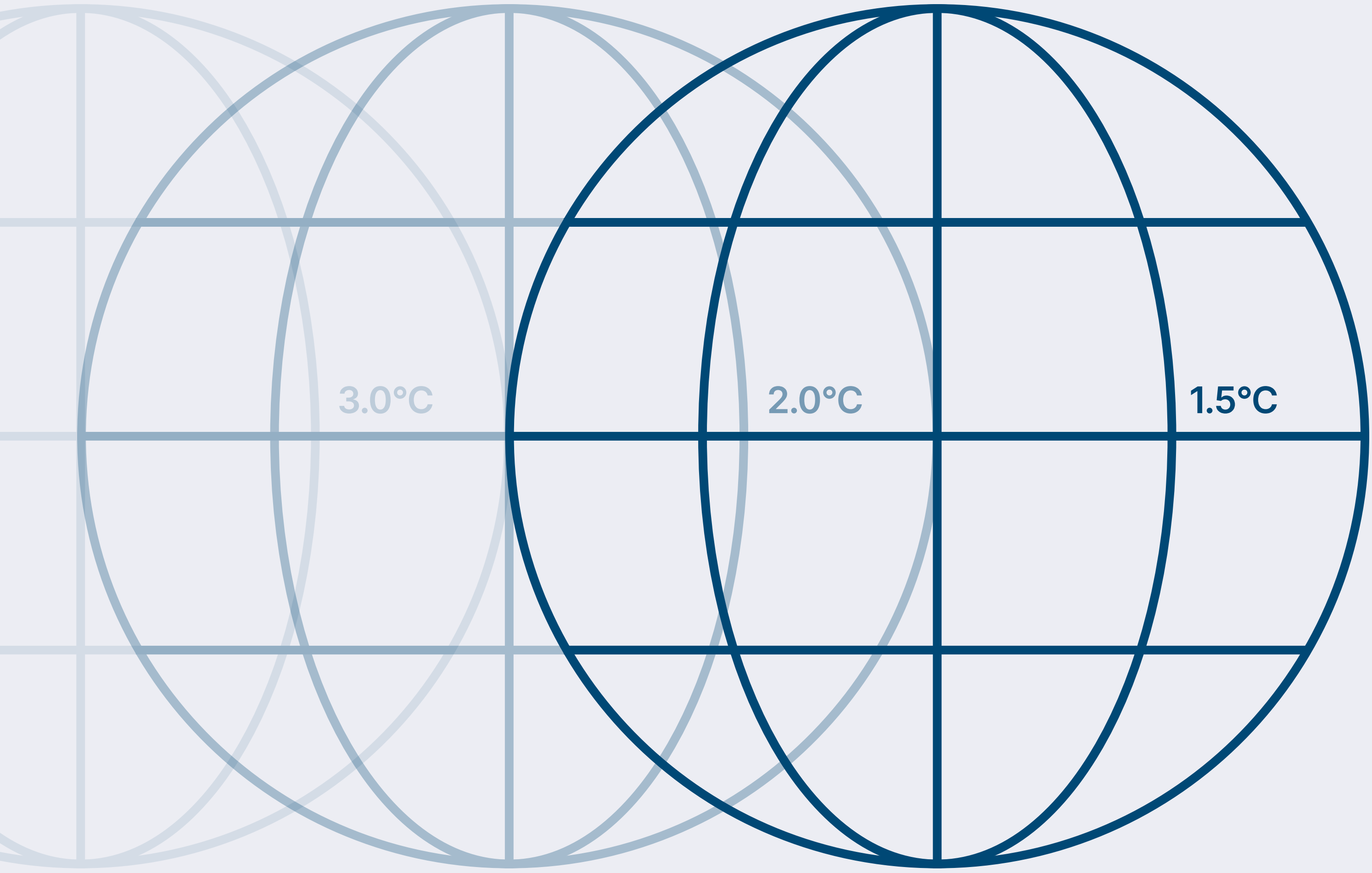
Keeping 1.5°C Alive: Closing the Gap in the 2020s

September 2021



Technical Annex

Energy Transitions Commission

Version 1.0

Technical Annex

Contents

This annex provides further details on the methodology and sources used in the analysis supporting the ETC's *Keeping 1.5°C Alive* report. The full report is available here.

