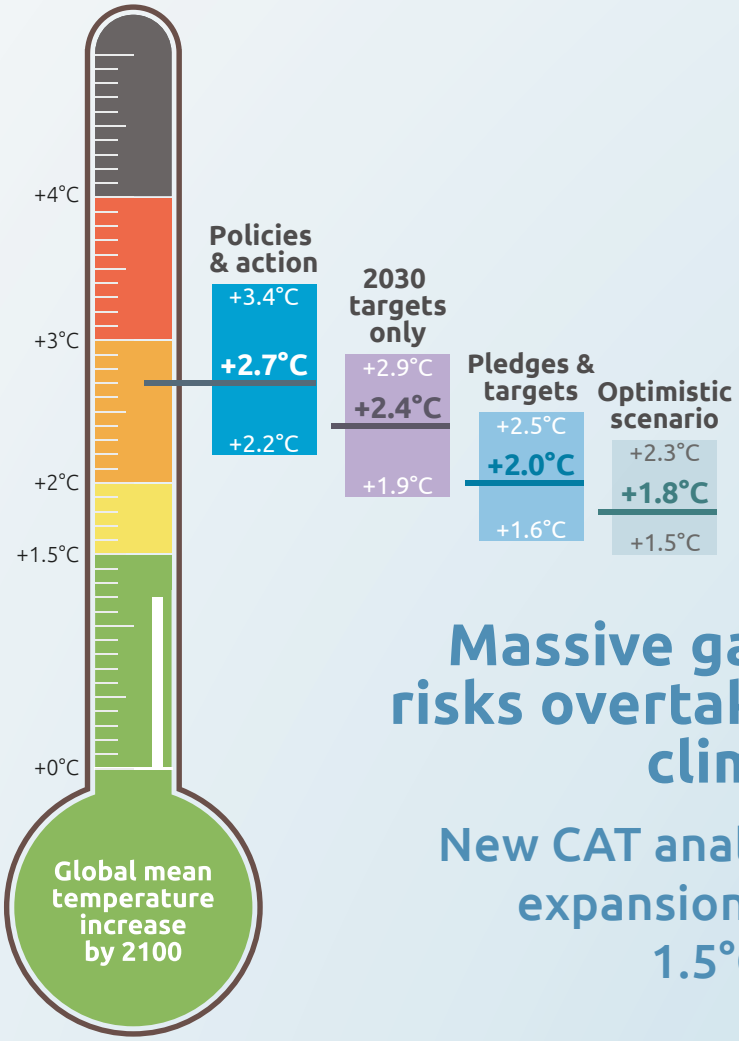
Climate Action Tracker



Massive gas expansion risks overtaking positive climate policies

New CAT analysis shows LNG expansion plans threaten 1.5°C warming limit

Climate Action Tracker

Warming Projections Global Update

November 2022

CLIMATE ANALYTICS

NEW CLIMATE INSTITUTE

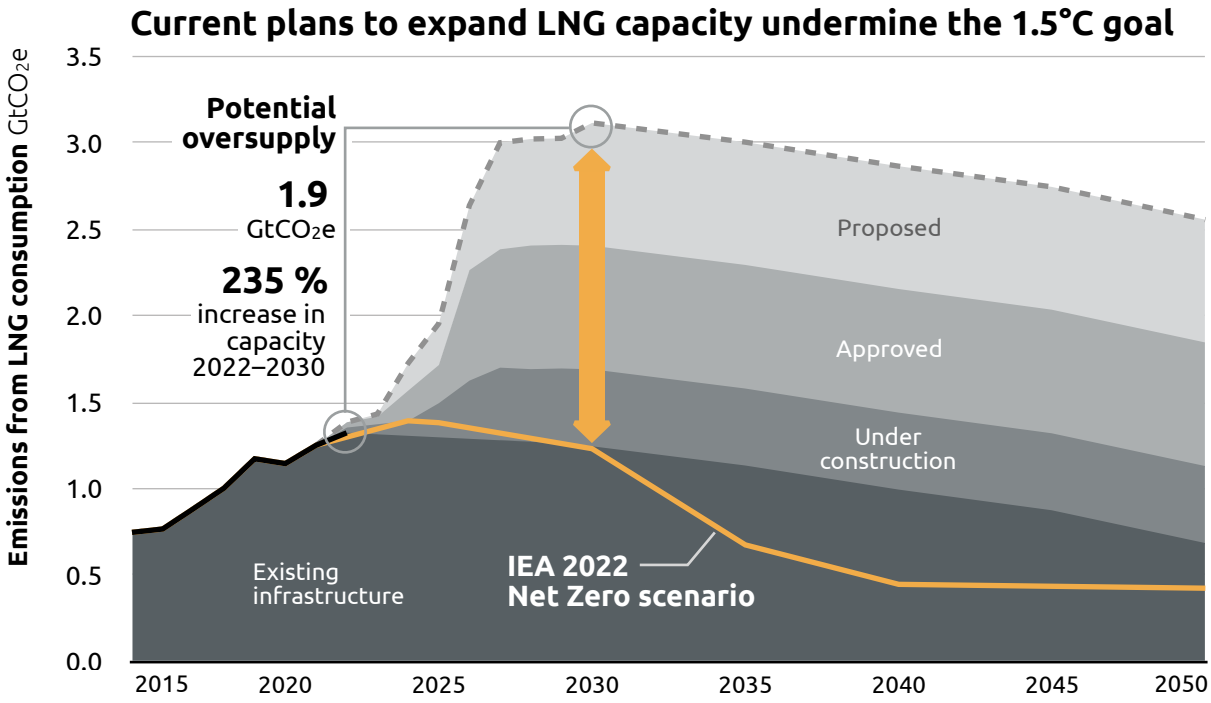
Summary

The goldrush for gas continues and is counterproductive to the Paris Agreement. The energy crisis caused by Russia's illegal invasion of Ukraine has sent governments scrambling to shore up energy security. However, in many cases governments are doubling down on fossil fuels – the very cause of the climate crisis – knocking climate action down the policy agenda, despite the fact that renewables, efficiency and electrification are by far the cheapest, fastest and most secure options. Across the world the oil and gas industry is pushing fossil gas as the route out of the crisis.

The 2022 update of the IEA's Net Zero by 2050 Road map shows that due to accelerating reductions in the cost of renewables and storage and other technologies, the total gas use globally by 2030 needs to be at least 30% below 2021 levels, about 45% faster than estimated a year ago in 2021.

Massive LNG expansion plans will seriously compromise meeting the 1.5°C limit. New CAT analysis finds the LNG capacity now under construction, coupled with expansion plans, could increase emissions by over 1.9 $GtCO_2e$ per year in 2030 above emission levels consistent with the IEA's Net Zero by 2050 scenario. This pipeline of new plants massively exacerbates the fact that existing capacity (as of 2021) will exceed IEA NZE needs by 2030.

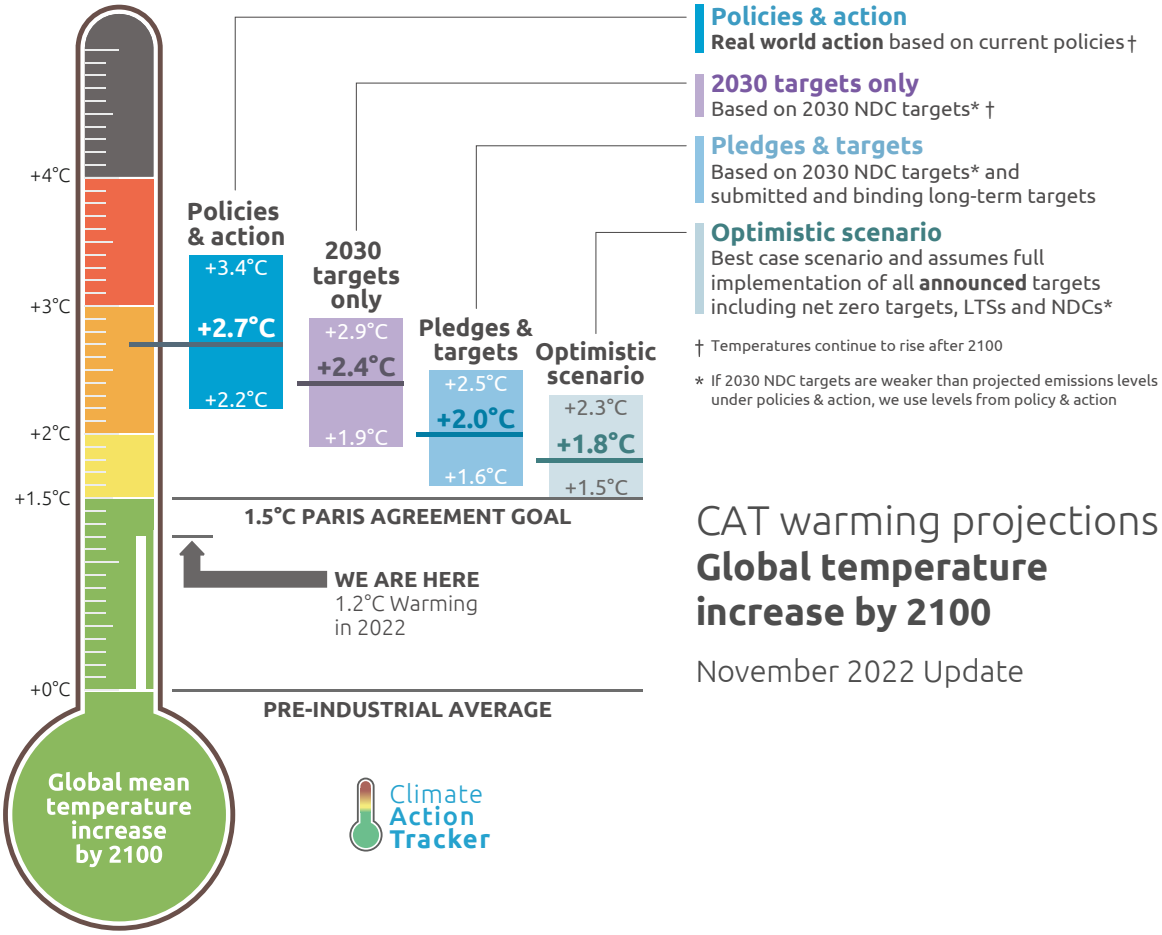
Between 2020 and 2050, cumulative emissions from LNG could be over 40 $GtCO_2$ higher, equal to around 10% of the remaining carbon budget. In 2030, oversupply could reach 500 Mt_{LNG}, almost five times the EU's imports of fossil gas from Russia in 2021, and over double Russian total exports. This reaction to the energy crisis is an over reach that must be scaled back.



The Glasgow NDC update process has failed to deliver the urgent emissions cuts governments promised to deliver to keep warming to 1.5°C. The world is heading for 2.4°C of warming under current 2030 targets. If that number looks familiar, it is because it is the same as last year.

Stronger targets from Australia, the UAE, Norway and Thailand are welcome, but not enough to move the thermometer, nor are they 1.5°C compatible. At the same time, the first three countries are increasing their export of fossil fuels, notably gas and LNG, while Thailand is planning a massive increase in LNG imports which will undermine renewables.

Updates from Brazil, Egypt, India, Indonesia, and the UK did not increase ambition. Updates from Singapore and Viet Nam came after we ran the numbers. While these may contribute to lowering warming, it is not likely on the scale that would impact our estimates.



There have been no substantial improvements of existing net zero pledges since COP26. Warming could be 1.8°C, if all targets under discussion are fully implemented, unchanged from last year. Stronger 2030 targets and policy implementation are needed to make these pledges believable and actually provide a reason for optimism.

Policy implementation has progressed, but remains too slow. There were notable developments in the US, which passed the most ambitious and potentially impactful climate policy package in its history, China, which adopted more ambitious clean energy policies in its 14th Five Year Plans and in the EU, which plans to overachieve its target with its new policies. But higher historical emissions and some methodology updates based on the latest science mean that our temperature estimate for policies and actions remains unchanged at 2.7°C.

International climate finance increased by only 4% in 2020 and remains nowhere near the level sufficient to support the implementation of additional emissions reductions in developing countries. No developed country we track has a better rating than 'Insufficient' on finance. All need to substantially scale up their level of commitment.

Sectoral initiatives have not yet lived up to the hype. Governments continued to join the **Global Methane Pledge** this year, but some of the top emitters have remained on the sidelines. Signatories have made plans to cut methane emissions or included measures in their NDCs, but the extent of implementation remains to be seen.

Cutting fugitive emissions is a common element in many plans, but this misses the real challenge: **to move beyond coal, oil and gas by phasing out production**. Just as there is no such thing as 'clean coal', there is also no 'clean oil' nor 'clean gas'. Dealing with fugitive methane emissions alone is not enough. Colombia is the one exception here, where the newly-elected President has already introduced legislation to ban fracking in the country, a key election promise.

Commitment to the Glasgow coal exit was not determinative of action in 2022 as progress, both from signatories and major emitters who remain outside the initiative, was mixed. The agreement to "phase down" coal under the Glasgow Climate Pact has largely been ignored by the big coal countries.

Electric vehicle adoption is heading in the right direction, but not fast enough. Many governments who signed the COP26 EV Declaration already had EV targets and policies in place. In 2022, they continued to implement those plans. Membership did not expand significantly this year. EU agreed to only sell CO_2-free cars as of 2035 but has not signed the declaration. The top three car manufacturing nations (China, the US and Japan) have not signed up: they do have EV sales targets, but these are not yet consistent with a 1.5°C pathway.

COP27 is being billed as the 'Implementation COP'. There were a few notable highlights this year, but broadly we are still not seeing the scale nor speed of implementation needed to close the gap and keep the possibility of 1.5°C open. We must build on the few positive developments of this year and see evidence of genuine accelerated policy implementation by the time world leaders convene in 2023 at the UN Secretary General's climate ambition summit. We cannot afford anything less.

Country snapshots

ARGENTINA is fast-traking a new gas pipeline and moving ahead with new offshore oil exploration, developments that will lock in fossil infrastructure. Agriculture emissions also need attention, as methane levels are high. Argentina's 2021 NDC update only leads to a 2% drop in emissions compared to its previous target (excluding LULUCF).

AUSTRALIA is the only G20 member that has submitted a clearly strengthened NDC target in 2022. The 43% emissions reduction target below 2005 by 2030 and the 2050 net zero target were made legally binding in September 2022. However, Australia continues to support new coal, gas and major new LNG export projects, clearly inconsistent with limiting warming to 1.5°C, and has few policies to meet its target.

BRAZIL'S 2022 NDC is better than the last, but it is still weaker than its original 2016 target. Brazil continues to focus on fossil fuels, especially gas, to fill energy needs, locking it into rising emissions and a carbon intensive future. Deforestation continues to rise amid illegal logging and weak enforcement. President-elect Lula has vowed to turn this around.

CANADA seems determined to export its LNG to Europe even though the timelines don't match given that it will need to build out the necessary export infrastructure on its East Coast. It approved an offshore oil and gas megaproject in April and won't commit to that being the last one. It did release its latest climate plan in March and is advancing on policy implementation, but like it's a pleasant Sunday afternoon and not a climate crisis.

CHILE has made remarkable progress on climate action, and, after being on the rise two years ago, 2030 emissions are projected to decline from today's levels. While its overall rating remains "Insufficient" the current policy projections have moved up to "Almost sufficient" and are on track to meeting the NDC target. Chile's coal phase-out is advancing as planned—1.2 GW have already been retired since 2019—and an early phase-out by 2030 is being discussed.

CHINA'S energy demand continues to grow year-on-year amidst a transitioning economy. China's energy transition is moving forward, highlighted by sectoral peaking plans and supercharged ambition on rapidly scaling up renewables. Unfortunately, dependency on carbon-intensive fossil fuels is set to stay for the immediate future as build-up of capacity continues due to energy security concerns.

