


Figure 10 – *Contribution of individual sectors to total GHG emissions in 2021. Consistent with the NECP scenarios and the greenhouse gas inventory, the building sector includes emissions from Agriculture 'energy'; Other sectors include the remaining fugitive and non-energy emissions (Industrial Processes, 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[73] 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 10).

[73] 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

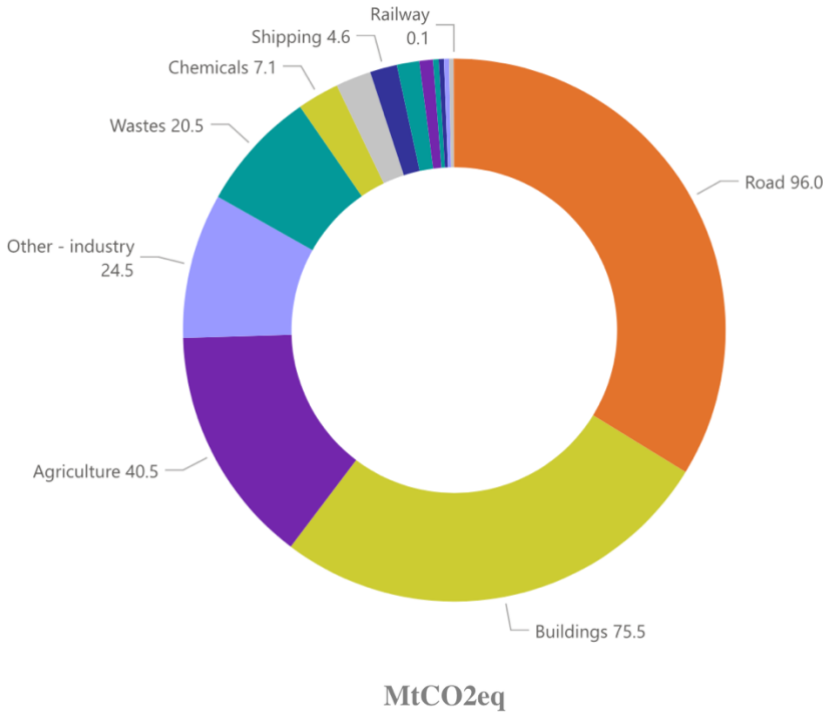


Figure 11 – *Emission contribution of the individual sectors compared to the total included in Effort Sharing. Date 2021. ECCO elaboration on ISPRA2021 data.*

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.

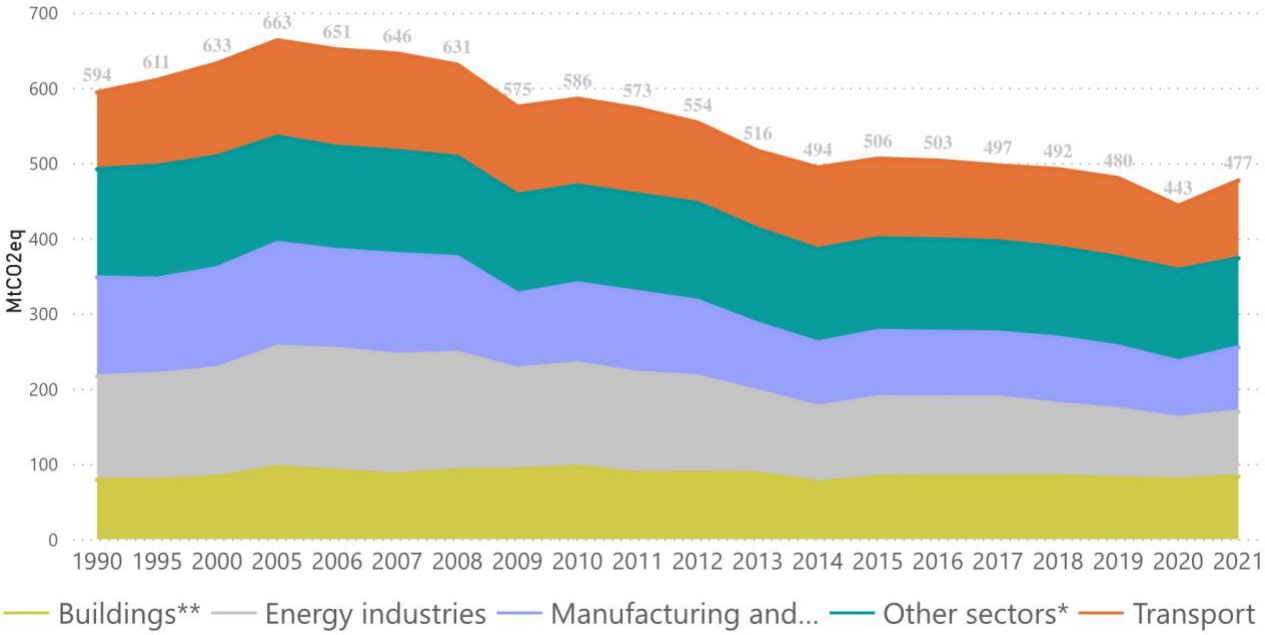


Figure 12 – *Historical evolution of GHG emissions by sector, excluding LULUCF. Other sectors* includes emissions from other energy and fugitive uses, agriculture (livestock and crops) and waste - Source: ECCO elaboration on UNFCCC data [MtCO2eq]*

The ECCO-FF55 scenario considers **Italy's commitment at the G7 towards a substantially decarbonised power system by 2035[74],** 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).

---

[74] 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[75],** 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%[76]: 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[77].**
- 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[78].
- In the **building sector[79],** 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%

[75] 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.

[76] 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.

[77] 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).

[78] 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.

[79] 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 7 – *Historical evolution of GHG emissions by sector (source: ISPRA) and emission scenario for 2021-2030 (source: ECCO elaboration)*

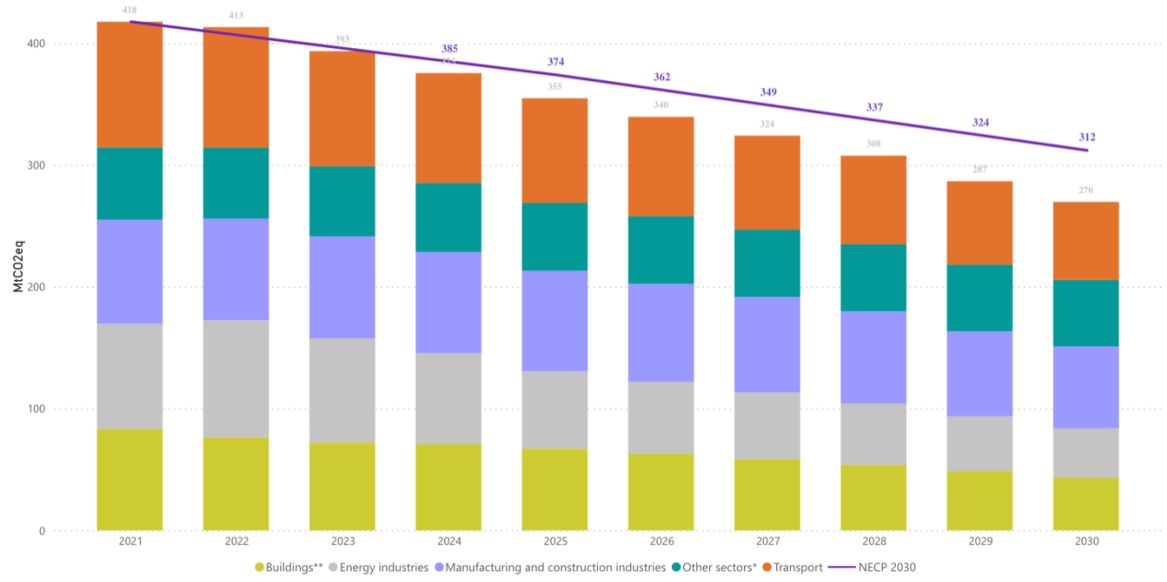


Figure 13 – *ECCO-FF55 emission scenario for 2021-2030, excluding LULUCF, and comparison with NECP scenario - Source: ECCO elaboration [MtCO2eq]*

5.1 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[80] 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).

[80] 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)[81]. 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.

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

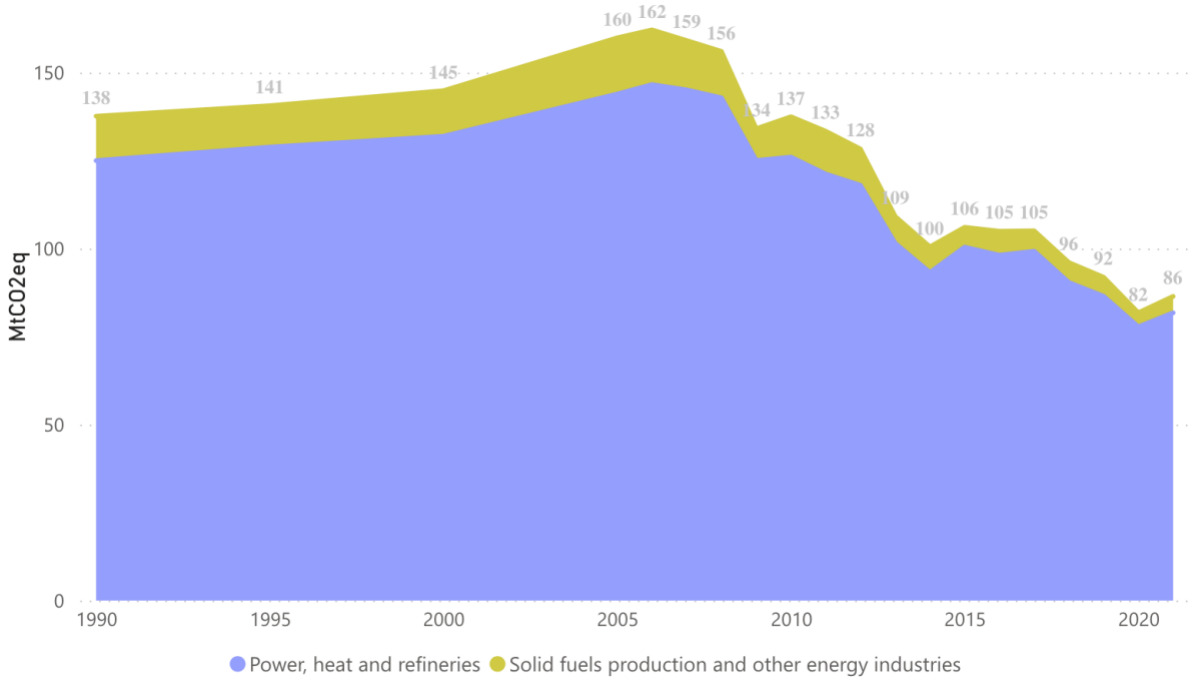


Figure 14 – *Trends in CO2eq emissions from energy industries from 1990 to 2021*[82].

5.1.1 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[83], 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 13). 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

[82] The 2022 emissions were calculated on the basis of Terna's 2022 production data and not from scenario data.
[83] 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 15). All coal-fired capacity is scheduled to be decommissioned by 2025, according to the NECP 2019 plan.

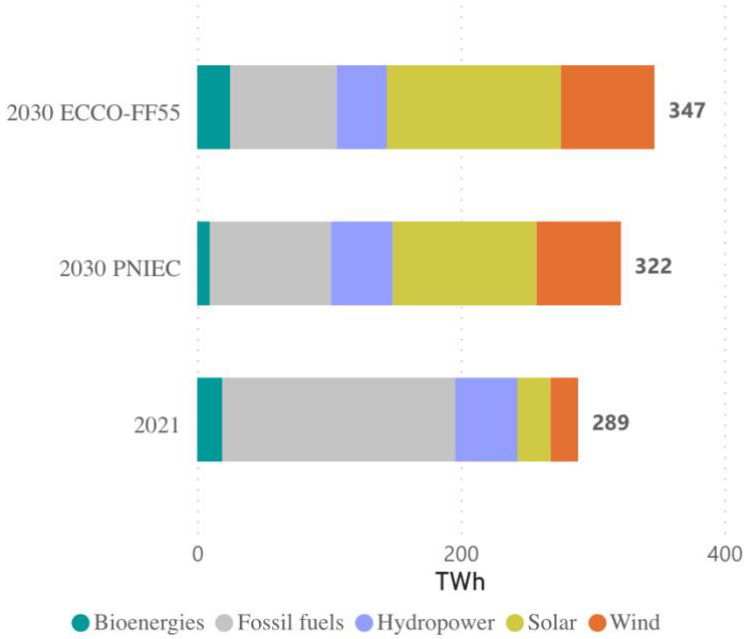


Figure 15 – *Gross electricity production from fossil and renewable sources in 2021 and in the NECP and ECCO-FF55 scenarios to 2030. In 2030, part of the renewable production used to make green hydrogen.*

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 8 – *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.

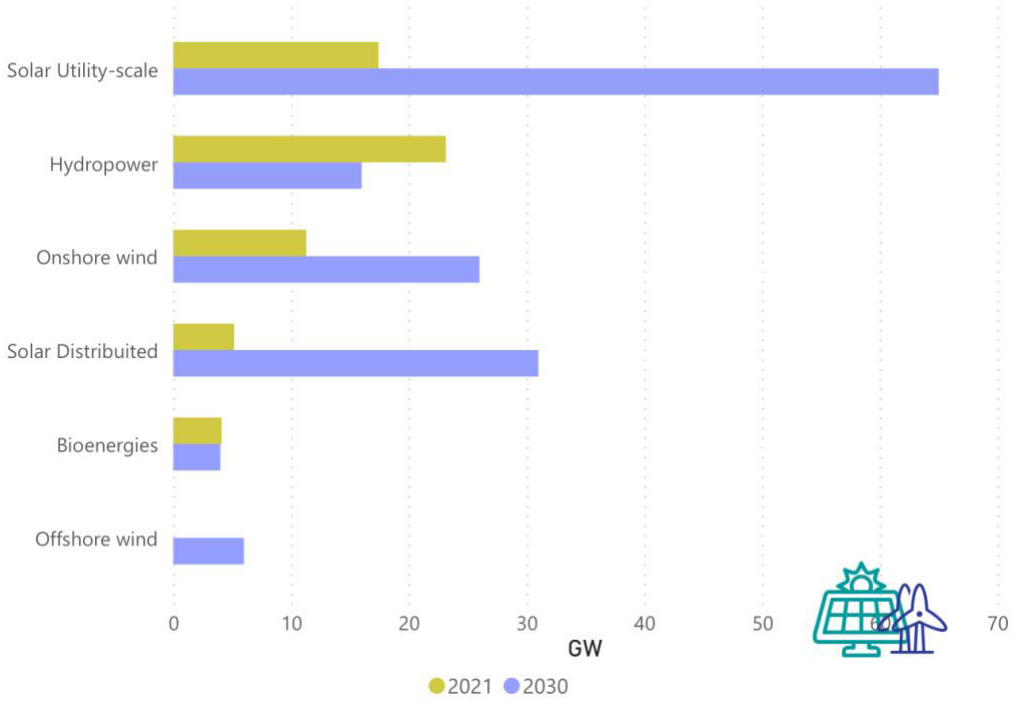


Figure 16 – *Installed capacity of renewables (MW) in the ECCO-FF55 scenario, compared with the installed capacity in 2021 (Source: ECCO-Artelys scenario)*

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 12). 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"[84], without taking into account the capacity already secured by Terna through the market.

[84] Page 260 of the NECP

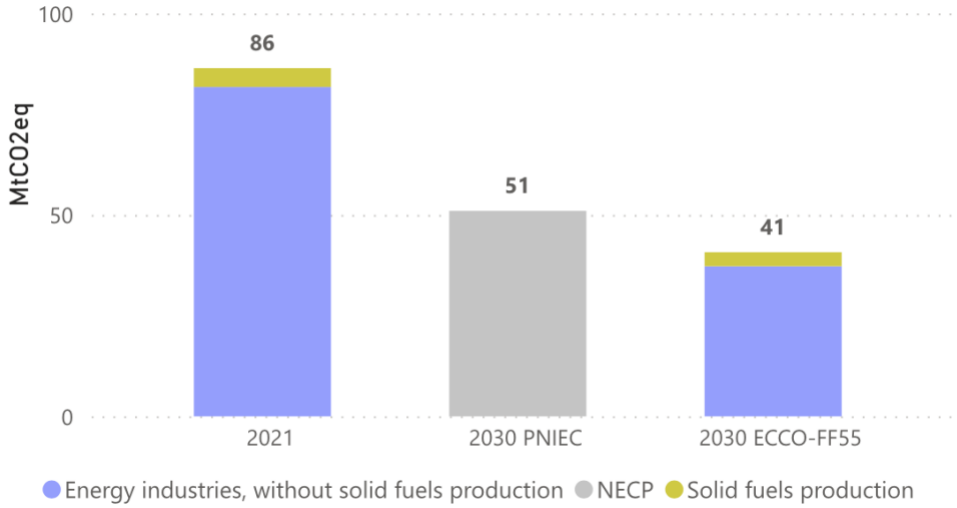


Figure 17 – *Comparison of CO_{2eq} emissions of energy industry in 2030 in the ECCO-FF55[85] scenario.*

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

[85] 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[86]. 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.

[86] Page 88 of the NECP

BOX 2 – 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 Chapter 4 and paragraph 3.3 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.

5.1.2 POLICIES AND MEASURES UNDERPINNING THE ECCO-FF55 SCENARIO

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[87].

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

[87] 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[88].

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:

---

[88] "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.

5.1.3 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 9 – *Estimated average annual investment costs (overnight costs) for 2025-2030 and 2030-2035 (billion euro/year). Source: ECCO-Artelys scenario.*

5.1.4 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

5.1.5 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[89]. 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

[89] 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.

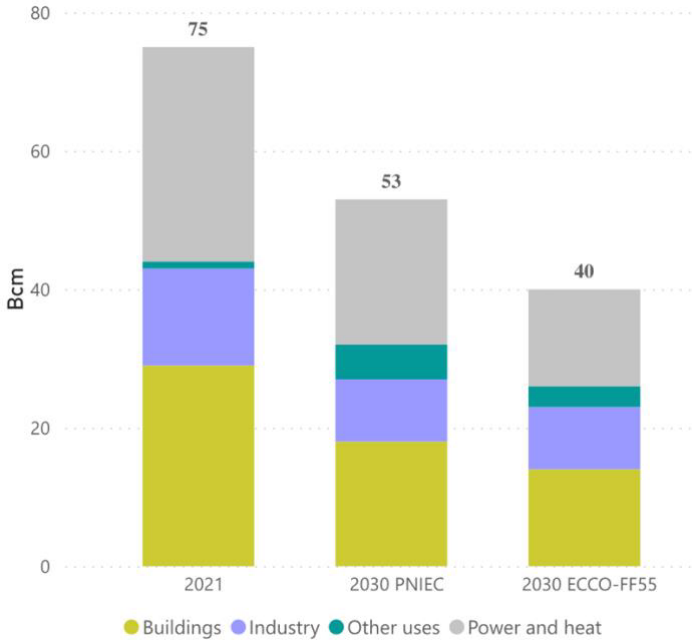


Figure 18 – *Comparison of Italian natural gas demand (billion cubic meters) in 2021 (historical data) and 2030 (NECP and ECCO-FF55 scenario).*

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.

5.2 BUILDING SECTOR

The main features of the building sector

- In 2021, greenhouse gas emissions from the building sector account for 75.5 $MtCO_{2eq}$ and represent 18% of the national total emissions. Non-residential buildings account for 25 $MtCO_{2eq}$, and residential buildings for the remaining part.
- Emissions have increased by about 5$MtCO_{2eq}$ since 1990, reaching their maximum level equal to 88$MtCO_{2eq}$ in 2010. The reduction is very low, only 12% compared to 2005, (from 86.7 to 75.5$MtCO_{2eq}$).
- Natural gas represents the main energy source, covering 50% of final energy consumption.

The greenhouse gas emission reduction scenario

- In the ECCO-FF55 scenario, emissions from buildings are equal to **35.6** MtCO2eq in 2030, with a reduction of 58% compared to 2005 (-49% vs 1990; -53% vs 2021). The largest contribution comes from **residential** sector, in which emissions are expected to decrease by **-61% compared to 2005 levels.**
- Compared to the NECP 2023 scenario, which forecasts building sector emissions at 48MtCO2eq in 2030, the ECCO-FF55 scenario shows a greater reduction of **about 12** MtCO2eq by 2030.
- **Compared to the NECP,** the ECCO-FF55 scenario **simulates a greater electrification of final consumption due to a faster replacement of traditional heating systems with electric heat pumps.**
- In the residential sector, the NECP takes into account a requalification rate of 1.9% in the period 2021-2030, compared to the ECCO-FF55 scenario. The latter estimates an **increasing rate from the current value of 0.37% to 4% by 2030.** The estimated average annual **investment** in the period 2024-2030 is **14 billion euros** and could be partly covered by the revenues obtained by a reform of the framework of electricity and gas tariffs. They account for about 6 billion euros per year. In 2022, the Superbonus determined investments for about 42 billion euros.

Which policies for decarbonisation

- The NECP **refers to a list of current measures suggesting their reform.** However, in most cases it remains just **indicative and does not inform of the needed changes** in those climate policies that generate the most significant impacts on public costs. On the contrary, the ECCO-FF55 scenario suggests targeted and synergistic measures aimed at promoting energy efficiency and end-user electrification:
    - **For residential buildings:** Reform of current tax deduction scheme
        - A longer timeframe, until at least 2030
        - Harmonization and rationalization of incentives currently in force
        - Premium for interventions that achieve high results in terms of reduction in energy consumption and emissions
        - Ban on incentives for fossil fuel-based technologies, including hybrid
        - Possibility of credit assignment in order to make energy renovation affordable to all income classes

- *For public buildings:*
  - **A fund** dedicated to the renovation of **public housing and schools**

Priority Enabling Policies

- Reform of the tariff structure to rebalance price signals for electricity and gas: nowadays the unbalance of tax and non-tax charges between electricity and gas bills favours gas consumption, thus slowing down electrification. This issue is not taken into account into the NECP
- Research and training programs addressed to construction companies and workforces in the building sector aimed at ensuring that they have the needed knowledge and skills
- Definition of a system of indicators to evaluate the effectiveness of policies and make any changes along the way

Following transport and energy industries, buildings represent the third sector for GHG emissions. In the period 1990-2021 it accounts for 20% of the total emissions in the energy sector.