1. Understanding the 2030 GHG Emissions Gap

ETC analysis in this report is focused on key feasible actions that can be taken beyond current NDCs to put the world on a 1.5°C trajectory by 2030. To assess the need for actions beyond NDCs, it is necessary to set out:

1. A baseline for 2030 emissions levels under current policy trajectories;

2. An estimate of 2030 emissions levels under NDC commitments made to date;

3. An estimate for 2030 emissions levels under a 1.5ºC aligned trajectory.

The "emissions gap" referred to in this report is defined as the difference in 2030 between (a) the NDC pathway (b) and the 1.5ºC trajectory pathway. ETC analysis in this report is focused on defining key feasible actions to close the "emissions gap".

Estimates for emissions in 2030 are based on work by Climate Action Tracker (CAT), an NGO which brings together analysis from Climate Analytics and the New Climate Institute. CAT has developed a widely cited assessment of emissions pathways, analysing the impact of existing and pledged policies on a country-by-country basis (including country NDCs) and aggregating them into an estimate for projection global GHG emissions (in CO_2e – i.e. not split by gas), and associated temperature outcomes.[1]

It is important to note that GHG emissions trajectories under the CAT pathways differ in some respects to others which have been developed in similar exercises. The UNEP's Emissions Gap Report (EGR) provides a meta-analysis of modelling studies drawn from a range of available literature, including CAT.[2] The UN EGR also assesses a range of GHG emissions trajectories, including current policy scenarios, NDC pathways (including the impact of both conditional and unconditional NDCs)[3], and a 1.5ºC trajectory, producing their own estimate of the "emissions gap" in 2030. Overall, the two estimates of "emissions gaps" have some differences, but are broadly aligned.

The following tables summarises the key differences across selected pathways in the CAT and UN work.[4]

Baselines

	Climate Action Tracker (used in this report)	**UN EGR**
Pathway	"Current policies"	"Conditional NDCs"[5]
2030 emissions	51-55 $GtCO_2e$ (Low/High)	51-56 $GtCO_2e$ in 2030 (median 53)
Methodology	Accounts for impact of all policies that have been implemented. Baseline for pathways is based on country-specific policy scenarios from literature., e.g. governments, national independent research, international sources (e.g. the IEA's World Energy Outlook). The Low/High range reflects uncertainty in the effect of policies on emissions in 2030. Baseline emissions have been adjusted to take into account slower economic growth as a result of COVID-19.	Accounts for impact of all conditional, as well as unconditional, NDCs from Paris, in addition to current policies. No adjustment has been made for impacts of COVID-19 on baseline emissions.

1 To assess the impact on global temperature outcomes (and therefore consistency with Paris Agreement Objectives), CAT then runs its global emissions pathway to 2100 as an input to a carbon-cycle / climate model (MAGICC6). Further detail on CAT's methodology is available here.
2 UNEP (2020), *Emissions Gap Report 2020: An Inflection Point*
3 Many developing countries have stated both unconditional and conditional components to NDCs. Unconditional NDCs are targets that are set independently of outside support (e.g. without any conditions, based on a country's own resources and capabilities). Conditional targets under NDCs is action that would only take place if additional climate finance was provided, or other conditions being met.
4 UN EGR estimates cited in this Annex here refer to the 2020 published report, estimates will be revised in upcoming 2021 EGR.
5 Note, the UN EGR "Conditional NDCs" pathway is includes in this Annex as a comparison to CAT's "Current policies" scenario as a baseline as the UN EGR "Conditional NDCs" pathway is limited to an assessment of the impact of conditional NDCs from Paris, and not since.