COLOMBIA'S new president has placed climate action at the top of his political agenda, pledging to reduce deforestation and to ban fracking. Despite this, Colombia will need to implement additional policies to meet its NDC target. Committing to a coal phase-out would support this.

COSTA RICA initiated the Beyond Oil and Gas Alliance (BOGA) at COP26 and committed to phasing out oil and gas production, however, it has since stepped back from leading BOGA after a change in government. The share of renewable energy in electricity production remains one of the highest in the world.

EGYPT'S updated NDC lacks ambition: while it now has an actual emissions reduction target, it can easily overachieve it with the policies it has put in place. A strengthened target with economy-wide coverage would help to show commitment to climate action. Egypt is also planning and investing in a massive expansion of gas.

ETHIOPIA'S civil war has led to a humanitarian crisis exacerbated by international energy and food shortages. There has been no significant climate policy development under these circumstances. Ethiopia is set to overachieve its unconditional and conditional NDC targets in 2030 under current policies. A truce was declared on November 2.

The **EU** has not submitted a strengthened NDC target ahead of COP27, failing to take leadership to limit warming to 1.5°C, even though the REPowerEU Plan could reduce 2030 emissions by up to 57% (excl. LULUCF)—beyond its current NDC. The EU is focusing too much on supporting additional LNG investments to replace Russian gas instead of the potential offered by accelerating renewable energy and strengthening energy efficiency.

THE GAMBIA'S continues to promote efforts to extract oil and gas in an attempt to offset its dependency on imported fuel oil. The most sustainable way to reduce dependency is via accelerated deployment of renewable energy and electrification of transport. To achieve this The Gambia will need international support.

GERMANY'S reaction to the energy crisis has been mixed: increased support for renewables is positive, but proposed gas and LNG infrastructure deals are of major concern. Planned LNG import capacity far exceeds needs consistent with the 1.5˚C transition, and claims that LNG capacity can be used for hydrogen have been challenged by research bodies. Germany needs to firmly commit to ending public finance for fossil fuels abroad, including possible gas extraction support in Senegal. Germany is projected to get close to its 65% emissions reduction target by 2030 with the government's planned policies.

INDIA submitted its NDC update, first announced in Glasgow. While the targets are stronger on paper, India will already achieve them with its current level of climate action and the new targets will not drive further emissions reductions. Details on the 2070 net zero target are still missing: it is unclear whether it covers just CO_2 or all GHGs. There is progress on renewable energy installation, but clear policy direction towards phasing out coal is still missing. The government is planning to add more coal capacity and increase fossil gas in the energy mix.

INDONESIA'S latest NDC, updated in September 2022, failed to drive additional emissions reduction: its target is well above its emissions trajectory under current policies. It put forward a 2050 coal phase-out date but is open to moving this into the 2040s with international support.

IRAN is the only country of those we assess that has yet to ratify the Paris Agreement. It is expected to overachieve its INDC due to an inflated baseline.

JAPAN still appears wedded to coal-fired power: four new plants began operating in 2022, with four more planned by 2024—still no commitment to a coal exit. It remains to be seen whether it will stop its significant public financing of fossil fuel projects overseas.

KAZAKHSTAN has made progress on climate policies, but it still has not updated its 2016 NDC. Its ongoing focus on fossil fuels is not a path toward decarbonisation: while coal will phase out, it is being replaced with oil and gas.

KENYA'S policies and action are rated as 1.5°C compatible, overall climate action "Almost sufficient". Renewables represent 85% of electricity, but coal plans are still in play. Kenya will well overachieve its unconditional NDC target and could therefore strengthen it.

MEXICO'S climate policies continue to go backwards, as the government prioritises fossil fuel use and dismantles climate-related policies and institutions. For example, over 70% of the 2022 Federal Budget for climate mitigation and adaptation has been allocated to fossil gas transport infrastructure. Its 2020 NDC resulted in higher emissions than the original 2016 climate targets, with the latter reinstated after a lawsuit from civil society in 2021.

MOROCCO does not have a net zero target, but in its 2021 long term strategy it pledges to evaluate ways to reach climate neutrality over the course of this century. The electricity sector is still heavily reliant on coal and the development of renewable energy has slowed down in the past couple of years.

NEPAL announced at COP26 it intends to become carbon neutral in the next decade, and carbon negative after 2045. It also intends to halt deforestation and increase forest cover to 45% by 2030.

NEW ZEALAND has a net zero emissions target enshrined in law, but exempts methane emissions from agriculture, livestock and waste—over 40% of total emissions—forcing reductions to come from the rest of the economy. It has a separate but unambitious methane target. Concerns have arisen around plans to meet a full two thirds of its 2030 targets through the purchase of offshore credits, and much of its policies focus on domestic offsetting.

NIGERIA recently released its Energy Transition Plan, which sets out a pathway to achieve its net zero target. However, the plan relies on significant action after 2030, with the period to 2030 declared the "Decade of Gas". This is a missed opportunity for more ambitious near-term action.

NORWAY continues to support an expansion of oil and gas exploration in its already large fossil fuel sector. It submitted its stronger "at least 55%" NDC reduction target below 1990 levels—already announced earlier this year—just days ahead of COP27.

PERU saw its highest rate of deforestation in the last two decades in 2020. The political turmoil since President Castillo's election has slowed Peru's progress in advancing climate policy. While renewables increase, the government is still investing in fossil fuels.

RUSSIA'S illegal invasion of Ukraine has highlighted the world's need to reduce the demand for fossil fuels as the right response to deal simultaneously with both the climate and energy crises. Russia is still firmly focussed on fossil fuel production and consumption; its renewables industry has barely begun. It has set a goal (without details) of doubling its forests sink, despite massive wildfires. Still "Critically insufficient."

SAUDI ARABIA has still not provided any details on its 2060 net zero target and its 2021 NDC target lacks transparency. Saudi Arabia is far from being on track to meeting its 50% renewable energy target by 2030. The economy continues to heavily rely on oil exports..

SINGAPORE submitted an updated NDC and LTS a few days prior to COP27. It has moved away from oil but has instead shifted towards fossil gas, including plans to become the world's largest LNG bunkering hub servicing Asia. Singapore plans an upward revision of its carbon tax, from 2023.

SOUTH AFRICA'S government has made new policy announcements to address the current energy crisis but it remains to be seen how this will help to meet its NDC target, which it strengthened in October 2021. South Africa and its donor countries intend to approve the first Just Energy Transition Partnership (JETP) investment plan to accelerate the retirement of coal plants by the end of 2022.

SOUTH KOREA submitted its new NDC in December 2021, confirming the 40% emissions reduction target by 2030 below 2018 levels. South Korea is reducing coal use, but it is replacing it with gas, and the share of fossil fuels in power sector is still at 67%. Renewables up, still only a 6% share.

SWITZERLAND'S parliament proposed a revised CO2 Act in September after the previous proposal was rejected in a 2021 referendum. It does away with unpopular tax increases in favour of CHF 4.1bn in new spending on buildings upgrades, EV charging points, and electric buses. Two thirds of the country's 50% emissions reduction target is now to be achieved domestically, down from the previously proposed three quarters, with the rest coming from overseas offsets.

THAILAND submitted a strengthened NDC just ahead of COP27, where it also promised to move its carbon neutrality target forward from 2065 to 2050. Its shift in power sector planning, from a dependency on coal to fossil gas with a large increase in LNG import capacity, will lead to higher long-term emissions and exacerbate fossil fuel lock-in. Thailand is due to publish its first-ever National Energy Plan later this year.

TÜRKIYE had signalled it would update its NDC, which allows GHG emissions to essentially double compared to current levels, ahead of COP27, but this has still not happened. Its climate action remains "Critically insufficient". Türkiye's energy investments continue to focus on domestic lignite and gas production with its largest gas field in the Black Sea set to start production in the first quarter of 2023.

The **UNITED ARAB EMIRATES** president of COP28 in 2023, submitted a strengthened NDC target in September 2022. The UAE is still planning to expand coal and gas-fired electricity by 2050, which is inconsistent with the net zero goal it announced last year. Coal target is being revised, but not yet officially dropped. The country also plans to double its LNG export capacity by 2026.

The **UK** did not strengthen its target ahead of COP27, contrary to the Glasgow Climate Pact. Credible policies cover only 40% of the reductions needed to meet the NDC. The UK's actions are not aligned with its fair share contribution: its either needs to strengthen its target or substantially increase its "Highly insufficient" climate finance.

UKRAINE: the CAT has suspended Ukraine's rating and assessment in light of Russia's illegal invasion.

The **US** took a major step forward with the Inflation Reduction Act, the most ambitious climate policy in US history which would lead to a substantial emissions reduction by 2030. As the world's largest oil and gas producer, the US should show the way beyond fossil fuel extraction—but unfortunately it is now doing exactly the opposite. It is planning to increase its LNG export capacity by about one third by 2026. The US has also not met the call to submit a strengthened NDC target in 2022, putting claims to climate leadership in question.

VIET NAM is a signatory of the global pledge to phase out coal-fired power generation but it has a significant coal pipeline (43 GW), with plans to only halt new coal-fired power plant builds after 2030. In spite of having one of Asia's highest solar and offshore wind capacities, it plans to build 22 LNG-to-power plants (55 GW) serviced via seven additional LNG import terminals.

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1 Fossil gas is the cause of the energy crisis, not the solution

Russia's illegal invasion of Ukraine has led to a profound global energy crisis. This has sent governments scrambling to shore up energy security, with many of them doubling down on fossil fuels – the very cause of the climate crisis – and pushing climate action down the policy agenda. Across the world, governments and industry groups are promoting fossil gas as the route out of the crisis.

Yet, the evidence could not be any clearer today. There can be no new fossil gas development projects if we are to meet the ambitions of the Paris Agreement (IPCC, 2022). The IEA's updated net zero emissions (NZE) scenario shows fossil gas has reached peak demand, and should now be swiftly phased out (IEA, 2022a). Fossil gas demand needs to be reduced by at least 30% below 2021 levels by 2030, and more than 60% by 2035. This is substantially faster than the reduction rate the IEA estimated in 2021.

We are witnessing a major push for fossil gas across the world – in Europe, Africa, North America, and Asia – which could cause global emissions to breach dangerous levels. Increasing our reliance on fossil gas cannot be the solution to today's climate and energy crises anywhere.

1.1 The aggressive expansion of LNG jeopardises the 1.5°C target

The energy crisis has led to an explosion in new LNG export and import terminal projects globally. On the export side, substantial expansion is projected from countries in Africa, Australia, the US, Canada and the Middle East. Large increases in LNG import capacity are projected for Europe and key countries such as Germany and Italy that appear to far exceed that needed to replace Russian gas in the short run. There are plans for LNG import capacity development in India, South East Asia (e.g. Thailand, Vietnam) and East Asia (Global Energy Monitor, 2022). Under current proposals, global LNG consumption could more than double by 2030, reaching over 800 Mt_{LNG}/year (Yang et al., 2022; IEA, 2022a).

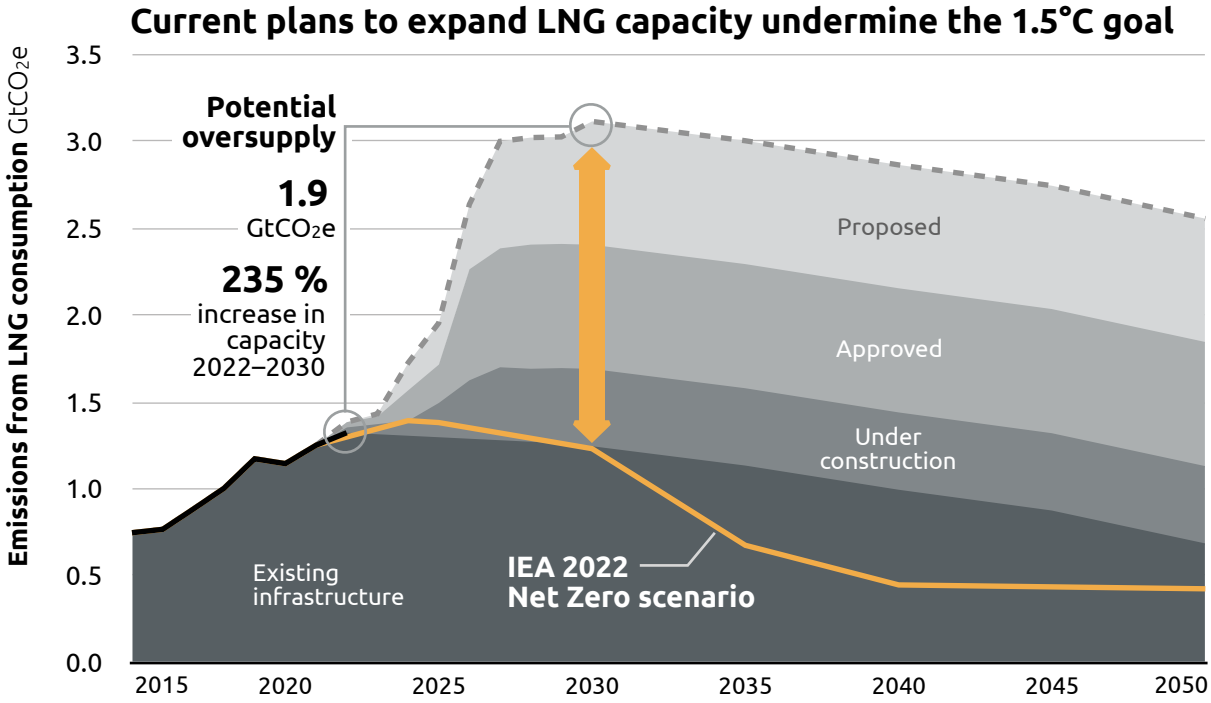

Figure 1 Global emissions from LNG consumption between 2015 and 2050. The figure compares global LNG consumption from the IEA's Net Zero scenario, which aligns with the 1.5°C target, and consumption based on the current pipeline of LNG capacity.

Assumptions: LNG capacity operates with an 80% capacity factor (IEA, 2022b); The emissions intensity of LNG is 2.8 tCO_2e/tLNG (Climate Analytics, 2021); Lifecycle emissions from production to degasification are 1 tCO_2e/tLNG (Roman-White et al, 2021).

Our analysis shows that this proposed growth in LNG capacity is incompatible with fossil fuel demands in 1.5°C compatible pathways (Figure 1). We compared the current project pipeline for new and expanded LNG export capacity with forecast demands in the IEA's latest NZE scenario and found we are heading to an oversupply in LNG of at least a factor of two (around 500 Mt_{LNG}) in 2030. This is more than double total Russian fossil gas exports in 2021, which were 250 bcm — equivalent to 184 Mt_{LNG} (IEA, 2022c). In addition, the IEA NZE already accounts for all LNG demand required to displace Russian fossil gas imports in the global economy. Therefore, **current LNG production capacity expansion far exceeds what is needed to displace Russian fossil gas exports**.

We found the oversupply of fossil gas could lead to excess emissions of at least 1.9 $GtCO_2e$ per year in 2030, compared to emission levels consistent with the IEA NZE scenario (IEA, 2022a) (Figure 1). Cumulatively, this would result in over 40 $GtCO_2$ of excess emissions between 2020 and 2050, or 10% of the total remaining carbon budget to limit warming to 1.5°C.

These projects simply do not align with 1.5°C, unless there was an accelerated reduction in fossil fuel consumption elsewhere in the global economy, even more rapid than the already ambitious IEA NZE scenario. In any case, these projects entail a significant risk of asset stranding. **LNG infrastructure expansion therefore risks either undermining the 1.5°C temperature limit, or substantial asset stranding**.

