



Addendum to the Report on Italy's Climate Targets and Policies in Relation to the Paris Agreement and Global Equity Considerations

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This addendum was prepared at the request of A Sud, in the context of legal proceedings brought against the Italian State, for the purpose of assessing the contribution of the Italian State towards meeting the Paris Agreement temperature goal, in line with the principles of equity and common but differentiated responsibilities as enshrined in that agreement.

1. Introduction

Since finalising the report entitled *Italy's Climate Targets and Policies in Relation to the Paris Agreement and Global Equity Considerations* (henceforth referred to as Climate Analytics (2021)), a number of agreements and papers have been published which bear relevance to the case against the Italian State, as well as to the report itself. This addendum provides an update to the original report in the context of these recent publications. Although the science underlying the original report is unaffected by recent events, we deem it relevant to the Court to provide a short synopsis of how these publications relate to the original report. In so doing, this addendum is divided into five sections (of which the first is this introduction). Section 2 will provide a summary of the Glasgow Climate Pact, signed by Italy in November 2021. Section 3 will summarise the most recent publication of Rajamani et al. The fourth section will assess the EU's updated climate targets, while the fifth section will implement the methodology used for country-level responsibility for warming to Italy. Finally, definitions of terms and abbreviations in this addendum are provided in the glossary of the original report.

2. Glasgow Climate Pact

The outcome document of COP26, known as the Glasgow Climate Pact, was signed by Italy and 196 other countries in November 2021. The document reinforces the long-term temperature goal (LTTG) of the Paris Agreement and emphasises limiting global warming to 1.5°C, stating that the Conference of Parties “recognizes that the impacts of climate change will be much lower at the temperature increase of 1.5 °C compared with 2 °C, and resolves to pursue efforts to limit the temperature increase to 1.5 °C.”¹ This clearly establishes 1.5°C as the long-term limit of the Paris Agreement, reflecting the best available science and the analysis provided in the Climate Analytics (2021) report.

In order to achieve this, the agreement recognises that limiting global warming to 1.5°C requires “rapid, deep and sustained reductions in global greenhouse gas emissions, including reducing global carbon dioxide emissions by 45 per cent by 2030 relative to the 2010 level”.² The emissions reduction scenarios underpinning the global 45% benchmark are categorised as pathways with “no or limited overshoot of 1.5°C” in the IPCC’s Special Report on Global Warming of 1.5°C (SR1.5),³ and are the same as those used in Climate Analytics (2021) to analyse the level of emissions reductions required by Italy to be 1.5°C compatible.

¹ UNFCCC, *Glasgow Climate Pact*, Decision 1/CP.26, <https://unfccc.int/sites/default/files/resource/cop26_auv_2f_cover_decision.pdf>, at para. 16; UNFCCC, *Glasgow Climate Pact*, Decision -/CMA.3, <https://unfccc.int/sites/default/files/resource/cma3_auv_2_cover%20decision.pdf>, at para. 21.

² *Ibid*, at para. 17; *Ibid*, at para. 22.

³ Rogelj, J., et al, Chapter 2: Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development, in *Global Warming of 1.5 C: An IPCC special report on the impacts of global warming of 1.5 C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change*, (eds. Masson-Delmotte, V., et al) (IPCC, 2018) https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_Chapter2_Low_Res.pdf, at p. 95.

The 45% emissions reduction below 2010 levels by 2030 represents the global average of emission reductions that countries collectively need to achieve to meet the Paris Agreement’s LTTG, according to the IPCC’s “no or limited overshoot” 1.5°C pathways. Applying the global average reduction rate from these pathways for the period 2020-2030 to Italy’s emissions from 2020 would require a reduction in greenhouse gas emissions of 63% below the 2010 level by 2030 (see Figure 1). As Italy’s 2010 emission levels are almost identical to its 1990 emissions, this 63% reduction figure remains the same if 1990 is used as the base year instead of 2010. In other words, for Italy to achieve the global average reduction rate implied by the Glasgow Climate Pact’s 45% benchmark, Italy would need to reduce its emissions by 63% by 2030 compared to 1990/2010.