NDCs

Both Climate Action Tracker, as well as the recently published UNFCCC (Sept. 2021) *Nationally Determined Contributions under the Paris Agreement: Synthesis Report* provide an estimate for the impact of the latest submitted and announced NDCs to date, with slightly differing approaches described below. Accounting for some range of uncertainty described below, CAT estimates a 2-5 $GtCO_2e$ impact, while the UNFCCC Synthesis report estimates the impact at 3.3-6.7 $GtCO_2e$.[6]

	Climate Action Tracker *(used in this report)*	**UN EGR** *(with adjustment based on UNFCCC Synthesis Report)*
Pathway	"Pledges and Targets"	"Conditional NDCs" pathway median, subtracting estimated impact of additional NDCs announced and submitted since Paris[7]
Reduction in 2030 emissions resulting from NDCs	2-5 $GtCO_2e$	Unconditional NDCs: 3.3 $GtCO_2e$ Conditional NDCs 6.7 $GtCO_2e$
2030 emissions	46-49 $GtCO_2e$ (based on CAT's "Low" case for Current Policies minus range of NDCs impact).	46-50 $GtCO_2e$ (based on unconditional/conditional NDCs range).
Methodology	Accounts for impact of all NDCs submitted and announced at and since Paris, and subtracts impacts already captured in "Current Policies". Range is based on best estimates of uncertainty ranges of countries' pledges, including around: 1. conditionality of NDCs, 2. uncertainty in the definition of pledges (e.g. China's intensity-based NDC, different year baselines) and 3. uncertainty around land-use assumptions Note that CAT's NDC estimate includes China, though it hasn't submitted a formal NDC.	Accounts for impact of all additional NDCs submitted and announced since 2020; therefore, captures the impact of additional actions since Paris NDCs. Range is based on unconditional and conditional elements of latest country pledges.

6 ETC analysis referred to the average of CAT's high/low assessments, or 3.5 $GtCO_2e$.

7 Estimate of emissions impact from NDCs submitted and announced since Paris is based on recently published UNFCCC (Sept. 2021) *Nationally Determined Contributions under the Paris Agreement: Synthesis Report by the Secretariat*

1.5°C trajectory

	Climate Action Tracker *(used in this report)*	**UN EGR**
Pathway	"1.5°C consistent"	"Below 1.5°C"
2030 emissions	21-28 $GtCO_2e$ in 2030 (median 26)	22-31 $GtCO_2e$ in 2030 (median 25)
Methodology	Based on IPCC 1.5°C aligned pathways which peak at 1.5-1.6°C with >80% probability	Based on IPCC 1.5°C aligned pathways which peak below 1.7°C with >60% probability

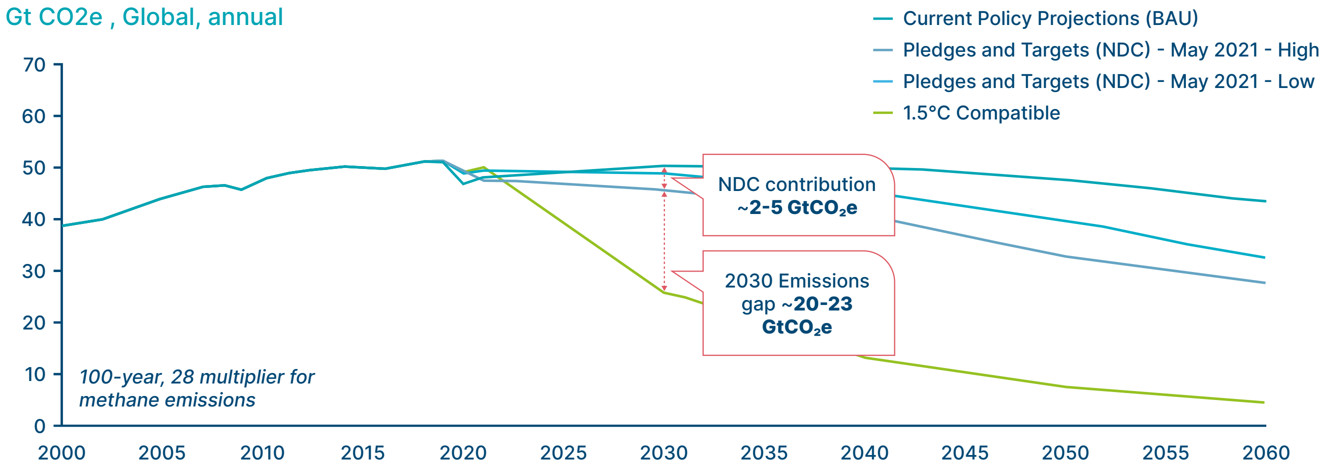
Resulting emissions Gap

	Climate Action Tracker *(used in this report)*	**UN EGR**
Emissions gap	20-23 $GtCO_2e$	~21-25 $GtCO_2e$ (based on unconditional/ conditional NDC range)