1.2 Europe's fossil gas strategy risks carbon lock-in and undermines global climate action

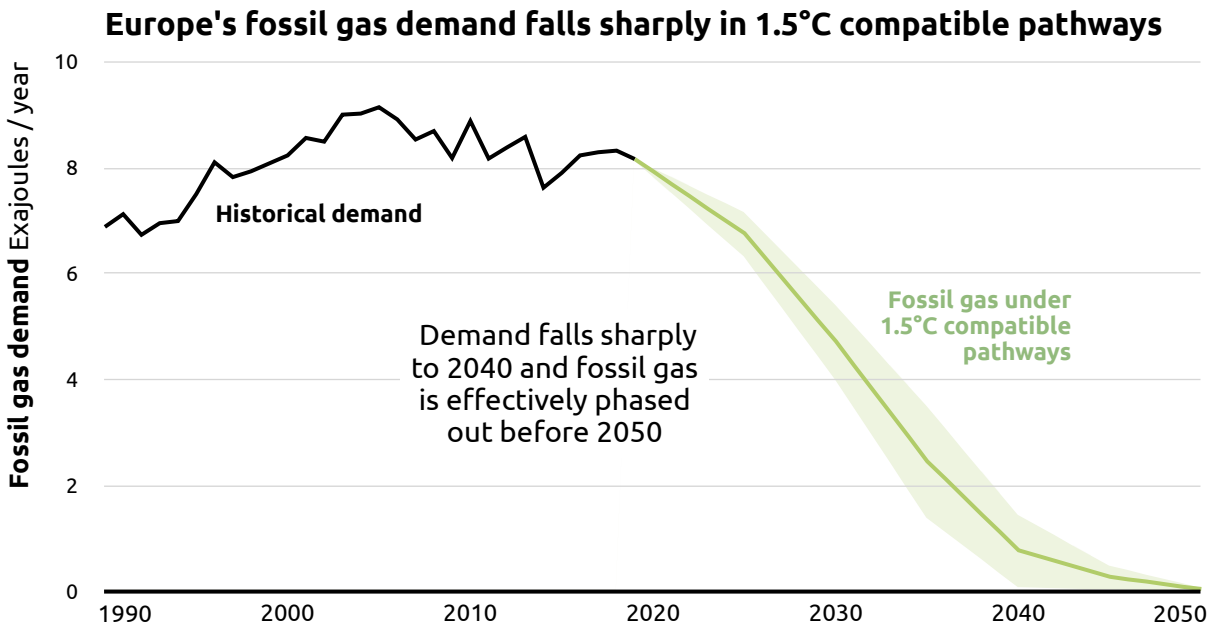

Figure 2: Fossil gas demands in final energy in European Union countries under 1.5°C compatible pathways.

The shocks of the energy crisis have rippled across the world. Yet Europe has been the centre-stage where the crisis has played out so far, due to its high dependency on Russian gas, as well as its actions to shore up supplies from other countries since the illegal invasion of Ukraine. The EU imported 155 bcm from Russia in 2021, equivalent to 45% of all fossil gas imports and 40% of total fossil gas demand (IEA, 2022a). Russia has been gradually reducing these exports, which have fallen by 80% since the war started, causing severe energy scarcity risks across Europe.

The EU's response to these disruptions has been mixed. In May 2022, it launched the REPowerEU plan to allocate EUR 100bn per year to wean itself off Russian gas while "tackling the climate crisis" (European Commission, 2022b). The plan increases the bloc's renewables target in 2030 from 40% to 45%, and also strengthens ambition on energy efficiency by increasing the target to reduce final energy demand from 11% to 13% (ibid.). These are steps in the right direction.

Yet the EU is also conducting large-scale procurement of fossil gas in both the short and long term. The REPowerEU plan proposes a "diversification of energy supplies" by displacing Russian fossil fuels with imports from other countries, including "untapped LNG potential" in sub-Saharan Africa (European Commission, 2022c).

This year, the EU agreed a USD 15bn package with Egypt and Israel to extract and export more fossil gas, while individual member states have also pushed to strike deals with gas-rich African countries, such as Algeria, Angola, Congo, Senegal, and Mozambique. The European Commission also regrettably classified fossil gas as a "sustainable" source of energy under its investment taxonomy reforms (European Commission, 2022c).

Since the illegal invasion of Ukraine, 26 new LNG terminals have been announced in the EU. At a cost of around EUR 6bn, these terminals would enable the continent to import up to 168 bcm, equivalent to around 41% of the bloc's fossil gas demand and exceeding total Russian imports before the illegal war in Ukraine.

The EU's frenzied action at home and abroad to secure long-term supplies of fossil gas begs the question: how much fossil gas does Europe need in the future? **Our analysis shows fossil gas demands fall sharply across the EU between now and 2040 under pathways compatible with the 1.5°C ambition.** Fossil gas would be effectively phased out of final energy demand across Europe before 2045 (Figure 2).

Europe's 1.5°C compatible fossil gas demands can be met with existing infrastructure (IISD, 2022). The short-term energy crunch Europe faces — which cannot be mitigated with additional import infrastructure due to construction lead times — can be alleviated through aggressive demand-side action. For example, energy efficiency and demand reduction programmes across the industry, commercial and residential sectors could cut up to two thirds of Russian fossil gas imports (Lau et al., 2022). **New fossil gas infrastructure in Europe is a false solution.**

1.3 Fossil gas expansion in Africa will not meet the continent's energy and development needs

Fossil gas expansion in Africa will not meet the continent's energy and development needs, but nor have finance and capital flowed into renewables at anywhere the scale needed.

While Europe has been cutting deals with African producers to secure fossil gas supplies and LNG imports, citizens across Africa have been badly hit by rising energy costs. Around 75 million people who recently gained access to electricity may lose their ability to pay for it, reversing a decade-long trend of increasing energy access (IEA, 2022b). Meanwhile, Egypt raised fossil gas exports to Europe, while curtailing domestic consumption in an effort to maximise export revenue.

In 2020, an IRENA study showed that Africa received only 2% of the USD 2.8tn that was invested in renewables globally between 2000 and 2020 (IRENA, 2022). This and other data indicate that the average annual investment in fossil fuels in Africa in recent years was around USD 33bn per year and in renewables around USD 5bn per year. In other words, annual fossil fuel investment appears to be 6-7 times greater than renewables in recent years.

It is in this context that the energy crisis has renewed a desire for many African countries to become major players in global fossil gas markets. Countries with significant fossil gas reserves – for example Nigeria, Egypt, Senegal, and Mozambique – are pushing to ramp up fossil gas production (African Climate Foundation, 2022), driven by the five-fold increase in the wholesale price of fossil gas this year (IMF, 2022a).

Multilateral development banks, as well as governments and industry lobby groups from developed countries (notably in Europe), are driving investment into fossil gas in several African countries. For example, this year the African Development Bank reached a major agreement to co-finance a new LNG plant in Mozambique at a cost of USD 20bn (ADBG, 2022). There are now around 905 new fossil gas projects planned in Africa, representing USD 400bn of investment. This is equivalent to 15% of Africa's GDP in 2021 (EnergyMonitor, 2022).

As we've already shown, these projects do not align with 1.5°C and will likely cause significant excess emissions, or stranded assets (Figure 1). Moreover, these projects entail substantial other risks for African economies:

- **Transition risks:** the global energy system is rapidly approaching peak fossil gas (IEA, 2022a). Global decarbonisation will mean a diminishing fossil gas market, in which new producers will be less competitive (Mercure et al., 2021). There is a high risk that new fossil gas infrastructure in Africa will be stranded assets from day one production (African Climate Foundation, 2022).
- **Debt distress and slower economic growth:** many African countries pursuing fossil gas expansion are either already in, or at high risk of, debt distress (IMF, 2022b). This means they are struggling to pay their debts and risk economic collapse. The fiscal consequences of stranded assets could be severe, impeding sustainable development and will entrench poverty in many countries on the continent (African Climate Foundation, 2022).

  African countries relying on fossil fuel exports have higher poverty levels, and some with economic growth that is up to three times slower than economically diversified countries (Bassey and Lemos, 2022). This is to be expected as the majority of fossil fuel projects in Africa are owned by multinational companies. Oil Change International estimates that about 60% of projected production in Africa (2020-2050) is controlled by countries outside Africa (BankTrack et al, 2022).

Fossil gas is not the solution for meeting energy access goals, nor development needs across the African continent (see our CAT report on fossil gas in Africa). The plummeting costs of solar, wind and battery storage technologies are making renewable energy systems reliable and cost-effective in developing country contexts (Barasa et al., 2018; Oyewo et al., 2019; Chen et al., 2020). The IEA NZE pathway shows that by focusing on renewables and efficiency universal access to electricity and clean cooking can be achieved by 2030 in Africa, but this needs well-formulated national strategies and international support (IEA, 2022a).

The energy transition in developing African countries requires international support to mobilise the level of finance and investment needed, which continues to fall far short of commitments from public finance and needs for investment in the energy sector. Developed countries, in particular from the European Union, should halt financial support for fossil gas resource development and LNG export infrastructure, and instead support and de-risk large scale investment into clean energy technologies to accelerate the transition in African nations and, where appropriate, the large-scale export of green hydrogen.

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2 Limited progress since Glasgow: Warming will still exceed Paris limit

Governments agreed to 'revisit and strengthen' their 2030 targets in 2022 as part of the Glasgow Climate Pact, but it is clear they have failed to deliver on this promise. Our global warming estimates are largely unchanged from last year, with now only eight years left of the critical decade in which to act.

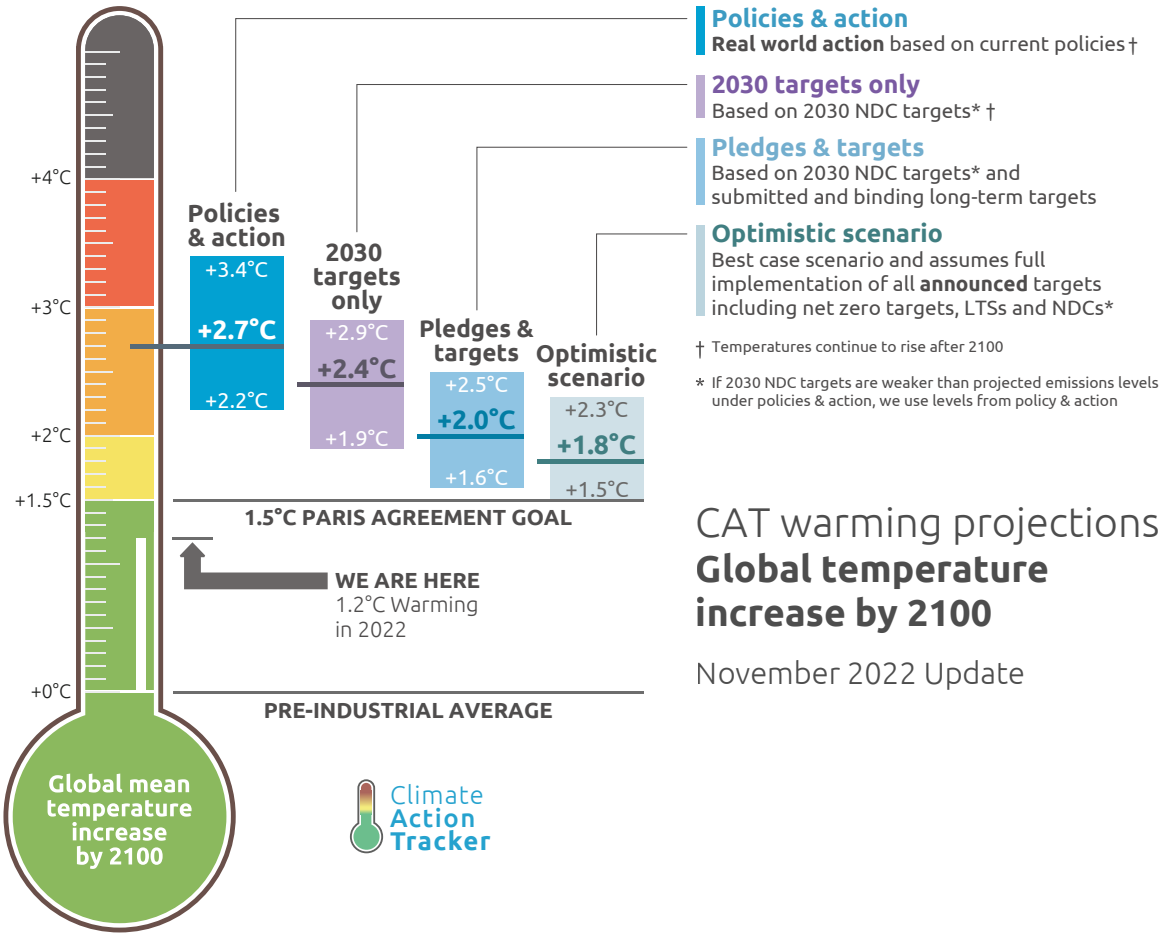

Figure 3: CAT thermometer with warming projections for 2100.

As most of the major emitters did nothing to strengthen their targets this year, it should come as no surprise that our 2030 target estimate remains at 2.4°C.[1] **India's** updated targets did not change our assessment: we use India's emissions in 2030 under current policies as both its original and update target are weaker than that level. **Brazil's** updated NDC does make a contribution, but one has to remember that this target is still weaker than the country's original NDC.

The stronger targets from **Australia, Thailand**, the **UAE, Norway** are welcome, but not enough to move the thermometer, nor are they not 1.5°C compatible. At the same time, the first three countries are increasing their export of fossil fuels, notably gas and LNG, while Thailand is planning a massive increase in LNG imports which will undermine renewables. The **EU's** promise to strengthen its target in 2023 is a year late: now is the time for climate leadership and the EU is set to overachieve its current target. Overall, the level of ambition governments have committed to in their 2030 targets will result in warming of almost a degree higher than the Paris Agreement's 1.5°C limit by the end of the century and will to continue to rise thereafter.

1 We have updated our methods substantially since our latest temperature estimate and now use the AR6 dataset and the latest version of the MAGICC climate model (MAGICC7). Overall, these method updates have a cooling effect on the CAT's target temperature estimates (i.e. lead to lower temperature estimates all else being equal). However, this effect has largely been cancelled out, due to higher current policy emissions in countries with weak targets. When a country has a weak target, meaning a target that is higher than our 2030 current policies estimates, and thus one easily (over)achieved, the CAT takes the current policy estimate rather than a target itself. In this update, a number of countries have higher current policy estimates than our previous assessment, and thus our targets pathway for these countries are higher, even though there has been no change in the NDC itself. See Annex 2 for details on our methods update. Current policies are discussed later in this section and in section 3.1.

If we consider binding[2] net zero targets in addition to 2030 NDCs (the 'Pledges and targets' scenario), our estimate has improved slightly, from 2.1°C in our Glasgow update to 2.0°C. The inclusion of the **Colombian, Vietnamese** and **Thai** net zero targets into this pathway are some of the key drivers[3] of this lower temperature estimate. Colombia enshrined its net zero target into law at the end of 2021, Viet Nam did the same in July 2022 and Thailand has strengthened its long-term target in its recently-submitted second NDC, accelerating the timeline to reach carbon neutrality to 2050 (from 2065) and net zero by 2065.[4]

While reaching the 2°C level is an important milestone, it must be stressed that this is based on only a 50 / 50 chance that warming will indeed be limited to 2.0°C by 2100. In probabilistic terms, it is "likely" to be below 2.2°C. And, of course, it is still well above 1.5°C. The difference between last year's estimate and today is also less than 0.1°C and is due to rounding..

Net Zero target warming

Warming under our 'Optimistic target' scenario, which assumes full implementation of all the net zero targets under discussion by governments, also remains at 1.8°C. Currently, about 90% of global emissions are covered by net zero target announcements at various stages of implementation. **There were no significant announcements of new net zero targets in 2022**, and, as discussed above, no significant movements on 2030 targets (which would help bring down cumulative emissions to the net zero target date), hence the lack of movement in the warming estimate.

Singapore and **Viet Nam** submitted and **Mexico** announced updated NDCs and **Argentina**, **Canada**, **Singapore** and **The Gambia** submitted or revised their LTS before or during the COP, however these submissions came too late to be included in our temperature update.