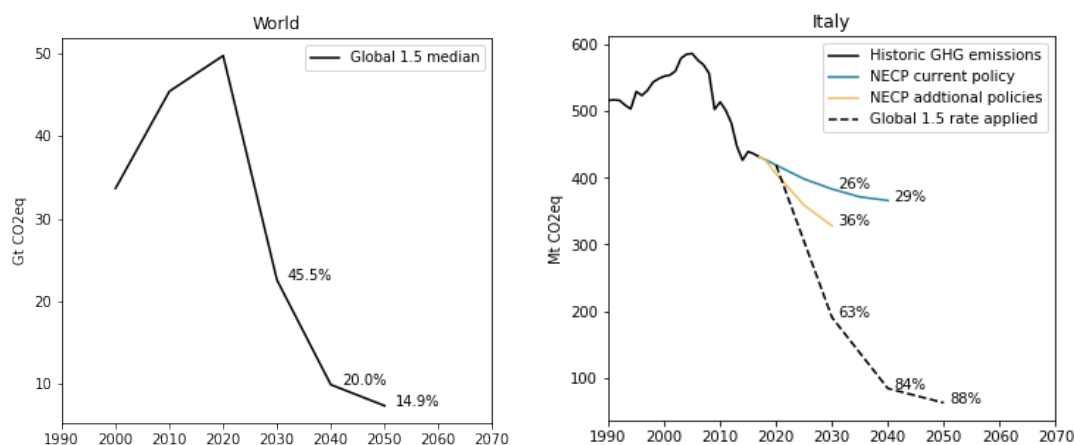


Figure 1 | Global median of 1.5°C greenhouse gas pathways from the IPCC SR1.5 (left) and average greenhouse gas emission reductions from the IPCC SR1.5 applied to Italy’s projected emissions under existing policies (right). The percentages in the left panel are the percentage reduction in emissions compared to 2010 emission levels; those in the right panel are compared to 1990/2010 emission levels (the two values are within 3Mt of each other and thus provide similar percentage reductions). Emissions from land use, land use change and forestry are excluded.

However, as described in Climate Analytics (2021), this level of emissions reduction would not be in line with Italy’s fair share contribution to the achievement of the Paris Agreement LTTG. According to the principle of Common But Differentiated Responsibilities and Respective Capabilities (CBDR-RC), it is necessary for developed countries, who have greater financial resources and larger shares of historical emissions, to take the lead in mitigating global warming. The Glasgow Climate Pact clearly recognises that achieving such rapid and deep emissions reductions “requires accelerated action in this critical decade, on the basis of the best available scientific knowledge and equity, reflecting common but differentiated responsibilities and respective capabilities”⁴.

For developed country governments, aligning with the Paris Agreement temperature goal can be done through a combination of domestic emissions reductions and funding or other forms of support for emissions reductions abroad. To be consistent with the modelled 1.5°C compatible scenarios that underpin the pact, Italy, as a developed country, would need to achieve faster domestic emissions reductions this decade than the global average (implying an emissions reduction by 2030 of *more than* 63% compared to 1990/2010) if the 1.5°C target is to be met. As reported in section 5.7 of Climate Analytics (2021), Italy would need to achieve emissions reductions of at least 92% by 2030 compared

⁴ Ibid, at para. 23.

to 1990 to be in line with the Paris Agreement’s LTTG and principles of equity and Common But Differentiated Responsibilities, which are highlighted in the Glasgow Climate Pact. In section 3 of this addendum, we present a significant recent paper that analyses national fair shares in line with principles of international environmental law, which leads to even higher necessary emission reduction contributions for Italy.

The Glasgow Climate Pact notes “*with serious concern*”⁵ that current global actions are falling far short of what is required to achieve the long-term temperature goal, and “*requests Parties to revisit and strengthen the 2030 targets in their nationally determined contributions as necessary to align with the Paris Agreement temperature goal*”.⁶ This is a call to action on all governments. The pact also recognises “*that enhanced support for developing country Parties will allow for higher ambition in their actions*”⁷ and “*urges developed country Parties to provide enhanced support...to assist developing country Parties with respect to both mitigation and adaptation*”.⁸

This means that implementation of the Glasgow Climate Pact requires commitment to a work programme which aims to strengthen mitigation ambition. Central to this are updated nationally determined contributions (NDCs) that align with the Paris Agreement’s temperature goal,⁹ which are to be submitted by the end of 2022 and will provide an important gauge of countries’ ambition towards achieving the 1.5°C long-term temperature goal. For Italy, this will require a significant ratcheting up of domestic emission reductions and international climate finance in order to meet its fair share under the Paris Agreement and Glasgow Climate Pact.

3. Rajamani et al.

Submission based on the findings of Rajamani, L., *et al*, *National ‘fair shares’ in reducing greenhouse gas emissions within the principled framework of international environmental law. Climate Policy* **21**(8), 983–1004 (2021).

A recent contribution to the literature, entitled *National ‘fair shares’ in reducing greenhouse gas emissions within the principled framework of international environmental law*, examines the ambition level required of countries according to principles of international environmental law (hereafter referred to as the “IEL ambition assessment”).¹⁰ The approach relies on a similar methodology as set out in Chapter 5 of Climate Analytics (2021), which is also applied by the Climate Action Tracker.¹¹ Similar to the methodology set out there, the paper performs a synthesised analysis of all the effort sharing categories set out by the IPCC in its Fifth Assessment report, and identifies an appropriate

⁵ Ibid, at para. 25.

⁶ Ibid, at para. 29.

⁷ Ibid, at para. 39.

⁸ Ibid, at para. 40.

⁹ Ibid at para. 29.

¹⁰ Rajamani, L., *et al*, *National ‘fair shares’ in reducing greenhouse gas emissions within the principled framework of international environmental law. Climate Policy* **21**(8), 983–1004 (2021).

<<https://doi.org/10.1080/14693062.2021.1970504>>.