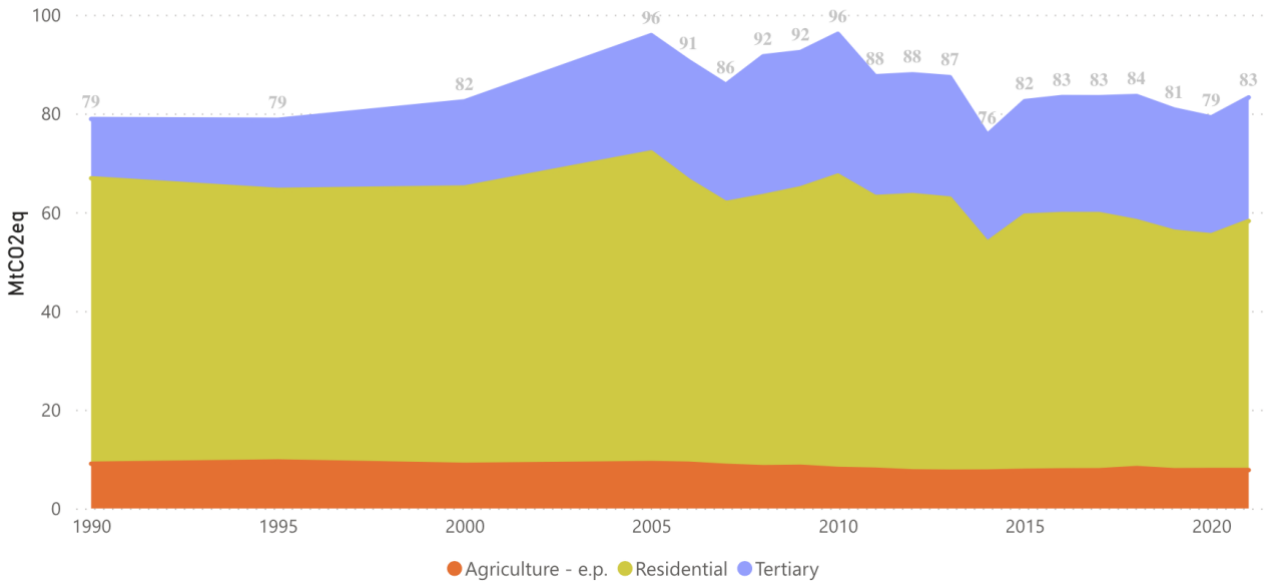


Figure 19 – *Trend of CO2eq emissions in the civil sector from 1990 to 2021. Agriculture represents the share of emissions due to energy processes alone.*

In 2021 the building sector recorded 75.5MtCO2eq of GHG emissions (+8% compared to 1990). Residential buildings account for 67% of the total. The remainder is generated by commercial and public buildings, and has grown significantly over the years, accounting today for more than 30% of total emissions. By looking at the trend from 1990 to 2021 it looks like to be stable, with a maximum in 2005 that is slightly above the 2010 level. And this despite the resources allocated to energy efficiency policies, in force since 2007 and boosted in 2020 with the introduction of the deduction rate at 110%. In fact, GHG emissions remain stable even in recent years, with an estimated average reduction of 1% due to the implementation of the so-called 110% Superbonus.

Despite the huge investments in building requalification, the trend of GHG is stagnating in the sector. This is due to high **share of fossil fuels** in energy consumption, which **has not changed substantially**

since 2010. More than 50% of the energy consumption in the residential sector is still covered by natural gas, followed by solid biofuels (wood, pellets) for almost 20% and electricity with 19%. In the non-residential sector, the latter covers a greater share of energy demand, but natural gas remains the primary energy source with a share of more than 40%.

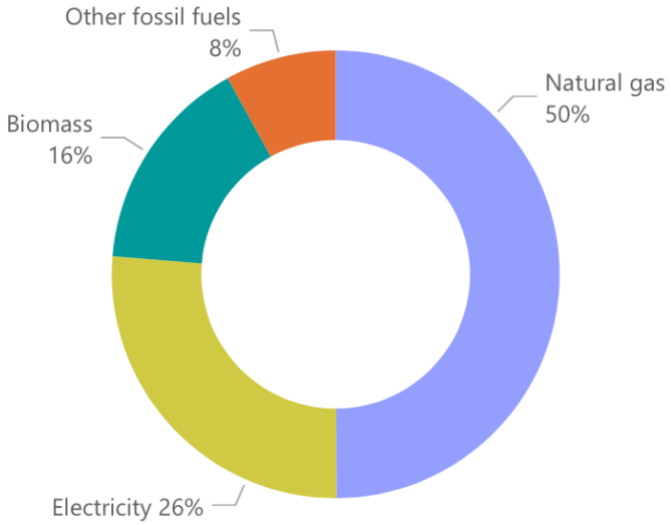


Figure 20 – *Fuel consumption in % in the building sector in 2021.*

The Italian building stock is characterized by over 60% of buildings being over 45 years old. However, contrary to what is often raised about the impossibility of adapting 'historic' buildings to modern efficiency standards, properties built before 1919 represent just 15% of the entire heritage. Additionally, those built between 1919 and 1945 add up to another 10%. For these categories, renovation works will encounter greater challenges and must take into account particular historical and architectural constraints, identifying tailor-made technical and systems solutions. However, the majority of interventions should primarily concern the portion built between 1950 and 2000, characterized by absent or inadequate energy efficiency criteria and a high level of thermal dispersion[90]. Analysing energy certificates, in fact, out of the 4.5 million Energy Performance Certificates (EPCs) present in the Information System (SIAPE), almost 55% identify a label greater than or equal to F, with estimated annual CO2 emissions of 38.5 kgCO2/sqm.

The ownership structure, on the other hand, can represent an advantage as Italy has one of the highest ownership rates in Europe (73% in 2021). In light of decarbonisation goals and the improvements of home safety, there arises the need to identify a long-term decarbonisation strategy capable of effectively achieving climate and energy objectives in an economically efficient manner.

5.2.1 DESCRIPTION OF THE ECCO-FF55 SCENARIO

As for other sectors, the ECCO-FF55 scenario starts from the UNFCCC inventory emissions of 2021, the year in which it emitted 75.5 Mt of CO_{2eq}, broken down as follows:

- 25.0 Mt CO_{2eq} in the non-residential sector;

[90] Buildings built between 1945 and 2000 account for 66% of the entire Italian building stock

- 50.5 Mt CO_{2eq} in the residential sector.

In terms of energy demand, in 2021 the sector consumed 47.9 Mtoe, of which 16.9 Mtoe in the commercial sector and 31.0 Mtoe in the residential sector. In both sectors, natural gas represents the main energy source.

The scenario focuses on the variables with the greatest potential for decarbonisation:

1. the improvement of energy efficiency, assuming an increasing requalification rate over the period of analysis, and
2. the electrification of end-use consumption, by replacing fossil fuel-based heating systems with exclusively electric heat pumps.

Unlike the NECP, the ECCO-FF55 scenario assumes an increasing **rate of deep renovation,** and consequently a greater retrofitted area per year, **and a faster deployment of electric heat pumps as replacement of traditional fossil fuel boilers.**

The proposed simulation is affected by both the binding EU target of reducing final consumption by 11.7% compared to the Primes Reference 2020 scenario and the obligation for annual energy savings (equal to an annual average of 1.49%), which drive the sector to pursue a greater effort on energy efficiency. Additionally, it is worth noting the effects of RES targets, which aim to increase the proportion of final consumption covered by renewables, specifically in cooling and heating services.

In this context, for the residential sector, the scenario foresees an increase in the rate of requalifications: for deep renovations[91] it assumes an increase from the current 0.37% up to 4% by 2030, as a result of incentive policies that promote retrofitting interventions **with an integrated approach capable of achieving high results in terms of both consumption and emissions reduction;** For other type of renovations (medium and low), the current 1%[92] remains constant. In this perspective, the scenario assumes restrictive policies towards heating systems with negative effects on GHG emissions, especially in urban areas characterized by particularly critical air quality levels. For this reason, the scenario foresees a faster replacement of oil-based heating systems with electric heat pumps, aiming at triggering dynamics for a profound change in the energy mix, today characterized by a high share of fossil fuels.

Furthermore, alongside the contribution of energy efficiency, there is a push towards the electrification of end-use consumption through individual interventions involving the replacement of fossil fuel-based heating systems with electric heat pumps. Priority is given to those using heating oil. These interventions, in addition to those already included among deep renovations, allow for the clean heating of a further 7.5% of the total occupied area by 2030.

For the non-residential sector, the ECCO-FF55 scenario simulates a **constant requalification rate** during the analysis period, which is slightly higher than the one estimated by the Strategy for Energy Renovation of National Building Stock (STREPIN), attached to the 2019 NECP. In addition to the energy efficiency and RES targets, the reduction of consumption is driven by specific measures for the public sector: the energy efficiency directive proposes an annual reduction rate of final

[91] Deep renovations include interventions that act in an integrated way on the building-plant, generating annual energy savings of more than 60%.
[92] The scenario considers 2022 as the reference base year and takes into account the interventions activated by the Superbonus until 31.12.2022.

consumption for public buildings equal to 1.7%, as well as an extension of the annual 3% buildings renovation obligation to all the levels of public administration.

Finally, the simulation also considers the effect of the increase in the average annual temperature on heat demand, corresponding to a decrease in heat consumption of 1,260 ktoe (about 140 ktoe per year)[93] by 2030, accounting for 10% of total energy savings between 2021 and 2030.

In ECCO-FF55 scenario, total GHG emissions are equal to 35.6 Mt CO_{2eq} by 2030, corresponding to a reduction of 59% compared to 2005 levels (-49% vs 1990; -53% vs 2021) (Figure 21). Total final energy consumption accounts for 35.4 Mtoe, 26% less than in 2021. The share covered by fossil fuels fell by 54% compared to 2021, with **natural gas decreasing from 23.9 Mtoe in 2021 to 11.5 Mtoe in 2030, and other liquid fuels below 0.4 Mtoe.**

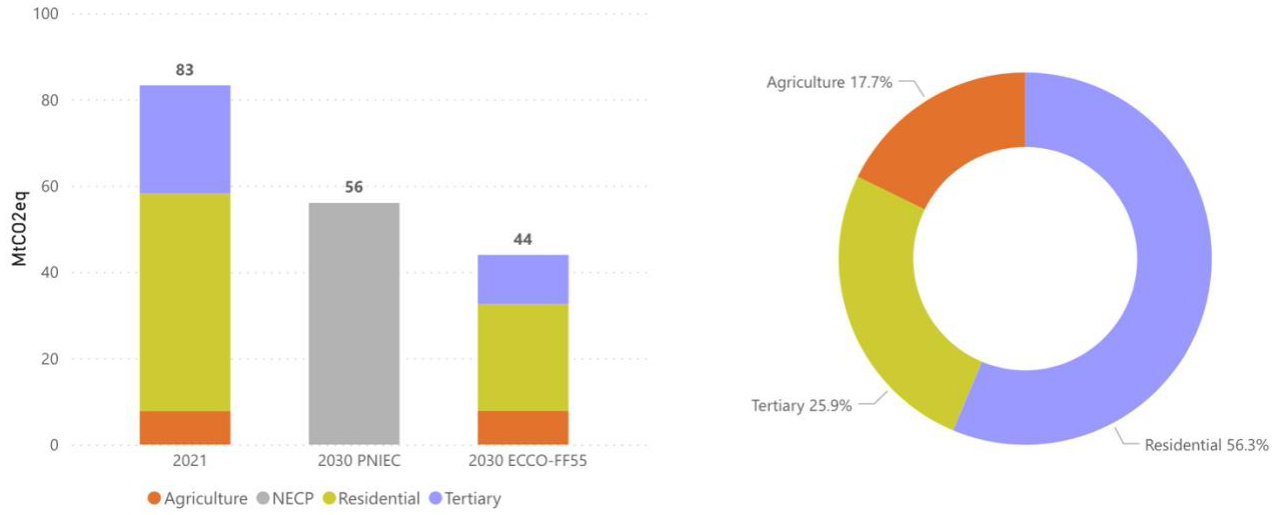


***Figure 21** – Comparison of CO2eq emissions for civil sector. This sector, in line with the national inventory and the NECP, includes the residential, Tertiary and Agriculture energy sectors by 2030 and % contributions in the FF55 scenario.*

Compared to the 2023 NECP, the ECCO-FF55 scenario estimated a further 23% reduction in GHG emissions (Figure 21). This is due to a stronger push towards energy saving interventions and electrification of final consumption, **through policies that exclude traditional fossil fuel- based systems from incentive mechanisms.** Unlike the 2023 NECP, the decline in emissions is faster during the period 2025-2030 period, even compared to the trend observed for 2021-2025. This is to account for an initial ramp-up phase, necessary for the development and launch of a long-term renovation plan for the building stock and for an adequate development of the construction and installation sector, which is experiencing a learning period in the use and installation of innovative technologies. To this end, it is essential for policies to have a long-term horizon and become as structural as possible.

From an energy point of view, the sector consumption is expected to decrease to 35.4 Mtoe by 2030 for the ECCO-FF55 scenario, compared to 41.0 Mtoe estimated by the NECP 2023 scenario.

[93] For this simulation, the RCP 2.8 scenario was taken into account, based on the evidence of the Emissions Gap Report 2022 and the temperature gradient estimated by ISPRA in the following publication: https://www.isprambiente.gov.it/files2018/pubblicazioni/rapporti/R_277_17_Consumienergetici_HDD.pdf

In the residential sector (Figure 21), natural gas is the fuel most affected by the reduction in consumption, with a cut of about 48% compared to 2021. At the same time, there is an **expansion of the electric vector, albeit relatively limited in absolute terms due to energy efficiency measures.** The contribution of biomass is assumed to remain constant, while **liquid fuels are expected to decline significantly.** The comparison with the NECP remains limited only to the total consumption expected by 2030, as the Plan does not include an estimate of the evolution of the energy mix in both residential and non-residential sectors.

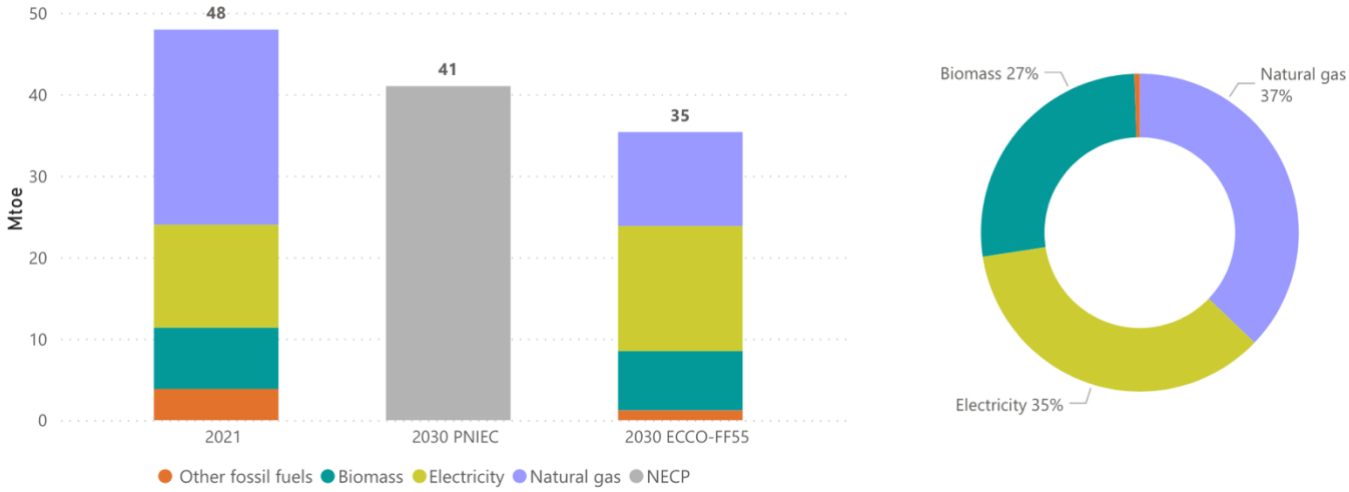


Figure 22 – *Final energy consumption in 2030 for the residential sector and % contributions in the ECCO-FF55 scenario.*

The share of electricity in final consumption for the non-residential sector is already quite high, as it reaches almost 50%. The ECCO-FF55 scenario confirms the central position of the electric vector, which increases by just 0.2 Mtoe, once again due to the effect of targeted energy efficiency measures. Natural gas reduces by about 59% compared to 2021, significantly lowering its weight in the energy mix, as do the remaining fossil fuels. Additionally, the contribution of biomethane in the building sector is estimated equal to 1 billion cubic meters by 2030.

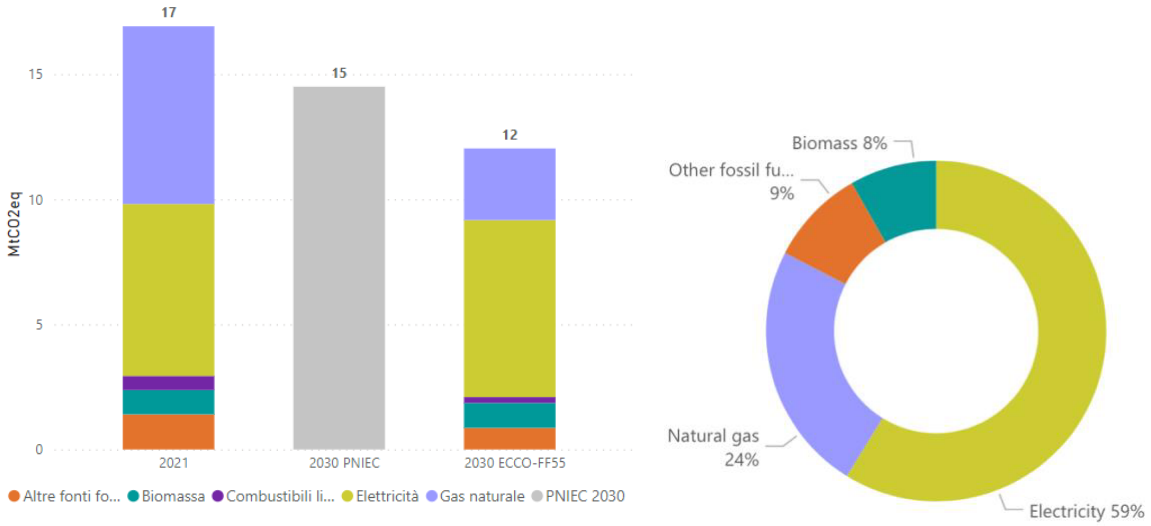


Figure 23 – *Final energy consumption in 2030 for the tertiary sector and % contributions in the ECCO-FF55 scenario.*

5.2.2 POLICIES AND MEASURES UNDERPINNING THE ECCO-FF55 SCENARIO

Compared to the extensive list of measures related to the energy efficiency dimension that the NECP recalls in the latest update, the following analysis focuses on the measures with the greatest potential impact on the decarbonisation path for the building sector and on the removal of barriers to the electrification of end uses. These measures were prioritized in the development of the ECCO-FF55 scenario.

Tax deductions for residential buildings

Italy has had a tax deduction scheme dedicated to building renovation since 1998, and one aimed at energy efficiency since 2007, the year the Ecobonus came into force. The latter was further strengthened in 2020 with the introduction of the 110% rate (Superbonus). Despite the investments activated – amounted to over 42 billion in 2022 – the trend of emissions reduction is not sufficient to achieve the2030 targets. The **Ecobonus appears to be poorly targeted towards savings and emission reduction,** at least by looking at the cost per ton of CO_2 abated, precisely because it is not tied to any check of the real consumption reduction (post-intervention). This is even more valid for generic renovations incentives (Bonus Casa), which completely lack conditionality regarding energy efficiency targets.

In just two years, over € 88 billion has been eligible for deduction with the Superbonus (September 2023), more than double the investments activated from 2014 to 2021 with the Ecobonus. It is worth noting that this instrument was introduced during the Covid-19 pandemic crisis to promote a key sector of the Italian economy, namely construction, thereby supporting GDP (Gross Domestic Product) in the context of the crisis. It was not a measure aimed at the efficiency and decarbonisation of homes. In terms of unit energy savings, it has generated a non-negligible cost for the state budget: about 6 Euros/kWh/year compared to 2.8 Euros/kWh/year of the Ecobonus.

According to the analysis conducted by the Parliamentary Budget Office, in 21.4% of the interventions completed by 2022 (amounting to approximately 20 billions) a deep energy

requalification was achieved, i.e. corresponding to average energy savings of over 82%. Moreover, about 60% of the units involved were in the lowest energy labels G and F, and in half of the case they reached the highest-label A (ranging from A1 to A4) thanks to interventions. Additionally, the Budget Office estimates that 21.5% of the renovated properties are capable of generating 70% of the total annual savings, absorbing 28% of the total investment. **Prioritising resources towards interventions that guarantee a greater consumption reduction, starting from buildings with the worst energy performance that show the highest savings potential, is crucial, especially in alignment with the** European EPBD Directive. This need for optimisation is further highlighted in the latest report "Greenhouse gas emissions in Italy: reduction targets and emission trends" published by ISPRA, according to which under current policies (including those identified by the NRRP, which take into account the Superbonus) the construction sector will be able to achieve an emission reduction of just 1% (compared to what would be achieved without interventions). Considering the inertia historically recorded by the sector, this trend that is insufficient to achieve the 2030 targets. According to ISPRA's analysis, **under the current measures, natural gas would continue to be the primary energy source used in the sector.** The significant costs of the interventions and their duration over time (such as the installation of a new systems presumably has a life cycle of 25-30 years) require a greater alignment between energy efficiency interventions and decarbonisation targets. Maintain natural gas as the primary energy source poses a challenge due to the need for transitioning away from fossil fuels.

To make Decree-Law No. 63/2013 on tax deductions for energy requalification more aligned to the sector's decarbonization pathway, it is fundamental taking into account the following criteria:

- **the extension of the time horizon for tax deductions until at least 2030** and the alignment with the targets for consumption and emission reduction. This facilitates the planning of interventions preventing inflationary and speculative phenomena.
- **Harmonising the existing schemes** (such as ecobonus, bonus casa, bonus facade, etc.) to more effectively allocate resources towards energy efficiency interventions.
- Introducing **premium to support interventions with a significant impact on emissions reduction and energy efficiency** (such as deep renovations guaranteeing savings of over 60% and promoting the progressive transition away from fossil fuels). For instance, in the paper we assumed the following rates:
    - In the case of deep renovations:
        - for multi-family buildings: 90% until 2025, 75% in 2026-2030
        - for single-family buildings: 65% until 2025, 50% in 2026-2030
    - In the case of partial renovations:
        - for multi-family buildings: 50% until 2025, 36% in 2026-2030
        - for single-family buildings: 36% until 2025
- Assessment within the Energy Performance Certificates (EPCs) of a pre- and post-intervention monitoring of energy consumption and emission.
- **Exclusion of fossil fuel-based systems from the technologies eligible for the tax deduction** (gas condensing boilers and hybrid systems).
- Application of the maximum tax rate for interventions that replace the heating system with *carbon-neutral* technologies if they fall within territorial areas not served by the gas network, or with particularly poor air quality levels.
- Elimination of the current distinction between "driving" and "driven" interventions. The incentive scheme must assess the interventions as a whole with respect to both the consumption and emission reduction and must be aimed exclusively at interventions with a significant positive impact on the latter.

- Maintenance of the credit transfer mechanism as a necessary tool for greater social accessibility to clean technologies, both to support lower incomes and to overcome the landlord-tenant dilemma.