Exhibit 1

Currently pledged NDCs are insufficient to stay on 1.5°C path – remaining "emissions gap" of ~20-23 $GtCO_2e$ by 2030 (Climate Action Tracker)

Global GHG Emissions: emissions based on pledged and current policies



Note: CAT estimates of the emissions gap are slightly lower than estimates cited by the UNEP Emissions Gap report, due to differing assumptions taken across baselines (e.g. factors such as COVID-19 adjustments in baseline emissions trajectories, range of uncertainty of NDCs, and range of IPCC's 1.5°C compatible scenarios. See Technical Annex for further detail.

NOTES: [1] Current Policies Scenario is based on implemented policies and country baseline trajectories from government and international sources. The Pledges and Targets Scenarios represents a quantification of country-by-country NDC commitments. The "1.5°C compatible" Scenario is defined as the median of pathways that limit global warming to 1.5°C, or below, throughout the 21st century with no or limited (<0.1°C) overshoot.

SOURCE: Climate Action Tracker, 2021.

Split by gas

Based on these references, ETC analysis then splits out a view of methane and carbon dioxide "emissions gaps" in 2030. [8]

Methane:

- BAU/Current Policies: 2030 BAU methane emissions are estimated to be in line with current levels, estimated around 9.3 $GtCO_2e$ in GWP=25 terms.[9]
- 1.5°C pathway: 1.5°C compatible methane emissions level in 2030 is based on the IPCC 1.5°C no/low overshoot scenarios median value (235 $MtCH_4$) (See Exhibits 2 and 3).[10]

8 As CAT does not provide a breakdown of pathways split by gases, we subtract methane emissions from their estimate of total GHG emissions, based on GWP = 25 (as per the CAT methodology). Elsewhere in this report we use a GWP of 28, as per the IPCC 5th Assessment report.

9 For methane, integrated assessment models (IAMs) show a wide range of BAU trajectories across scenarios based on socioeconomic assumptions, including pathways where 2030 BAU methane emissions are in line with current levels. In our analysis we have taken an assessment of 2030 BAU methane emissions to be line with current levels.

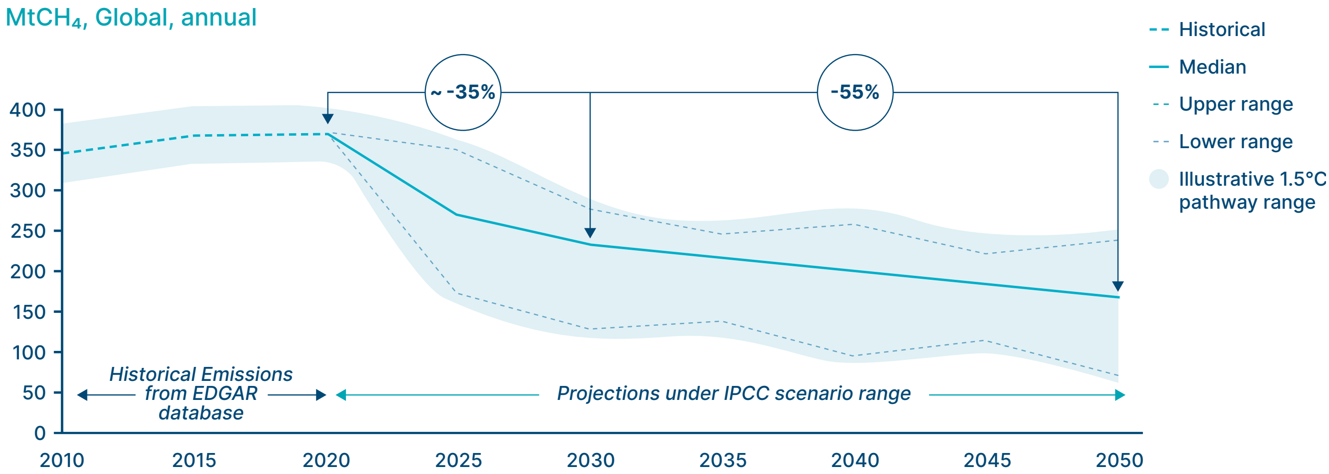
10 IPCC (2018) *Global warming of 1.5°C. An IPCC Special Report*