¹¹ www.climateactiontracker.org.

ambition level for countries from the perspective of ensuring that the sum of individual contributions is collectively compatible with the Paris Agreement's LTTG. The IEL ambition assessment is the first peer-reviewed study to apply principles of international environmental law to quantify and interpret fair share emission ranges for individual countries. It is also worth noting that some of the scientists who are among the authors of this paper have been involved in developing the fair share methodology set out in Climate Analytics (2021). Furthermore, some of the scientists involved in developing the fair share methodology and IEL ambition assessment co-authored the study which provides the basis for the effort sharing analysis of the IPCC in its Fifth Assessment report (see references in section 5.1 of Climate Analytics (2021)).

Two main differences exist between the methodology applied in the IEL ambition assessment and the methodology used in Climate Analytics (2021).

First, on the basis of the legal principles on which it relies, the IEL ambition assessment excludes approaches to effort sharing that are based on cost-effectiveness and grandfathering, on the basis that these approaches are not in line with principles of international environmental law.¹² Excluding these approaches usually leads to a lowering of the fair share range for developed countries¹³ (see section 3.2 of Rajamani et al. for the methodology of determining fair share ranges for each country). Second, it relies on a scenario inference method for determining the necessary level of ambition within the fair share range,¹⁴ which is different from the method set out in section 5.6 of the Climate Analytics (2021) report to assess the same.¹⁵

The ambition levels for individual countries which result from this approach are nonetheless comparable to those that result from the methodology in Climate Analytics (2021). In Figure 2 we provide an update of Figure ES.2 from the original report to include the results from the IEL ambition assessment (depicted with a horizontal dark blue line labelled 'Rajamani et al. 1.5°C').¹⁶

¹² Rajamani, L., *et al.*, above n 11, at pp. 995-997.

¹³ *Ibid.*, at p. 1000.

¹⁴ *Ibid.*, at p. 998.

¹⁵ See Ganti, G., *et al.* (submitted), Fair National Greenhouse Gas Reduction Targets Under Multiple Equity Perspectives – A Synthesis Framework. Climate Policy, for an analysis of the differences between the two respective methodologies.

¹⁶ These levels are drawn from the supplementary materials to this paper. Available at: <https://www.tandfonline.com/doi/suppl/10.1080/14693062.2021.1970504?scroll=top>.

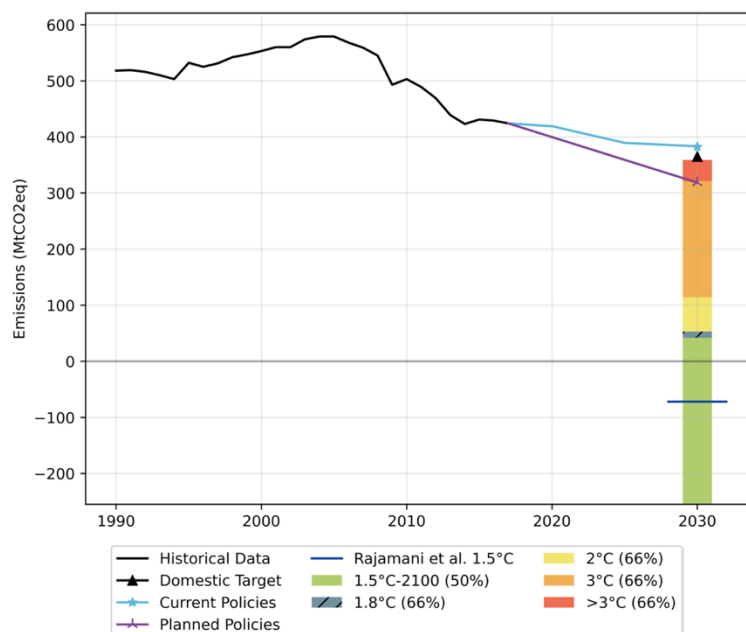


Figure 2 | 1.5°C, 1.8°C, 2°C and 3°C fair share ranges for Italy. The green bars represent the 1.5°C Paris compatible fair share range. The 1.5°C compatible level from the Rajamani et al. paper is indicated by the horizontal blue line.

The IEL ambition assessment paper concludes that to be in line with limiting global temperature to below 1.5°C, developed states with high historic responsibility for past emissions have a Paris Agreement compatible emissions level that is around zero or net-negative in 2030. In the case of Italy, the study concludes that the fair share 1.5°C consistent allocation for 2030 amounts to a reduction of emissions to at least 114% below Italy’s 2010 emissions level. This result is similar to the fair share emissions allocation required from the EU as a whole, calculated in this paper as equivalent to an emissions reduction of about 111% below the EU’s 2010 emissions level.¹⁷ This means that these states will have exhausted their fair share emissions allocation by 2030, and would need to both accelerate emissions reductions domestically and provide support to others to achieve emissions reductions elsewhere so that the total level of emission reductions are equivalent to the overall level of emission reductions needed to be consistent with the fair share level, based on the principle of cooperation.¹⁸

4. EU Assessment

4.1. Introduction

In Section 3.2 of Climate Analytics (2021), we addressed the latest developments on the long-term climate strategy of the European Union. We noted that the EU27 planned to strengthen its previous 2030 intermediate target for GHG emissions reductions, with significant implications for Italy’s capacity to “achieve the proposed higher level of EU-wide ambition.” In light of some relevant outcomes that followed the publication of the Climate Analytics report in 2021, this addendum

¹⁷ Rajamani, L., et al, above n 11, at p. 997.