Policies for the public sector

The new Energy Efficiency Directive (EED) asks the public sector to take the leadership in energy efficiency, acting as a driver to stimulate market transformation towards more efficient products, buildings and services, and to encourage behavioral changes in citizens and businesses regarding energy consumption. According to Article 5 of the EED, public administrations are required to plan energy-saving actions in schools, hospitals, nursing homes and social housing, with the aim of improving the quality of the indoor environment and supporting households in energy poverty. With 500,000 dwellings, social housing now accounts for 2% of Italy's residential stock. According to literature estimates[94], a plan for the renovation of these buildings, paired with a program to increase their number – 650,000 families are on the waiting list for social housing[95] –, would require an investment of around 15-20 billion euros. These types of buildings, as well as schools, need greater and dedicated resources in order to overcome the economic barriers (e.g., landlord-tenant dilemma[96], impossibility of access to credit, etc.), informational and cultural barriers (e.g., lack of information of both the available technologies and financial instruments) that make the deployment of energy efficiency measures even more difficult among low-income classes. Part of the resources of the Social Climate Fund could be dedicated to the renovation of public housing.

At the same time, it is estimated that 40 billion euros will be needed to renovate the entire school building stock, consisting of 56,000 buildings for a total of over 84 million square meters. Half of these resources are needed by 2030 in the ECCO-FF55 scenario to maintain a renovation rate of 5% per year.

For these building types, schools and social housing, dedicated measures with **coverage of 100% of expenses** are proposed. The necessary resources could be partly provided through non-repayable loans, using funds already allocated by the NECP, and partly through a fund continuously fed by the value of current energy bills, duly discounted to account for a minimum percentage of savings.

Tax and parafiscal charges between electricity and gas bills

Alongside the presence of fiscal incentives, **energy costs represent the variable with the higher impact on the economic sustainability of different technological solutions,** particularly concerning winter heating. For example, with the current tariff structure, and without considering tax deductions, only in the case of a high initial energy demand, the electric solution (electric heat pump, radiant floor heating, photovoltaic plat and induction cooktop) generates a cash flow capable of balancing the initial investment, operating energy costs and maintenance costs.

---

[94] Ruggieri G., Zangheri P. (2020). https://fondazionefeltrinelli.it

[95] https://www.forumdisuguaglianzediversita.org/wp-content/uploads/2023/07/FORUMDD_Report-110-per-cento-DEF.x87346.pdf

[96] 41% of households in poverty live in rented accommodation, compared to a national average of 18%. https://www.forumdisuguaglianzediversita.org/wp-content/uploads/2023/07/FORUMDD_Report-110-per-cento-DEF.x87346.pdf

The electricity tariff is more burdened with more tax and parafiscal charges than the gas tariff. This results in a price signal that discourages consumers from adopting electric appliances to meet their heating and cooking needs, thereby slowing down the electrification process and increasing the payback time. The unbalance is determined by the fact that the electricity tariff includes both the charges due to the ETS in the production phase and the entire cost for the previous development of RES. On the other hand, in the gas sector energy efficiency programmes are mostly financed by general taxation.

Under ordinary market conditions, i.e. at pre-energy crisis 2021-2022 values, **a household pays tax and parafiscal levies of € 22.9/GJ for the electricity bill compared to € 7.7/GJ applied to the gas bill.** During the 2021-2022 energy crisis, thanks to the zeroing of system charges in the electricity bill, this unbalance was reduced. However, from the second quarter of 2023, system charges were reintroduced, while VAT at 5% on gas consumption (instead of 10-22%) was extended. **This further increased the gap in tax and parafiscal charges in favour of gas over electricity,** not only disincentivising electrification, but also continuing to provide support to the gas bill, which remains indiscriminate in terms of commitment to savings and efficiency and compared to the actual needs of the beneficiary. In this regard, in the event of further increases in raw material prices due to market dynamics, support mechanisms should not incentivize behaviours that are incoherent with decarbonisation and energy efficiency. They should not be proportional to consumption but should be designed as a fixed contribution linked to an income/asset assessment of the consumer's economic situation.

Under these conditions, common to several European countries, the diffusion of electric solutions, despite significant incentives, is likely to remain limited. To mitigate this barrier, Europe has proposed, from 2027, or 2028 in the case of exceptionally high energy prices, to extend the ETS emissions trading system to domestic heating (ETS II). The effect of this measure in providing a more favourable price signal for electricity consumption will be limited, as well as he impacts on the final consumer – it is estimated that this would generate an average increase in monthly heating expenditure of € 10 per household[97]. A rebalancing of the tax and parafiscal charges between the electricity and gas bills would have a more significant impact.

In this regard, the scenario takes into account the positive effect of a reform of taxation and parafiscal charges, in particular regarding energy products, as a coherent and virtuous tool in the integration of energy systems to support families and businesses in their efforts towards decarbonization, efficiency, and energy independence. In this work, a reform of the gas and electricity tariff structures has been hypothesised. This could generate revenues to be allocated to **the financing of decarbonisation measures, such as the Ecobonus, and providing them stability over time.**

A reform of the tariff structure should take into account the following principles:

- Being functional and effective with respect to the decarbonisation pathway, taking into account the embodied emission of the product, in coherence with the energy carriers of other sectors.

[97] https://www.ansa.it/europa/notizie/sviluppo_sostenibile_digitale/2023/05/05/ecco-da-ets2-aumenti-minimi-7-euro-al-mese-su-carburanti_29a0b5d3-d8cf-44fd-a4e8-60f6b3e3cb23.html

- Paying particular attention to the economic and social impacts by developing proposals in favour of the most vulnerable income classes who do not have access to sufficient financial resources.
- Ensuring the competitiveness of companies and the innovation process, through on the one hand a coherent view of the fiscal and parafiscal charges and on the other hand the resources available for decarbonization.
- Fornire un disegno quanto più possibile stabile nel tempo in maniera da avere una previsione del gettito pubblico a fronte di un progredire degli obiettivi di decarbonizzazione;
- Providing a design that is as stable as possible over time in order to have a forecast of public revenues to be addressed to polices for the decarbonisation.

Local measures for the fossil fuel phase put in heating demand

The ECCO-FF55 scenario envisages an acceleration of the fossil fuel phase out (liquid fuels, such as oil and diesel) through an increase in the deplyoment of electric heat pumps as a primary heating system, by replacing the traditional and less efficient oil-fired boilers. This is not only due to climate objectives but also as a mitigation action for the poor air quality, which reaches particularly critical levels for many days[98] in some areas of the peninsula. Air pollution has significant negative health impacts, increasing the risk of premature death and diseases such as stroke, heart and lung disease. Italy, which pays the highest price within the EU in terms of premature deaths[99], needs to reduce the level of key pollutants (particulate matter, nitrogen dioxide and ozone), also in view of the new EU Directive on air quality that reduces limit values by 2030 and 2035.

In addition to transport, agricultural and industrial activities, household heating contributes to emissions from various pollutants, in particular, fine particulate matter $PM_{2.5}$, which is particularly high, for example, in Po Valley – the Italian area most at risk.

For this reason, the ECCO-FF55 scenario considers the planning **for the phase out of the most polluting fossil fuels, starting from heating** consumption, as a priority for municipalities characterized by high levels of pollutants. In this regard, there is a need for coordination between the ministries, research agencies and municipalities to encourage the adoption of such a plan and introduce a premium (e.g. maximum rate) for buildings located in these municipalities. It is also proposed to include municipalities and areas not yet covered by gas network, because there the transition to electric solution could accelerate.

Measures to overcome non-economic barriers

The heterogeneity and complexity of the building sector, as well as the success of a decarbonisation plan for Italian real estate, require a high level of expertise and professionalism of all the stakeholders involved: from the municipal technicians, to the designer/energy managers, to the installers, the banks, the administrators, up to the property owners. It is necessary to develop an organizational system that, by involving all the stakeholders, can reach a high degree of maturity and implementation speed by 2030. Hence the need to invest in **the training of qualified technical**

[98] https://discomap.eea.europa.eu/atlas/?page=Air-pollution
[99] https://ambientenonsolo.com/la-valutazione-del-rischio-sanitario-per-la-qualita-dellaria-dellagenzia-europea-per-lambiente/

personnel at the local level (already insufficient to manage the administrative workload smoothly); develop research and **training** for construction companies and operators in the sector to identify the most reliable technological solutions, which are aligned with the decarbonisation pathway; provide upgrading courses for condominium administrators to speed up the procedures for approving interventions and applying for building permits.

5.2.3 MONITORING INDICATORS

The adoption of a monitoring system to track the progress and effectiveness of the implemented interventions, in terms of energy and emission targets, is essential for introducing any corrections to the existing policies. The ECCO scenario identifies a series of indicators, some already public, others to be developed, to be evaluated at least annually.

Primary indicators:

- GHG emissions in residential and non-residential sectors. Source: ISPRA
- Primary and final energy consumption by source. Source: MEES/Eurostat
- Emission intensity for final energy consumption. Source: ISPRA
- Rate of electrification. Source: ISPRA
- Share of renewable energy for summer cooling and winter heating. Source: ESM/MEES
- Number of buildings (or surface area in sqm) renovated by type; requalification rate by type of intervention (low, medium, deep). Source: ENEA (Italian National Agency for New Technologies)
- Number of heating systems installed and replaced with electric solution, both in number and power (MW-kW). Source: ENEA

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

- Final energy consumption by building type (kWh/sqm). Source: MASE/ENEA
- Average energy cost for different types of consumers. Source: ARERA
- Average renovation cost by type of intervention. Source: To be evaluated
- Public resources addressed to building renovation. Source: MEF (Ministry of Economy and Finance)
- Number of one-stop-shops per capita. Source: To be evaluated
- Number of buildings with a smart meter. Source: to be evaluated (Enel/Terna?)
- Percentage of electric heat pumps produced and sold in the market (Italian and European). Source: Anima Percentage of electric heat pumps produced and sold in the market (Italian and European). Source: Anima Percentage of electric heat pumps produced and sold in the market (Italian and European). Source: Anima

5.2.4 INVESTMENT NEEDS

In the residential sector, energy renovations (deep and low or medium) envisaged by the ECCO-FF55 scenario in the period 2023-2030 entail an estimated total investment of € 193 billion. The public share is 53%, or € 103 billion. Annually (for 7 years starting from 2024) the public investment exceeds 14 billion euros. In addition to these, the renovation of schools requires 20 billion euros and about 55

billion for commercial and office buildings (of which 23% is accounted for public buildings). Total annual public expenditure is estimated at € 5.7 billion (includes schools and PA offices).

A share of the annual public expenditure could be covered by a reform of the current tax and parafiscal structure of the gas and electricity bill, as described above. The estimated revenue that could be allocated to the financing of energy efficiency is 5.8-6.0 billion euros/year. The proposed revision of the taxation and parataxation of tariffs does not increase the charges already present on the bill today. In additions, there are revenues from the new ETS II that are estimated equal to € 2.1 billion/year, according to a preliminary analysis that considers a CO2 price of € 45/tCO2. Furthermore, it is possible to consider a contribution from European funds, in particular from the NRRP fund, in the case of a possible resource reallocation, and from the Social Climate Fund from 2026 to support low-income classes against energy poverty.

BOX 3 – THE SOCIO-ECONOMIC IMPACTS OF ENERGY TRANSITION – EXISTING INCENTIVES FOR ENERGY EFFICIENCY

The right to adequate housing, understood as the economic, social and cultural right according to UN, entails ensuring a standard of living adequate for health and well-being for oneself and one's family, and it is a fundamental human right (Constitutional Court, sentence No. 119 of 24 March 1999). A strategy for the renovation of the built environment cannot fail to include the social dimension in its assessments and in the definition of policy measures. However, attention to the social impacts of renovation policies is particularly lacking in the NECP, which fails to seize the opportunity to combine energy transition and the fight against inequalities, by integrating decarbonisation objectives towards interventions that simultaneously improve the quality of life and promote the development of the most vulnerable territories.

Italy has introduced tax incentive policies for building requalification since 1998, extending them since 2007 to promote energy efficiency. These, from the Bonus Casa to the Ecobonus, are distributional policies that tend to have a **regressive nature,** i.e. they benefit more those taxpayers with medium-high income, who have sufficient liquidity and tax capacity to claim the deduction. Thanks to the mechanisms of the invoice discount, the credit transfer and the 110% rate, the Superbonus has led to a greater progressivity in the redistribution of resource, although partial. Even those who did not have the availability to pay in advance, those who had zero fiscal space, or those who were not homeowners of the were able to access the incentive. However, the permanence of a deduction covering the expenditure and the possibility of transferring the credit to third parties are not mechanisms which the State budget can sustain in the long run; and indeed they have been modified and limited starting from 2023. The regressive effect of these mechanisms, which need to be revised to better allocate resources towards decarbonisation objectives, so as to be an effective lever for private investment and for the structuring of an entire supply chain suitable for the required path, is an intrinsic feature of them. But in a phase of technical and technological immaturity, incentives, adequately planned according to the different phases of the innovation process, are **functional to favour the "learning curve" of technologies.** In other words, they accelerate the reduction of production and installation costs of new technologies, so that thanks to economies of scale they become accessible to all income classes.

The problem of the fight against energy poverty, and more generally of "housing deprivation", is a much more complex issue, even just in terms of identification, which cannot be addressed exclusively with building bonuses and with a differentiation of deductions based on ISEE (Equivalent Economic Situation Indicator). The effect would be marginal and not exhaustive to effectively reduce the phenomenon. A multi-year strategy and a plan for housing in a systemic and lasting logic is needed that not only responds to the needs of decarbonisation, but also reflects the criteria of just transition, and that works by geographical area, inserting building renovation within a broader strategy of urban regeneration. The Social Climate Fund or the Urban Regeneration Fund have precisely this objective and can be sources of funding.

5.3 TRANSPORT SECTOR

The main features of the transport sector

- In 2021, greenhouse gas emissions from the transport sector account for 103.3 million metric tons of CO2 equivalent (MtCO2eq) and represent 24.5% of the national total. Road transport accounts for 93% of transport total, with emissions from private cars mobility dominating (60%). Transport emissions have increased since 1990.
- Italy's motorization rate, 672 cars per 1000 inhabitants in 2022, is the second highest in Europe. The adoption of pure battery electric vehicles (BEVs) is very slow compared to other major European economies. On average, the annual rate of new registrations for BEVs in Italy is less than 4%, notably lower than the European average of over 10%.
- Around 77.6% of citizens' journeys in Italy occur within urban areas, typically ranging from 2 to 10 kilometers in distance. Additionally, approximately 60% of these journeys are systematic, meaning they occur regularly throughout the week.

The greenhouse gas emission reduction scenario

- In the ECCO-FF55 scenario, emissions from the transport sector are projected to amount to 64.1 MtCO2eq by 2030. This represents a significant reduction of 50% compared to the 2005 levels. The largest contribution to this reduction comes from road transport emissions, which are expected to decrease by 51.5% compared to 2005 levels.
- Compared to the NECP 2023 scenario, which forecasts transport sector emissions at 76.8 MtCO2eq in 2030, the ECCO-FF55 scenario achieves an additional reduction of 12.8 MtCO2eq by 2030.
- Instead of the NECP's goal of 4.3 million BEVs, the ECCO-FF55 scenario projects a maximum of 3.5 million BEVs by 2030. This adjustment is based on considerations of historical sales trends and the assumption of a **more impactful purchase incentive scheme** in the ECCO-FF55 scenario.
- The ECCO-FF55 scenario assumes by 2030 10% fewer vehicles in the circulating fleet and an average 15% reduction in mileage compared to 2021. The NECP does not quantify reductions in the rate of motorization and in the expected demand for private mobility.
- In the absence of other official sources, the ECCO-FF55 scenario considers the same amount of biofuels as in the NECP. However, the ECCO-FF55 scenario provides a **sensitivity analysis** with respect to the potentials assumed in the NECP and the consequences on emission reductions.
- For the shipping sector, the combined effect of port dock electrification measures provided for by the NRRP (National Recovery and Resilience Plan) and the partial replacement of the passenger ferry fleet with electric technologies were assumed.

Which policies by objective

- While the NECP scenario refers to current policies, the ECCO-FF55 scenario evaluates the **effects of targeted and synergistic** packages of measures aimed at promoting the electrification of the road vehicle fleet and reducing inefficient private transport demand. These measures include:
  - ***Electrification of the circulating fleet***:
    - Targeted car purchase incentives for electric vehicles only (BEV-*Battery Electric Vehicles)*.
    - Tax incentives to encourage electrification of corporate fleets.
    - Expanding the public fast charging network to support EV usage.
    - Rationalizing car taxation to incentivize the adoption of EVs.
  - ***Demand reduction (number and mileage of private vehicles):***
    - Rationalization of fuel taxation.
    - Increasing the provision of infrastructure and public transport alternatives to the private car for sustainable mobility.
    - Regulating urban circulation to restrict the use of polluting vehicles.

Priority Enabling Policies

- **Targeted allocation of public resources:**
  - **Reform of the Prime Ministerial Decree of 6 April 2022 on car purchase incentives** to support the sales of BEVs only. Extra-bonus provided under the new scheme are linked to both the income level of citizens' and vehicle efficiency. The reform includes subsidies for the installation of private and domestic Wallboxes for charging BEVs.
  - **Reform of taxation for company cars** (deductibility and taxation of fringe benefits) according to a bonus-malus system based on CO2 emission parameters, i.e. 100% deductibility for BEV vehicles.
  - **Reform of car taxation** (registration and ownership) by adopting progressivity criteria according to vehicle emission parameters.
- **Regulatory measures – coherence of the governance framework**
  - **Update of the National Plan on Electric Vehicle Charging Infrastructure (PNIRE),** and finalization of fast and ultra-fast charging infrastructures as envisaged by Mission 2, Component 2, Investment 4.3 of the NRRP.
  - **Completing the projects and installations outlined in the National Recovery and Resilience Plan** for Mission 2 Component 2 and Mission 3 Components 1 and 2, as well as the Complementary National Plan, the Social Cohesion Fund, the 2022 Budget Law.
  - **Addressing delays in implementing regulatory measures on traffic restrictions for polluting vehicles,** as stipulated in Article 7, paragraph 9 of the Codice della Strada amended by Law Decree 78 of 2022 (Article 7.1).

In 2021, the transport sector recorded 103.2 MtCO2eq of GHG emissions, equal to 24.5% of the national total[100], up 1% compared to 1990. Road transport accounts for 93% of the total, with cars emissions (60%) dominating, followed by truck and bus (19%), light commercial vehicles (11%), motorcycles (3%).

[100] Considering energy emissions alone, i.e. net of process emissions typical of industry, the transport is the leading sector in terms of emissions, accounting for 31% of the national total.

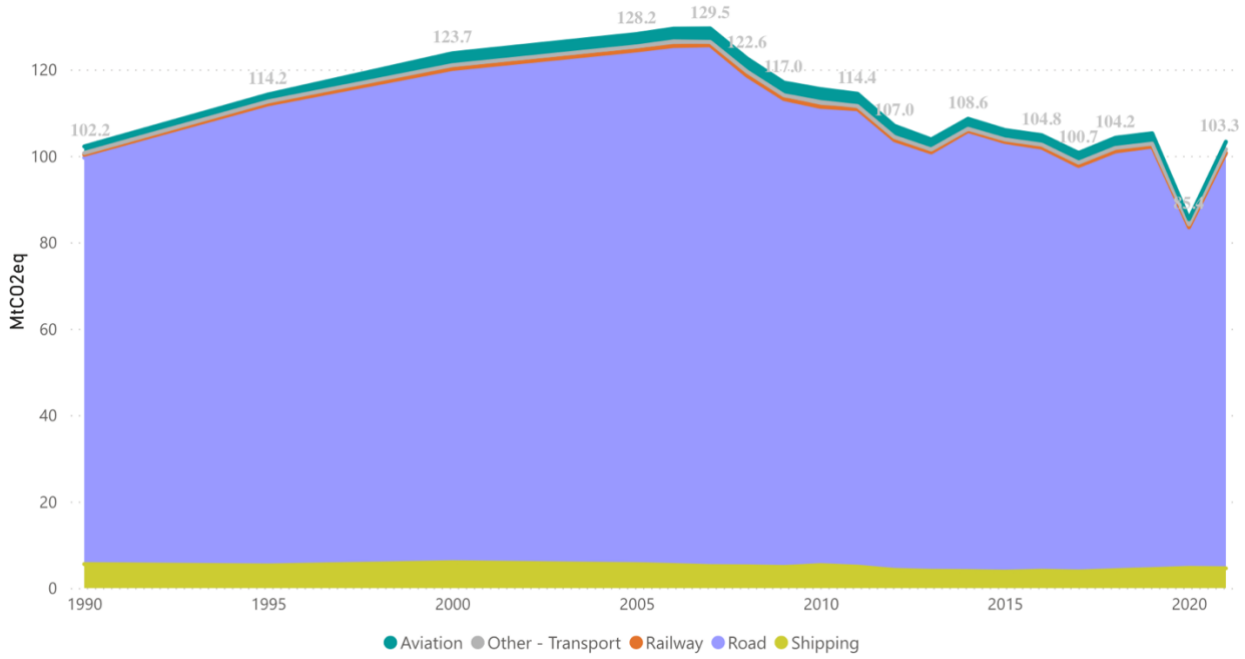


Figure 24 – *Greenhouse gas emissions from transport 1990-2021 (MtCO2eq) – Source: Data processing from ISPRA National Emissions Inventory*[101]

Regarding road transport, based on ISPRA database of average emission factors for the vehicle fleet on the road[102], the specific emissions of passenger cars result around 165 gCO2/km. For light commercial vehicles, the figure is 243 gCO2/km, which becomes 668 gCO2/km for trucks and 727 gCO2/km for buses. Two- wheelers have an average specific emissions of 99 gCO2/km.

TYPE OF VEHICLE	BILLION OF vehicle-km	EMISSIONS (MtCO2)	AVERAGE SPECIFIC EMISSIONS (gCO2/km)
Car	**390,71**	**64,52**	**165,14**
Petrol	108,99	17,64	161,89
Diesel	230,08	38,48	167,26
LPG Bifuel	24,67	4,27	173,00
Bifuel Methane	13,55	2,44	179,99
Diesel Plug-in Hybrid (PHEV)	1,90	0,27	140,82
Gasoline Plug-in Hybrid (PHEV)	1,39	0,18	127,82
Gasoline Hybrid (HEV)	9,07	1,24	136,66
Electric (BEV)	1,05	0,00	0,00
Light commercial vehicles	**49,00**	**11,92**	**243,30**
Truck	**26,70**	**17,84**	**668,39**
Bus	**4,03**	**2,93**	**727,04**
Motorcycle	**28,53**	**2,83**	**99,31**

Table 10 – *Mileage, total emissions and specific emissions of road vehicles Source: ISPRA/Copert data processing.*

[101] https://unfccc.int/ghg-inventories-annex-i-parties/2021

[102] The database of average emission factors for the vehicle fleet in Italy (isprambiente.it)

From an energy point of view, in 2021 the final energy consumption of the sector was 35.2 million tonnes of oil equivalent (Mtoe), of which 33.7 Mtoe as petroleum refining products (95% from imported crude). More than 90% of consumption is associated with road transport, with a preponderant share of private cars (61%), followed by heavy transport by trucks and buses (19%) and transport by light commercial vehicles (11%).

As of 2022, the national car fleet comprised about 40 million cars, mainly petrol and diesel[103]. The Italian average motorisation rate of 672 cars per 1,000 inhabitants is well above the European average (567 cars/1000 inhabitants)[104].