Policies & action warming

Our estimate for the level of end-of-century warming under current policies and action remains at 2.7°C. While the headline figure has not changed, there were some key developments this year. The passage of the Inflation Reduction Act in the **US** resulted in a 600 $MtCO_2e$-1.4 $GtCO_2e$ drop in our estimate for 2030 emissions. The top end of our policy estimate for **China** is also 600 $MtCO_2e$ lower in 2030 due to more ambitious clean energy developments, and policies integrated in the 14th Five Year Plans.

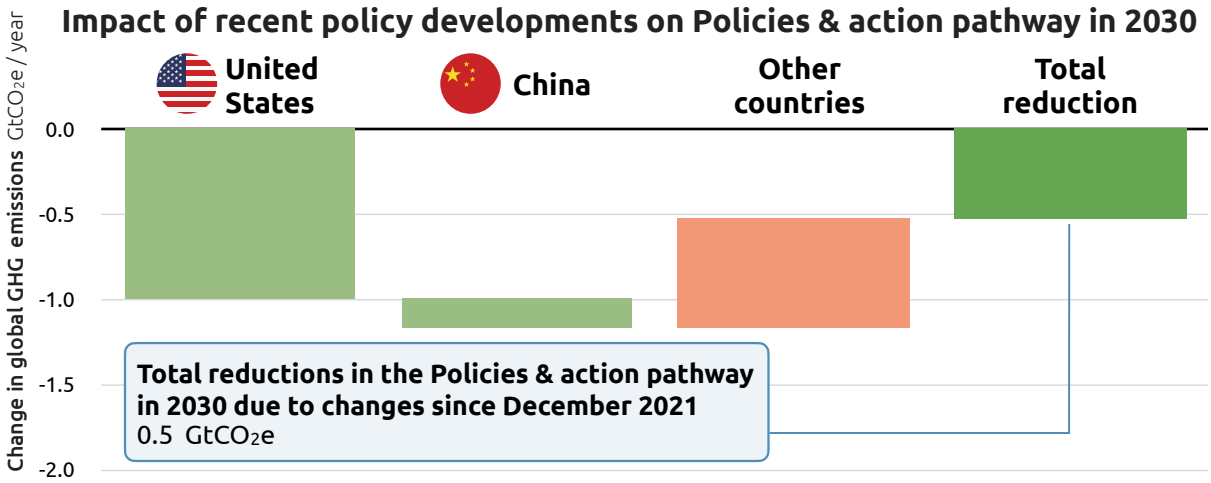

Figure 4: Impact of recent policy developments on the CAT Policies and Action pathway in 2030.

2 We consider targets to be binding if they have been adopted in domestic legislation or submitted, with sufficient clarity, in long-term strategies to the UNFCCC. We exclude older submissions if we deem that the country has abandoned its target. See Annex I for details.

3 There are also method changes and changes to target quantifications, as described in footnote 1, but these largely cancel one another out.

4 Thailand submitted its LTS in 30 October 2021, however it was not possible to include this target in last year's assessment.

Two elements worked in the opposite direction, essentially cancelling out these positive developments (see Figure 4):

- **First**, for many countries we track, historical emissions have been revised upwards in recent years, resulting in higher emissions in 2030, even with slowing economic growth and policy development. These higher historical emissions are largely due to a rapid rebound from the pandemic, which had a less significant and lasting impact on emissions than originally anticipated, and, in some cases, higher revised estimates for recent years due to better data
- **Second**, we have updated our modelling approach to be consistent with the latest IPCC science.[5] The newer models assume that decarbonisation will occur at a slower rate if emissions remain high in 2030 and will thus lead to higher warming estimates.

COP27 is being billed as the 'Implementation COP'. Governments need to finally listen to this message and accelerate climate action. But what our current update demonstrates is that it is imperative that all countries ramp up their efforts. Our 2.7°C estimate is for warming levels in 2100: the temperature will continue to rise after that date.

1.4 Warming outlook has improved since Paris but stalled this year

The CAT has been tracking the impact of governments' targets and policy action against end of century global warming for more than a decade (Figure 5). Our analysis shows that the Paris Agreement is clearly working, with both warming levels decreasing for both targets and policies since the Agreement was adopted, but it has really stalled in the last year.

We must build on the few positive developments of this year and see evidence of genuine accelerated policy implementation by the time world leaders convene in 2023 at the UN Secretary General's climate ambition summit. We cannot afford anything less.

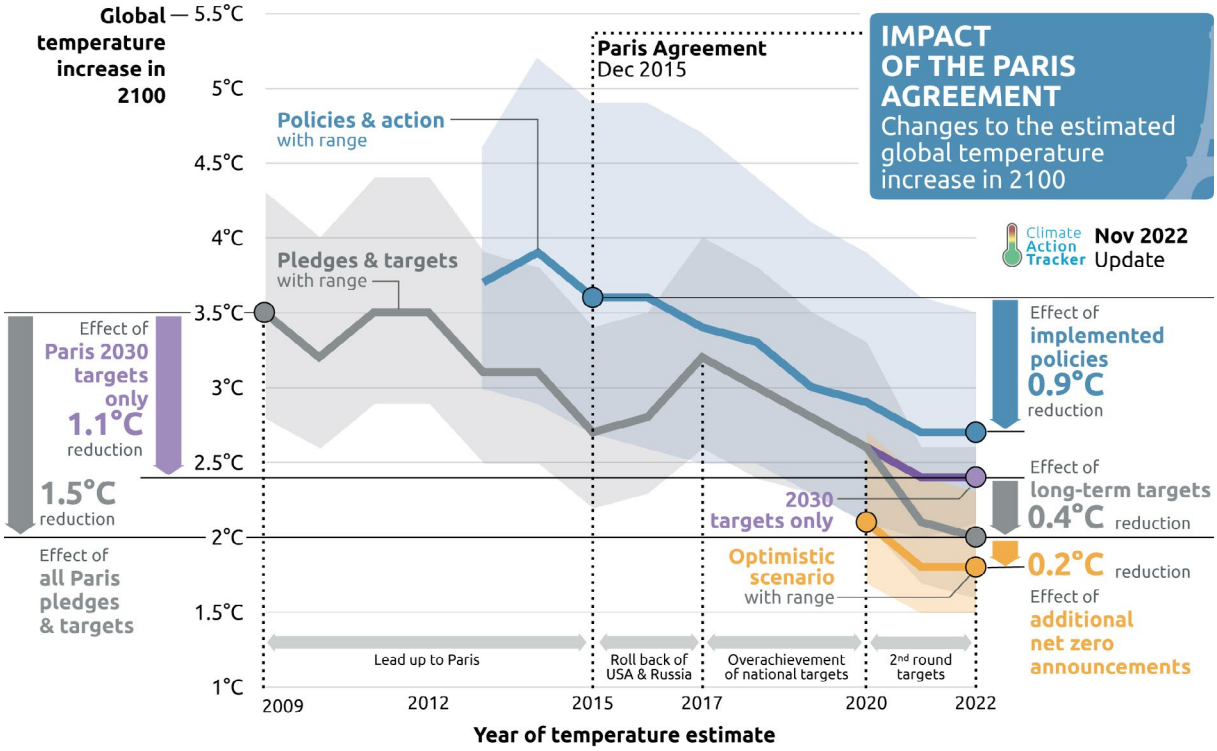

Figure 5: Impact of the Paris Agreement on the estimated global warming increase in 2100. Figure shows the estimates of the Climate Action Tracker from 2009-2022 for 'pledges and targets' and 'policies & action'.[6]

5 See Annex 2 for details.

6 The Climate Action Tracker is continuously updating and refining its methodology. As a result, the temperature estimates in this figure cannot solely be attributed to target improvements or real-world action; however, the figure does show the overall progression of our estimates.

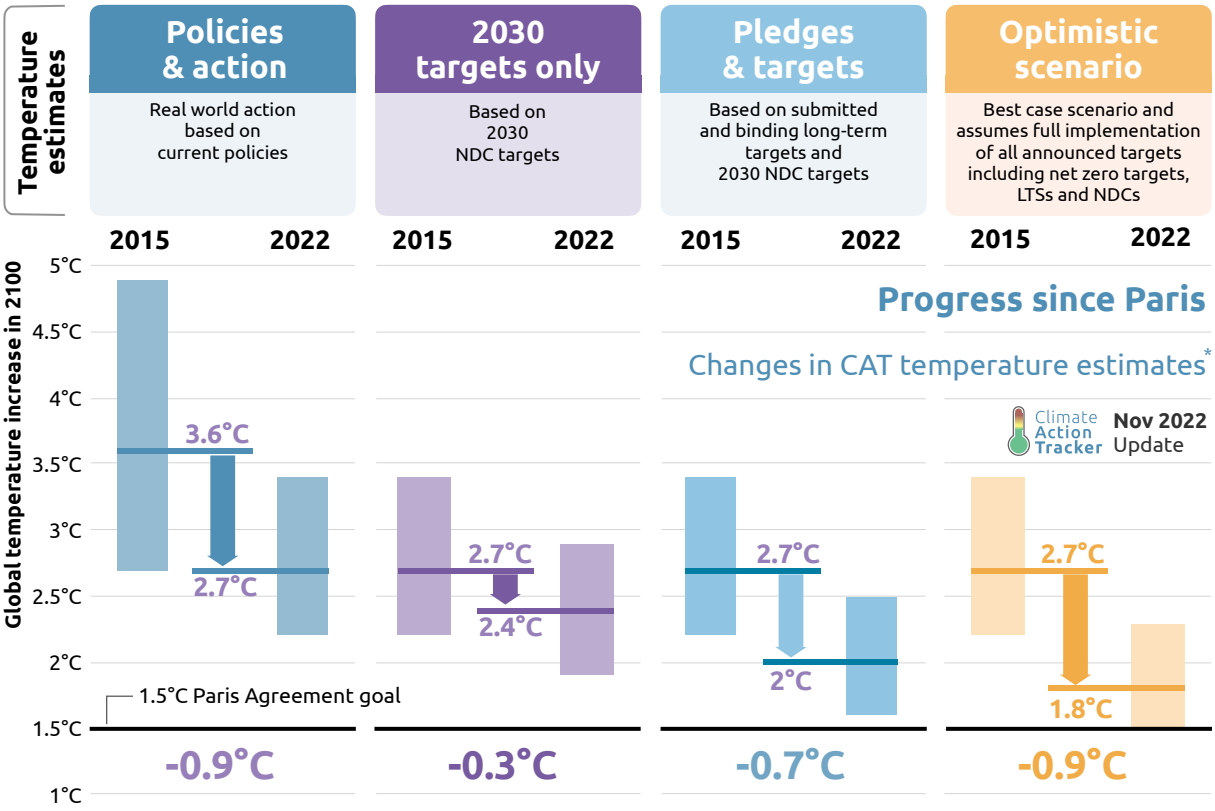

Figure 6: Impact of the Paris Agreement on the estimated global warming increase in 2100. Figure shows the difference between the Climate Action Tracker's 2015 and 2022 estimates.

* The Climate Action Tracker is continuously updating and refining its methodology. As a result, the temperature estimates in this figure cannot solely be attributed to target improvements or real-world action; however, the figure does show the overall progression of our estimates.

3 Few NDC updates highlight Glasgow Climate Pact's failure to deliver so far

Few countries submitted updated 2030 targets (NDCs) in 2022, contrary to the Glasgow Climate Pact. Emission reductions in 2030 remain woefully inadequate.

In 2022, **only 28 countries submitted NDC updates**, contrary to the Glasgow Climate Pact agreement that all countries should revisit and strengthen targets this year.[7] To make matters worse, few of the updates represented genuine increases in ambition. **Brazil** and **India** officially submitted the targets they announced in Glasgow: both may look stronger on paper, but Brazil's is weaker than its first NDC and India's will already be achieved with its current level of climate action and will not drive further emissions cuts. But President-elect Lula de Silva has promised a stronger Brazilian NDC and to ramp up action.

Indonesia also failed to increase ambition, only strengthening its targets on paper. Outgoing COP president, the **UK**, trod water in its NDC submission, failing to strengthen its domestic target or do its fair share in supporting others. COP27 president, **Egypt**, did little better: finally adopting a quantifiable target for the first time, but not one that will drive real emissions cuts and it doesn't cover the entire economy. The **US**, the **EU** and **China** NDC targets remain unchanged.

Only a handful of countries submitted stronger targets, with a few others signalling they will do the same. **Australia** was the only G20 country to strengthen its target, but its starting point is far behind its peers after three decades of inaction. The **UAE**, COP28 host, improved its target, a positive step, but its continued commitment to significantly increasing fossil fuel production and consumption remains problematic. **Thailand, Norway** and **Singapore** all submitted stronger targets just ahead of COP27.

Mexico announced what appears to be stronger targets ahead of COP27, but the announcement was short on details and so it is not yet clear. An updated NDC had not been submitted as of 8 November 2022. **Viet Nam** submitted an updated NDC on November 8, which we have not yet analysed.

The **EU** has signalled the possibility of strengthening its target further, once the internal negotiations of its climate package are completed in the next few months, but true leadership would have been to update the target well in advance of the COP to encourage others to act.

7 Decision 1/CMA. 3, paragraph 29. Submissions as of 8 November 2022

IMPROVEMENTS

- **Australia** adopted a stronger NDC target after a change in government earlier this year. While a positive step forward, the target still falls short of the cuts needed to limit warming to 1.5°C. Australia also still has a long way to go in terms of contributing its fair share and scaling up its level of climate finance.
- The **UAE** submitted a stronger target in advance of its COP28 hosting duties. While this is a positive step, the UAE is also planning for a significant increase in fossil fuel production and consumption, particularly fossil gas, which is not consistent with limiting warming to 1.5°C. Its 2030 target needs to be supported by more ambitious short-term and medium-term sectoral targets and actions, such as clearly committing to halting the expansion of coal-powered electricity and setting phase out dates for other fossil fuel power generation.
- **Thailand** strengthened its target just ahead of COP27. While the updated NDC is an improvement, it does not yet reflect a fair share contribution and is still far from being 1.5°C compatible. In 2022, Thailand has focused on securing fossil supply and doubling down on gas as the fuel for the future, having planned a massive build-out of new LNG import capacity, approving a new 1,400 MW gas-fired power plant, and securing gas fields in Myanmar. The potential for renewable energy remains high and largely untapped, with deployment stagnating since before the pandemic. Thailand also strengthened its long-term target, accelerated its target date for "carbon neutrality" from 2065 to 2050 and achieving net zero GHGs by 2065. An official revision of its LTS has not yet been submitted.
- **Norway** announced in a joint press conference with the EU in February 2022 that it would move to a 55% reduction target, having previously committed to a range of 50-55%. It officially submitted this updated target just before COP27. This stronger target is now 1.5°C compatible when compared to a modelled domestic pathway for Norway based on global least cost. This 1.5°C compatible rating should not stop Norway from keeping in lock step with the EU and strengthening its domestic target further next year. It should be noted that the rating does not consider exported emissions from its large oil and gas production sector. Norway is also not contributing its fair share and should provide additional, predictable, finance to others.
- **Singapore** strengthened its NDC target, but it is only slightly below our estimate of emissions in 2030 under current policies and action and far from 1.5°C compability. It does not yet reflect a fair share contribution. Singapore also revised its LTS bringing forward its net zero target date to 2050 (from an undefined point in the second half of the century).

HEADING IN THE RIGHT DIRECTION

- **Brazil**: President-elect, Luiz Inácio Lula da Silva, has promised to submit an updated NDC with stronger targets and strengthen the country's climate action, especially on stopping deforestation. No timeline has been set for the update, though the head of Lula's environment team and a former environment minister have said that producing Brazil's first NDC in 2015 (and its most ambitious to date) took a year.
- **EU** ministers have agreed to strengthen their target after their climate legislation, the 'Fit for 55' package is finalised in the next few months. Depending on the changes in the energy mix, the REPowerEU Plan, put forward by the Commission in May 2022, may enable the bloc to exceed its current target by a few percent. However, the EU still needs to go around 5 percentage points further to adopt a 1.5°C compatible target.