¹⁸ Ibid, at p. 999.

provides an update on the adoption of a new 2030 mitigation target at the EU level and its implications in terms of projected emissions reductions (section 4.2). In addition, the following chapter assesses the fair share contribution of the EU towards meeting the Paris Agreement’s long-term temperature goal, in line with the principles of equity and common but differentiated responsibilities (section 4.3).

4.2. Emissions profile

The GHG emissions of the EU27 have fallen relative to 1990 levels.¹⁹ As of 2019, GHG emissions were 26% below 1990 levels excluding LULUCF.²⁰ The CO₂ emissions from fuel combustion in the EU decreased by 25% from 3,557 MtCO₂ in 1990 to 2,673 MtCO₂ in 2019.²¹ Most of this reduction has come from coal (-55%) and oil (-17%). However, emissions from natural gas have increased by 38% over the same period.²²

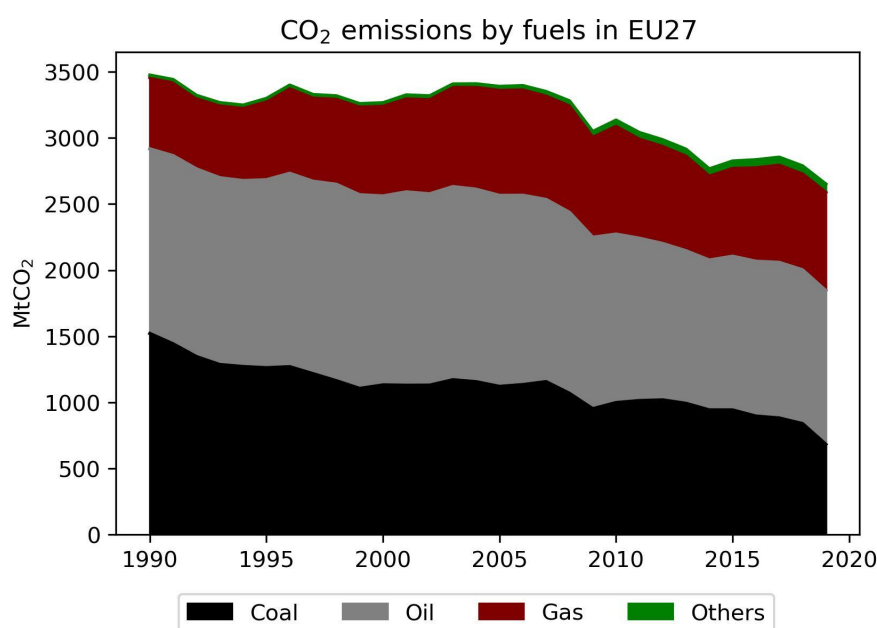


Figure 3 | CO₂ emissions by fuels in the EU from 1990 to 2019. Based on (International Energy Agency database, 2021)²³.

The EU’s emissions reduction targets

In its first NDC submitted to the UNFCCC in 2015, the EU had a target of reducing GHG emissions (excluding LULUCF) by “at least 40%” below 1990 levels by 2030.²⁴ In December 2020, the EU

¹⁹ Historical emissions data were obtained from the EU’s Data Viewer and cover the period up to 2019. European Environment Agency Data Viewer, *EEA greenhouse gas data viewer* (EEA, 2022) <<https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer>>.

²⁰ Ibid.

²¹ Ibid.

²² Based on CO₂ emissions from fuel combustion database obtained from the IEA. International Energy Agency, *Greenhouse Gas Emissions from Energy* (IEA, 2021) <<https://www.iea.org/data-and-statistics/data-product/greenhouse-gas-emissions-from-energy>>.

²³ <https://www.iea.org/data-and-statistics/data-product/greenhouse-gas-emissions-from-energy#ghg-emissions-from-fuel-combustion>.

²⁴ European Union, *Intended Nationally Determined Contribution of the EU and its Member States* (2015)

submitted an updated NDC which contains a revised 2030 domestic emissions target of “at least 55%” net reductions below 1990 levels.²⁵ The target is defined in terms of a “net” reduction because it includes carbon sinks from the LULUCF sector in both the base year in 1990 and the target year 2030, although the European Climate Law, adopted in June 2021, provides an upper limit of 225 MtCO₂e for the LULUCF emissions sink that can be used to meet the NDC.²⁶ Excluding LULUCF emissions and/or removals from both the base year and the target year, the EU’s updated target equates to a 52.8% GHG emissions reduction below 1990 levels.²⁷

As is also noted in the EU’s updated NDC, in December 2019 EU Member States agreed to the goal of “climate neutrality” (i.e. net zero GHG emissions) by 2050.²⁸ In the preceding year, the European Commission presented eight emissions reduction scenarios for 2050, two of which – 1.5TECH and 1.5LIFE – result in net zero GHG emissions by 2050.²⁹ However, in both scenarios gross emissions fall by only 91% and 94% respectively compared to 1990, with the rest compensated for by CDR technologies and LULUCF.³⁰

In the section of its updated NDC entitled “How the Party considers that its nationally determined contribution is fair and ambitious in the light of its national circumstances,” the EU states:

“The EU’s enhanced NDC represents a significant progression beyond both its current undertaking of a 20% emissions reduction commitment by 2020 compared to 1990, and its NDC submitted at the time of ratifying the Paris Agreement. Both the initial NDC and this update require significantly higher emissions reductions than were projected as business as usual at the time of their adoption.