The private car is the most popular mode of transportation for Italians. According to Isfort's Audimob surveys for 2022[105] (with partial data for the first half of the year), approximately 64% of total journeys were conducted using private cars. Among these journeys, approximately 77.6% occurred within urban areas and covered distances of less than 10 kilometers. In terms of purpose, work-related travel accounted for 32.4% of total journeys, while family-related travel (including trips to school) constituted 32.1%, and leisure travel represented 30%. The majority of these journeys were systematic and occurred regularly on weekdays, with around 60% taking place during peak hours.

In 2022, the car market performance saw the registration of 1.3 million new cars, a figure that has remained relatively constant since 2020. Among these registrations, vehicles in the CO2 emission range between 61 and 135 gCO2/km were prevalent, accounting for 66.7% of the total. A significant portion of these vehicles were electrified HEV hybrid models, totaling 448.2 thousand units, primarily running on petrol. The breakdown of new registrations by fuel type is as follows: 365.3 thousand traditional petrol models, 257.8 thousand diesel models, 118.1 thousand LPG models, and 10.7 thousand CNG models. Additionally, there were 67.3 thousand new registrations of PHEV plug-in hybrid cars and 49.2 thousand of BEV battery electric vehicles.

The historical trend of the BEV market in Italy shows a rapid increase starting from 2019, reaching a peak in demand in 2021, when a bonus incentive scheme was in force for promoting this type of vehicles, including those purchased on a leasing base. With the entry into force of the **Prime Ministerial Decree** of 6 April 2022 for incentives, which reduced the amounts granted compared to the 2021 scheme, there was a **sharp slowdown of the BEV car market,** with a 27% reduction in sales compared to the previous year.

In the first eight months of 2023, there were 40.8 thousand new BEV registrations (+33% compared to the same period in 2022). Despite this growth, **in comparison with other European countries Italy still lags behind:** as of July 2023, BEV registrations in Germany reached 270 thousand units, 155 thousand in France, 176 thousand in the United Kingdom.

Regarding EV charging infrastructure, as of September 2023, Italy had 47,288 charging points for electric vehicles installed, marking a significant increase of 44% compared to the same period in 2022. These charging points are distributed across 26,069 stations located in over 17 thousand locations, primarily on public land. The distribution of charging infrastructure across different regions

[103] ACI Studi e ricerche - Autoritratto 2022
[104] Motorization rates in the EU, by country and vehicle type - ACEA - European Automobile Manufacturers' Association
[105] 19th Report on the Mobility of Italians – ISFORT

shows a higher concentration in the northern regions and Lazio, compared to the central and southern regions as well as the islands[106].

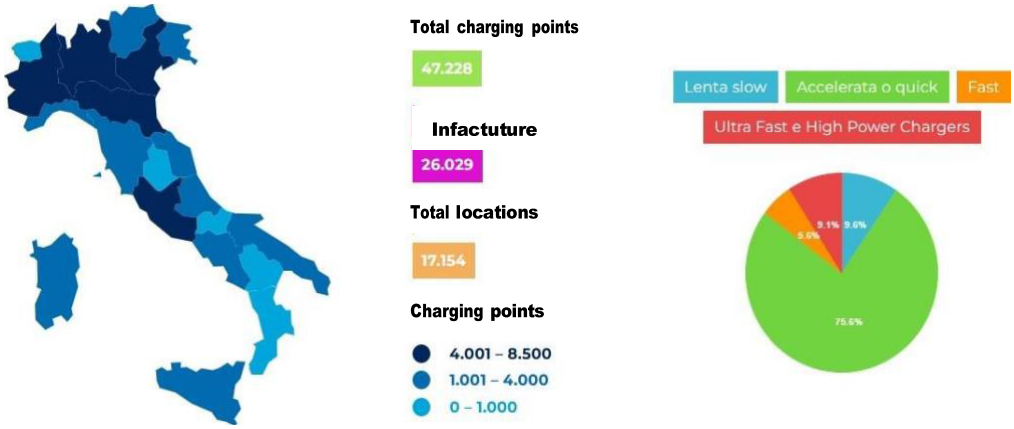


Figure 25 – *Charging infrastructure in Italy (Source: Motus-e)*

5.3.1 DESCRIPTION OF THE ECCO-FF55 SCENARIO

Given the significant contribution of emissions from road mobility, the ECCO-FF55 scenario analysis and simulations focused primarily on this sector, particularly emphasizing variables with substantial decarbonization potential:

1. Electrification of the vehicle fleet[107];
2. Reduction in the number of vehicles and average mileage.

The **ECCO-FF55 scenario** quantifies the impact of policies aimed at further promoting the electrification of passenger cars fleet, which translates into **3.5 million BEV vehicles** on the road by 2030. The estimate aligns with a **realistic sales trend** for these vehicles in the upcoming years, assuming the implementation of a **renewed and more impactful incentive scheme for BEV purchase** coupled with the expected decrease in the purchase costs of these vehicles.

[106] Market Analysis - Motus-E
[107] Q&A Auto elettrica - ECCO (eccoclimate.org)

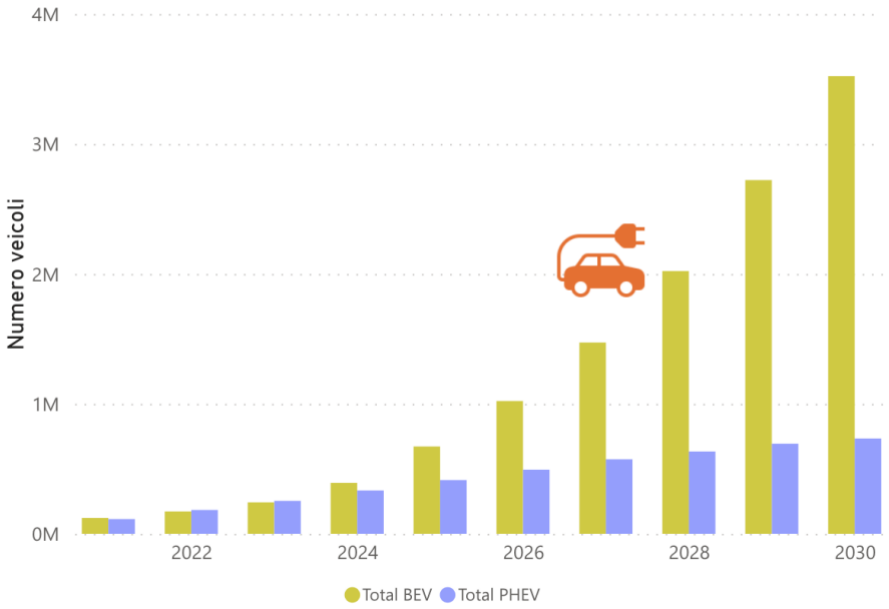


Figure 26 – *BEV and PHEV fleet in the ECCO-FF55 scenario*

In addition to the electrification of the car fleet, the scenario estimates the effect of an average **reduction of 10% in the circulating fleet compared to 2021,** for a total of about 4 million fewer cars[108]. This reduction aims to realign the country with the European average motorization rate[109] and is in line with the ambitions outlined in Italy's long-term strategy for greenhouse gas emission reduction in a trajectory compatible with the ambitions of the *Italy's long-term strategy on the reduction of greenhouse gas emissions*[110], which estimates 24 million vehicles on the road by 2050. Additionally a **15% reduction in average vehicle mileage** compared to 2021 values is also taken into account

In these assessments, the scenario takes into account the effects associated with expanding the availability of mobility services as alternatives to private cars. This is achieved through the implementation of projects outlined in the NRRP (National Recovery and Resilience Plan), particularly focusing on rapid mass transport, digitalization, enhancement of public transport in urban areas, growth of *sharing mobility* services. Additionally, the scenario considers the effects of the implementation of fiscal policies aimed at discouraging car ownership and usage, along with policies to regulate the circulation of polluting vehicles, particularly in urban areas[111].

Regarding the utilization of biofuels, the scenario relied on the potentials outlined in the NECP. However, a **sensitivity analysis was conducted** to assess the risks associated with achieving these targets, which are not assured, as emphasized in the NECP itself. The primary objective of this analysis was to uncover any risks originating from the possibility of overestimating the potentials of biofuels. According to the ECCO-FF55 scenario, **greenhouse gas emissions from the sector are projected to**

[108] In this configuration, the scenario considers an increase in the emission efficiency of the circulating fleet of 5% on average by 2030 compared to 2021. The estimation is based on: i) analysis of the historical trend of emissions of the vehicles and expected progress as a result of the new emission standards in place for cars and vans, as well as for heavy-duty vehicles; ii) projections of the main baseline studies.
[109] Passenger cars in the EU - Statistics Explained (europa.eu)
[110] LTS_Gennaio 2021 (mase.gov.it)
[111] The assessments also take into account the effects of changes in fuel prices expected from the introduction of the new ETS2 Regulation, as well as the effects of demographic dynamics and other macroeconomic variables (EU Reference Scenario 2020 (europa.eu)).

reach 64.1 MtCO2eq by 2030, marking a 50% reduction compared to 2005 levels (38% reduction compared to 1990 and 37.3% reduction compared to 2021)[112].

Compared to the NECP 2023 scenario, the ECCO-FF55 scenario shows a further 20% reduction in emissions (76.9 vs 64.1 $MtCO_2eq$), despite a lower penetration of electric cars in the circulating fleet. The difference is attributable a more ambitious implementation of policies aimed at offering more effective sustainable mobility services as alternatives to private cars, along with measures to discourage private car usage. **The main contribution to emissions reduction comes from road which sees a decrease of 51.5% compared to 2005 levels and 40.1% compared to 2021 levels.**

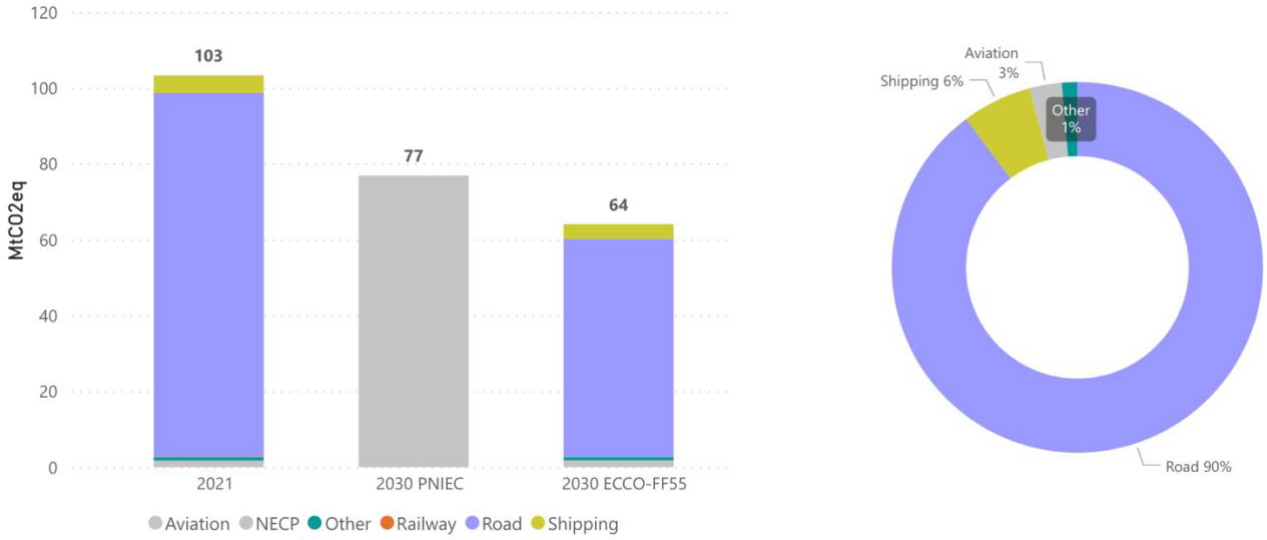


***Figure 27** – Transport emissions by mode (MtCO2eq) and % contributions to 2030 in the ECCO-FF55 scenario. Source: ECCO elaboration*

From an energy perspective, in the **ECCO-FF55 scenario the sector's consumption expected in 2030 amounts to 29.5 Mtoe,** compared to 32.6 estimated by the NECP 2023 scenario. Also in this case, the main contribution relates to the reduction of consumption in the road sector, which falls from 32.9 Mtoe in 2021 to 23.9 Mtoe in 2030, with a reduction of 27% and an incidence on the total of 81%, compared to the 87% registered in 2021.

[112] Including consumption for international aviation.

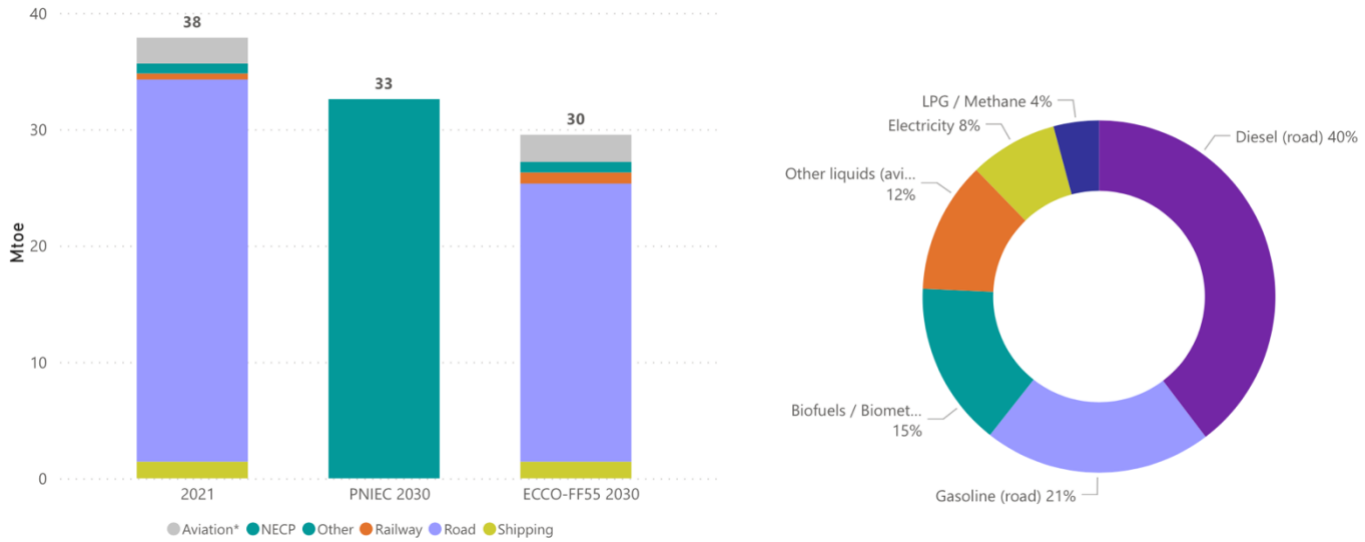


Figure 28 – *Transport energy consumption by mode (Mtoe) and fuel contributions in % in the ECCO-FF55 scenario. Source: ECCO elaboration*

Disaggregated by **energy source,** out of the 29.5 Mtoe of final consumption registered by ECCO-FF55 scenario, the share from fossil fuels accounts for a total of 22.7 Mtoe, 84% of which is used to power ICE vehicles (diesel 52%, petrol 27%, LPG and methane 5%), while 16% concerns consumption in the shipping and aviation sectors. Estimates of **total electricity consumption amount to 2.4 Mtoe, approx. 27.7 TWh,** of which 40% is associated with rail modes, 28% with road vehicles, and 32% with other modes of transport. The consumption of liquid biofuels and biomethane as included in the scenario relates to the 4.46 Mtoe assumed by the NECP.

Consumption of biofuels

In the ECCO-FF55 scenario, the consumption of biofuels matches the ambitions of the NECP, for a total of 4.46 Mtoe by 2030. Out of this amount, 63.4% (2.83 Mtoe) are liquid fuels (mainly biodiesel), one third of which is from feedstock competing with food and feed supply chains (*single counting*), and two thirds from the processing of waste (*double counting*, both advanced and non-advanced). Of the total amount of biofuels, 27.8% is advanced biomethane, whose contribution estimated by the NECP is 1.24 Mtoe. The remaining 8% are *Renewable Fuels of non-biological origin* (RFNBO, 0.39 Mtoe). Added to the electricity consumption from renewable sources as estimated in the ECCO-FF55 scenario, the overall scenario contribution of renewable energy sources from transport (RES-T) equals 6 Mtoe.

Calculated under the new RED III Directive (Renewable Energy Directive), this contribution amounts to about 33% of the total transport energy consumption estimated in the scenario, against the minimum target of 29% set by the directive. In terms of **saved emissions, the contribution of RES-T in the scenario amounts to 22% of the total, compared to the minimum 14.5% required by the directive.**

Considering the analysis of biofuel potentials outlined in the dedicated Box below, it appears prudent to reassess the assumed scenario hypothesis even for reduced quantities of biofuels through a sensitivity analysis. If the Renewable Energy Sources in Transport (RES-T) consumption of the ECCO-FF55 scenario were adjusted to meet the minimum targets of the Renewable Energy Directive III (RED III), it would necessitate reducing biofuel consumption by approximately 1.4 million tonnes of

oil equivalent (Mtoe). Consequently, this reduction would lead to an increase in scenario emissions of approximately 4.5 MtCO2e. This increase would raise the total emissions of the ECCO-FF55 scenario for the sector to 68.6 MtCO2eq, a value that is still **well below the emissions projected by the NECP2023 scenario** and still in line with European decarbonisation targets.

Given the particular complexity decarbonizing the transportation sector and the **relatively ineffective strategies implemented thus far in Italy**, it is advisable to intervene with a more targeted adjustment of various reduction strategies. This involves emphasizing the reduction of inefficient transport demand within a framework that balances with other solutions.

A comprehensive strategy might entail **reducing forecasted biofuel consumption while prioritizing the development of production chains for the most promising advanced biofuels**. This approach seeks to diminish the country's dependence on imported biomasses, a key objective of the Plan.

BOX 4 – BIOFUELS AND THE NECP

The latest updates in the RED III regulatory framework[113] underscore the significance that the European legislature places on biofuels in attaining the 2030 road transport emission reduction objectives. However, the regulation's rationale refers to the necessity of limiting this contribution, with provisions for gradually transitioning its usage to ships and aircraft, as evidenced by the distinct bonus coefficients designated for these sectors. The potentials of biofuels in the NECP are explored below, given their substantial contribution to decarbonizing the transport sector (33% final consumption in the NECP compared to 29% in the RED III), even surpassing the ambitious targets established by the RED III.

Biofuels in the NECP

In the NECP 2023 scenario for transportation, the estimated consumption of biofuels amounts to approximately 4.1 Mtoe and to an additional 0.39 Mtoe of other synthetic fuels of non-biological origin, referred to as RFNBOs, bringing the total to 4.46 Mtoe. Out of this total, 93.6% (4.17 Mtoe) is used in road transport: 72% of this quantity comprises liquid products (2.63 Mtoe biofuels; 0.36 RFNBO), while 29% is advanced biomethane (1.19 Mtoe).

Biodiesel

The largest part of the over 2,6 Mtoe of liquid biofuels envisaged by the NECP for road transport is biodiesel, **produced in Italy and imported[114]**. For domestic production, the main reference points are Eni's plants in Porto Marghera, Gela and, in the future, Livorno[115], for which an installed production capacity of about 1.7 million tons is expected as early as

[113] Council and Parliament reach provisional deal on renewable energy directive - Consilium (europa.eu)
[114] In 2021, the consumption of liquid biofuels in Italy was 1.6 million tonnes, of which 1.57 (98%) was biodiesel. In total, 493,000 tons of biodiesel were produced domestically (31% of the total), but only 92,000 tons with local feedstock (6% of the total). 41% of the liquid biofuels released for consumption in Italy are produced with raw materials from China and Indonesia (cf. Energy in Transport 2005-2021.pdf (gse.it))
[115] The European Commission did not allow the financing of these projects with Community funds under REPowerEU in the NRRP funding review process.

2025[116]. To supply the plants, large quantities of **vegetable oil from agricultural raw materials grown in African countries**[117] are expected to be imported. Further biomass imports will involve Asian countries, particularly China and Indonesia, encompassing **both agricultural biomass[118] and biomass sourced from waste and refuse [119]**.

Considering the significant reliance on foreign imports for supplies, it appears less risky to decrease the quantities of consumption outlined in the NECP. This reduction could be achieved by implementing a **structural decrease** in consumption and emissions from private road transport while promoting and incentivizing effective sustainable mobility policies.

This approach becomes even more advantageous, particularly given the uncertainties surrounding the actual climate benefits of biofuels[120], including biodiesel derived from castor oil[121], along with the collective **costs associated** with subsidizing their production[122].

Biomethane

Regarding **biomethane,** the NECP projections indicate a final consumption across all sectors of 5 Mtoe, equivalent to approximately **5.7 billion cubic meters** of annual production by 2030. This **theoretical potential** is based on forecasts for further development of production chains, including *the* technological *upgrade* of biogas plants currently in operation. For transport, the consumption target is set at 1.24 Mtoe, equivalent to approx. 1.4 billion cubic meters of gas, or about a quarter of the estimated theoretical potential.

According to a study by ENEA (Italian National Agency for New Technologies) in 2019[123], the technical potential of advanced biomethane that can be produced in Italy amounts to approx. 4.2 billion cubic metres, or 3.7 Mtoe of energy, even without considering environmental and economic evaluations of possible alternative-competitive uses of agricultural biomass used in the production process. Even more conservative estimates

[116] 2023 Capital Markets Update & 2022 Full Year Results (eni.com). The company's plan calls for a capacity installed global production of more than 5 million tonnes of biorefining products by 2030 (see Appendix I). Eni's evolution: the long-term Strategic Plan to 2050.

[117] The reference concerns Eni's agri-feedstock projects in Africa, which envisage production in Kenya and Congo – and planned in Angola, Côte d'Ivoire, Mozambique and Rwanda – with the stated aim of supplying the company's biorefineries with over 700 thousand tonnes of castor oil by 2026 (cf. Agri-feedstock projects in Kenya and Congo | Eni). There are no known ILUC impact studies of these projects.

[118] Approximately one third of the biodiesel consumption envisaged by the NECP relates to so-called single-counting products, i.e. products derived from agricultural raw materials.

[119] The reliability of certification of origin for imported biomass derived from refuse and waste remains a concern due to potential fraud. Evidence supporting this concern can be found in reports such as the 2019 Report of the European Anti-Fraud Office (The OLAF report 2019 - Publications Office of the EU) and the 2016 Special Report of the European Court regarding the EU system for the certification of sustainable biofuels (The EU system for the certification of sustainable biofuels). A 2019 fact-checking survey conducted by the Italian Parliament further emphasized the real risk of adulteration of imported waste biomass at its origin with virgin vegetable oils, such as palm oil, to gain access to higher incentive quotas. Specifically, concerns about fraud pertain to imports of used cooking oil (UCO) and palm oil mill effluent (POME) (Parliamentary Acts camera.it).

[120] Environmental sustainability of biofuels: a review - PMC (nih.gov);

[121] The CO2 emission savings of biodiesel produced from castor oil are estimated to be just over 60% compared to the emissions of conventional diesel (cf. Life cycle assessment of biodiesel production from selected second-generation feedstocks.