UNCHANGED

- **Egypt** submitted emission reductions targets for some sectors in its NDC update, the first time it has put forward quantified targets, along with a list of policies and measures for other sectors. These targets appear to be weak and well above its anticipated emissions in 2030, though the lack of transparency in its update makes the assessment difficult. This lack of ambition from the COP host is disappointing.
- **India** also officially submitted some – but not all - of the targets it had announced at COP26. While the new targets are stronger on paper, India will already achieve them with its current level of climate action, so the update will not drive further emissions reductions. Prime Minister Modi had also announced a 500 GW non-fossil capacity target in Glasgow: it was not included in the NDC (but is included in its domestic energy plan). At most, this target would have driven minor emission reductions. Overall, India needs to propose further cuts in its 2030 emissions to put it on a 1.5°C pathway, for which it will need support to achieve.
- **Indonesia** strengthened both its unconditional and conditional targets, but these remain weak. The country is set to significantly overachieve both targets with policies it already has in place, so its update does not represent a true increase in ambition. Both targets depend heavily on the forestry sector, which accounts for around 60% of the emissions reduction effort. Indonesia also needs to make headway in reducing emissions in other sectors, especially energy: its power sector is dominated by coal and set to grow throughout the decade.
- The **UK** did not strengthen its emissions reduction target in its NDC update, instead providing additional information on how it will achieve its current target. The NDC failed to strengthen the UK's fair share contribution, with no additional climate finance finance or support for emissions reductions abroad.

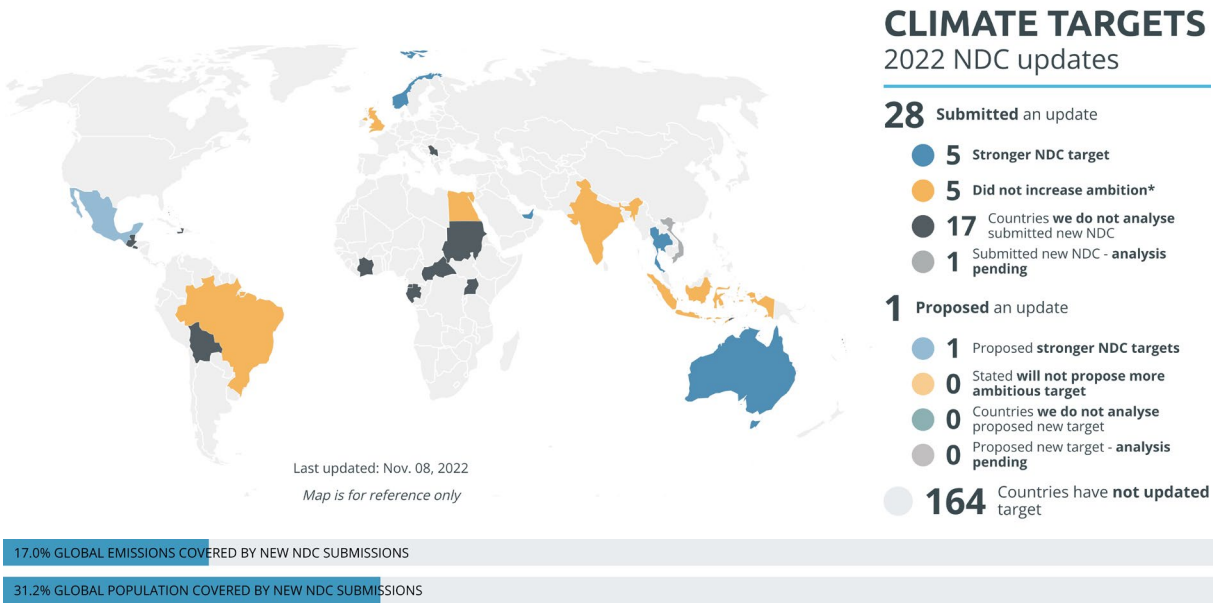

Figure 7: Status of NDC updates as of 8 November 2022. See our Climate Target Update Tracker page for further details

3.1 Inching forward with implementation

Implementation – actually taking action to cut emissions – is critical to limiting warming to 1.5°C. For as long as the CAT has been estimating global temperature warming, the actions of most governments have always lagged behind the targets they have set for themselves. In 2022, there were some notable and much-needed developments on the implementation front, but also some concerning trends. We are still not seeing the scale nor speed of implementation needed to close the gap and keep the possibility of 1.5°C open.

In August, the **US passed the most ambitious and potentially impactful climate policy in its history**, the Inflation Reduction Act (IRA). **But it will need to do more to meet its target**: the measures in the Act are not enough to meet its NDC, although they will firmly put the country's emissions on a downward trajectory. The passage of the Act also sends a signal that the world's largest historical emitter is now finally beginning to meet its responsibilities.

Not all developments in the US were positive. Concessions in the Act and other actions taken by the Biden administration in response to the energy crisis may encourage domestic oil and gas production. A June Supreme Court ruling limited the EPA's ability to regulate carbon emissions from power plants and sets a worrying precedent for the future of climate action, and there are more cases to come that could undermine domestic action. However, market dynamics are likely to continue to drive the decarbonisation of the US power sector, albeit not at the speed needed to meet its goal of 100% emissions-free power sector by 2035.

China's 20th Party Congress in October 2022, **delivered no new headline policy updates on climate and environment but re-emphasised the key trends of the last year**: pushing for modernisation and efficiency gains in industry and energy systems, evolving the economy towards higher value and cleaner production, and the necessity of coal as a backstop for energy security. While renewables and clean technology are still on track for rapid scaleup, the outlook on carbon-intensive fossil fuels looks equally robust.

The EU advanced its climate action in some areas and misstepped in others. Russia's illegal invasion of Ukraine has really crystalised the climate paths it can pursue: replace dependency on Russian fossil fuel imports with reliance on fossils from other countries, thus risking stranded assets and delayed decarbonisation, or take decisive action and switch to domestic sources of renewable energy.

In May, the Commission put forward the REPowerEU Plan which seeks to increase renewables and reduce energy consumption and would enable the bloc to overachieve its 2030 NDC by a few percentage points. But it also includes substantial funding for new LNG and fossil gas pipeline infrastructure and to delay the coal phase-out and switch gas to coal power. While the final contours of the Plan are still being negotiated by the various EU decision-making bodies, a number of member states are accelerating investment in LNG infrastructure (see fossil gas section above).

A decision by the European Commission in March to classify fossil gas and nuclear as "sustainable" sources of energy under certain conditions under its investment taxonomy also does not help. Gas is a fossil fuel; it is not a "clean" fuel, and both the IEA and the IPCC are clear that it needs to be out of the world's energy systems almost as fast as coal. Additional investments in nuclear will shift needed resources away from energy efficiency measures and renewables, both of which can be deployed much faster and have a more immediate impact on mitigating the current energy and climate crises.

India continues to rapidly expand its renewable energy capacity, but its coal usage remains problematic. A draft of its latest electricity plan was released in August, under which wind and solar capacity grow substantially over the next decade, but so too would coal, with another 26 GW of coal capacity 2027. The government's focus on coal may be waning as the Ministry of Power has appointed an expert committee to explore halting new coal-based power units after 2030. To be 1.5°C compatible, India needs to pursue a coal phase much faster: cutting is usage dramatically by 2030 and completely by 2040.

On October 30, Luiz Inácio Lula da Silva was elected President of **Brazil**, ousting Jair Bolsonaro. During the election campaign, Lula, who also served as President from 2003-2010, promised to submit an updated NDC with stronger targets and strengthen the country's climate action, especially on stopping deforestation. No timeline has been set for the update, though the head of Lula's environment team and a former environment minister said that producing Brazil's first NDC in 2015 (and its most ambitious one to date) took a year. Implementing his climate plans will not be without challenges as Lula will have to contend with a more conservative Congress and a number of other pressing issues, including growing hunger.

Chile, while it has not updated its NDC, has made remarkable progress, turning emissions around from rising two years ago to a projected decline, closing coal-fired power plants, discussing bringing the full coal exit forward to 2030, and implementing electric vehicle policies. Its legally binding target is enshrined in a law that ensures climate policies cover all ministries in government.

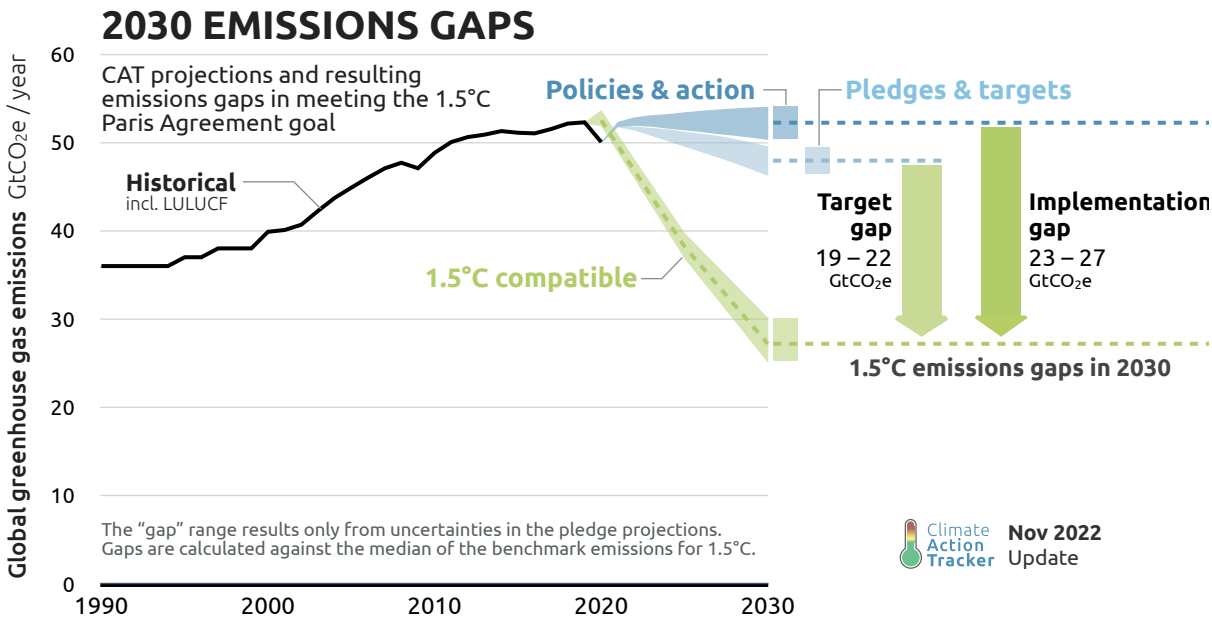

Figure 8: 2030 emissions gap between NDC targets ('target gap) and policies and action ('implementation gap') and levels consistent with 1.5°C.

Overall, countries have been making headway with closing the targets emissions gap, bringing them closer to a 1.5°C pathway. However a substantial implementation emissions gap between *current policies* and *needed action* remains (Figure 8). We need to build on the few positive developments of this year and see evidence of genuine accelerated policy implementation by the time world leaders convene in 2023 at the UN Secretary General's climate ambition summit.[8]

8 1/CMA.3, paragraph 86.

4 Sectoral initiatives have not yet lived up to the hype

Several sectoral initiatives were launched in Glasgow to accelerate climate action. We look at four of those here: cutting methane, eliminating coal, phasing out oil and gas production and transitioning to EVs. While one can find some positive developments, these are largely not moving fasting and are still missing major players.

4.1 From methane pledge to beyond oil and gas

Atmospheric methane concentrations saw the largest year on year increase in 2021 since records began close to 40 years ago. The causes are not entirely clear, but could be the result of climate feedback in tropical wetlands. Regardless, the increase only serves to underline the urgency with which we need to cut emissions. Signatories of the Global Methane Pledge agreed to cut emissions in all sectors by 30% below 2020 levels globally over the next decade.

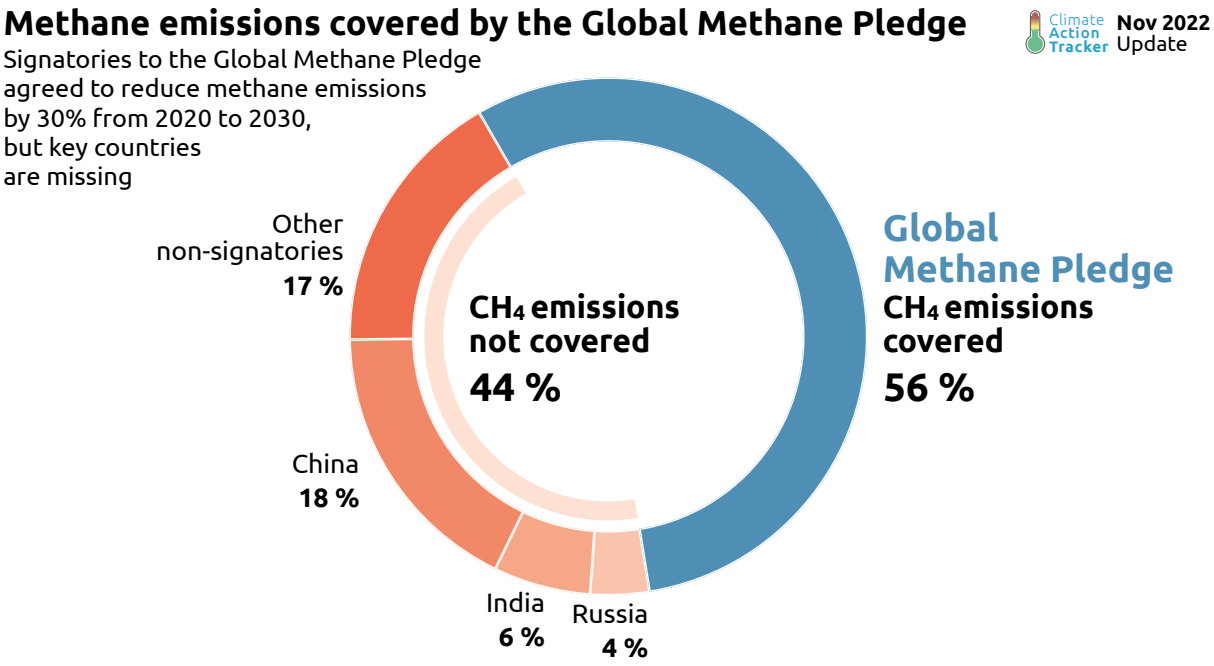

Figure 9: Global Methane Pledge emissions coverage. 2021 emissions data extracted from Gütschow et al 2022.

The Pledge itself is not consistent with 1.5°C. The global target would need to be strengthened in the region of 40% to be 1.5°C compatible.

Two-thirds of the world has signed up to the Global Methane Pledge, but some of the top emitters remain on the sidelines. In 2022, over a dozen countries joined the Pledge, most notably **Australia, Bangladesh, Egypt, Qatar** and **Mongolia**, but the Pledge still only covers 56% of global methane emissions, as three of the largest emitters: **China, Russia** and **India** have not yet signed up.[9]

9 As of 31 October 2022, 125 countries had joined the pledge according their website.

Action in the non-signatory top emitters suffered setbacks or is undermined by fossil fuel expansion plans.

- **China** signaled its intention to tackle methane emissions in its 14th Five-Year Plan, but further action as part of a joint US-China initiative has stalled due to trade and political tensions. China suspended bilateral climate talks in August in response to a high-level US visit to Taiwan. Meetings had been planned for September to discuss action on methane.
- **Russia** is committed to supporting its fossil fuel sector, as outlined in its 2035 energy strategy (Russian Federation, 2020). It also does not have a great track record with past pledges: it has not met flaring targets first introduced in 2012 and has recently pushed back the date to achieve these. It continued to flare the most gas than any other nation in 2021 (Global Gas Flaring Reduction Partnership (GGFR), 2022). The sector also suffers from substantial leakage. In early 2022, satellites detected the largest methane leak from a coal mine ever recorded. Russia has also reportedly burned off some of the fossil gas it would have otherwise sold to Europe.
- **India's** plans to increase its fossil gas consumption and transform the country into a "gas-based economy" are not heading in the right direction. While India will need to import much of its fossil gas, these plans will likely drive up its own methane emissions as well as continue to encourage production elsewhere.