Exhibit 2

Under IPCC pathways for low/no 1.5C overshoot, methane emissions must decline by ~35% by 2030

Methane

Methane in IPCC SR 1.5 Low Overshoot Pathways



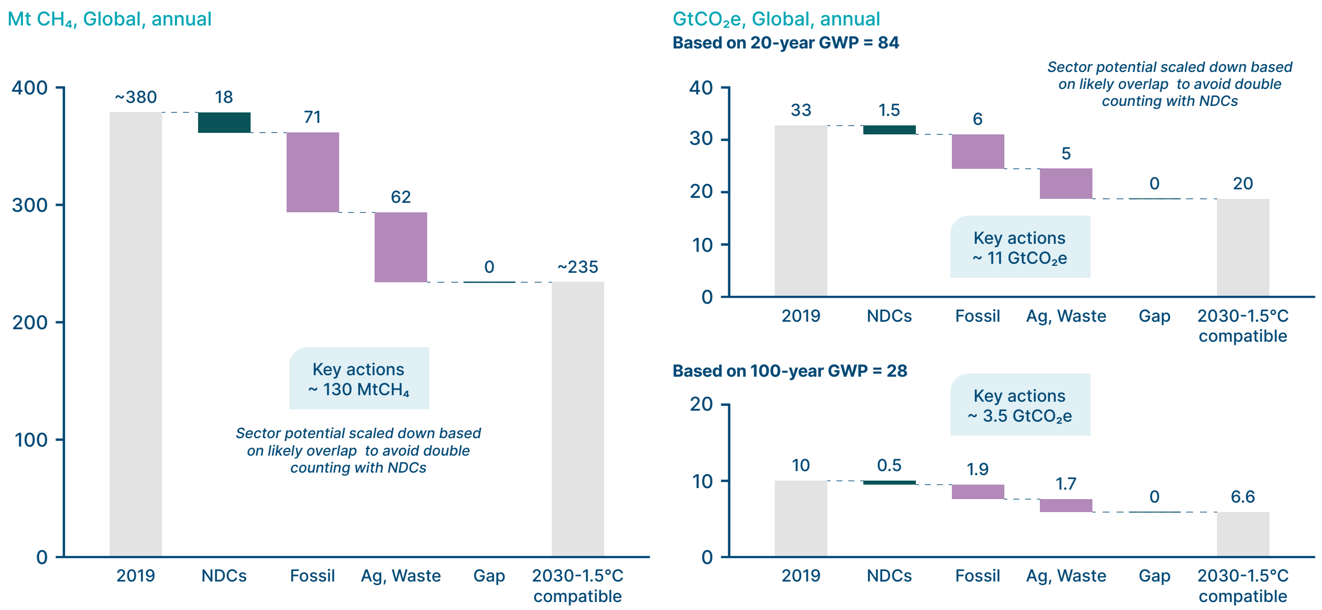
NOTE: Historical values for methane emissions have a very high range of uncertainty.

SOURCE: EDGAR database, IPCC (2018), ***Global warming of 1.5°C. An IPCC Special Report***

Exhibit 3

Highly feasible actions to reduce methane can deliver an additional ~130 $MtCH_4$ (3.5-11 $GtCO_2e$) beyond current NDCs in 2030

Global CH_4 emissions



NOTE: NDC emissions reductions are based on average of CAT "pledges and targets" pathway adjusted for CH_4. 1.5C compatible levels in 2030 are based on IPCC 1.5C no/low overshoot scenario median.