[122] Activity Report 2021 (ESM)

[123] Theoretical potential of advanced biomethane in Italy (enea.it)

come both from a study conducted by the Italian Biogas Consortium (CIB)[124], which suggests the actual potential is around **2.7 billion cubic meters less than projected in the NECP** and a study by the Green Bocconi Renewable Gas Observatory[125], indicate that the economic potential of biomethane ranges between 2 and 2.5 billion cubic meters in total.

In light of the aforementioned findings, it would be advisable to lower the potentials envisioned by the NECP. Moreover, meticulous monitoring of the quantities produced should be prioritised, especially concerning biodiesel and biomethane. **Contingency measures** should also be considered in the event that the projected potentials are not achieved.

5.3.2 POLICIES AND MEASURES UNDERPINNING THE ECCO-FF55 SCENARIO

Considering the significant emissions from road transport, the policies and measures outlined in the ECCO-FF55 scenario concentrated on the anticipated impacts on variables with the highest potential for decarbonization. This includes increasing vehicle electrification and decreasing the number of vehicles in the circulating fleet, as well as reducing average mileage, ultimately aiming to diminish the demand for private transport. The following packages of measures were deemed necessary to achieve this outcome.

Car Purchase Incentives

In terms of electrifying the vehicle fleet, simulations were conducted on the expansion of the market for pure battery electric cars (BEVs) in response to changes introduced to the DPCM of 6 April 2022, aimed at incentivizing the demand for non-polluting vehicles[126]. Specifically, **it was assumed that a reform of Prime Ministerial Decree would prioritize the sales of BEVs exclusively** [127] This would involve allocating incentives only to vehicles within the 0-20 gCO2/km emission range, alongside the introduction of income-based bonuses. Additionally, incentives would be provided for selecting more efficient and smaller vehicles. The series of measures considered can be summarized as follow:

- Incentives provided exclusively for the purchase of M1 vehicles (cars) in the 0-20 gCO2/km emission range.
- Increase in the unit value of incentives granted, similar to the scheme in force in 2021 – Expansion of purchase-related scrappage to include EURO5 vehicle categories - Introduction of bonus incentives for the purchase of more energy-efficient vehicles, particularly those in segments A and B.
- Introduction of premium incentives to assist individuals with medium and low incomes (based on ISEE Declarations), or implementation of a social leasing scheme similar to the French model.
- Expansion of access to incentives for legal entities for rental/leasing purposes.
- Expansion of incentives to support the installation of private and domestic charging infrastructure, including Wallbox).

Car taxation

[124] Potenzialità_biometano_Italia_DEFINITIVO.pdf (consorziobiogas.it)
[125] Quotidiano Energia
[126] Ecobonus (mise.gov.it)
[127] Electric mobility incentives: which ones? - ECCO (eccoclimate.org)

As an additional stimulus for car electrification, the effects of a reform in car taxation have been evaluated. This reform aims to **encourage the adoption of zero-emission cars while discouraging the selection of polluting vehicles**. Specifically, the proposed reform involves adjusting taxes on purchase (registration) and ownership (vignette) based on CO2/km emissions. Given that these taxes are collected at the regional level and by Autonomous Provinces according to local regulations, it is recommended that the NECP includes the preparation of a comprehensive policy document aimed at revising taxation in collaboration with local governments. This collaborative approach will ensure alignment and consistency in the implementation of taxation reforms across regions and provinces.

Company Fleets

Corporate vehicles represent a significant portion of new car registrations in Italy and are experiencing a growing trend. Additionally, these vehicles tend to have an average mileage that is over twice that of normal private users. The direct adoption of electric company fleets would therefore lead to a substantial and rapid reduction in emissions from private road mobility. Furthermore, considering the average turnover period of a company's fleet, which is typically around 36 months, the adoption of electric company fleets would accelerate the development of the second-hand electric vehicle market. This expansion would enhance the accessibility of electric vehicle technology to a broader range of citizens.

In light of these considerations, the scenario contemplates the **implementation of a tax reform for company car fleets aimed at incentivizing the adoption of zero-emission vehicles**. The key criteria for such a reform include: i) Adjusting the deductibility of costs associated with purchasing or leasing a corporate car based on CO2/km emission parameters, with increased deductibility for Battery Electric Vehicles (BEVs); ii) Revising taxation on car fringe benefits to incorporate a progressive tax structure based on the CO2/km emissions parameters of vehicles. By incorporating these criteria into the tax reform, the scenario seeks to encourage companies to transition towards zero-emission vehicles, thereby contributing to the reduction of emissions from road transportation and promoting the widespread adoption of electric vehicles[128].

Charging infrastructure for electric vehicles

The ECCO-FF55 scenario takes into account the anticipated effects of **expanding the electric charging infrastructure across the national territory**. Recognizing that the perceived lack of a robust charging network can deter consumers from purchasing electric vehicles[129], the scenario prioritizes the **update of the National Plan for electric vehicle charging infrastructure** (PNIRE). The goal is to achieve at least 100,000 stations with 200,000 charging points by 2030. As part of these projections, the scenario also incorporates the completion of the installation of all fast and ultra-fast charging infrastructures outlined in Mission 2, Component 2, Investment 4.3 of the NRRP by 2026. This entails establishing a minimum of 7,500 super-fast charging stations for electric vehicles on extra-urban roads (excluding motorways) and a minimum of 13,755 fast charging stations in urban centers.

[128] Politiche fiscali mobilità elettrica - ECCO (eccoclimate.org);
[129] EY Mobility Consumer Index 2023 | Download the report)

The scenario's projections also rely on regulatory interventions to address issues related to the installation of private charging points in common areas of buildings and the installation of Wallboxes or dedicated meters by individual users. These interventions aim to resolve issues such as authorizations, competencies, and technologies. Furthermore, the scenario evaluates the positive impact of increased adoption of private charging stations for businesses and employees. This assessment considers the dedicated fund established in accordance with Law No. 126 of 13 October 2020 and the Ministerial Decree of 25 August 2021, which governs its disbursement.

Fuel taxation and ETSII

In the ECCO-FF55 scenario, the impact of **fuel prices signals** on consumer behavior and potential responses towards reducing consumption is considered. The scenario assumes that **no interventions will be implemented to adjust fuel prices**, such as providing discounts on excise duties, even in the event of price increases due to market dynamics or policy effects. This decision is motivated by the recognition that such interventions can have **regressive and inequitable effects**, and it is instead prioritized to allocate public resources towards supporting the genuine mobility needs of low-income individuals, while also aiming to reduce fuel consumption[130].

Furthermore, the scenario evaluates the positive effects of an **energy sector tax reform** that introduces mechanisms to ensure the effectiveness of the fuel price signal, even if there is a reduction in the cost of energy products. Revenue generated from fuel excise duties should primarily be directed towards initiatives aimed at addressing mobility poverty[131] and facilitating the transition to a decarbonized transport system.

The scenario also considers the potential impact of extending the European Union Emissions Trading System (ETS) to the transport sector, referred to as ETS2[132], which is anticipated to come into effect no earlier than 2027, or in 2028 if energy prices are exceptionally high[133].

Sustainable mobility

In the ECCO-FF55 scenario, the contribution to emission reduction from a **decrease in passenger and freight mobility demand** through alternative sustainable mobility solutions is taken into account. This reduction is expected to be facilitated by investments outlined in the **National Recovery and Resilience Plan** (NRRP) for Mission 2 Component 2 and Mission 3 Components 1 and 2, as well as the Complementary National Plan, the Social Cohesion Fund, and the 2022 Budget Law.

In particular, these interventions encompass the development of new railway infrastructure at both national and regional levels, improvements in mass rapid transit systems, renewal of the bus fleet, enhancement of metropolitan railway nodes, establishment of urban cycle paths, and digitalization initiatives[134]. The total budget allocated for these interventions exceeds 90 billion euros, with most implementation timelines aligning with the expectations of the 2030 scenario.

---

[130] Non rinnovare lo sconto sulle accise vale 9 mld di euro - ECCO (eccoclimate.org)
[131] Understanding transport poverty | Think Tank | European Parliament (europa.eu)
[132] EU Emissions Trading System for buildings and road transport ("EU ETS 2") | International Carbon Action Partnership (icapcarbonaction.com).
[133] This aspect, together with a relatively low forecast of the initial impact of the measure on the price of fuels - according to ECCO's estimates this would be an average increase in monthly expenditure on fuel of EUR 7 per vehicle - makes the impacts of the measure considered in the scenario marginal.
[134] The National Recovery and Resilience Plan (NRRP) (camera.it)

Effective financing and close coordination for implementation are crucial elements that must be integrated into the Plan Governance, in coordination with the structures responsible for reviewing the NRRP. Proposed amendments to the NRRP by the government to the EU[135] intervene on the objectives and timing of some investments deemed essential for the advancement of sustainable mobility services as alternatives to private car usage. Notable **critical changes referring to Mission 2 Component 2** include:

- Modifications to investments for strengthening cycling mobility (M2C2-I4.1), which involve the defunding of projects for tourist cycle paths and postponement of works in urban areas.
- Adjustments to the development of rapid mass transport (M2C2-I4.2), including delayed implementation of works and removal of references to selected cities and modal splits for planned works. In this regard, it is here emphasized the importance of enhancing the offer of light mass rapid transport services in metropolitan cities in order to reduce private vehicle traffic and related emissions by 2030.
- Rescheduling of implementation deadlines and flexibility requested for the composition of objectives concerning the development of electric charging infrastructures (M2C2-I4.3). In this regard, it is here emphasized the importance of equipping long-distance roads with an adequate number of fast and ultra-fast charging stations as quickly as possibile.

On the activities of Mission 3 Components 1 and 2, significant changes concern the allocation of funding for various railway works, including high-speed and regional transport, diagonal east-west connections, metropolitan railway nodes, and freight logistics. The government's report on the revision of the Plan[136], **acknowledges the overarching goals of the Mission but suggests the possibility of canceling some financing under the NRRP in the future. It reserves the right to implement measures to reprogram these resources while ensuring that the overall objectives are met**. **However, specific details regarding how and when these measures will be implemented are not provided**. Given the significance of these infrastructure works for achieving the 2030 transport decarbonization targets, there is a hope for further specific commitments from the government.

In addition to the anticipated effects of enhancing national and local sustainable mobility infrastructures, the ECCO-FF55 scenario recognizes the necessity for further actions, particularly in urban areas. These entails **raising the service standards for local public transport** by augmenting the number of seat-kilometers and frequency of rides, particularly during periods of peak traffic, such as rush hours associated with commuting to and from work or school. These times constitute over 50% of daily mobility demand and are characterized by high predictability. By enhancing public transport services to better align with these peak demand periods, the scenario aims to encourage greater utilization of public transit, reduce reliance on private vehicles, and ultimately contribute to the decarbonization of urban mobility.

Further advances considered in the scenario concern **advancements in urban and peri-urban transport planning through digitalization**. Digital technologies enable the monitoring of user travel patterns to and from key locations, providing valuable data for public administrations and transportation managers to organize more efficient and adaptable service offerings. Moreover, by cross-referencing this information with big data analysis of origin-destination flows in private

[135] PNRR - LE PROPOSTE DEL GOVERNO PER LA REVISIONE DEL PNRR E IL CAPITOLO REPOWEREU (camera.it)
[136] Revisione-e-aggiornamento-del-PNRR-parlamento-27-luglio-2023-1.pdf (osservatoriorecovery.it)

mobility, previously unidentified travel needs can be intercepted, facilitating the planning of additional actions to enhance service provision. This integration of digital tools and data analytics holds promise for optimizing urban transportation systems and improving overall mobility experiences for commuters and residents alike.

The significance of digitalizing information and its accessibility is further amplified within the anticipated implementation of **Mobility as a Service**[137], solutions. In MaaS, a variety of shared and collective mobility options – such as local public transport, trains, carsharing, bike-sharing, scooter-sharing, and ride-splitting, etc.[138] – are integrated into a cohesive service offering accessible to users for journey planning and scheduling. This integrated approach eliminates the necessity for individuals to own a private car, as they can conveniently plan and utilize various modes of transportation according to their specific needs and preferences.

Local car traffic regulation measures

In line with the NECP 2019, the ECCO-FF55 scenario emphasizes the prioritization of **policies aimed at limiting vehicle traffic within urban centres.** With the growing availability of alternative mobility services, such measures should be viewed as incentives for increased utilization of alternative modal solutions.

Effective coordination among relevant ministries and municipalities is essential to promote the adoption of traffic restriction measures in urban areas. This coordination is necessary to overcome regulatory delays associated with amendments to Decree Law 78 of 2022[139], which modifies Article 7.1 of the Codice della Strada[140] for the establishment of Limited Traffic Zones (LTZs) and Zero Emission Zones (ZEVs). Specifically, it is crucial that the ministerial decrees outlined in the aforementioned amendment are drafted, taking into account the impact of vehicle technologies. These decrees should extend and revise the pricing of traffic restriction zones to ensure an effective reduction in the circulation of the most polluting vehicles, which are less efficient in terms of greenhouse gas emissions.

5.3.3 MONITORING INDICATORS

Implementing a system to monitor the progress and effectiveness of interventions in relation to objectives is crucial for introducing necessary corrections to existing measures. The ECCO scenario identifies several indicators, many of which can be sourced from an existing public database with annual variability.

Indicators:

- Greenhouse gas emissions by mode of transport – Source: ISPRA
- Final energy consumption by mode of transport and type of fuel – Source: MEES/Eurostat
- Consumption of biofuels in transport – Source: ESM

[137] The Ws of MaaS: Understanding mobility as a service from a literature review (researchgate.net); Mobility as a Service: A Critical Review of Definitions, Assessments of Schemes, and Key Challenges (researchgate.net); A topological approach to Mobility as a Service - ICoMaaS Proceedings.pdf (lesscars.it)
[138] Il ventaglio della mobilità – Lesscars.it
[139] DECRETO-LEGGE 16 giugno 2022, n. 68 - Normattiva
[140] Servizi ACI - Art. 7. Regolamentazione della circolazione nei centri abitati.

- Fuel prices at the pump – Source: Mimit
- Emission intensity of the circulating vehicle fleet by type of vehicle – Source: ISPRA/Copert
- Trend in new vehicle registrations by emission bands – Source: Unrae
- Composition of the vehicle population and rate of motorisation – Source: ACI/Eurostat
- Numero punti di ricarica per tipologia e distribuzione territoriale - Fonte: Motus-e
- Replacement of the city bus fleet with electric buses – Source: Asstra
- Use of public transport and sustainable mobility rate – Source: Isfort/miscellaneous
- Adoption of restricted traffic zones in urban areas – Source: Isfort/miscellaneous
- Trend in shared mobility demand – Source: Sharing mobility observatory
- Progress of infrastructure projects for sustainable mobility – Source: Opendata Italiadomani

5.3.4 ESTIMATION OF INVESTMENT NEEDS

The ECCO-FF55 scenario projects investments in new vehicle purchases (including passenger cars, freight vehicles, and buses) totaling €422 billion for the period 2023-2030. This amount is approximately €65 billion less than the forecasts of the NECP scenario. The difference primarily stems from lower growth expectations in the BEV and PHEV markets in the ECCO-FF55 scenario, with projections of 3.5 million BEV units and 0.7 million PHEV units, compared to 4.3 million BEV units and 1.7 million PHEV units in the NECP scenario.

Within the ECCO-FF55 scenario, the estimates for investment in renewing the circulating car fleet amount to around €275 billion. Approximately €92 billion (33%) of this total is associated with the growth in BEV vehicle registrations.

VEHICLES / SCENARIOS	ECCO-FF55	NECP 2023
Electric vehicles (BEVs)	***92***	
Plug-in hybrid cars (PHEVs)	22	
Combustion Cars (ICE)	162	
Subtotal passenger cars	**275**	
Other Vehicles	147	
TOTAL	**422**	**525**

Table 11 – *Estimated investment in new vehicles*

According to Decree-Law No. 17 of 1 March 2022 (Article 22), €8.7 billion of public resources are allocated for the transition of the automotive sector, sourced from general taxation, forecasts of new revenues, and allocation of resources from reserve funds as outlined in Article 42 of the same decree. For the 2024 timeframe, fund resources totaling €2.7 billion have been allocated, with €1.95 billion earmarked for purchase incentives (Prime Ministerial Decree of 6 April 2022), of which approximately €1.2 billion remains unspent. Additionally, €750 million is allocated for the redevelopment and conversion of the automotive supply chain, in accordance with the Prime Ministerial Decree of 4

August 2022, sourced from facilities provided under the Contracts for Development and Agreements for Innovation[141]. Looking ahead to 2030, the remaining balance of the fund amounts to €6.75 billion.

The proposed reform of the current incentive scheme[142], suggests leveraging the inventories of the automotive fund to support private investments aimed at increasing the number of electric cars in the circulating vehicle fleet. This initiative also aims to lay the groundwork for an industrial policy focused on competitively transitioning the automotive sector towards electric vehicles.

However, to achieve the ultimate goal of transitioning to EVs, it is imperative to identify additional economic resources supported by appropriate financial instruments[143] These resources could potentially stem from the ongoing process of revising the objectives of the National Recovery and Resilience Plan (PNRR), as well as from a reassessment of environmentally harmful subsidies.

[141] Development contracts pursuant to art. 43 of Decree-Law No. 112 of 25 June 2008, converted, with amendments, by Law No. 133 of 6 August 2008: Innovation agreements activated under the Fund referred to in art. 23 of Decree-Law No. 83 of 22 June 2012, converted, with amendments, by Law No. 134 of 7 August 2012.
[142] Incentivi mobilità elettrica: quali? - ECCO (eccoclimate.org)
[143] Mappatura degli strumenti finanziari per la transizione green - ECCO (eccoclimate.org)

5.4 INDUSTRY SECTOR

The main characteristics of the industrial sector

- Net of emissions from energy industries, the Italian manufacturing sector contributes 22% of national greenhouse gas emissions[144] in 2021.
- In the period from 1990 to 2021 greenhouse gas emissions from Italian industry decreased by 35% both as a result of the implementation of climate policies, such as the EU ETS, and due to a reduction in production and the number of active companies, particularly after the economic crisis of the years 2008-2009.
- About 57% of emissions from the manufacturing sector fall within the EU ETS sectors, with the remainder in the ESR sectors, for which the national reduction target is in force [145]. This means that about 36 Mt CO_{2eq} fall within the national competence under Effort Sharing Regulation.

The greenhouse gas emissions reduction scenario

- The NECP scenario envisages a 24% reduction in energy emissions from the industrial sector by 2030 compared to 2021 levels, while the ECCO-FF55 scenario predicts a 37% reduction.
- The NECP scenario shows a final energy consumption by industry of 24.3 Mtoe by 2030, while in the ECCO-FF55 scenario a final energy consumption of 22.2 Mtoe is reached.
- To achieve this result, the proposed scenario assumes a progressive and constant improvement in the energy efficiency of production processes, the partial electrification of low and medium temperature heat, the use of green hydrogen, the allocation of a significant share of biomethane to industry and the conversion of the Ilva plant in Taranto with the DRI (Direct Reduced Iron) technology[146]. In contrast to the draft NECP, by 2030, in the ECCO-FF55 scenario it has also been assumed that CCS (Carbon Capture and Storage) technologies will not be used up to 2030.

Which policies by objective

- The NECP should include strategies for reducing emissions from the manufacturing sector in a dedicated chapter that address in an integrated way both production processes direct decarbonization and adequately support the demand for 'green' products.
- Specifically for the 2030 targets, it is considered necessary that the NECP includes:
  - Policies to support innovation and technologies for decarbonisation, also in *hard- to-abate* sectors
  - Policies for selectively stimulating the demand for low-carbon products.

[144] ECCO processing based on ISPRA data. In this document, the term industry refers to the manufacturing and construction sectors.
[145] ECCO elaborations starting from data "EU Emissions Trading System (ETS) data viewer", European Environment Agency, 27 July 2023 and "Italian Greenhouse Gas Inventory 1990-2021", ISPRA, 2023.
[146] Based on the updated assumptions of the scenario already published in the Taranto study, primary steel production, 2021.

Priority Enabling Policies

- In the case of industry, sectoral analyses that are able to capture the specificities of individual supply chains appear necessary to identify a framework of coherent policies aimed at decarbonisation, while safeguarding the competitiveness of companies, with targeted financial instruments and adequate social policies.
- Specific measures dedicated to SMEs appear to be a priority, in the light of the national industrial ecosystem.
- In the industrial sector, the time component plays a particularly significant role, with policies that must aim to take advantage of short-term reduction opportunities and set up the new decarbonisation solutions of the future.

The Italian industrial sector contributes to 22% of national greenhouse gas emissions[147]. In the period from 1990 to 2021 greenhouse gas emissions from Italian industry decreased by 35%[148]; there are multiple factors that contribute to this reduction:

- the adoption of the European Union's emissions trading system (EU ETS[149]) from 2005
- the adoption of energy efficiency measures at the European and national level
- the shift from higher emitting fossil fuels (coal and oil) to natural gas and renewables.

The decrease in production and in the number of active companies, in particular following the economic crisis of the years 2008-2009.

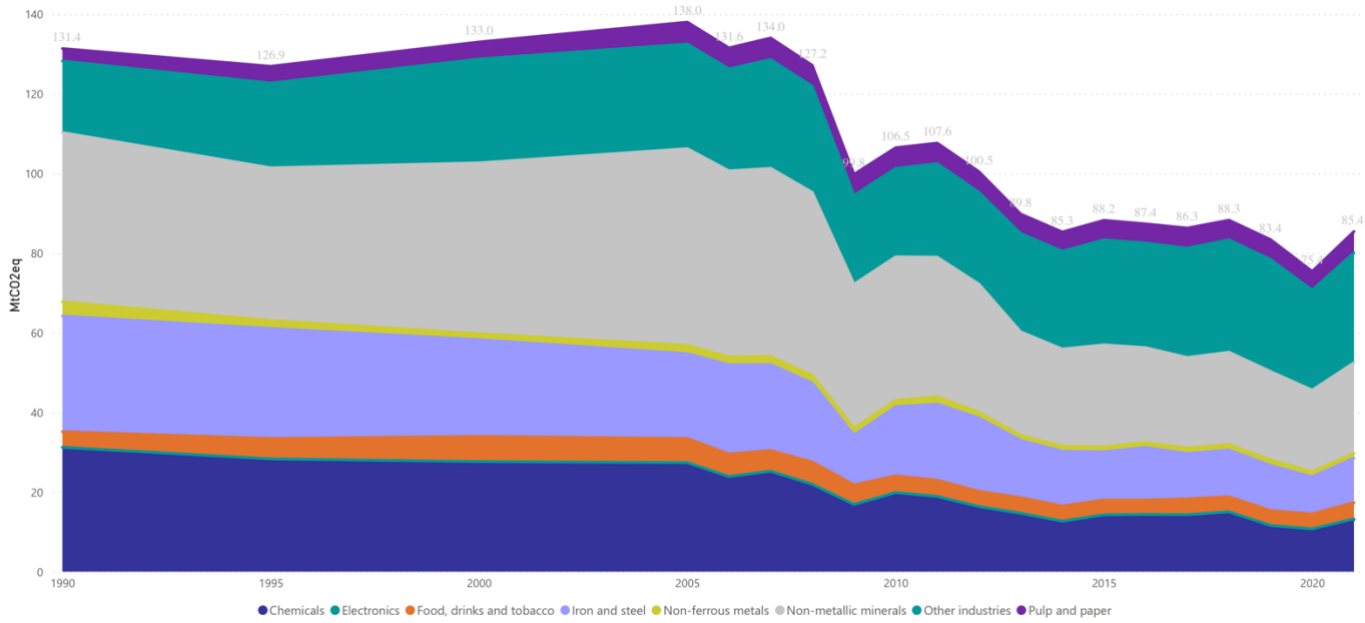


***Figure 29** – Trends in emissions from the industrial sector (MtCO2eq)*

National production plants can be distinguished between those subjects to the EU ETS Directive, i.e. electricity production plants and energy-intensive sectors (steel, chemical, paper, glass, bricks, cement, lime, etc.) and plants with installed power exceeding 20MW, for which, therefore, the

[147] ECCO elaboration based on ISPRA data.
[148] ECCO elaboration based on ISPRA data.
[149] "EU Emissions Trading System", European Commission. https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets_en

component of energy production is relevant. The other plants fall under the Effort Sharing Regulation.