Signatories have made plans to cut methane emissions, but the extent of implementation remains to be seen. Governments that have signed the Pledge have developed economy-wide methane reduction plans (e.g. US, EU, Canada) or included methane reduction measures in their NDCs (e.g. Colombia, Mexico, Nigeria, Egypt, UAE). More country plans are expected to be announced at COP27.

Cutting fugitive emissions is a common element in many plans. Methane is produced in the mining or extraction and transport of coal, oil and fossil gas, with each of the fossil fuels contributing to roughly a third of methane emissions from the energy sector. The IEA notes that if all oil and gas producers were as efficient as Norway, methane production from that sector would drop by more than 90%.

- **Colombia** adopted a resolution to reduce leaks and venting in February.
- **Mexico's** state-owned oil company committed in June to reducing methane emissions from its oil & gas exploration by up to 98% (Secretaría de Relaciones Exteriores, 2022).
- **Nigeria's** Energy Transition Plan published in August aims to eliminate gas flaring by 2030 and reduce fugitive emissions 95% by 2050.
- **Canada**, the **EU** and the **US** had already adopted or announced oil and gas sector measures last year.

These plans miss the real challenge: to phase out coal oil and gas production. Just as there is no such thing as 'clean coal', there is no 'clean oil and gas'. Dealing with fugitive methane emissions alone is not enough. In 1.5°C compatible pathways, total methane emissions are reduced by 37% below 2019 levels by 2030. A much larger rate of methane reductions – 64% - is needed in the energy supply sector by 2030.[10] In these pathways, fossil gas demand falls 26% below 2019 levels by 2030, and oil consumption falls 16%. Reducing demand as well as tackling fugitive emissions is essential for methane reductions, and drives CO2 emission reductions through reduced fossil combustion as well. In contrast, a number of the signatories plan to increase fossil fuel production, even though the IEA has said that there can be no further development if the world is serious about 1.5°C. **Colombia** is the one exception here. The newly elected President has already introduced legislation to ban fracking in the country, fulfilling one of his main election promises.

The Beyond Oil & Gas Alliance (BOGA) seeks to facilitate a managed phase out of oil and gas production, but has no major producer members. The Danish and Costa Rican-led initiative was launched at COP26. None of its dozen or so national and sub-national government members are major oil and gas producers and so their participation is meant to start the conversation on an oil and gas phase out and spur action in others.

10 2030 global methane reductions from 2019 levels in IPCC 1.5°C compatible pathways, filtered for sustainability criterion.

New Zealand, an associate member of the alliance, had already banned new offshore oil and gas exploration in 2018 (Government of New Zealand, 2018). Denmark banned new developments in 2020 and agreed to a phase out by 2050, though research suggests that that date could be much sooner. In April 2022, the Canadian province of **Quebec**, a sub-national member, passed a law banning any further production and mandated that existing drill sites be shut down within three years. The move is largely symbolic as the province is not a producer of oil and gas, though there had been efforts earlier in the year to resurrect an LNG project in light of Russia's illegal invasion of Ukraine. Disappointingly, **Costa Rica** has stepped back from leading BOGA after a change in government.

Oil and gas majors have created their own initiative, but have little to show in 2022. At the US Leaders' Summit on Climate in April 2021, Canada, Norway, Qatar, Saudi Arabia and the United States, established a 'Net-Zero Producers Forum' (Natural Resources Canada, 2021; U.S. Department of Energy, 2021). The UAE joined the initiative in May 2022. The forum stated aim is to develop 'pragmatic net-zero emission strategies', including reducing methane emissions and supporting the use of CCS. Beyond holding its first Ministerial meeting and establishing a working group in March 2022, there is little evidence of concrete action more than a year after forming.

2022 also highlighted the fragility of fossil infrastructure and the need for alternatives. The alleged sabotage of the Nord Stream gas pipelines in late September resulted in what will likely be one of the largest methane leaks at a single location. While this release is tiny compared to the oil and gas sector's annual methane emissions, it could still equate to around a day and half of global methane emissions. The deadly and tragic flooding in Nigeria also hampered the country's LNG production. The need for alternatives is clear.

4.2 2022 coal renaissance must be short-lived

Under the coal exit initiative, governments pledged to transition away from unabated coal power by the 2030s or 2040s and to cease building new coal plants. Unlike the methane pledge, it does not have a governance structure of its own, which hinders the ability to track government action.

No new governments signed up to the coal exit in 2022. Over 85% of total coal-fired power generation occurs in 10 countries, **China**, **India**, the **US**, **Japan**, **South Korea**, **Indonesia**, **South Africa**, **Germany**, **Russia** and **Australia**, only three of which – South Korea, Indonesia and Germany – signed up to the coal exit. Indonesia did not commit to stopping to build new coal plants, only to consider phasing out coal by the 2040s with international support. Overall, signatories of the coal exit represented about 12% of coal-power generation in 2021.

In 2021, **coal-fired power generation reached an all-time high**, resulting in close to 10 $GtCO_2$, a 7% jump over 2020 levels and a reversal of the downward trend emissions had been on in 2019-2020. The record level in 2021 was also constrained by high prices and supply chain issues, otherwise it would have been even higher. The US, EU, India and China all saw significant year over year growth. Another spike in 2022 is likely as countries, especially in the EU, seek to deal with the energy crises caused by Russia's illegal invasion of Ukraine.

Progress, both from signatories and major emitters who remain outside the initiative, was mixed.

The signatories

South Korea lacks a credible plan to implement its pledge to phase out coal in the 2030s. It has been progressively reducing the amount of coal power in its 2030 electricity mix plans, but its latest draft electricity plan still envisages drawing over 20% of its electricity from coal in 2030. To be 1.5°C compatible, coal must be phased out entirely by that date. Near-term emissions from coal are also on the rise: The state power utility, KEPCO, has increased coal power in 2022 in response to higher gas prices. The continued reliance on fossil fuels makes KEPCO susceptible to higher coal and gas prices, putting the company at risk of default.

Indonesia is taking positive steps in planning a phase out of coal-fired power generation, but will need the support of the international community to succeed. The country recently set a 2050 coal phase out date, but is in talks with international partners about how to bring that date forward. As indicated in Glasgow, the country is open to a 2040s phase out with support. To be 1.5°C compatible, unabated coal power needs to drop dramatically by 2030 and be completely phased out by 2040. At the moment, coal provides 61% of electricity generation and is projected to continue increasing until 2027. By 2030, coal will generate 64% of the country's power, unless plans change.

Germany intends to phase out coal by 2030 and is working with energy companies on that timeline, though the deadline in the phase out plan remains 2038. Emissions from coal power usage rose by 6% in 2021 and will likely increase in 2022 as well, as the government brought a number of coal plans back online in August in response to the energy crisis and the need to reduce dependence on Russia gas.

Non-signatories

China remains inconsistent on its stance on coal dependency. In 2021, President Xi announced that coal consumption would be 'strictly controlled' to 2025 and start phasing down thereafter. However, ensuring a stable supply of fossil fuels has been a key strategic priority since China's power shortage in 2021 (which was caused by a mix of high energy demand pressure and low coal supplies), when production reached at an all-time high.

China had introduced new coal-friendly policies to counter the shortage, including opening new mines, stabilising coal prices, raising coal cap prices, and increasing production targets. Power consumption is again expected to increase by 5% to 6% in 2022. China has more than half of the world's installed capacity of coal power and capacity is expected to grow further until 2030. To be compatible with a 1.5°C pathway, China would need to decrease the share of unabated coal in power generation to at least 35% in 2030, with a complete phase-out before 2040 (Climate Action Tracker, 2021a).

India helped weaken the final agreement in Glasgow, watering down the text to a coal "phase down" not "phase out" (Reuters, 2021). Yet the government is continuing to support coal in various ways and its latest electricity plan would add another 26 GW of coal capacity to 2027. Close to 30% of the country's power would still come from coal in 2030. On the bright side, the government has appointed an expert committee to explore halting new coal-based power units after 2030. The falling cost of solar and the benefits an accelerated shift to renewable energy would bring in terms of jobs and improved health represent a significant opportunity for the country.

The **US** did not adopt the coal phase-out statement, but does have a goal to achieve carbon-free power no later than 2035. Although high natural gas prices resulted in more coal-fired generation in 2021, this is not expected to affect the downward trend of coal use in the power sector in the future. Coal continued to be retired in 2022. About 30% of the installed capacity of coal-fired power plants has been retired since 2010. No new coal-fired capacity has been introduced in the US since 2013 and none are planned.

Japan has finally started to shift, albeit way too slowly, away from coal power domestically. Under the latest electricity plans, coal power is 19% of generation in 2030, a considerable step forward, but still far from being 1.5°C compatible. Yet, the country is still opening new plants, with four coming online in 2022 and four more planned by 2024 (JBC, 2022). These coal plans stand in stark contrast to the G7 commitment to achieve "fully or predominantly" decarbonised electricity by 2035 (G7, 2022).

Australia's electricity generation mix is dominated by coal. The country lacks a national plan to phase-out coal from its generation mix, despite recent blackouts and energy crisis related to ageing coal fired power stations. However, there has been significant action at the state level this year with a number of states announcing or bringing forward coal phase-out dates: Western Australia (2030), Queensland (2035), Victoria (mid-2030s).

4.3 Electric vehicle adoption is heading in the right direction, but not fast enough

Electric vehicles (EVs) should account for 75–95% of annual sales of cars and light trucks in 2030 and 100% by 2035: phasing out the internal combustion engine, to be 1.5°C compatible. In 2021, sales were less than 9% and need to accelerate five-fold in order to meet 2030 targets. At COP26, a coalition of national and subnational governments and industry stakeholders pledged to work towards 100% EVs by 2035 in leading markets and 100% by 2040 globally.

Many countries who signed the declaration already had EV targets and policies in place. In 2022, they continued to implement those plans. **Membership has not expanded significantly**.[11] A handful of largely European countries joined right after COP26. Greece is the only country to have signed up in 2022. The biggest step is that in October, the **EU** as a whole reached a deal for 100% zero emissions vehicles in 2035, consistent with the COP26 Declaration, though with most of the target to be achieved post 2030. But the EU, nor Germany or France, have joined the initiative yet.

The signatories

Norway leads the world on EV adoption. Its 2025 phase-out of fossil fuel vehicle sales is a decade earlier than the COP26 pledge of 2035. Battery electric sales were 78% of sales in September 2022, and all plug-in electric vehicles reached 87.8%.

New Zealand has imposed fees on high emitting vehicles and given rebates on low-emitting ones since April. Starting next year, vehicle importers will have to meet CO_2 emission reduction targets, to be strengthened annually until 2027. The scheme stops short of banning the import and manufacturing of internal combustion engine vehicles by 2035 at the latest, which was recommended by the government's climate advisory body in 2021 and would be consistent with the pledge New Zealand made at COP26. Emissions standards have only just been introduced for the first time.

The **UK** has committed to a 100% sales target in 2030, a faster timeline than the COP26 declaration. The government will set legally binding targets for EV sales from 2024 and aims to have 300,000 public charging points by 2030. In 2021,12% of car sales were battery electric, which is above the government's own projections of the deployment rate needed to achieve the country's climate targets. While positive, the UK's accompanying policies to reduce emissions from fossil fueled vehicles are too weak and need strengthening.

Canada has a number of policies in place to support EV adoption and to develop its charging network. In its latest climate plan, the government has promised to establish sales mandate regulations to ensure that its 2035 and interim targets are met, but has yet to follow through on this promise. In 2021, 3.6% of LDV sales were battery electric, 10% when you include hybrids.

India has a target of a 30% share of electric vehicles (EV) in new sales for 2030. At COP26, India signed the 100% EV declaration with a focus on two and three-wheeler auto-rickshaws. The government is working on plans to require all two-wheelers to be electric by 2026, much sooner than the COP26 timeline.

Chile has less than 1% EV sales in 2021 and has limited public charging infrastructure. The sector is growing exponentially and the government has put in place policies to support charging infrastructure, but it will need additional policies to meet its target.

11 As of 5 November 2022.

The top three car manufacturing nations have EV sales targets, but are not yet consistent with a 1.5°C pathway.

- **China** has a 2030 sales target of 40% for new energy vehicles (which includes battery electric vehicles, plug-in hybrids and fuel cells) and may reach 20% sales by next year. The government has reduced policy support of the sector in its latest five-year plan and will withdraw all NEVs subsidies this year, which is a sign of sector maturity. China could reach price parity with conventional vehicles in the next 5–10 years, before considering fuel savings.
- The **US** has set a goal to make 50% of all new vehicles sold in 2030 zero-emissions vehicles, and has introduced support measures for the industry. A number of US states and cities have stronger targets and did adopt the COP26 pledge.
- **Japan** has not adopted the zero emission vehicles target and instead pushed to remove the target from this year's G7 commitment. Japan currently aims for 100 % new sale of "electrified vehicles" which includes non-plug-in hybrids (HVs) and plug-in hybrid vehicles (PHV) by, latest, 2035.

So, it would seem that declaration or not, the headline remains the same: **Electric vehicle adoption is heading in the right direction, but not fast enough.**

5 Climate finance contributions are still far from being sufficient

Climate finance is nowhere near sufficient levels to support the implementation of additional emissions reductions in developing countries. In 2020, all developed countries together provided only USD 83.3bn in climate finance to developing countries out of the USD 100bn pledged yearly from 2020 to 2025—an increase of just 4% compared to 2019 (OECD, 2022). Projections from 2021 show the USD 100bn goal would only be reached in 2023 (OECD, 2021). Since then, only a few countries have made additional commitments—more is clearly needed. No developed country out of the 11 we rate provides sufficient climate finance.

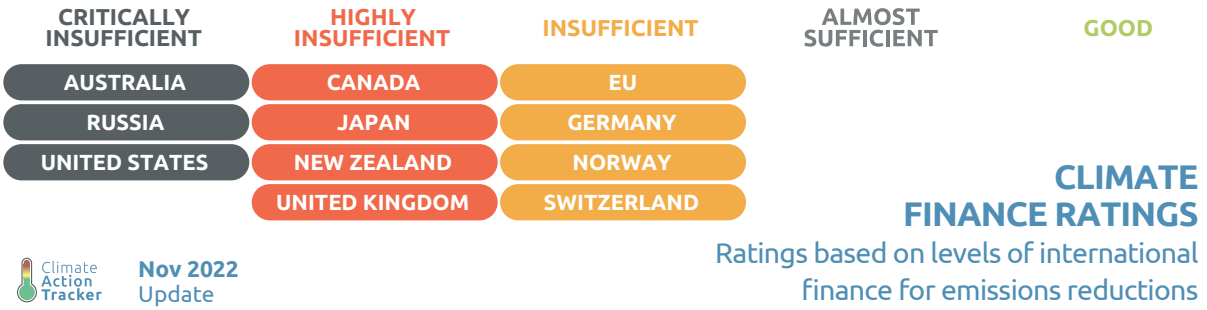

Figure 10 CAT climate finance ratings of developed countries.

One of the largest gaps remains the US' "Critically insufficient" climate finance. In March 2022, the US Congress approved only USD 1bn of international climate finance. This falls far short of the USD 11.4bn yearly pledge President Biden made in 2021 and what its fair share would be. The US also failed to fulfil its original promise of USD 3bn to the Green Climate Fund, only delivering on a third of the amount. Australia, also rated "Critically insufficient", has committed to doubling its international climate finance to a total of USD ~1.3bn (AUD 2bn) in 2021–2025, but even this remains too low. It has not yet contributed to the Green Climate Fund's current funding round. Russia's contribution to the GCF has been small compared to the level of finance it should be providing. The UK is doing slightly better than these three, with an overall rating of 'Highly insufficient', but recently failed to deliver on its funding commitments to the GCF and another climate fund, which has resulted in project delays, and calls into question the UK's resolve to follow through on its pledges.