SOURCE: IPCC (2018), *Global warming of 1.5°C. An IPCC Special Report*, Climate Action Tracker (CAT), SYSTEMIQ analysis for the Energy Transitions Commission (2021).

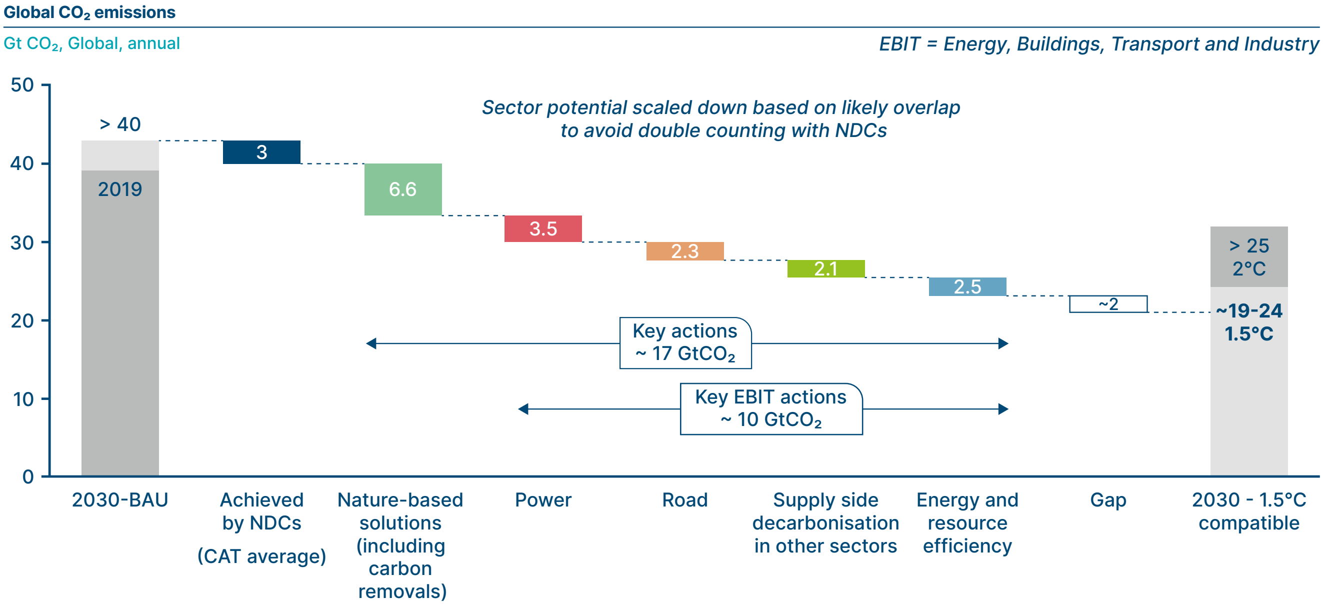
Carbon Dioxide:

- BAU/Current Policies: 2030 BAU CO_2 emissions range is estimated based on CAT's GHG 2030 "Current Policies" average (53GtCO_2e) minus current methane levels in GWP=25 terms (9.3 GtCO_2e). CAT's "Current Policies" High case is broadly aligned to 2030 BAU CO_2 emissions for the energy, buildings, transport and industry sectors referenced by the IEA in its Net Zero Trajectory report, which is ~43 GtCO_2.

- 1.5ºC and 2°C pathway ranges: 1.5ºC and 2ºC compatible emissions level in 2030 on are based on 1.5ºC and 2ºC GHG emissions pathway ranges defined by CAT, adjusted for CO_2 by subtracting methane. The higher end of these estimates is broadly aligned with 2030 1.5ºC compatible CO_2 emissions for the energy, buildings, transport and industry sectors referenced by the IEA in its Net Zero Trajectory report (21 GtCO_2).[11] (See Exhibit 4)

Exhibit 4

Highly feasible actions to reduce carbon dioxide can deliver an additional ~17 GtCO_2 reductions beyond current NDCs in 2030



NOTE: 2030 BAU CO_2 emissions are estimated based on CAT CO_2e 2030 BAU average (53GtCO_2e) minus current methane levels in GWP=25 terms (9.3 GtCO_2e). NDC emissions reductions are estimated based on average of CAT "pledges and targets" pathway adjusted for CO_2. 1.5°C and 2°C compatible levels in 2030 are based on IPCC 1.5°C no/low overshoot scenario ranges.