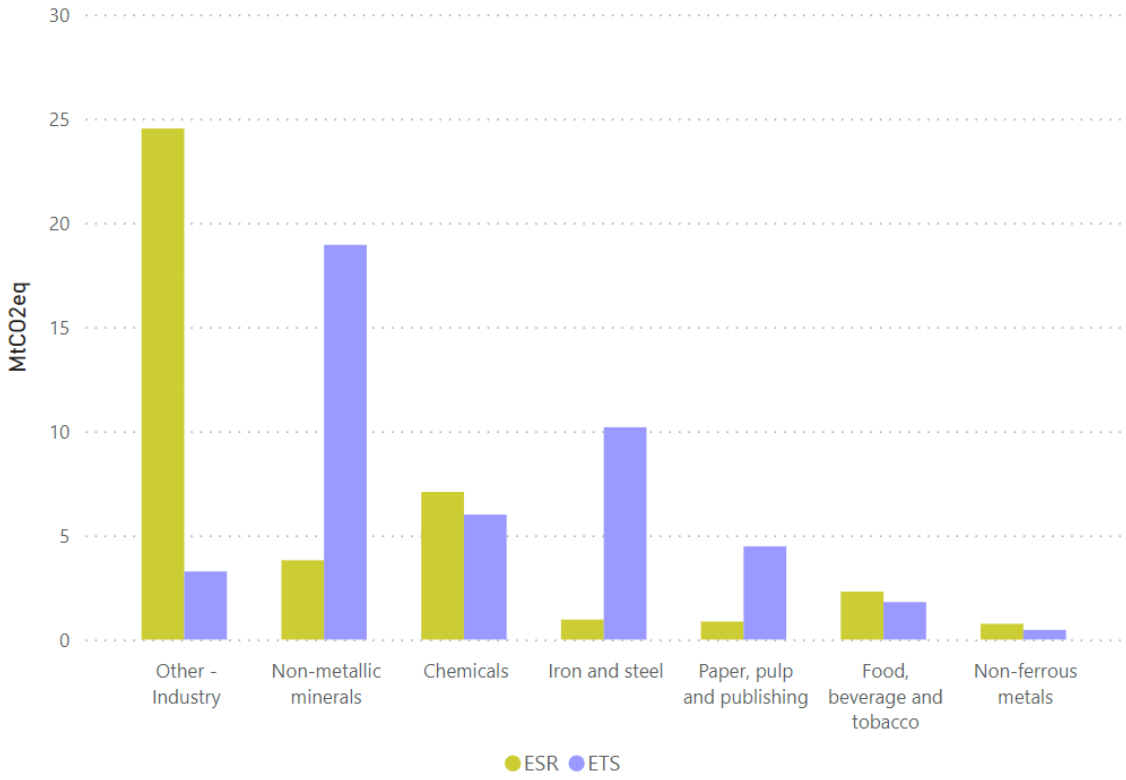


Figure 30 – *Greenhouse gas emissions from industry between sectors subject to the ETS and ESR regulations. The emissions of the individual sub-sectors are reported in absolute values in millions of tons of CO2eq and refer to the year 2021 – Source: ECCO elaboration based on ISPRA data.*

The national economy has been historically characterized by high levels of energy efficiency[150]. With the introduction of the EU ETS in 2005, industry began to reduce final consumption, which showed a more marked trend than value added, leading to a reduction in energy intensity, with an average annual rate from 2005 to 2019 of -2.7%. This reduction was also accompanied by a reduction in value added in the period 2007-2014 of 21% and +8.6% from 2014 to 2019.

Looking at historical data, moreover, the industry shows a rate of electrification of final consumption that in constant growth since 1990, with an acceleration since 2005. In this sector, electricity consumption accounts for 41.8% of final consumption in 2019[151].

[150] The International Energy Efficiency Scorecard still ranks Italy 5th in the world for performance of Energy efficiency of the economic system

[151] https://www.isprambiente.gov.it/files2021/pubblicazioni/rapporti/r343-2021.pdf

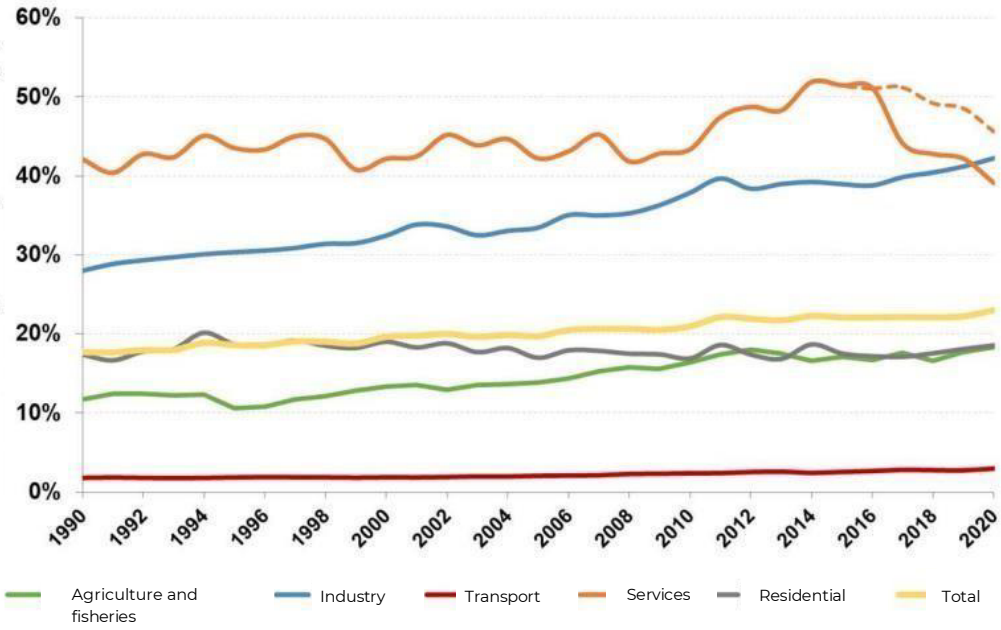


Figure 31 – *Trend in the share of electricity consumption in final energy consumption by sector. For services, the share net of final consumption for ambient heat from heat pumps is also reported (dotted line from 2017). Source ISPRA, 2022.*

The energy crisis that began at the end of 2021 had a direct impact on final energy consumption, that, in the industrial sector, recorded a decrease of 8% in 2022[152]. A significant part of the industry's savings can be explained by the change in the production mix in response to high energy prices. In industry, the share of companies with energy costs above 10% of turnover rose from just over 22% to almost 42%. However, the results of a survey by MBS Consulting Innovation Team and ECCO shows that some of the numerous interventions implemented in emergency will lead to reductions in structural consumption, especially for smaller companies. **The survey also shows that 70% of companies see further margins for reduction and 55% of them would be ready to face new investments to this end.**

For this reason, in the development of the ECCO-FF55 scenario, it was intended to specifically investigate the efficiency and electrification potentials that can be exploited for the achievement of the 2030 targets and which policies should be used for this purpose.

5.4.1 DESCRIPTION OF THE ECCO-FF55 SCENARIO

The ECCO-FF55 scenario, like the NECP scenario, was developed from data from 2021, the year in which the industrial sector emitted 85.4 $MtCO_{2eq}$, of which:

- 53.9 $MtCO_{2eq}$ are “energy" emissions, resulting from the combustion of fossil fuels
- 31.8 $MtCO_{2eq}$ are "non-energy" emissions, linked to chemical reactions in industrial processes.

[152] “Crisi energetica ed efficienza”, Osservatorio Energia. https://eccoclimate.org/wp-content/uploads/2023/10/Crisi-energetica-ed-efficienza-alcune-evidenze_articolo-MBS-ECCO.pdf

In 2021, the final energy consumption of the Italian industrial sector was 29.3 Mtoe (Figure 31 – Figure 32), divided into:

- 11.4 Mtoe of natural gas
- 6.8 Mtoe of other fuels (solid fuels, liquid fuels, renewable energy, biofuels, non-renewable waste)
- 10.3 Mtoe of electricity.

The consumption of natural gas and other fuels was calculated from UNFCCC (United Nations Framework Convention on Climate Change) inventories, net of the share of fuels used to produce electricity with cogeneration plants and the related losses. The data on electricity consumption were obtained from the National Energy Balance[153].

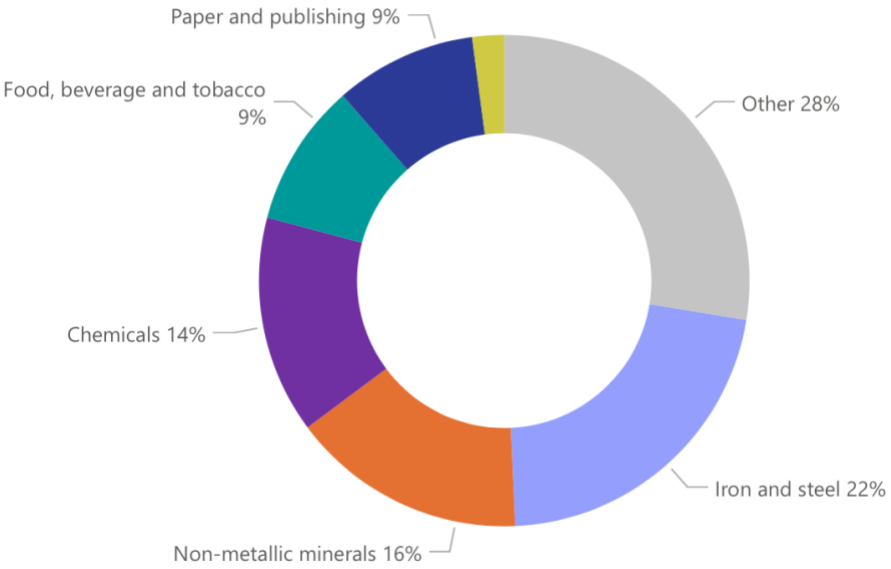


Figure 32 – *Energy consumption of Italian industry in 2021 by sector.*

Sector	% SME [154]	EE Consumption [Mtoe]	ET consumption for fuels [Mtoe]		ET consumption per temperature [Mtoe]			
			Natural gas	Other fuels[155]	T<100° C	100°C<T<150° C	150°C<T<500° C	T>500° C
Chemistry	98.5 %	1.2	1.7	1.3	0.5	0.2	0.9	1.4
Feed Beverages & Tobacco	99.8 %	1.3	0.8	0.7	0.8	0.5	0.1	0.06
Iron & Steel	96%	1.6	2.0	2.8	0.5	0.2	0.2	3.8

[153] "Simplified energy balances", *EUROSTAT*.
[154] "Local Units and Employees: Class of Employees, Economic Sectors (Ateco 3 Digits)", ISTAT.
[155] Consumption of liquid fuels, solid fuels, biofuels and biomass and waste has been grouped under "Other fuels".

Sector	% SME [154]	EE Consumption [Mtoe]	ET consumption for fuels [Mtoe]		ET consumption per temperature [Mtoe]			
			Natural gas	Other fuels[155]	T<100° C	100°C<T<150° C	150°C<T<500° C	T>500° C
Non-Ferrous metals	98.8 %	0.2	0.4	0.02	0.03	0.01	0.02	0.3
Non-metallic Minerals	99.8 %	0.8	2.4	1.3	0.3	0.5	0.2	2.8
Paper & press	99.8 %	0.8	1.9	0.01	0.8	0.2	1.0	0.02
Other	99.7 %	5.0	2.4	0.7	2.3	0.4	0.2	0.2

Tabella 2 – *Consumi di energia elettrica (EE) e termica (ET) dei settori dell'industria italiana nel 2021. I consumi di energia termica sono suddivisi in funzione della tipologia di combustibile utilizzato e del livello di temperatura alla quale è richiesto il calore. Elaborazione ECCO a partire da dati BEN e UNFCCC.*

As evident from Table 12, the electrification potential appears to be concentrated in the food, paper and "other" sectors, which encompasses several sub-sectors of industry, highly represented also in the population of non-ETS installations (Figure 29). Considering this data, therefore, policies aimed at exploiting this potential could contribute to the reduction of national emissions, minimizing to the reduction of the gap identified in the NECP proposal.

In the proposed scenario, a progressive and constant improvement in the energy efficiency of production processes has been assumed, with an average rate of improvement in emissions performance of 2.5% per year. This value was established on the basis of the rate of improvement of the sectoral *benchmark* values, developed by the Commission based on data reported by companies and developed to consider the technological improvement for the fourth phase of the EU ETS[156].

In the past, Italian industries have focused on basic measures that allowed for immediate results in terms of reducing energy costs, but there are opportunities for improvement through more advanced solutions with long-term returns[157]. These interventions mainly concern energy recovery and auxiliary systems for industrial application. Energy efficiency is also fostered by the adoption of monitoring and automation systems, such as Internet of Things (IoT) technologies, an integral part of Industry 4.0 transformation.

In addition to the energy efficiency measures integrated in the reference scenario, further actions are planned in the ECCO-FF55 scenario, namely:

- Electrification of part of the heat required at medium-low temperatures. In 2021, the industry consumed a total of 18.3 Mtoe of heat, of which an estimated 7 Mtoe at temperatures below 150°C. In the proposed scenario, it is expected that 50% of the industrial thermal demand at a temperature below 150°C, equal to 3.5 Mtoe, can be electrified with appropriate guidance and

[156] "Update of benchmark values for the years 2021-2025 of phase 4 of the EU ETS", European Commission, 12 ottobre 2021.
[157] Gianluigi Torchiani, "Italia già avanti nell'efficienza energetica nell'industria: ecco cosa si può ancora fare", Lumi, 28 gennaio 2020. https://www.lumi4innovation.it/about-us/

support policies. It is assumed that only direct heat will be electrified, while no intervention is made on heat from cogeneration. The cogeneration systems used in industry are, typically, highly efficient plants with high heat recovery, for which it is probable that there will be no substantial intervention by 2030. With this measure, it is possible to reduce 8.3 MtCO2eq by 2030 across all industrial sectors, considering the natural gas emission factor.

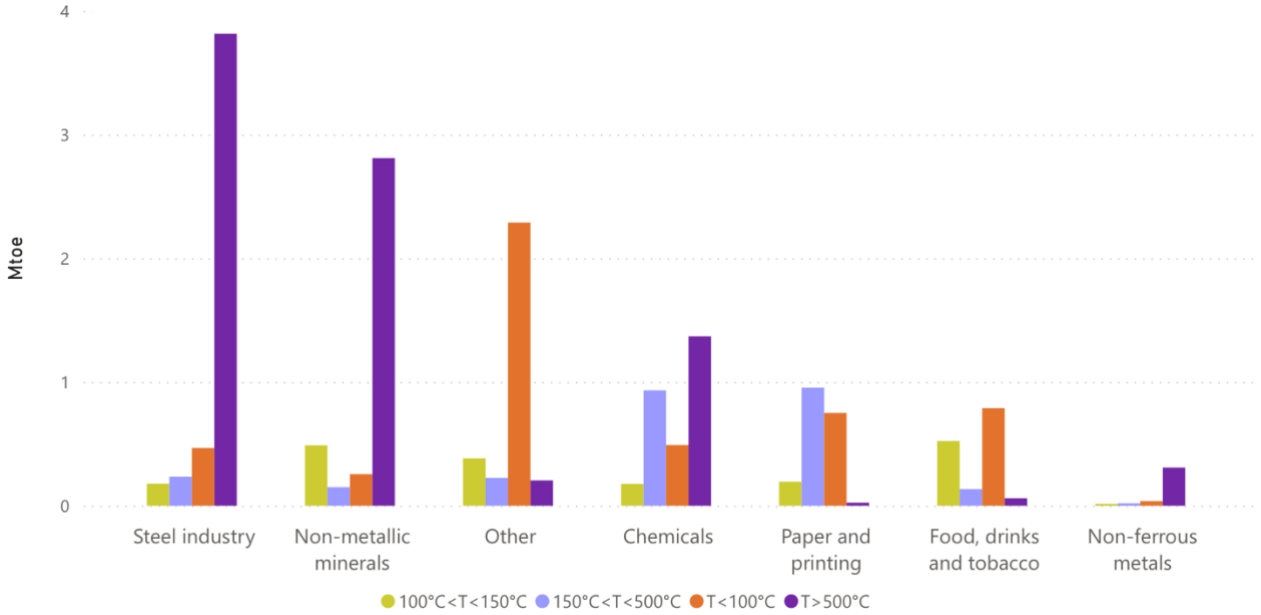


***Figure 33** – Thermal energy consumption of the Italian industrial sectors divided by temperature levels in the 2021*[158].

- Use of biomethane. In substitution of natural gas, an increasing consumption of biomethane is assumed, equal to 1.5 billion cubic meters by 2025 and 3.3 billion cubic meters by 2030. The NECP estimates an availability of biomethane from renewable biomass at 5.7 billion m3 by 2030; 57% of this has been allocated, hypothetically, to the industrial sector. This measure reduces emissions by 6.5 MtCO2eq by 2030 across all sub-sectors[159].
- An increasing consumption of green hydrogen. It is assumed that the green hydrogen produced by electricity generation will be used for steel, chemical and petrochemical industries and the refining, for a total of 8 TWh by 2030[160] and a reduction in emissions of 1.6 MtCO2eq, considering the emission factor of natural gas.
- The conversion of the ILVA plant in Taranto to the DRI technology. In this scenario, the conversion of the former Ilva plant in Taranto to DRI technology is envisaged. This conversion,

[158] Processing of ECCO data from the NFCCC, National Energy Balance and Kosmadakis, Georg; «Estimating the potential of industrial (high-temperature) heat pumps for exploiting waste heat in EU industries", Applied Thermal Engineering, 20 April 2019.
[159] That figure is based on two fundamental assumptions, namely the assumption of the biomethane potential equal to that of the NECP (for which reference should be made to the considerations expressed in the box on biofuels) and an allocation of the quantities of biomethane to industry which, in the case of biomethane being fed into the network, should be verified.
[160] This figure is one of the results reported in the study "Development of a transition pathway towards a close to net-zero electricity sector in Italy by 2035", Artelys in collaboration with ECCO, June 2023. https://eccoclimate.org/wp-content/uploads/2023/06/Development-of-a-transition-pathway-towards-a-close-to-net-zero-electricity-sector-in-Italy-by-2035_19giugno.pdf

based on the sectoral scenarios developed by ECCO[161], implies the initial use of natural gas, possibly blended with hydrogen, to power DRI plants, with a gradual transition to the exclusive use of green hydrogen. By 2030, it is estimated that 6 Mt of steel will be produced using the DRI technology, with a blend of 90% - 10% natural gas and green hydrogen. By 2030, this measure will result in a reduction of 2 MtCO2eq in total[162].

Under these assumptions, in the ECCO-FF55 scenario, natural gas consumption decreases from 11.5 Mtoe in 2021 to 7.6 Mtoe in 2030 (Figure 34). Energy efficiency and electrification measures account for a large part of the reductions in gas consumption and emissions, as well as the consumption of biomethane and green hydrogen. On the other hand, the conversion of the ILVA steel mill in Taranto to the DRI technology, partly fueled by natural gas, leads to an increase in gas consumption in the medium term. In the long term (post-2030) it is expected that the natural gas used to power the DRI plants will be completely replaced by green hydrogen, leading to the elimination of both natural gas consumption and greenhouse gas emissions.

In the proposed scenario, the electricity consumption of the industrial sector decreases from 11 Mtoe in 2021 to 9.1 Mtoe in 2030. This reduction is the result of a combination of energy efficiency measures, which reduce electricity consumption, and an increased electrification of production processes.

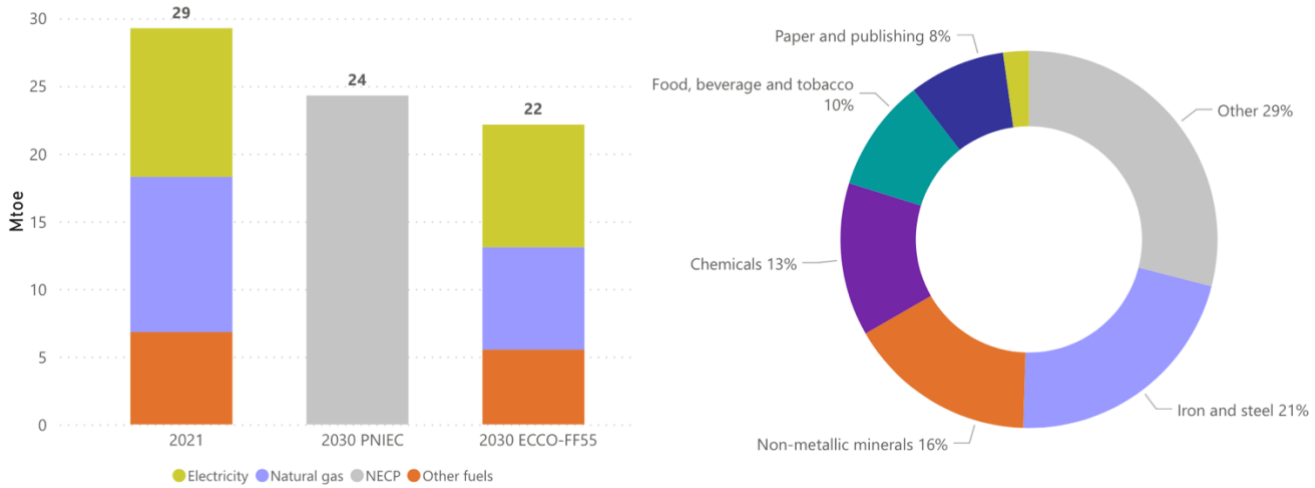


Figure 34 – *Comparison between the CO2eq emissions of the Italian industrial sectors and % contributions to 2030 in the scenario ECCO- FF55.*

In the ECCO-FF55 scenario, the greenhouse gas emissions of Italian industry are equal to 82.6 $MtCO_{2eq}$ in 2025 and 67.2 Mt in 2030 (Figure 35). This value shows a 37% decrease compared to 2021 (-49% compared to 1990).