This will ensure the EU continues to be the most greenhouse gas efficient major economy. The emissions in the EU Member States peaked in 1979. By the end of 2019, the EU and its Member States have already reduced their emissions by around 26% on 1990 levels while GDP has grown by more than 64% over the same period. As a result, average per capita emissions across the EU and its Member States have

https://www4.unfccc.int/sites/submissions/INDC/Published_Documents/Latvia/1/LV-03-06-EU_INDC.pdf, at p. 1.

²⁵ European Commission, *Update of the NDC of the European Union and its Member States* (2020) https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/European%20Union%20First/EU_NDC_Submission_December%202020.pdf, at p. 6.

²⁶ European Union, Regulation (EU) 2021/1119 of the European Parliament and of the Council: Establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 (‘European Climate Law’) (2021) <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R1119>, at Article 4.1.

²⁷ Climate Action Tracker, *CAT Climate Target Update Tracker: EU | December 2020 Update* (2020) <https://climateactiontracker.org/climate-target-update-tracker/eu/>.

²⁸ European Council, *European Council meeting (12 December 2019) – Conclusions, EU CO 29/19, 12/12/2019* (2019) <https://www.consilium.europa.eu/media/41768/12-euco-final-conclusions-en.pdf>, at p. 1.

²⁹ European Commission, *A clean planet for all. A European long-term strategic vision for a prosperous, modern, competitive and climate neutral economy* (2018) https://ec.europa.eu/clima/system/files/2018-11/com_2018_733_analysis_in_support_en.pdf, at pp. 196-198.

³⁰ *Ibid.*

fallen from 12 tonnes CO₂-eq in 1990 to 8.3 tonnes CO₂-eq. This has also made the EU already today the most greenhouse gas efficient major economy.”³¹

The claim that the EU is the most greenhouse gas efficient major economy is based on an assessment of the EU’s emissions intensity, i.e. the amount of GHG it emits per unit of GDP,³² but this emissions intensity is unrelated to any of the principles of equity outlined by the IPCC (see section 5.1 of Climate Analytics (2021)). The EU’s NDC further states, in a sub-section specifically relating to “fairness considerations, including reflecting on equity”, as follows:

“The IPCC Special Report on global warming of 1.5°C shows that pathways limiting warming to 1.5°C typically achieve net zero greenhouse gas emissions at global level in the second half of this century. This enhanced NDC is in line with the EU’s agreed objective of achieving a climate-neutral EU by 2050. The EU therefore considers the enhanced NDC to be a fair contribution towards the global temperature goal of the Paris Agreement.”³³

This sub-section of the EU’s NDC makes no reference to any principle of equity and offers no explanation as to how the EU has determined its fair share of the emissions reductions envisaged by the pathways that limit warming to 1.5°C as outlined in SR1.5, nor how it would meet its fair share through a combination of domestic emissions reductions and support for emissions reductions overseas. Furthermore, the text focuses on a 2050 time horizon and does not refer to the emissions reductions that occur by 2030 in the 1.5°C pathways assessed in the SR1.5, which are critical to the success of these pathways. As a result, the EU’s NDC is missing the basis on which it has calculated its fair share of those emissions.

It is also important to note that “pathways limiting warming to 1.5°C” referred to in this sub-section cover a broad range of pathways including the so called 1.5°C high overshoot pathways referred to in section 4.1 of Climate Analytics (2021). As is noted in that section, these pathways rely to a very large extent on deploying large scale carbon dioxide removal (CDR) technologies. As is also noted in that section of the report, the IPCC states that the feasibility of achieving large-scale deployment of CDR measures is “uncertain and entails clear risks.”³⁴ In addition to feasibility and sustainability concerns about deploying CDR measures at large scale, pathways that allow for a high overshoot have a much larger likelihood of triggering irreversible tipping points, such as the melting of the permafrost, which would lead to further temperature increase. The EU has not indicated in its NDC that it excluded such pathways when calculating its updated 2030 target.

³¹ European Commission, *Update of the NDC of the European Union and its Member States* (2020), above n 26, at pp. 17-18.

³² den Elzen, M. *et al.* Are the G20 economies making enough progress to meet their NDC targets? *Energy Policy* 126, 238–250 (2019). Fig 3.

³³ *Ibid*, at p. 18.

³⁴ Rogelj, J., *et al*, above n 3, at p. 95.