SOURCE: IPCC (2018), *Global warming of 1.5°C. An IPCC Special Report*, Climate Action Tracker (CAT), SYSTEMIQ analysis for the Energy Transitions Commission (2021).

11 IEA (2021) *Net Zero by 2050: A Roadmap for the Global Energy Sector*

2. Key actions in the 2020s: sizing of technical and feasible potential

ETC analysis aims to identify actions that could deliver significant reductions in emissions in the 2020s. The analysis builds on key external studies, including the IEA's Net Zero pathway report, to assess technical potential for emissions reductions in 2030. We then scale down the technical potential to account for higher feasibility, according to the set of criteria discussed in depth in Chapters 3 and 4 in the main report. This section provides an overview of the methodology and key assumptions in determining the sizing of key actions for emissions reductions.

It should be noted that emissions reductions potentials by action in this report are defined as potential reductions compared to a "current policies" or "BAU" baseline in 2030, as described above. This approach therefore estimates calibrates potential for action in relation to these what is included in these baseline trajectories (e.g. a level of declining emissions in the power sector, increasing emissions in the road transport sector).[12]

1. Methane

Methane – Fossil

Action	2030 emissions reductions vs BAU (Technical Potential)	Methodology	Source	2030 emissions reductions vs BAU (Feasible Potential)
75% total reduction in Russia, US, China, Canada	22 $MtCH_4$	Estimate based on assessment from IEA, validated by expert interviews with FlareIntel and MIQ, that ~75% of current emissions are technically feasible to abate (50% reduction is cost-negative or low-cost; additional 25% reduction is higher cost).	IEA (2021) *Net Zero by 2050: A Roadmap for the Global Energy Sector*, IEA Methane Tracker 2020, 2021, FlareIntel expert interviews.	22 $MtCH_4$ 100% of technical potential is achieved
50% total reduction in other countries	37 $MtCH_4$	Estimate based on assessment from IEA, validated by expert interviews with FlareIntel and MIQ, that ~75% of current emissions are technically feasible to abate (50% reduction is cost-negative or low-cost; additional 25% reduction is higher cost).	IEA (2021) *Net Zero by 2050: A Roadmap for the Global Energy Sector*, IEA Methane Tracker 2020, 2021, FlareIntel expert interviews.	25 $MtCH_4$ 66% of technical potential is achieved
80% low-cost reduction in coal-mining emissions	32 $MtCH_4$	60% of reduction assessed as low-cost potential by the UN *Global Methane Assessment*, +20% upside based on parallel assumption on falling coal use by 2030; some residual coal mine methane emissions remain even when coal mines are abandoned	UN (2021) *Global Methane Assessment: Benefits and Costs of Mitigating Methane Emissions.*	32 $MtCH_4$ 100% of technical potential is achieved

12 Methane and AFOLU CO_2 emissions in a 2030 BAU are assumed to be in line with current levels. For methane, integrated assessment models (IAMs) show a wide range of methane BAU trajectories across scenarios based on socioeconomic assumptions. In our analysis, we have taken an assessment of 2030 BAU methane emissions to be line with current levels. For AFOLU CO_2, while emissions estimates are highly uncertain, a BAU/current policies scenario is expected to see fairly consistent net levels of CO_2 emissions from the AFOLU sector over the next decade (~6 Gt CO_2), as assessed in Roe et al (2019), *Contribution of the land sector to a 1.5 °C world.*