[161] "A green steel strategy", ECCO, August 2022.
[162] It is noted that part of the emissions related to ILVA's industrial complex and, in particular, those arising from the production of coke, are accounted for in the energy industries.

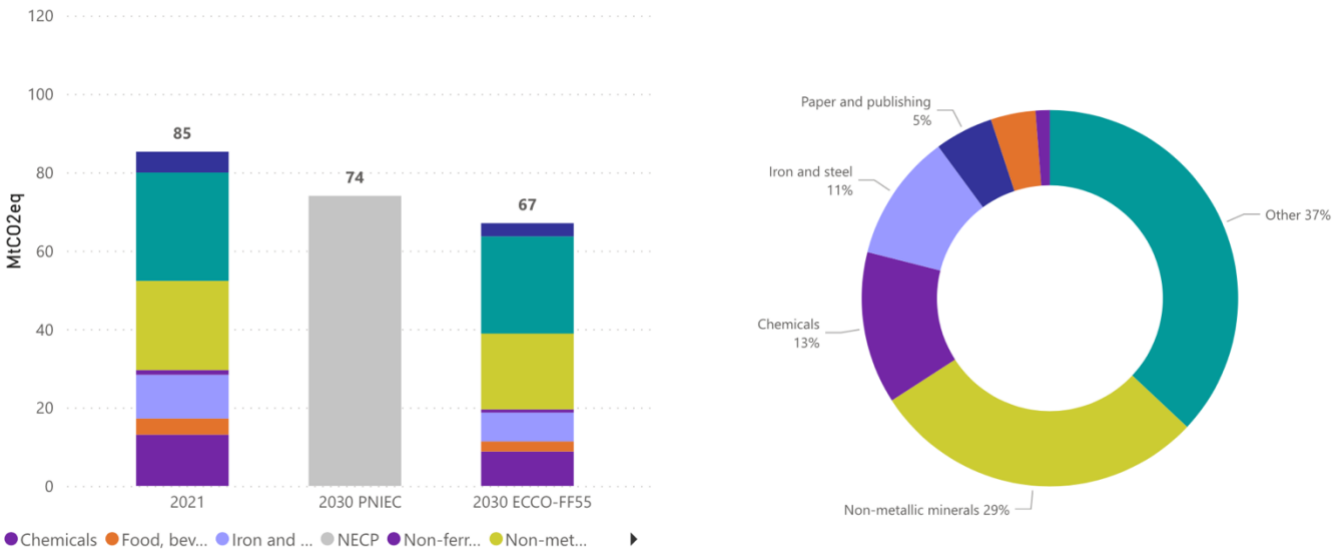


Figure 35 – *Comparison between the CO2eq emissions of the Italian industrial sectors and % contributions to 2030 in the scenario ECCO- FF55.*

5.4.2 POLICIES AND MEASURES UNDERPINNING THE ECCO-FF55 SCENARIO

As mentioned in Chapter 4, due to the importance of the industrial sector, the policies for its decarbonisation should be part of a dedicated chapter in the Plan andgrouped by macro-objectives.

The necessary policies for transition should take maximum account sectoral specificities and, at the same time, identify cross-cutting measures that can accelerate technological innovation and support companies in making necessary investments.

A NECP for industry should include measures to reduce greenhouse gas emissions, but also to preserve the competitiveness of industry and jobs. A chapter dedicated to the decarbonisation of industry should identify the analytical tools and policies for the management of industrial transformation related to decarbonisation according to two main guidelines, namely:

- Policies to support innovation and decarbonisation technologies, **including for hard-to-abate sectors.**
- Policies to **selectively support the demand for decarbonised products** in synergy with the policies to promote the circular economy.

The Plan should also identify possible tools to analyse the **links between innovative production chains,** highlighting the opportunities and risks arising from the acceleration towards the uptake of zero/low emission technologies, to encourage the adoption of **policies for the management of industrial transformation,** including in terms of employment.

SUPPORT FOR INNOVATION AND TECHNOLOGIES TO REDUCE EMISSIONS

Promotion of energy efficiency and electrification of consumption

There is need for clear guidance and support for companies to invest in innovative technologies to reduce emissions, which are often characterized by high risks and investment costs. In the same way, it is necessary to better address existing policies which, in addition to the 'energy efficiency'

component, can enhance that of reducing emissions. This is important especially to accelerate the decarbonisation of industrial plants falling under the Effort sharing Regulation, but not only that, contributing substantially to the achievement of national objectives.

The instruments listed below and referred to in the NECP have multiple destinations or objectives and do not always explicitly combine energy efficiency requirements with decarbonisation requirements. In the NECP, it would be necessary to organize and prioritize these schemes, as well as make changes based on the effectiveness of already implemented measures to improve efficiency or electricity consumption **prioritise and possibly modify these schemes in relation to the effectiveness.** The modalities of access to funds should be simplified and, as far as possible, linked to a single instrument and implementing body, rather than being fragmented. In this context it is necessary to recognize the peculiarities of SMEs and to give them easier access to funding. In addition, the energy price signal induced by the presence or absence of the EU ETS scheme should be adequately considered in policy-making.

1. White Certificates[163]

The White Certificates Mechanism promotes energy efficiency in sectors such as industry, infrastructure and services. It consists of issuing certificates, known as TEE (Energy Efficiency Certificates – Titoli di Efficienza Energetica), after the implementation of significant energy saving interventions. One TEE corresponds to the saving of one ton of oil equivalent (toe). Electricity and gas distributors with more than 50,000 end customers (obliged entities) must comply with primary energy savings obligations and achieve annual targets. This can be done through energy efficiency projects or the purchase of TEEs from third parties, in particular energy service companies (ESCOs).

Since its introduction, the mechanism has certified energy savings of 29.1 Mtoe and released 57.7 million TEE[164]. In recent years, there has been a sharp decline in TEE recognized and certified savings[165]. The 2019 NECP provided *for the continuation of the process of updating and strengthening the White Certificates Mechanism with the aim to simplifying and optimising the methodologies for quantifying and recognizing energy* savings, reducing the time for the approval, issuing and offering of TEE on the market[166].

In line with that purpose, the NECP 2023 could include a relaunch of this scheme that provides a reward for those interventions that, in addition to increasing energy efficiency, allow a reduction in direct greenhouse gas emissions. In this way, the mechanism of White Certificates would be functional not only to improve efficiency, but also to achieve objectives for both ETS and ESR companies.

2. Industrial Trasition Fund[167]

The objective of this fund is to help the Italian production system to adapt to EU policies for combating climate change. The Fund has a budget of 300 million €, half of which is reserved for

[163] "White Certificates", ESM. https://www.gse.it/servizi-per-te/efficienza-energetica/certificati-bianchi
[164] Annual Report on White Certificates 2022, *GSE*.
[165] Annual Report on White Certificates 2022, *GSE*.
[166] "Piano Nazionale Integrato per l'Energia e il Clima", Ministry of Economic Development, December 2019.
[167] Industrial Transition Fund, Invitalia. https://www.invitalia.it/cosa-facciamo/sosteniamo-grandi-investimenti/fondo-transizione-industriale

energy-intensive companies. The subsidies are granted in the form of a non-repayable contribution to companies that carry out interventions to improve energy efficiency in the execution of their activities and/or efficiency in the use of resources, through reducing the use of the same also through reuse, recycling and use of recycled raw materials. The Fund also encourages the installation of plants for the self-production of energy from RES, hydrogen and high-efficiency cogeneration plants. However, interventions that lead to an increase in the production capacity of the plant are not permitted. The Fund has a wide range of actions and is clearly focused on the financing low-risk interventions. The fund's focus on electrification and measures to reduce the sector's direct emissions could create a favorable environment for the decarbonisation of industry.

3. Green 5.0 transition

This is an intervention of more than €4 billion introduced in the revision of the National Plan of Recovery and Resilience of July 2023. Transition 5.0 is a digital innovation scheme to support the green transition in the production system. It will be implemented via a tax credit mechanism and will cover a wide range of economic sectors, including tourism. The objectives are the acceleration of the transformation of instrumental assets and the production processes of companies and the promotion of the creation of new plants and the expansion of those already in place for the production of energy from renewable sources. Projects that aim to reduce energy consumption in production processes, replace the use of fossil fuels, reduce emissions into the atmosphere, promote the recovery of critical raw materials and promote circularity in production processes through a more efficient use of resources are encouraged. The decisive direction of these resources towards interventions in line with the DNSH (Do No Significant Harm) principle, with precise indications of induced and direct emission reductions, could have significant impacts, considering the propensity of companies towards this type of intervention[168].

4. National Energy Efficiency Fund[169]

This instrument promotes the interventions necessary to achieve the national energy efficiency objectives achieved by companies and the Public Administration. The Fund has a budget of 310 million € and is divided into two sections: the granting of guarantees on individual financing projects (30%) and the provision of loans at subsidized rates (70%). Invitalia is in charge of managing the Fund. The reduction of energy consumption in industrial processes is one of the supported interventions. As far as companies are concerned, the Fund appears to be complementary and partially overlapping with other listed measures, for which its contribution should be weighed against the results achieved and the greater or lesser efficiency compared to the other instruments presented here.

5. Thermal Account

The Thermal Account incentivizes interventions to increase energy efficiency and the production of thermal energy from renewable sources for small-scale plants. The beneficiaries are mainly public administrations, but also companies and individuals, who will be able to access funds for 900 million

[168] According to the results of the survey referred to in the preamble, according to which as many as 70% of companies see room for a reduction in gas demand and with or without incentive policies, 55% are ready to invest in this direction.
[169] "Fondo Nazionale Efficienza Energetica", Ministry of Environment and Energy Security. https://www.mase.gov.it/energia/efficienza-energetica/fondo-nazionale-efficienza-energetica

euros per year. In order to optimize dedicated tools for efficiency in enterprises, the instrument based on performance indicators should be revised to this end.

6. Sustainable Growth Fund

The Sustainable Growth Fund (FCS – Fondo per la Crescita Sostenibile) is intended to finance programmes and interventions with a significant impact at national level on the competitiveness of the production system with multiple purposes:

- Promotion of research, development and innovation projects
- strengthening the production structure and re-launching areas of national importance that are in complex crisis through the signing of program agreements
- the promotion of the international presence of companies and the attraction of investments from abroad.

Such a very articulated fund should see a close correlation between the measures and interventions promoted and the policies envisaged in the NECP.

7. Sabatini green

The Sabatini green measure is an incentive offered by the Ministry of Enterprise and Made in Italy aimed at simplifying the obtaining of finance by companies, with the aim of enhancing the competitiveness of the national production sector. Part of the financial allocation of this measure is earmarked for investments with a reduced environmental impact for micro, small and medium-sized enterprises. This provision concerns "green investments" related to the purchase of machinery and plants with "low environmental impact" that improve the eco-sustainability of products and production processes. These measures could be expanded and made more targeted, favoring efficiency and electrification projects.

8. Support for electrification in plants that are under to the EU ETS Directive

The latest revision of the EU ETS Directive provides that Member States (Art. paragraph 1), in the transposition of the directive, may allow installations that fall below the thresholds for inclusion in the emissions trading system, due to electrification interventions, to remain subject to the rule and, therefore, ensure that the investment pays off through the free allocation of CO2 emission allowances. It is hoped that in the transposition of the law, the Government will decide to allow this possibility, favoring companies that electrify process heat and reduce their emissions.

Support for innovation in Hard to Abate sectors

1. Financing instruments for innovative technological solutions

In interventions that involve the adoption of particularly innovative solutions, it is necessary to establish a form of risk-sharing between private and public investors and to support, in addition to CapEx, OpEX[170]. Una form of support can be Carbon Contracts for Difference (CCfD). CCfDs make it possible to ensure investments in decarbonisation technologies and the associated economic return,

[170] See Paragraph 3.2.

absorbing the risk of eventual failure. A Carbon Contract involves an agreement between the Government or an institution and a private producer to set a carbon price (strike price) for a specific period. If the market price is lower than the agreed price, the government pays the difference to the producer; if the market price is higher, the private sector returns the surplus to the government. These contracts balance the price volatility of CO2 emissions and reduce the risk associated with investments.

This form of investment support is suitable to cover both CapEX and OpEX and, for this reason, it has also been accepted as a financing methodology for Innovation Fund's projects, since the last revision of the EU ETS Directive. By extending the scope of this fund, this methodology can finance particularly risky investments and support private investment through public guarantees.

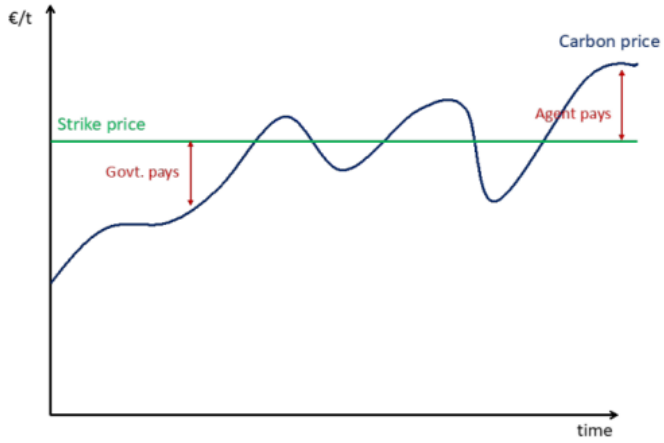


***Figure 36** – Schematization of the operating principle of Carbon Contracts for Differences* [171].

Conversion of the former ILVA in Taranto

The NECP mentions the conversion of the ILVA plant but apart from this it does not reflect which strategy will be pursued to this end. Although the NECP claims to have taken this conversion into account, it does not explicitly outline the steps and expected effects. In the investment chapter, the financial requirements for the conversion are not specified, nor are its timelines, expected social consequences (to be considered in the estimation of the Plan's socioeconomic impacts), or the just transition measures to be undertaken, aside from mentioning the Just Transition Plan. In previous studies[172], ECCO has analysed the technological, economic and social feasibility of the conversion, identifying DRI technology as a possible mature technological solution for a full conversion of the production process.

The establishment of the company DRI d'Italia seemed to be moving towards implementing the conversion of the production site from blast furnaces to DRI, using funding from the NRRP (National Recovery and Resilience Plan). However, with the July 2023 revision, the € 1 billion allocated to DRI d'Italia for initiating the conversion process has been removed from the Recovery and Resilience Plan and, currently, there is no certainty about the fate of these resources and which alternative funds will

[171] "Carbon Contracts for Differences: their role in European industrial decarbonization", Climate Friendly Materials Platform, September 2020.
[172] "A green steel strategy", ECCO, August 2022. https://eccoclimate.org/wp-content/uploads/2022/09/REPORT-ACCIAIO-Una-strategia-per-lacciaio-verde-en.pdf
e "Taranto, primary steel production in the challenge of decarbonisation", ECCO, November 2021. https://eccoclimate.org/wp-content/uploads/2021/11/Taranto-eng-1.pdf

be used. The revision of the NECP could provide an opportunity to plan conversion interventions that can combine the economic and social sustainability of investments with the environmental sustainability of the project.

The role of hydrogen in industry

Regarding the role of hydrogen, the results of the study carried out by ECCO in collaboration with Artelys were considered as input for the elaboration of the ECCO-FF55 scenario, where the assumptions and the simulations' result of a substantially decarbonised electricity system by 2035 are presented[173]. This report shows a production of 8 TWh of green hydrogen by 2030 due to overproduction of electricity from renewable sources. In the ECCO-FF55 scenario, it is assumed that all this hydrogen will be destined to the steel, chemical, petrochemical and refinery sectors. In this regard, it is evident how the decarbonisation of the electricity sector enables that of other sectors, specifically, industry. The policies referred to in chapter 6.1.2 relating to renewable energy production also enable the transformation of industry. Complementary to these policies are those related to the promotion of green hydrogen from the NRRP (National Recovery and Resilience Plan) and REPowerEU (EU Communication COM).

BOX 5 – THE NECP AND THE ROLE OF CCUS TECHNOLOGIES

Carbon Capture and Storage (CCS) involves a series of processes that encompass the separation of CO_2 from energy sources or emitted gas streams and its transport to a storage location for long-term confinement. Alternatively, CO_2 can also be employed in industrial processes for the production of chemicals, construction materials, or fuels, which is referred to as Carbon Capture and Use (CCU).

Internationally, there are 40 operational commercial facilities applying CCUS to industrial processes, fuel treatment, and energy generation, with a combined capture capacity of 45 million metric tons of CO_2 annually[174]. Announcements have been made for over 50 new capture facilities expected to be operational by 2030, capturing an additional 125MtCO_2 annually. However, as of June 2022, final investment decisions had been made for only 10 of these projects.

Additionally, the International Energy Agency states that even if all 50 announced new facilities were to be built, the use of CCUS would remain a marginal technology for achieving net-zero carbon emissions by 2050. In the NECP proposal, these technologies are associated with different uses, such as the decarbonisation of the electricity system, hydrogen production, and the reduction of emissions in hard-to-abate industrial sectors, in particular, cement, chemicals and steel. The Plan indicates that targets for CO_2 capture and storage will be established based on available storage capacity, without providing quantification of the captured emissions by 2030, the planned capture methods and the related CO_2 management (geological storage or use in industrial processes).

[173] "Development of a transition pathway towards a close to net-zero electricity sector Italy by 2035", ECCO e Artelys. https://eccoclimate.org/programme/energy/

[174] "Carbon Capture, Utilisation and Storage", IEA. https://www.iea.org/energy-system/carbon-capture-utilisation-and-storage#tracking

CCUS technologies are characterized by high investment and operational costs (in particular energy costs) which, at the moment, are limiting their large-scale adoption, as also emerged from a series of interviews with various large industrial entities conducted by ECCO last year. Furthermore, CCS does not contribute to secondary targets for the reduction of emissions, which characterise, for example, thermal power plants and integral cycle plants for steel production. The transition to renewable energy sources and production processes that do not require the use of coal allows to achieve results in terms of reduction of greenhouse gas and pollutant emissions, with positive local effects.

Given the multiple uncertainties related to these technologies, in the development of the ECCO-FF55 scenario ECCO has decided not to consider their application by 2030.

With a broader horizon, it is considered that a priority group of sectors entitled to use the available carbon storage capacity should be identified– such as, for example, the cement and lime industrial sectors –and these solutions should be used where no alternatives are available. More cost- effective technologies are available for the decarbonisation of the electricity system and to produce hydrogen, as highlighted in the previously illustrated scenarios. In these areas, focusing on CO_2 capture and storage, rather than aiming for a drastic reduction in emissions at source, requires the implementation of a complex management and control system both from a technological and governance point of view.

REDUCING PRODUCT DEMAND AND SELECTIVELY SUPPORT PRODUCTS WITH LOW CARBON FOOTPRINT

The decarbonisation of materials requires the reduction of emissions during production processes and the creation of a market for low-carbon products.

As far as the reduction of the demand for raw material products is concerned, the reference of the NECP to the Circular Economy Strategy is a good starting point. However, there is a lack of specific policies aimed at reducing and selectively encouraging demand for such products.

For example, the introduction of a **deposit return system** (DRS) would significantly improve the recycling of plastics, glass and metal, while meeting Europe's circular economy objectives. Some countries that have already implemented DRS have achieved positive results; for example, the PET collection rate in DRS countries is 90%, while in Italy it is 46%[175]. The DRS not only increases the collection rate, but it also allows waste streams to be effectively separated while promoting high-quality recycling.

With regards to selective support for '*low-carbon*' products, the intervention of the public sector through the Green Public Procurement is essential to stimulate the creation of a *low-carbon* market and the market uptake of these products. However, at the moment the **Minimum Environmental Criteria** (MECs) do not include specific requirements for products with a low carbon footprint. The introduction of constraints in MEC for the use of "*low carbon*" products makes it possible to stimulate demand and maintain the competitiveness of companies. It is also necessary to establish shared European standards and certifications to define when a product can be considered "*low carbon*".

[175] "PET collection rates across Europe", Unesda.

Currently, these criteria do not include the carbon variable in a systematic way, so a revision is needed in this regard, starting from the ongoing review processes at MASE.

5.4.3 ESTIMATION OF INVESTMENT NEEDS

Estimating the overall amount of investments required for decarbonization in the industry is a complex exercise, primarily from a conceptual point of view. What we commonly call the "industrial sector" is, in fact, a heterogeneous set of production sectors, each with very different processes and technologies and interconnected through articulated supply chains.

The assessment of the investments necessary to decarbonise the economy is subject to considerable variability, also in relation to the methodologies used. On the latter, the IPCC (Intergovernmental Panel on Climate Change) distinguishes between a "*broad*" and a "narrow" definition of investment. The term 'broad' refers to investments in technologies that can be adopted and purchased directly by end-users, such as cars or heating and air conditioning systems. The "narrow" definition, on the other hand, focuses on the specific components or subsystems incorporated into the broader applications available to end users, such as compressors, vehicle engines and heat generators. These two definitions do not directly align and generally produce incomparable results. The order of magnitude of investments under the "broad" definition is significantly higher (a multiple of 6 – 10 times) compared to that derived from the "narrow" definition. It is therefore not surprising that efforts to calculate investments using a *bottom-up approach* (based on the collection and analysis of specific technologies) are often inconsistent with *top-down* estimates obtained from integrated macroeconomic-climate models, which instead refer to aggregated economic and sectoral categories. In the industrial context, the challenge becomes even more complex as the need to reduce greenhouse gas emissions must be balanced with the need to preserve the productivity and competitiveness of companies. These targets are heavily influenced by many factors, including environmental constraints, costs, and energy price volatility.

As part of the assessment related to the ECCO-FF55 scenario, three components have been considered to calculate the investments necessary to reduce greenhouse gas emissions in industry by 2030:

1. Investments in energy efficiency
2. Electrification of final energy consumption
3. Initiation of the conversion to DRI technology of the former Ilva plant in Taranto

ENERGY EFFICIENCY MEASURES

The estimations of investments required for energy efficiency interventions, are made according to the "Energy Efficiency Report" by Politecnico di Milano [176]. The report forecasts an investment of 23.1 billion euros between 2021 and 2030 leading to a reduction in final energy consumption in the industrial sector of 5,367 ktoe, thanks to energy efficiency measures. This results in a specific investment of €4.3 million per ktep of reduced energy consumption through energy efficiency measures.

[176] "Energy efficiency report 2023", Politecnico di Milano.

In the ECCO-FF55 scenario, a reduction in energy consumption of 4,830 ktoe is achieved between 2023 and 2030 thanks to energy efficiency measures, resulting in a cumulative investment of € 16.2 billion.

ELECTRIFICATION OF FINAL ENERGY CONSUMPTION

In the ECCO-FF55 scenario, it is projected that between 2023 and 2030, 3.5 Mtep of heat required at temperatures below 150°C will be electrified. Considering an investment cost of electrification technologies of between € 0.1 and € 0.3 million per MW of thermal[177] and an operation of 6,000 hours per year, the necessary investment will range between € 0.5 and € 2.3 billion, depending on the solution adopted (electric boilers, solar thermal, electric industrial heat pumps).

As of now, the emission comparison between, for example, a gas boiler and a heat pump of equal performance is clearly in favor of the latter technology. The replacement of a 30MW gas boiler with a heat pump can decrease carbon emissions from about 40kCO_2/year down to 15.6kCO_2/year. It is evident that with the advancement of renewable sources in the electricity sector, there is a progressive decarbonisation of other sectors of the economy, including industry.