Projected emissions reductions of the EU

According to the latest projections by the European Environment Agency (EEA) of the EU's domestic emissions reductions, the EU's emissions (excluding LULUCF) are projected to reach 35% below 1990 levels by 2030.³⁵ These projections are based on EU Member States' national "with existing measures" projections of GHG emissions under the Monitoring Mechanism Regulation.³⁶ Based on the aggregation of ambition levels expressed in National Energy and Climate Plans (NECPs) submitted by the Member States to the European Commission in 2019 and 2020, GHG emissions are projected to reach 41% below 1990 levels by 2030.³⁷ The difference between the projections under the Monitoring Mechanism Regulation and those based on projections contained in Member States' NECPs is explained by the fact that the latter are 'with planned measures' projections (which are similar to 'with additional measures' projections).³⁸

The "Fit for 55" package of measures presented by the Commission in July 2021 aims at implementing the new emissions reduction goal.³⁹ However, the legislative proposals still need to be agreed upon by the Council and the European Parliament and implemented by member states.

4.3. Fair share analysis

In Chapter 5 of Climate Analytics (2021), we provided a fair share analysis of Italy's 2030 climate target. This chapter applies the same fair share methodology to evaluate whether the new EU-wide 2030 target of a net 55% reduction compared to 1990 levels is aligned with the LTTG of the Paris Agreement, once global equity considerations are taken into account.

The 1.5°C Paris compatible fair share emissions reduction ranges for the EU for 2030 are shown as the green bar in Figure 4. The figure also shows the EU's fair share ranges for a warming level of 2°C (yellow) and 3°C (orange). In order to contribute its fair share towards achieving the Paris temperature goal, the EU would need to achieve GHG emissions reductions to at least 95% below its 1990 emissions level (excluding LULUCF emissions) by 2030. In absolute terms, this would be equivalent to a maximum GHG emissions level for the EU of 382 MtCO₂e excluding LULUCF.⁴⁰ This reduction level would be

³⁵ European Environment Agency database, *Member States' greenhouse gas (GHG) emission projections. GHG_Projections_2021_xlsx - including pivot chart* (2021) <<https://www.eea.europa.eu/data-and-maps/data/greenhouse-gas-emission-projections-for-8>>.

³⁶ Regulation (EU) No 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC <<https://eur-lex.europa.eu/eli/reg/2013/525/2018-12-24>>.

³⁷ European Environment Agency, *Trends and projections in Europe 2021* (2021) <<https://www.eea.europa.eu/publications/trends-and-projections-in-europe-2021>>, at p. 11.

³⁸ European Environment Agency, *Technical background document – Accompanying the report Trends and projections in Europe* (2021) <<https://www.eea.europa.eu/publications/trends-and-projections-in-europe-2021/technical-background-document/view>>, at p. 17.

³⁹ European Council, *Fit for 55: The EU's Plan for a Green Transition* (2021) <<https://www.consilium.europa.eu/en/policies/green-deal/eu-plan-for-a-green-transition/>>.

⁴⁰ Note that there may be small changes in this number if the base year emissions level in a future greenhouse gas inventory changes due to revisions to inventory methodologies or global warming potentials.

sufficient to achieve the Paris Agreement LTTG if all other countries pursued an equivalent level of ambition according to their respective fair share ranges (as set out in sections 5.3 to 5.6 of Climate Analytics (2021)). Achieving this fair share level of ambition can be done through a combination of domestic emissions reductions and funding or support for emissions reductions in (primarily developing) countries outside of the EU27.

As can be inferred from Figure 4, if all other countries were to follow the ambition level of the EU for its domestic 2030 target, the global temperature would rise between 2 and 3°C (with a 66% probability) by the end of the century.