The Egyptian presidency has made **climate finance one of the key priorities for the COP27 negotiations.** Governnments will need to agree on a new commitment beyond 2025. Ultimately, the USD 100bn goal is still far from what is needed to support transformative change.

Just energy transition partnerships (JETPs) could lend a helping hand to the "implementation" agenda. COP26 saw the announcement of the first of the JETP with South Africa to support a transition away from coal in the power sector—with around USD 8.5bn of grants and concessional finance over three to five years. JETPs are also being developed with India, Indonesia, Viet Nam and Senegal and G7 members.

In parallel to climate finance, it is important that governments stop international public finance of fossil fuels. At COP26, a number of countries signed a pledge to end new public finance for unabated fossil fuels by the end of 2022 — "except in limited and clearly defined circumstances that are consistent with a 1.5°C warming limit and the goals of the Paris Agreement". Of the developed countries we track, this includes Canada, Germany, New Zealand, Switzerland, the UK and the US. Australia, the EU, Japan, Norway and Russia did not sign the statement.

In June 2022, **G7 leaders** put forward a watered down version of this commitment. While they also committed to ending public finance for unabated fossil fuels abroad by the end 2022, their statement allows countries to create their own definition of the "limited circumstances" that could see international public finance for fossil fuels permitted. Germany's Chancellor Scholz has made statements about investing in developing a gas field in Senegal, destined for export as LNG to Europe. There are also signs that Japan, the largest provider of international public finance for fossil fuels, could still intend to invest in upstream fossil fuel projects.

6 Net zero targets remain mostly unsubstatiated and vaguely defined

No substantial improvements of existing net zero pledges since COP26

While many governments announced new net zero targets or updated their existing ones around COP26 in Glasgow last year, there have been no major new net zero announcements nor developments since (Table 1). Türkiye, Argentina, Canada, Germany, Singapore and Colombia provided further details on their respective net zero pledges. Yet, the United Arab Emirates, Saudi Arabia and India have communicated no specifics on their net zero targets, meaning their announcements last year remain unsubstantiated. Ethiopia and South Africa have also not followed up on their net zero announcements, although there are indications these countries in are in the process of developing plans to underpin their pledges.

Other major economies still have not set any long-term deep decarbonisation targets – neither net zero nor any other targets. Egypt, Iran and The Philippines have no targets beyond their NDC for 2030, while it remains uncertain whether Mexico's government will have to reinstate its goal of reducing emissions by 50% below 2000 levels by 2050 after a recent court ruling (Greenpeace México, 2021; Poder Judicial de la Federación, 2021).

Most governments' net zero targets are unlikely to incentivise deep reductions in the coming years, due to a lack of comprehensive planning and clarity on what net zero actually means to them. For instance, the United Kingdom's High Court ruled that the UK government's Net Zero Strategy is in breach of UK law for failing to provide sufficient detail on how the measures in the strategy will enable the UK to achieve its net zero target (Justice Holgate, 2022). The UK Climate Change Committee noted there are delivery risks to achieving this target and argues the government's approach cannot be considered credible until it provides contingency plans and addresses policy gaps (Climate Change Committee, 2021).

Table 1 Overview of Climate Action Tracker's net zero target evaluations for G20 member countries (excluding non-CAT countries France and Italy) and selected others as of 7 November 2022.

Changes to Climate Action Tracker net zero target evaluations		
Country	**Previous rating** November 2021	**Current rating** 7 November 2022
Chile	ACCEPTABLE	ACCEPTABLE
Colombia		ACCEPTABLE
Costa Rica	ACCEPTABLE	ACCEPTABLE
EU	ACCEPTABLE	ACCEPTABLE
United Kingdom	ACCEPTABLE	ACCEPTABLE
Viet Nam		ACCEPTABLE
Canada	AVERAGE	AVERAGE
Germany	AVERAGE	AVERAGE
Nigeria	INFORMATION INCOMPLETE	AVERAGE
South Korea	AVERAGE	AVERAGE
Switzerland		AVERAGE
Thailand		AVERAGE
United States	AVERAGE	AVERAGE
Argentina	INFORMATION INCOMPLETE	POOR
Australia	POOR	POOR
China	POOR	POOR
Japan	POOR	POOR
Kazakhstan		POOR
New Zealand	POOR	POOR
Russia	INFORMATION INCOMPLETE	POOR
Singapore		POOR
The Gambia		POOR
Türkiye	INFORMATION INCOMPLETE	POOR
Brazil	INFORMATION INCOMPLETE	INFORMATION INCOMPLETE
Ethiopia		INFORMATION INCOMPLETE
India	INFORMATION INCOMPLETE	INFORMATION INCOMPLETE
Indonesia	INFORMATION INCOMPLETE	INFORMATION INCOMPLETE
Peru		INFORMATION INCOMPLETE
Saudi Arabia	INFORMATION INCOMPLETE	INFORMATION INCOMPLETE
South Africa	INFORMATION INCOMPLETE	INFORMATION INCOMPLETE
UAE	INFORMATION INCOMPLETE	INFORMATION INCOMPLETE
Egypt	NO TARGET	NO TARGET
Iran	NO TARGET	NO TARGET
Kenya	NO TARGET	NO TARGET
Mexico	NO TARGET	NO TARGET
Morocco	NO TARGET	NO TARGET
Norway	NO TARGET	NO TARGET
Philippines	NO TARGET	NO TARGET

Note: The evaluation of Bhutan's and Nepal's net zero targets remains work-in-progress as of November 2022.

Most of global emissions covered by inadequately designed net zero targets at present

According to the CAT's "good practice" net zero analysis, the design of net zero targets covering a total of 74% of global emissions remains insufficient (Figure 11). Just six countries have defined their targets in an 'acceptable' way in terms of scope, architecture and transparency representing only 8% of global emissions. This means most global emissions are captured by inadequate net zero targets.

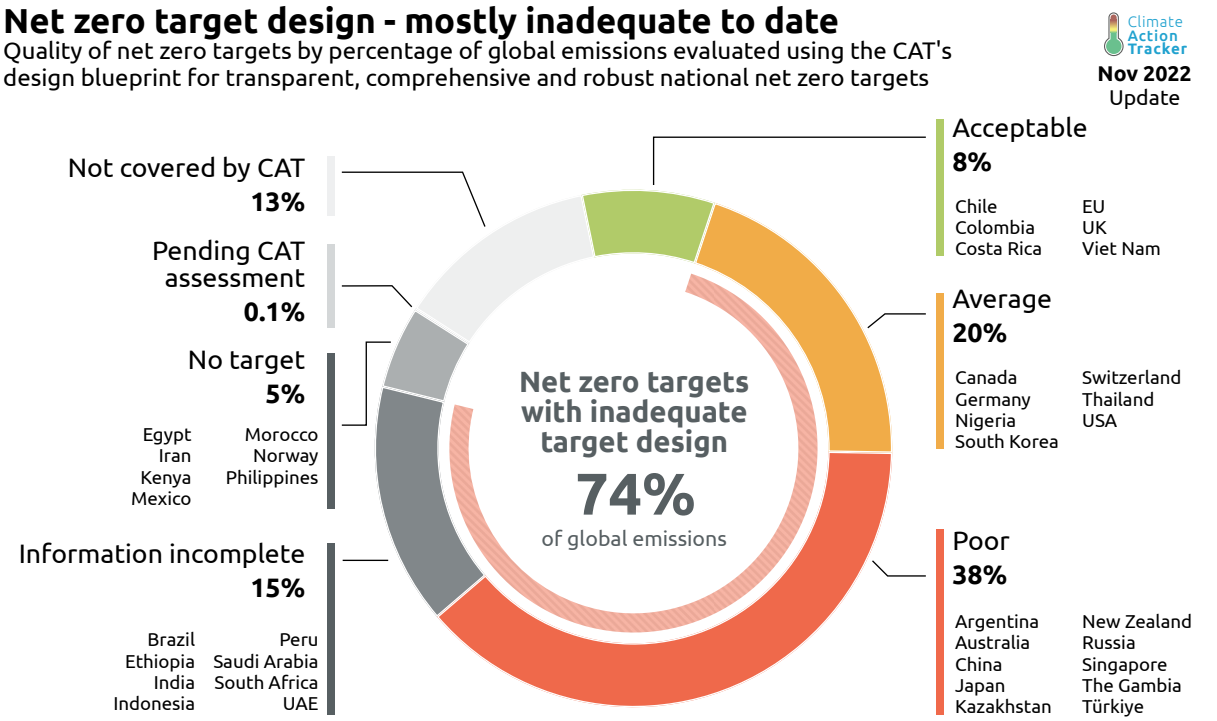

Figure 11 Share of global GHG emissions by Climate Action Tracker's headline evaluation for announced net zero targets as of September 2022. Emissions data excluding LULUCF for 2019 taken from PRIMAP emissions database (Gütschow et al., 2021).

The six countries with an 'acceptable' net zero target are Chile, Costa Rica, the European Union, the United Kingdom, Colombia and Viet Nam. None of these six follow best practice for all elements of net zero goals. The CAT observes there is substantial room for improvement when it comes to including emissions from international aviation, setting separate targets for emission reductions and removals, and explaining why the net zero target is a fair contribution to the global goal of limiting warming to 1.5°C.

Seven countries, jointly responsible for 20% of global emissions, have put forward net zero pledges that we evaluate as 'average': Canada, Germany, Nigeria, South Korea, Switzerland, Thailand and the US. Their net zero pledges lack key details. For example, Germany's target is not backed by a comprehensive planning structure, and it does not detail assumptions around carbon dioxide removal and storage in a transparent manner. Meanwhile, the United States' net zero target relies on the use of emissions offsetting.

Argentina, Australia, China, The Gambia, Japan, Kazakhstan, New Zealand, Russia, Singapore and Türkiye have proposed targets that we evaluate as 'poor', meaning they lack critical detail on scope, target architecture and transparency. These countries jointly represent 38% of global emissions. For example, New Zealand excludes excludes biogenic methane from agriculture and waste from its net zero target coverage, representing over 40% its emissions. None of the eight countries rule out offsetting (indeed New Zealand has proportionally huge international offsetting plans at home and interantionally), and none include international aviation and shipping in their net zero targets.

A lack of information means we were unable to evaluate the targets of another ten countries jointly responsible for 15% of global emissions . This includes major emitters such as Saudi Arabia, Brazil, India, and Indonesia. These net zero pledges will only be credible if they are followed by robust legislation and comprehensive strategies on how to realise net zero emissions, as well as stronger emission reduction targets for 2030.

The CAT has identified ten key elements of each country's net zero target to assess whether the scope, architecture, and transparency meet what we define as good practice (Figure 12).

Figure 12 Identified good practice for all ten key elements in the Climate Action Tracker's evaluation methodology for countries' net zero targets (Climate Action Tracker, 2021b).

Annex

A1 Scenario definition

What is included in the Climate Action Tracker's various temperature scenarios?

Table 2 includes the input used for the CAT's temperature estimates. A handful of countries submitted or announced new NDCs or long-term strategies after we completed our analysis. These are noted in the footnotes.'

Table 2: Overivew of inputs for each country under the Climate Action Tracker's various temperature projections for 2100 (November 2022 update).

Country	2030 targets only (no hot air)*	Pledges & Targets		Optimistic targets		Policies & action data from
		2030 NDC target*	Net Zero targets	NZT included?	Method	
Argentina	Updated NDC (2021)	Updated NDC (2021)	No[12]	Yes	Conservative global estimate	October 2022
Australia	Updated NDC (2022)	Updated NDC (2022)	Yes (max)	Yes (min)	CAT estimate	August 2022
Bhutan	Current policies	Current policies	No	Yes	Conservative global estimate	April 2022
Brazil	Updated NDC (2022)	Updated NDC (2022)	No	Yes	CAT estimate	September 2022
Canada	Updated NDC (2021)	Updated NDC (2021)	Yes[13] (max)	Yes (min)	CAT estimate	November 2022
Chile	Updated NDC (2020)	Updated NDC (2020)	Yes	Yes	CAT estimate	November 2022
China	Current policies	Current policies	Yes	Yes	CAT estimate	November 2022
Colombia	Updated NDC (2020)	Updated NDC (2020)	Yes	Yes	CAT estimate	November 2022
Costa Rica	Updated NDC (2020)	Updated NDC (2020)	Yes (max)	Yes (min)	CAT estimate	July 2020
Egypt (new addition)	Current policies	Current policies	--	No target	--	March 2022
Ethiopia	Current policies	Current policies	No	Yes	Conservative global estimate	November 2022
EU27	Updated NDC (2020)	Updated NDC (2020)	Yes (max)	Yes (min)	CAT estimate	November 2022
Germany	Covered in EU27					
India	Current policies	Current policies	No	Yes	CAT estimate	November 2022
Indonesia	Current policies	Current policies	No	Yes	CAT estimate	October 2022
Iran	Current policies	Current policies	--	No target	--	September 2021
Japan	Updated NDC (2021)	Updated NDC (2021)	Yes (max)	Yes (min)	CAT estimate	October 2022
Kazakhstan	First NDC (Dec. 2016)	First NDC (Dec. 2016)	No	Yes	CAT estimate	September 2022
Kenya	Current policies	Current policies	--	No target	--	May 2022

12 6 November 2022 LTS submission not considered.

13 31 October 2022 LTS submission not considered.

Country	2030 targets only (no hot air)*	Pledges & Targets		Optimistic targets		Policies & action data from
		2030 NDC target*	Net Zero targets	NZT included?	Method	
Mexico	First NDC (2016)[14]	First NDC (2016)	--	No target	--	July 2022
Morocco	Updated NDC (2021)	Updated NDC (2021)	--	No target	--	July 2020
Nepal	Current policies	Current policies	Yes	Yes	CAT estimate	November 2022
New Zealand	Updated NDC (2021)	Updated NDC (2021)	Yes (max)	Yes (min)	CAT estimate	November 2022
Nigeria	Updated NDC (2021)	Updated NDC (2021)	No	Yes	CAT estimate	November 2022
Norway	Updated NDC (2022)	Updated NDC (2022)	Yes (max)	Yes (min)	CAT estimate	June 2022
Peru	Current policies	Current policies	No	Yes	Conservative global estimate	September 2022
Philippines	Current policies	Current policies	--	No target	--	October 2022
Russian Federation	Current policies	Current policies	Yes	Yes	CAT estimate	November 2022
Saudi Arabia	Current policies	Current policies	No	Yes	CAT estimate	November 2021
Singapore	Current policies[15]	Current policies	Yes[16]	Yes	CAT estimate	November 2022
South Africa	Updated NDC (2021)	Updated NDC (2021)	Yes	Yes	CAT estimate	October 2022
South Korea	Updated NDC -domestic target (2021)	Update NDC -domestic target (2021)	Yes	Yes	CAT estimate	November 2022
Switzerland	Updated NDC -domestic target (2021)	Updated NDC -domestic target (2021)	Yes	Yes	CAT estimate	June 2022
Thailand	Updated NDC (2022)	Updated NDC (2022)	Yes[17]	Yes	CAT estimate	November 2022
The Gambia	Current policies	Current policies	No[18]	Yes	Conservative global estimate	July 2022
Türkiye	Current policies	Current policies	No	Yes	CAT estimate	November 2022
UAE	Updated NDC (2022)	Updated NDC (2022)	No	Yes	CAT estimate	November 2022
UK	Updated NDC (2022)	Updated NDC (2022)	Yes	Yes	CAT estimate	October 2022
Ukraine**	Updated NDC (2021)	Updated NDC (2021)	No	Yes	CAT estimate	December 2021
USA	Updated NDC (2021)	Updated NDC (2021)	Yes (max)	Yes (max)	CAT estimate	August 2022
Viet Nam	Current policies[19]	Current policies	Yes	Yes	CAT estimate	November 2022

* For weak targets, we take a country's estimated 2030 level under current policies, if that level is lower than the target.