CONVERSION OF THE FORMER ILVA PLANT TO DRI TECHNOLOGY

To estimate the investments required for the conversion of the Taranto steel production plant from coal-fired blast furnace to DRI technology, the following costs were considered:

1. DRI plant: An estimated investment of 2.5 billion euros is estimated for the construction of the DRI plant, which by 2050 will produce 8 million tons of steel per year, including the construction of direct reduction units, electric arc furnaces and pelletizers. This does not include the costs of decommissioning existing blast furnaces and layout changes.
2. Hydrogen storage systems: To ensure safety and continuity of operation, it is necessary to store an amount of hydrogen sufficient to power five working days, i.e. 6.8kt of hydrogen. An investment of € 4.4 to € 5.9 billion is estimated for hydrogen storage systems.

The sum of these cost items leads to a total investment of between 6.9 and 8.4 billion euros for the complete conversion of the former Ilva steel plant in Taranto to DRI technology powered by green hydrogen. The cost of electrolysers has been allocated to the electricity sector as it is assumed that the hydrogen needed to power the steel mill will come from renewable overgeneration.

By 2030, a production of 6 Mt is estimated using DRI technology with a mixture of natural gas and 90% - 10% green hydrogen.

Therefore, to start the conversion and produce by 2030 6Mt of steel/year using DRI technology with a natural gas-hydrogen blend at 90%-10% respectively, a total investment of € 2.8 - 2.9 billion is estimated.

It should be noted that initially the National Recovery and Resilience Plan (NRRP) envisaged an investment of 1 billion euros for the implementation of projects for the production of pre-reduced iron through the DRI process powered by green hydrogen. However, after an amendment in July

[177] "Long term projections of techno-economic performance of large-scale heating and cooling in the EU", *European Commission*.

2023, these resources were removed from the plan, and it is currently unclear whether they will be maintained and allocated in what ways and timeframes.

In conclusion, considering also the investments needed for energy efficiency and electrification, the total estimated investment to achieve the industry's targets ranges between 18.9 and 20.8 billion euros, equal to an average of 2.7 – 3 billion euros per year, simplifying basic assumptions as much as possible. It should be noted that the draft revision of the NECP reports a cumulative investment for industry of € 12.6 billion for the period 2023 – 2030, which is about half of the estimated investment in the ECCO-FF55 scenario. No details are provided regarding the methodology used for the estimation and the cost items considered. It is not clear, for example, how such a modest investment can be sufficient despite the extensive use of CCUS technologies, systems characterized by very high investment costs.

BOX 1 – THE ASSESSMENT OF SOCIOECONOMIC IMPACTS OF THE TRANSITION – THE EMPLOYMENT IMPACT OF THE CONVERSION OF THE FORMER ILVA IN TARANTO

Within the socioeconomic impact assessment of the of the Plan, the evaluations related to industrial transformation should have a specific focus. In the 2030 Plan, there should be greater consideration of the impacts of the conversion of the Taranto site, which is included among the proposed interventions by 2030.

In previous studies[178], ECCO has analysed the employment repercussions associated with to the conversion to green hydrogen-based DRI (Direct Reduced Iron) technology of the former Ilva steel plant in Taranto, where steel is currently produced using the integrated coal cycle.

Currently, there are 8,200 employees working at the Acciaierie d'Italia plant in Taranto, of which 5,000 work in the hot area [179]. The adoption of DRI technology results in a reduction in the level of employment as it requires fewer plants for steel production, and consequently, fewer workers are needed to operate them. The current workforce exceeds the actual need of the plant, if it was to be converted to DRI and achieve a production level of 8 million tons of steel per year.

Literature suggests that a DRI plant requires between 227 and 400 employees to produce one million tons of steel per year[180], resulting in a total workforce ranging from 1,816 to 3,200 people, with a surplus of 1,800 to 3,184 employees.

Producing the necessary hydrogen on-site opens up the possibility of developing a hydrogen supply chain. According to the Preliminary Guidelines of the National Hydrogen Strategy, the Italian government plans to install approximately 5 GW of electrolysis capacity by 2030, double what is necessary for the conversion of the Taranto steel plant. Based on these guidelines, the impact on employment in Taranto, linked exclusively to hydrogen production, could result in the creation of about 100,000 temporary jobs during the construction phase and 50,000 permanent

[178] "A green steel strategy", ECCO, August 2022. https://eccoclimate.org/wp-content/uploads/2022/09/REPORT-ACCIAIO-Una-strategia-per-lacciaio-verde-en.pdf
e "Taranto, primary steel production in the challenge of decarbonisation", ECCO, November 2021. https://eccoclimate.org/wp-content/uploads/2021/11/Taranto-eng-1.pdf
[179] "Proposta di soluzione tecnica per il rilancio dello stabilimento di Taranto", Federmanager, May 2020.
[180] "Proposta di soluzione tecnica per il rilancio dello stabilimento di Taranto", Federmanager, May 2020.

jobs. The significant investment required for hydrogen-based DRI technology is therefore justified by various advantages, including the reduction of greenhouse gas and pollutant emissions, as well as the establishment of a local hydrogen supply chain with positive impacts on employment.

The analysis described shows the implications of the different technological choices with respect to the production and employment reconfiguration of the site. Although such analysis may not be included in the Plan, it should at least refer to analyses addressed in other programming documents, such as, for example, the measures regarding the phase out of coal, mentioned in the Plan.

6 CONCLUSIONS AND RECOMMENDATIONS

The Integrated National Energy and Climate Plan is a key tool for setting up a national strategy for the decarbonisation of the economy, but also for setting up an economic recovery consistent with national and international climate objectives. The need for this study arises from the need to broaden the horizon of the Plan, increase its ambition and offer a design that makes it implementable, more concrete and integrated with the country's strategic, economic and financial planning tools.

The NECP proposal sent to Brussels by Italy last July does not meet the emission reduction and energy efficiency targets and declares that it intends to use suchproposal as a basis for further sectoral in-depth analyses to raise the level of ambition until the final version due by June 2024.

In addition to the level of ambition, attention should be paid to the implementation of actions to reduce emissions and the concrete realisation of the ambitions expressed. For the concrete achievement of the climate and energy objectives, the lack or ineffectiveness of policy implementation against the targets is at least as significant as the stated levels of ambition.

In fact, the European Court of Auditors' report on the EU's energy and climate targets notes that of the 2,053 policies and measures declared by Member States, only 1,391 (68%) have been implemented and that the effects on emission reductions are explicit for only 474 policies. There is a lack of assessment at EU and national level of the costs and benefits of policies and which policies and why they have actually been implemented.

In addition to the ambition and implementation instrument for Energy and Climate Policies, the NECP should provide guidelines for greater coherence in the development and implementation of its policies and strategy, as well as in the assessment of the effectiveness of public spending, especially for the broad public interest of the policies and measures it contains.

To this end, it is considered necessary for the NECP2024 to respond to the following recommendations:

1. **The *governance* of the Plan is the essential element for its implementation.** The NECP should be approved by means of an implementing regulatory instrument, e.g. a CIPESS deliberation. The coordination and implementation body of the Plan should be placed at the highest decision-making levels and establish a close dialogue with the different levels of government, both central and local. This steering committee should also coordinate with stakeholders in various capacities involved in the implementation of the Plan and evaluate and adjust policies and measures with respect to objectives over time.
2. **The measures of the NECP should be accompanied by strategies for their implementation.** The NECP should clearly identify priority sectoral policies, based on an explicit assessment of the effects achieved so far and the policy objectives to be pursued. For each measure, in addition to the effectiveness in reducing emissions or deploying renewables, the Plan should report the necessary financial needs and how these are met, as well as the expected socio-economic impacts, at least in terms of costs and benefits, and clearly identify the stakeholders and locations responsible for implementing the measures and how they are included in the decision-making process.
3. **The NECP should include a sectoral chapter dedicated to the manufacturing industry.** Due to the strategic importance of the manufacturing sector in the country's economy and the technological, economic and social challenge that its transformation implies, it is considered

essential that the NECP makes explicit in a dedicated chapter the decarbonisation strategy for the manufacturing industry that, as much as possible, deepens specific sectoral analyses, which highlight the risks and opportunities offered by the acceleration towards innovation of the supply chains imposed by the decarbonisation of the economy.

7 ANNEX I – EXAMPLE OF THE 'FLAGSHIP MEASURES' TABLE FOR THE NECP

#	Objective of the measure or policy	Estimated financial needs to 2030	Source of funding	% Public Coverage	Financing instrument	Leverage (% private inv)	Socio-economic impact	Monitoring indicators	Governance of the measure
	Brief description of the objective of the measure	*Estimation of the overall financial needs of the measure*			*Taxation, incentives, subsidies, loans, etc.*		*Scope and assumptions within which the measure is defined*		*Entities - reference stakeholders to be involved in the design of measures*
1	***Efficiency promotion energy in buildings***	*228 billion*							
1.1	*Efficiency improvement of private residential buildings*	*193 billion (~ 27 billions/year no)*	*From the State Budget*	*~ 53%*	*Incentive - (eco)bonus*	*~ 47%*	*Objective – Upper middle class* *Direct impacts to consider - number of workers, supply chains affected*	*Renovation rate/average primary consumption kWh/sqm/share of consumption covered by renewables/no. of electric heat pumps installed/*	*E.g. MEES, ENEA, Condominium administrators, AssoESCO, ANCE/Federcostruzioni*
1.2	*Efficiency improvement of public buildings (e.g. schools, public residential)*	*20 billion (~ 2.8 billions/year no) for schools*	*From the state budget or from EU ETS auction proceeds (one-off to start the fund)*	*100%*	*Subsidised financing - Revolving fund*		*Objective - all citizens.* *Direct impacts to consider - workers and supply chains Interested*	*No. of redeveloped schools with energy performance index/Rate of redevelopment/ amount of renewable energy vs. consumption*	*E.g. Fund managed by ESM-MEES, Local Administrations (ANCI), AssoESCO, etc.*

#	Objective of the measure or policy	Estimated financial needs to 2030	Source of funding	% Public Coverage	Financing instrument	Leverage (% private inv)	Socio-economic impact	Monitoring indicators	Governance of the measure
	Brief description of the objective of the measure	*Estimation of the overall financial needs of the measure*			*Taxation, incentives, subsidies, loans, etc.*		*Scope and assumptions within which the measure is defined*		*Entities - reference stakeholders to be involved in the design of measures*
1.3	*Public housing*	*€ 15 billion for public housing*	*Social Climate Fund (max 7 (billion) ETS 2 (Max 15 billion)*	*100%*	*Non-repayable grant*		*Objective - disadvantaged social classes - reduction of energy poverty. Direct impacts to consider - workers and supply chains affected*	*Energy Poverty Indicators/Renovation Rate/No. of New Dwellings Made Available with Energy Classification/Average Energy Cost*	*E.g. Fund managed by ESM-MEES. To be involved: ANCI; ANCE, AssoESCO, etc.*
1.R	***Enabling measure: Correction of gas-electricity tariff imbalance.*** *The estimated revenue is between €5.8 and €6 billion/year and can be achieved through reform of the parafiscal system of energy bills. This revenue can be reinvested to finance the transition of the civil and transport sectors*								
2	***Decarbonisation of steel production from ore (ILVA)***	*€2.8-2.9 billion (the figure includes the construction of the DRI and related plants. It does not include the mitigation of the socio-economic impacts implied by the conversion plan, nor those of layout modification and remediation of the site)*							
2.1	*Support for the creation of DRI production capacity*	*€ 2,8-2,9 billion*	*[NRRP]*	*36% (da attuale assetto societario)*	*Contributo a fondo perduto + CCfD*	*36% (from current corporate structure)*	*Direct impacts - new jobs*	*CO2 emissions/Emissions of other pollutants/Production level with DRI technology/number of employees*	*MEES, MIMIT, trade unions, EELL, company*

#	Objective of the measure or policy	Estimated financial needs to 2030	Source of funding	% Public Coverage	Financing instrument	Leverage (% private inv)	Socio-economic impact	Monitoring indicators	Governance of the measure
	Brief description of the objective of the measure	*Estimation of the overall financial needs of the measure*			*Taxation, incentives, subsidies, loans, etc.*		*Scope and assumptions within which the measure is defined*		*Entities - reference stakeholders to be involved in the design of measures*
2.R	***Mitigating the socio-economic impact of the transition to DRI***	*€ 0,8 billion*	*Just Transition Fund*	*100%*	*Non-repayable grant*		*Direct impacts - Employment of 2-3 thousand people with complete conversion of the plant*	*Number of employees/ Number of employees on redundancy fund*	*MEES, Agency for Territorial Cohesion, trade unions, EELL*
3	***BEV Mobility***								
3.1	*Public electric charging infrastructure*	*>1,7 billion*	*NRRP*	*Not more than 40%*	*Non-repayable grant*	*Not less than 60%*	*Direct impacts - Employment increase*	*No. of public charging infrastructures installed*	*MIT, MEES, suppliers, etc.*

#	Objective of the measure or policy	Estimated financial needs to 2030	Source of funding	% Public Coverage	Financing instrument	Leverage (% private inv)	Socio-economic impact	Monitoring indicators	Governance of the measure
	Brief description of the objective of the measure	*Estimation of the overall financial needs of the measure*			*Taxation, incentives, subsidies, loans, etc.*		*Scope and assumptions within which the measure is defined*		*Entities - reference stakeholders to be involved in the design of measures*
3.2	*Replacement of the circulating fleet in favour of BEV - Private Mobility*	*91,6 billion*	*Automotive Fund*	*2% - 5%*	*Non-repayable contribution to the purchase*	*95% - 98%*	*Objective - Upper middle class* *Direct impacts to consider - number of workers, supply chains affected*	*CO2 emissions from transport - Electric car market trend*	*MIMIT - MEES - Producer associations - consumer Ass.ni, etc.*
3.3	*Wallbox installation*	*3,5 billion*	*Automotive Fund*	*2%-5%*	*Non-repayable contribution to the purchase*	*95% - 98%*	*Objective - Upper middle class* *Direct impacts to consider - number of workers, supply chains affected*	*CO2 emissions from transport - Electric car market trend /Nr. fixtures*	*MIMIT - MEES - Producer Associations - Consumer ass.ni, etc.*

#	Objective of the measure or policy	Estimated financial needs to 2030	Source of funding	% Public Coverage	Financing instrument	Leverage (% private inv)	Socio-economic impact	Monitoring indicators	Governance of the measure
	Brief description of the objective of the measure	*Estimation of the overall financial needs of the measure*			*Taxation, incentives, subsidies, loans, etc.*		*Scope and assumptions within which the measure is defined*		*Entities - reference stakeholders to be involved in the design of measures*
3.4	*Replacement of the circulating fleet in favour of BEVs - Electrification of company fleets*	*TBD in relation to the specific measure and the period of implementation*	*Reform of environmentally harmful subsidies*	*tbd*	*Tax*	*tbd*	*Objective - Businesses and professionals* *Direct impacts to consider - number of workers, supply chains affected*	*CO2 emissions from transport - Electric car market trend*	*MEF, MEES, trade associations (e.g. ANIASA)*
3.R	***Car tax reform:** a reform of car taxation by adopting measures aimed at encouraging the choice of zero-emission cars, penalizing at the same time, choices of polluting cars, i.e. a reform that provides for the modulation of taxes on purchase (registration) and possession (stamp duty) with respect to CO2/km emissions. Since these are taxes collected at regional level and by the Autonomous Provinces on the basis of local regulations, it is believed that the NECP should provide for the preparation of a general policy document aimed at revising taxation in agreement with local governments.*								

GLOSSARY

BAT – Best Available Techniques.

BEV – Battery Electric Vehicle.

Capacity market – Mechanism by which Terna procures capacity through long-term procurement contracts awarded through competitive bidding.

CCfD – Carbon Contract for Difference. Type of contract that can be used, for instance, to support manufacturing processes that are carbon neutral.

CIPESS – Italian Interministerial Committee for Economic Planning and Sustainable Development (*Comitato Interministeriale per la Programmazione Economica e lo Sviluppo Sostenibile*)

CITE – Interministerial Committee for Ecological Transition (*Comitato Interministeriale per la Transizione Ecologica*)

CSCA – Climate and Environment Scientific Council (*Consiglio Scientifico per Clima e Ambiente*)

CSDDD – Corporate Sustainability Due Diligence Directive. EU Directive, whose aim is to impose due diligence obligations on large companies with regard to their actual and potential adverse impacts on human rights and the environment.

CSRD – Corporate Sustainability Reporting Directive. EU Directive, whose aim is to obligate large and listed companies to share information on how they monitor a wide range of ESG issues and their impact on our planet.

Demand Response: Consumers' capacity to change the power consumption of an electric utility in the short-term to better match the demand for power with the supply.

Direttiva CCS: Directive 2009/31/EC. European directive providing a legal framework for CCS (*Carbon Capture and Storage*) practices.

Energy Efficiency Directive: Directive (EU) 2012/27. EU Directive that established a reduction target forprimary and final energy consumption of 32.5% at the European level by 2030.

Direttiva Emissions Trading: Directive 2003/87/CE establishing a system for greenhouse gas emission allowance trading within the EU.

Renewable Energy Directive (RED1): Directive 28/2009/CE, it set the EU's goals on renewables, to be achieved by 2020. The Renewable Energy Directive (RED2 – Directive 2018/2001/EU set the new energy and climate goals adopted by the European Council in 2014 and to be achieved by 2030.

DNSH – Do No Significant Harm. Binding principle – necessary to access RRF Funds – which ensures that an investment in an activity that has an environmental or social goal does not significanclty harm any environmental or social objectives.

Effort Sharing Regulation: EU 2018/842 Regulation which sets an emission reduction target of 40% in specific sectors at the European level, compared to 2005 levels.

ENEA: Italian National Agency for New Technologies, Energy and Sustainable Economic Development (*Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile*).

EPBD: Energy Performance of Buildings Directive (2010/31/EU). It aims to achieve a fully decarbonised building stock in the EU by 2050.

ESG – Environmental, Social and Governance. Series of criteria concerning a company's environmenta and social sustainability as well as their governance.

EU Green Deal: Legal framework for the achievement of climate neutrality in the European Union by 2050. It was promulgated in December 2019.

FIT FOR 55: Package which includes a set of reforms for reducing emissions by at least 55% by 2030 compared with 1990 levels. The package is part of the EU Green Deal.

Governance Regulation: Regulation EU 2018/1999, which includes the necessary elements to track progress in the implementation of EU climate legislation.

GSE – Italian state-owned energy service system operator (*Gestore dei Servizi Energetici*)

IPCC – Intergovernmental Panel on Climate Change.

ISPRA – Italian National Institute for Environmental Protection and Research (*Istituto Superiore per la Protezione e la Ricerca Ambientale*).

JTF – Just Transition Fund.

JTM – Just Transition Mechanism.

LTS – Long Term Strategy.

LTZ – Limited Traffic Zones.

LULUCF – Land Use, Land-Use Change and Forestry.

Maas – Mobility as a service. Mobility concept that allows users to plan, reserve and pay different private and public mobility services such as car sharing and public transportation.

MASE – Italian Environment and Energy Security Ministry (*Ministero dell'Ambiente e della Sicurezza Energetica*).

MEF – Italian Economy and Finance Ministry (*Ministero dell'Economia e delle Finanze*).

NDC – Nationally Determined Contribution.

NECP – National Energy and Climate Plan.

NextGenEU (or Ngeu): Next Generation EU. European instrument to support Member States' economic recovery following the 2020 Covid-19 crisis.

NFRD – *Non-Financial Reporting Directive* (2014/95/UE) that requires the disclosure certain types of non-financial and diversity information (ESG) by large public-interest companies (with more than 500 employees) in EU Member States in their yearly management reports.

NPBs – National Promotional Banks. Banks that are created by a country's government and that provide financing for the economic development of the country.

NRRP – National Recovery and Resilience Plan

OIPE – Italian Observatory on Energy Poverty (*Osservatorio Italiano sulla Povertà Energetica*).

PHEV – Plug in Hybrid Electric Vehicle. Electric vehicle which is equipped with both a battery and an internal combustion engine.

PNACC – Italian National Plan for Adaptation to Climate Change (*Piano Nazionale di Adattamento ai Cambiamenti Climatici*).

RePowerEU – EU Communication COM(2022)230, published on 18 May 2022, to ensure EU independence on natural gas imported from Russia.

RES – Renewable Energy Source.

RRF – Recovery and Resilience Facility. Defined by Regulation (EU) 2021/241 and which provides Member States with financial support to recover from the Covid-19 pandemic.

SCF: Social Climate Fund (SCF), established with the EU 2023/955 Regulation

SFDR – Sustainability Finance Disclosure Regulation. Regulation (EU) 2019/2088 concerning the disclosure on ESG risks and impacts by finance operators, such as insurance companies.

TJTP – Territorial Just Transition Plan.

UNFCCC – United Nations Framework Convention on Climate Change.

ZEV – Zero Emission Vehicle.

THE ITALIAN CLIMATE CHANGE THINK TANK

This document has been edited by:

Chiara Di Mambro, Head of Decarbonisation Policy, ECCO
chiara.dimambro@eccoclimate.org
Francesca Andreolli (Chapters 5, 5.1 and 5.2), Senior Researcher Energy & Building, ECCO
francesca.andreolli@eccoclimate.org
Massimiliano Bienati (Chapter 5.3), Transport Lead, ECCO
massimiliano.bienati@eccoclimate.org
Lorenzo Carrozza (Chapter 3.1 revision), Senior Policy Advisor Parliamentary Affairs, ECCO
lorenzo.carrozza@eccoclimate.org
Gabriele Cassetti (Result systematisation and rendering), Senior Researcher Energy Systems, ECCO
gabriele.cassetti@eccoclimate.org
Giulia Colafrancesco (Chapter 3.3), Senior Policy Advisor Governance & Just Transition, ECCO
giulia.colafrancesco@eccoclimate.org
Simone Gasperin (Chapter 4 and revision of chapter 3.3), Senior Associate Industry, ECCO
simone.gasperin@eccoclimate.org
Michele Governatori (Chapter 5.1), Power & Gas Lead, ECCO
michele.governatori@eccoclimate.org
Beatrice Moro (Chapter 3.2), Senior Policy Advisor Sustainable Finance, ECCO
beatrice.moro@eccoclimate.org
Mario Noera (Chapter 3.2 and revision of chapter 3.3), Senior Associate Finance, ECCO
mario.noera@eccoclimate.org
Giulia Novati (Scientific contribution for chapter 4 and 5.4), Research Associate Industry, ECCO
giulia.novati@eccoclimate.org
Giulia Signorelli (Chapter 5.1), Researcher Decarbonisation, ECCO
giulia.signorelli@eccoclimate.org
Matteo Leonardi (Supervision), Co-founding Director, ECCO
matteo.leonardi@eccoclimate.org

The opinions expressed in this document are solely those of ECCO Think Tank, author of the report.

For interviews or more information on the use and dissemination of the content in this report, please contact:

Andrea Ghianda, Head of Communications, ECCO
andrea.ghianda@eccoclimate.org
+39 3396466985

www.eccoclimate.org

Date of publication:
05 December 2023