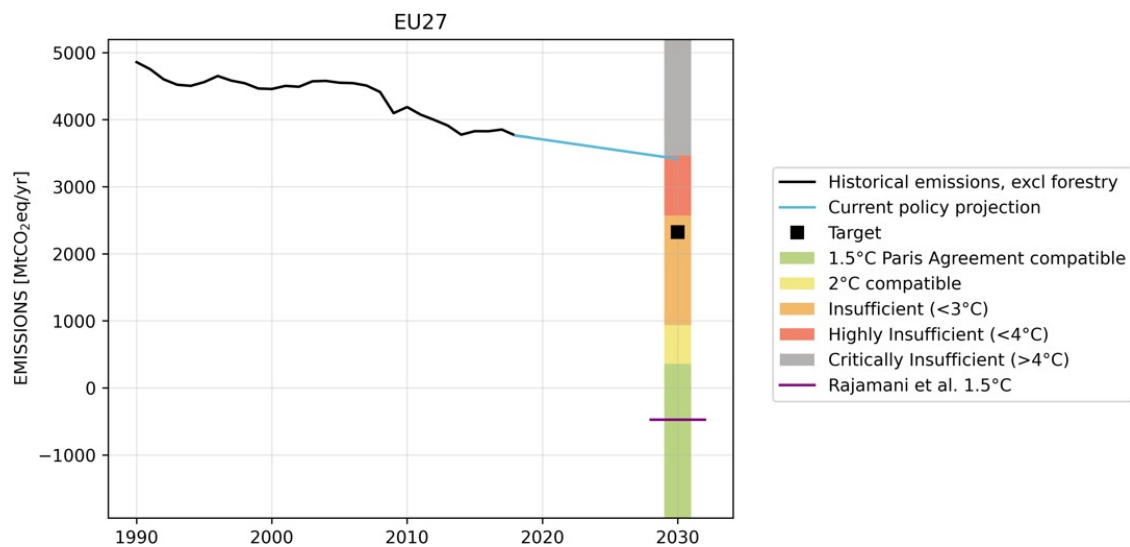


Figure 4 | Assessment of the EU's 2030 target and projected emissions reductions with respect to its fair share of the mitigation effort required to achieve the LTTG of the Paris Agreement. The green bar represents the 1.5°C Paris compatible fair share range. The yellow and orange bars correspond to the emission levels that would result in keeping warming below 2°C and 3°C respectively throughout the century with a 66% probability.

The results from the recently published IEL ambition assessment paper (discussed in section 3 of this addendum) are also shown in Figure 4 (depicted with a horizontal purple line labelled 'Rajamani et al. 1.5°C'). On the basis of the IEL ambition assessment, to contribute its fair share of limiting global temperatures to below 1.5°C by the end of the century the EU would need to achieve emissions reductions globally equivalent to 114% below its 1990 level, or 111% below its 2010 emissions level.

In conclusion, the EU's emission reduction target for 2030 is not compatible with the vast majority of interpretations of equity as represented in the literature when considering mitigation required to meet the Paris Agreement's LTTG. Assuming an equal level of ambition for each country within the full range of results from the equity literature, the EU would need to achieve emissions reductions that are equivalent to at least 95% by 2030 compared to 1990 to be in line with the Paris Agreement's LTTG. This is significantly far from the current net 55% reduction in 2030 compared to 1990. The emissions gap between a Paris compatible emissions reduction for the EU and the planned policy

emissions reduction amounts to 2785 Mt CO₂e in 2030.⁴¹ Closing this emissions gap requires a rapid scaling up of mitigation measures and a rapid transition towards a carbon-free economy within the EU. In addition, the EU may close part of the gap beyond the level that can be achieved domestically through concrete commitments to funding or supporting mitigation in developing countries, if these mitigation actions were truly additional, contributing to an overall mitigation in global emissions, and not counted towards those countries' own reduction targets.

5. Submission based on Beusch, L., Nauels, A., Gudmundsson, L., Gütschow, J., Schleussner, C. F., & Seneviratne, S. I. (2022). Responsibility of major emitters for country-level warming and extreme hot years. *Communications Earth & Environment*, 3(1), 1-7.

A recent contribution to the literature, entitled *Responsibility of major emitters for country-level warming and extreme hot years*, examines the responsibility of the five largest emitters (China, US, EU27, India, and Russia) in driving global warming.⁴² One of the approaches adopted in the paper is a comparison of “what-if” scenarios to illustrate the effect of the difference in per-capita emission levels by countries. The authors investigate scenarios, designed such that the emissions worldwide would follow the per-capita emissions of each of the five major emitters. If per-capita emissions of a country are above (or below) the global average per-capita emissions over a given period, this would lead to a higher (or lower) warming over this period. The results are then compared to the projected emissions under currently pledged NDCs.⁴³ This comparison is performed for two policy-relevant time periods – the period since the publication of the first report of the Intergovernmental Panel on Climate Change (IPCC, 1991 – 2030) and the Paris Agreement period (2016 – 2030).⁴⁴ In the following, we follow the same approach and present the same computation for Italy (Figure 5).

Italy had per-capita fossil CO₂ emissions of 7.7 and 6 t CO₂/capita in 1991 and 2016 respectively. We calculate this using fossil CO₂ emission estimates from the PRIMAP database⁴⁵ and population projections based on the population projections from the Shared Socioeconomic Pathways (SSP)

⁴¹ Based on the With Existing Measures scenario for the EU27 excluding LULUCF, and compared with the fair share level described above. Projected emissions are taken from <https://www.eea.europa.eu/data-and-maps/data/greenhouse-gas-emission-projections-for-8> GHG_Projections_2021_xlsx - including pivot chart.

⁴² Beusch, L., Nauels, A., Gudmundsson, L., Gütschow, J., Schleussner, C. F., & Seneviratne, S. I., Responsibility of major emitters for country-level warming and extreme hot years. *Communications Earth & Environment*, 3(1), 1-7 (2022).

⁴³ Ibid, at p. 3.

⁴⁴ Ibid, at p. 2 “The focus is set on the contributions of the top five largest emitters—China, the United States (US), the European Union (EU27), India, and Russia—to country-level warming and extreme hot years with respect to pre-industrial climate (1850–1900) over two time periods: (1) the time period during which policy-makers have been informed about the looming climate crisis by the IPCC (1991–2030, henceforth the IPCC period), and (2) the time period after the Paris Agreement was reached (2016–2030, henceforth the Paris period).”