** We have suspended our rating for Ukraine as the country defends itself from the unlawful Russian invasion. We have used the data from our last assessment as it is not possible to estimate more recent emissions given the uncertainty created by the war.

CAT temperature estimates are done using the MAGICC climate model. More information on the model is available here.

14 Mexico's announced NDC update came too late to be included in our analysis.

15 4 November 2022 NDC update not considered.

16 3 November 2022 addendum to LTS not considered.

17 We have included Thailand's 7 November 2022 revised LTS in our estimate.

18 September 2022 LTS submission not considered.

19 8 November 2022 NDC update not considered.

A2 Methodolocal changes in warming estimates for COP27

This section provides an overview about the methodological changes in the assessment of global emission pathways and temperature projections that have been introduced since the CAT update in November 2021. Most changes were made to incorporate the latest scientific methods applied in the new IPCC AR6 Report for assessing the global warming for global emission scenarios (Nicholls et al 2022). The IPCC methods are adapted for use within the Climate Action Tracker framework. This short overview outlines the major consequences of these method and data changes on our warming estimates:

The following methodology changes have been introduced for the 2022 assessment:

1. The software for performing the pathways extension method for extending mitigation scenarios beyond a given year, e.g. NDCs in 2030, has been updated. The method is still based on the concept of equal level of ambition (Gütschow et al. 2018), but is now based on the open-source package Silicone (Lamboll et al, 2020). This means that the code used for our calculations is now more transparently available for others to check.
2. The gas completion methodology, for separating a basket of greenhouse gases into separate gases, is also based on the Silicone package (Lamboll et al, 2020). It follows mostly the AR6 temperature assessment methods (Nicholls et al 2022) and the suggestions in this related publication (Lamboll et al, 2020). Among several available methods, the previous method to relate gases to a lead gas has been changed from an "Equal quantile walk" to a "Quantile rolling window" approach (see paper above). This approach implies a weaker statistical relation between the climate relevant gases and has been reported to better represent the underlying Integrated Assessment Model (IAM) scenarios.
3. The previously used reduced complexity coupled climate-carbon cycle model MAGICC6 has been replaced by its newest version MAGICC7 (Meinshausen et al, 2011, Meinshausen et al 2020, Nicholls, in prep) that was also used in the IPCC AR6 temperature assessment.

The data sources included in the new 2022 assessment are:

1. The methodology of the Climate Action Tracker to close data gaps and project global pathways is based on IAM pathways. The previously used dataset was based on the IPCC AR5 and the Special Report on 1.5C Report. In the new assessment, this has been updated to the new IPCC AR6 scenario data set. The tailored AR6-based scenario data set used for the CAT is the result of intensive data cleaning and filtering for suitable and complete scenarios. The full filtering set and explanation will be published in a forthcoming scientific publication.
2. Statistical infilling of the individual climate relevant gases from the global Kyoto greenhouse gas pathways has been updated based on the published IPCC-AR6 gas data set (Nicholls et al 2022).
3. Historical emissions data was updated to the newest published version of PRIMAP-Hist (https://zenodo.org/record/7179775).
4. With updating to the latest historical data, additional NDC quantifications by the NDC_mitiQ tools (Günther et al, 2021) and baseline scenarios from PIK (Gütschow et al, 2021) for smaller countries have been harmonised to the latest 2015 historical data.

Methodology impacts on the CAT thermometer temperatures

The combined changes to the methodology impact the various scenarios provided by the Climate Action Tracker differently. We highlight three observations that are helpful to understand the differences between the methodology primarily based on IPCC AR5 and the new one that aligns with IPCC AR6:

1. The historical year for AR6 IAM scenario harmonisation moved to 2015 compared with 2010 in AR5. During this period, actual historical emission after 2010 exceeded the median projected global emissions in the AR5 scenarios. This means that the AR5 pathway set underestimated the actual historical trend. Therefore, on average, the new AR6 pathways follow this higher historic development and have been harmonised to recent historic emissions, which generally shifts emission pathways upwards.
2. The high emission pathways statistically show a slightly later peaking year for emissions and slightly higher end of century emissions level. Thus, the comparably high emissions values in 2030 for the Policies and action scenarios are extended by a slightly higher long-term emissions projection pathway and therefore a slightly higher level of warming by the end of the century.
3. In contrast, ambitious low emission pathways show a steeper rate of decarbonisation in the AR6 pathway set. New IAM scenarios are adapted to higher rates of installed renewables, faster price reductions and other newly available technology. This optimistic reduction potential has a minor cooling effect on all Pledge pathways of the Climate Action Tracker and the Optimistic pathway of up to -0.1°C.

Thus, the IAM scenarios of the IPCC AR6 report send the clear message that if we globally set our targets more ambitiously, faster reduction rates could be achieved. For both Policies and action scenarios, the method updates largely counter-act the political changes (mainly driven by changes for the United States). For the "2030 targets only" pathway, the decrease of 0.08°C is similarly counter-balanced by more optimistic decarbonisation projections in the new methodology. The Pledges and Targets pathway and the Optimistic pathway include much more information about the long-term targets and therefore are less affected by the update of the methodology.

Table 3 Effect of 2022 political update (changes to policies and pledges) and methodology updates on median global mean temperature estimates in 2100 for all CAT scenarios.

Temperatures in °C	Political update	Methodology update	Total change
Policies and action (high)	-0.09	0.12	0.03
Policies and action (low)	-0.04	0.08	0.04
2030 targets	0.08	-0.06	0.02
Pledges and targets (high)	0.01	-0.03	-0.02
Pledges and targets (low)	0.00	-0.10	-0.01
Optimistic scenario	0.02	-0.01	0.01

A3 Country ratings summary

Table 4: Summary of Climate Action Tracker's Overall rating and rating components.

Country	Climate Action Tracker Overall rating Combined rating based on rating components Climate Action Tracker Nov 2022 Update	Rating components			
		Policies & action	Domestic or supported target	Fair share target	Climate finance
Costa Rica	ALMOST SUFFICIENT				
Ethiopia	ALMOST SUFFICIENT				
The Gambia	ALMOST SUFFICIENT				
Kenya	ALMOST SUFFICIENT				
Morocco	ALMOST SUFFICIENT				
Nepal	ALMOST SUFFICIENT				
Nigeria	ALMOST SUFFICIENT				
Norway	ALMOST SUFFICIENT				
United Kingdom	ALMOST SUFFICIENT				
Australia	INSUFFICIENT				
Brazil	INSUFFICIENT				
Chile	INSUFFICIENT				
Colombia	INSUFFICIENT				
EU	INSUFFICIENT				
Germany	INSUFFICIENT				
Japan	INSUFFICIENT				
Kazakhstan	INSUFFICIENT				
Peru	INSUFFICIENT				
South Africa	INSUFFICIENT				
Switzerland	INSUFFICIENT				
United States	INSUFFICIENT				
Argentina	HIGHLY INSUFFICIENT				
Canada	HIGHLY INSUFFICIENT				
China	HIGHLY INSUFFICIENT				
Egypt	HIGHLY INSUFFICIENT				
India	HIGHLY INSUFFICIENT				
Indonesia	HIGHLY INSUFFICIENT				
South Korea	HIGHLY INSUFFICIENT				
Mexico	HIGHLY INSUFFICIENT				
New Zealand	HIGHLY INSUFFICIENT				
Saudi Arabia	HIGHLY INSUFFICIENT				
UAE	HIGHLY INSUFFICIENT				
Iran	CRITICALLY INSUFFICIENT				
Russia	CRITICALLY INSUFFICIENT				
Singapore	CRITICALLY INSUFFICIENT				
Thailand	CRITICALLY INSUFFICIENT				
Türkiye	CRITICALLY INSUFFICIENT				
Vietnam	CRITICALLY INSUFFICIENT				

A4 Detailed overview of net zero target assessments

Table 5: Subratings Overview of Climate Action Tracker's net zero target evaluations for G20 member countries (excluding France and Italy as both not separately analysed by the CAT) and selected other countries per key elements as of November 2022.

Rating the comprehensiveness of national net zero target design Climate Action Tracker Nov 2022 Update Country	Rating	Net zero target design elements 1 Target year	2 Emissions coverage	3 International aviation and shipping	4 Reductions or removals outside of own border	5 Legal status	6 Separate reduction & removal targets	7 Review process	8 Carbon dioxide removal	9 Comprehensive planning	10 Clarity on fairness of target
Chile	ACCEPTABLE	2050	✓	✗	✓	✓	✓	✓	✓	✓	✗
Colombia	ACCEPTABLE	2050	✓	✗	✓	✓	✓	✓	−	✓	✓
Costa Rica	ACCEPTABLE	2050	✓	✗	✓	−	✓	−	✓	✓	✗
European Union	ACCEPTABLE	2050	✓	−	✓	✓	✗	✓	✓	✓	✗
United Kingdom	ACCEPTABLE	2050	✓	✓	✗	✓	✗	✓	✓	−	−
Viet Nam	ACCEPTABLE	2050	✓	✗	✗	✓	✓	✓	−	✓	✗
Canada	AVERAGE	2050	✓	✗	✓	✓	✗	✓	✗	−	✗
Germany	AVERAGE	2045	✓	✗	✗	✓	✓	✓	✗	−	−
Nigeria	AVERAGE	2050-2070	−	✗	✓	−	✗	✓	✗	−	✗
South Korea	AVERAGE	2050	✗	✗	✓	✓	✓	−	✓	−	✗
Switzerland	AVERAGE	2050	✓	✓	−	−	✓	✗	✗	−	✗
Thailand	AVERAGE	2065	−	✗	✓	−	✓	−	✓	✓	✗
United States	AVERAGE	2050	✓	✗	✗	−	✗	−	✓	−	✗

Note: The evaluation of Bhutan's and Nepal's net zero targets remains work-in-progress as of November 2022. Egypt, Iran, Kenya, Mexico, Morocco and the Philippines has no net zero target. Norway has committed to a 90-95% GHG emissions reduction below 1990 levels by 2050 and included this target in their long-term strategy submitted to the UNFCCC. While the target generally covers the key elements, it should be noted that Norway has not yet committed to an actual net zero target.

Table 6: List of all net zero targets included in the 'optimistic scenario' modelling runs for the global aggregation based on Net Zero Tracker (2022) and WRI (Climate Watch, 2022) as of 8 September 2022 complemented by CAT analysis. The compilation includes countries that have joined the Climate Ambition Alliance announced at COP25 (Climate Ambition Alliance, 2019). All Member States of the EU27 are included in the modelling runs through EU27, not individually.

Country	Status	Country	Status
Afghanistan	Target Under Discussion	**European Union**	In law
Angola	Target Under Discussion	**Finland**	In Policy Document
Andorra	In Policy Document	**Fiji**	In law
The United Arab Emirates	Target Under Discussion	**France**	In law
Argentina	Target Under Discussion	**Micronesia**	Target Under Discussion
Armenia	In Policy Document	**United Kingdom**	In law
Antigua and Barbuda	In Policy Document	**Guinea**	Target Under Discussion
Australia	In Policy Document	**The Gambia**	In Policy Document
Austria	In Policy Document	**Guinea-Bissau**	Target Under Discussion
Burundi	Target Under Discussion	**Greece**	Target Under Discussion
Belgium	In Policy Document	**Grenada**	Target Under Discussion
Benin	Target Under Discussion	**Guyana**	Target Under Discussion
Burkina Faso	Target Under Discussion	**Croatia**	In Policy Document
Bangladesh	Target Under Discussion	**Haiti**	Target Under Discussion
Bulgaria	Target Under Discussion	**Hungary**	In law
Bahrain	Target Under Discussion	**Indonesia**	In Policy Document
The Bahamas	Target Under Discussion	**India**	Target Under Discussion
Belize	Target Under Discussion	**Ireland**	In law
Brazil	In Policy Document	**Iceland**	In Policy Document
Barbados	In Policy Document	**Israel**	Target Under Discussion
Bhutan	In Policy Document	**Italy**	In Policy Document
The Central African Republic	Target Under Discussion	**Jamaica**	Target Under Discussion
Canada	In law	**Japan**	In law
Switzerland	In Policy Document	**Kazakhstan**	In Policy Document
Chile	In law	**Cambodia**	Target Under Discussion
In Policy Document	In Policy Document	**Kiribati**	Target Under Discussion
China	In Policy Document	**Saint Kitts and Nevis**	Target Under Discussion
The Democratic Republic of the Congo	Target Under Discussion	**South Korea**	In law
Colombia	In law	**Laos**	Target Under Discussion
The Comoros	Target Under Discussion	**Lebanon**	Target Under Discussion
Cabo Verde	In Policy Document	**Liberia**	In Policy Document
Costa Rica	In Policy Document	**Saint Lucia**	Target Under Discussion
Cyprus	Target Under Discussion	**Sri Lanka**	In Policy Document
Czechia	Target Under Discussion	**Lesotho**	Target Under Discussion
Germany	In law	**Lithuania**	Target Under Discussion
Djibouti	Target Under Discussion	**Luxembourg**	In law
Dominica	Target Under Discussion	**Latvia**	In Policy Document
Denmark	In law	**Monaco**	Target Under Discussion
The Dominican Republic	Target Under Discussion	**Madagascar**	Target Under Discussion
Ecuador	Target Under Discussion	**Maldives**	In Policy Document
Eritrea	Target Under Discussion	**Marshall Islands**	In Policy Document
Spain	In law	**Mali**	Target Under Discussion
Estonia	In Policy Document	**Malta**	In Policy Document

Country	Status	Country	Status
Ethiopia	In Policy Document	**Myanmar**	Target Under Discussion
Mozambique	Target Under Discussion	**South Sudan**	Target Under Discussion
Mauritania	Target Under Discussion	**Sao Tome and Principe**	Target Under Discussion
Mauritius	Target Under Discussion	**Suriname**	In Policy Document
Malawi	Target Under Discussion	**Slovakia**	In Policy Document
Malaysia	In Policy Document	**Slovenia**	In Policy Document
Namibia	Target Under Discussion	**Sweden**	In law
The Niger	Target Under Discussion	**Seychelles**	Target Under Discussion
Nigeria	In Policy Document	**Chad**	Target Under Discussion
Nicaragua	Target Under Discussion	**Togo**	Target Under Discussion
The Netherlands	In Policy Document	**Thailand**	In Policy Document
Nepal	In Policy Document	**Timor-Leste**	Target Under Discussion
Nauru	In Policy Document	**Tonga**	Target Under Discussion
New Zealand	In law	**Trinidad and Tobago**	Target Under Discussion
Pakistan	Target Under Discussion	**Türkiye**	In Policy Document
Panama	In Policy Document	**Tuvalu**	Target Under Discussion
Peru	In Policy Document	**Tanzania**	Target Under Discussion
Palau	Target Under Discussion	**Uganda**	Target Under Discussion
Papua New Guinea	Target Under Discussion	**Ukraine**	In Policy Document
Portugal	In law	**Uruguay**	In Policy Document
Romania	Target Under Discussion	**United States of America**	In Policy Document
Russia	In law	**Saint Vincent and the Grenadines**	Target Under Discussion
Rwanda	Target Under Discussion	**Viet Nam**	In law
Saudi Arabia	Target Under Discussion	**Vanuatu**	Target Under Discussion
The Sudan	Target Under Discussion	**Samoa**	Target Under Discussion
Singapore	In Policy Document	**Yemen**	Target Under Discussion
Solomon Islands	In Policy Document	**South Africa**	In Policy Document
Sierra Leone	Target Under Discussion	**Zambia**	Target Under Discussion
Somalia	Target Under Discussion		

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Climate Analytics is a non-profit institute leading research on climate science and policy in relation to the 1.5°C limit in the Paris Agreement. It has offices in Germany, the United States, Togo, Australia, Nepal and Trinidad and Tobago.

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