⁴⁵ Gütschow, J., Günther, A., & Pflüger, M. The PRIMAP-hist national historical emissions time series (1750-2019) (2021). v2.3.1. zenodo. <https://doi.org/10.5281/zenodo.5494497>

database⁴⁶ (we follow the “middle of the road” SSP2 projections). To estimate the 2030 per-capita fossil CO₂ emissions in 2030, we use projections from the National Energy and Climate Plan.⁴⁷ Since they only report the overall fossil greenhouse gas emissions, we estimate the fossil CO₂ emissions using the historical average (around a 90% share). Using population projections until 2030, we estimate the 2030 per-capita projections of Italy’s emissions at 5.3 t CO₂/capita. By multiplying Italy’s per-capita emissions with the global population (historical and projected between 1991 and 2030), we obtain the global emission pathway, if global per-capita emissions follow Italy’s per-capita emissions. The resulting pathways are used as an input to the reduced-complexity carbon cycle and climate model MAGICC6⁴⁸ as used in Beusch et al.⁴⁹

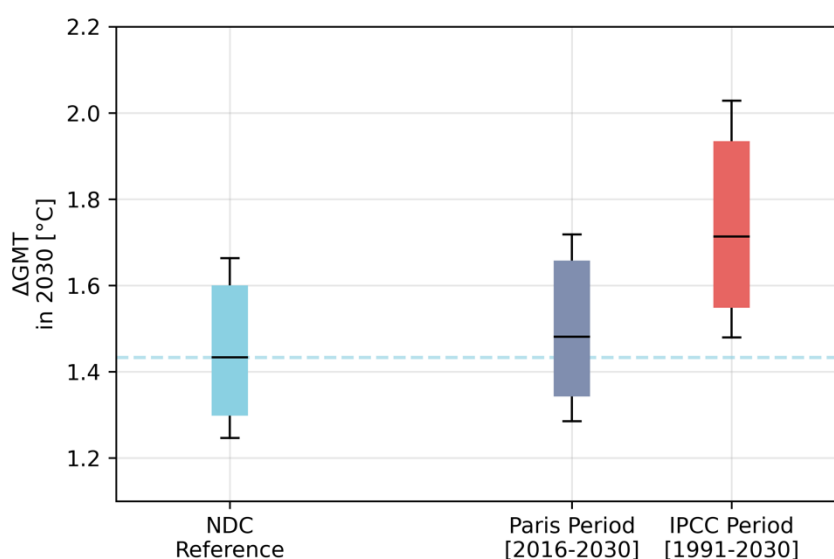


Figure 5 | Median warming in 2030 under historical emissions and currently pledged NDCs and for illustrative per capita scenarios in which the whole world emits fossil CO₂ per capita like Italy during the Paris and IPCC periods.

The resulting temperature rise (in 2030, relative to the 1850-1900 reference period) is calculated over the two time periods, and compared to the projected temperature rise in 2030 if the current NDCs and policies of all countries would be implemented, with a continued consistent level of effort over the rest of the century (the NDC reference case).⁵⁰ In the reference case (i.e., the NDC projections), the median temperature rise in 2030 (relative to 1850-1900) is projected to be 1.43°C. If the world followed Italy’s per-capita emissions between 2016 and 2030 (the Paris Period), the corresponding

⁴⁶ Samir K. C., & Wolfgang, L., The human core of the shared socioeconomic pathways: Population scenarios by age, sex and level of education for all countries to 2100, *Global Environmental Change*, 42, 181-192, (2017). ISSN 0959-3780, DOI: 10.1016/j.gloenvcha.2014.06.004

⁴⁷ Ministry of Economic Development, Ministry of the Environment and Protection of Natural Resources and the Sea, Ministry of Infrastructure and Transport, Integrated National Energy and Climate Plan. Italy (2019). Available at: https://ec.europa.eu/energy/sites/ener/files/documents/it_final_necp_main_en.pdf. Last accessed 25 February 2022.

⁴⁸ Meinshausen, M., Raper, S. C., & Wigley, T. M., Emulating coupled atmosphere-ocean and carbon cycle models with a simpler model, MAGICC6–Part 1: Model description and calibration. *Atmospheric Chemistry and Physics*, 11(4), 1417-1456 (2011).

⁴⁹ Beusch, L., et al., above n 43, at p. 5.

⁵⁰ Climate Action Tracker, *Temperatures* (2022). <https://climateactiontracker.org/global/temperatures/>. Last accessed 25 February 2022.

median temperature rise would be 1.48°C, or 0.05°C above the NDC reference. The IPCC Working Group 1 Sixth Assessment Report assesses the anthropogenic warming in the year 2015 as around 1.07°C (for the 2010-2019 decade),⁵¹ which implies that the NDC induced warming amounts to about 0.4°C over the 2016-2030 period. If the world was to follow per-capita emissions of Italy, this would increase by 12%. If the world followed Italy's per-capita emissions between 1991 and 2030 (the UNFCCC period), the corresponding median temperature rise would be 1.71°C or 0.28°C above the NDC reference warming.

This analysis illustrates that the contribution of Italy to global warming is not just historically disproportionate, but also that Italy's emissions under its reduction targets until 2030 lead to a disproportionate and unequal contribution to global warming.

⁵¹ IPCC, *Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. P. Pan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press (IPCC, 2021).