Methane – Agriculture and Waste

Action	2030 emissions reductions vs BAU (Technical Potential)	Methodology	Source	2030 emissions reductions vs BAU (Feasible Potential)
Shift to plant-based diets	33 $MtCH_4$	Estimate based on 2050 potential cited in Roe et. al (2019), based on "Plausible scenario" from Hawken (2017) where 50% of the global population will adopt a plant-rich diet by 2050[13]	Roe et al (2019) *Contribution of the land sector to a 1.5 °C world*; Hawken, P (2017), *Project Drawdown: The most comprehensive plan ever proposed to reverse global warming.*	13 $MtCH_4$ 20% global adoption of plant-rich diets (up from ~10% today)
Reducing food waste (pre-consumer)	33 $MtCH_4$	Estimate based on 2050 potential cited in Roe et. al (2019), based on "Plausible scenario" from Hawken (2017) where 50% reduction in total global food loss and wastage is achieved by 2050	Roe et al (2019) *Contribution of the land sector to a 1.5 °C world*; Hawken, P (2017), *Project Drawdown: The most comprehensive plan ever proposed to reverse global warming.*	19 $MtCH_4$ 60% progress to 2050 potential by 2030, based on 2030 trajectory in Roe et al. (2019)
Other waste reductions (Reduce landfill (organic waste) and wastewater)	27 $MtCH_4$	Estimate based on EDGAR database, assuming maximum rates of wastewater treatment and landfill reductions.	EDGAR database.	18 $MtCH_4$ Estimate based on EDGAR database, pathway where upper middle-income countries reduce landfill emissions by 45%, high income countries by 75%[14]; and assumes SDG6 Target 2 is met by 2030, increasing treated wastewater from only 20% today to 60% globally[15]
Improved agricultural practice	40 $MtCH_4$	Estimate based on 2050 potential in trajectory in Roe et. al (2019); based on "Needed mitigation" from Wollenberg et al. (2017) and "feasible mitigation at $25/ tCO_2e" from Frank et al. (2017)	Wollenberg, E. et al. (2016), "Reducing emissions from agriculture to meet the 2 °C target."; Frank, S. et al. (2017), "Reducing greenhouse gas emissions in agriculture without compromising food security?"	19 $MtCH_4$ Based on feasible mitigation potential in 2030 cited in Roe et al. (2019) (under $25 carbon price assumption – reflecting most ambitious carbon price scenario)

13 Meat constrained to 57 grams per day; Purchasing locally produced food when possible) by 2050. Estimate only reflects emissions reductions from diverted agricultural production, not from avoided land use change.

14 Note, potential for minor overlap with emission reductions from Reducing food waste (pre-consumer) lever.

15 SDG 6 calls to ensure avialabiltiy and sustainable management of water and sanitation for all. Target 2 sets out that by 2030, the world should achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.

2. Nature-based solutions (including carbon removals)

Action	2030 emissions reductions vs BAU (Technical Potential)	Methodology	Source	2030 emissions reductions vs BAU (Feasible Potential)
Ending deforestation (Reductions)	3.6 $GtCO_2$	Estimate based on "Maximum additional" mitigation potential by 2030 from Griscom et al. (2017)	Griscom et al. (2017) *Natural Climate Solutions.*	3.6 $GtCO_2$ Assessed as 100% of technical potential.
Ending conversation coastal wetlands and peatlands (Reductions)	1 $GtCO_2$	Estimate based on "Maximum additional" mitigation potential by 2030 from Griscom et al. (2017)	Griscom et al. (2017) *Natural Climate Solutions.*	1 $GtCO_2$ Assessed as 100% of technical potential.
Reforestation (Removals)	3 Gt CO_2	Estimate based on "Cost-effective" mitigation potential by 2030 from Griscom et al. (2017). This potential would restore forests on more than 320 Mha of land an area consistent with the NYDF and Bonn Challenge targets of 350 Mha by 2030.	Griscom et al. (2017) *Natural Climate Solutions.*	1.5 $GtCO_2$ Assessed as 50% of technical potential.
Restoration coastal wetlands and peatlands (Removals)	0.6 $GtCO_2$	Estimate based "Cost-effective" mitigation potential by 2030 from Griscom et al. (2017).	Griscom et al. (2017) *Natural Climate Solutions.*	0.3 $GtCO_2$ Assessed as 50% of technical potential.
Improved forest management and agroforestry (Removals)	1.6 Gt CO_2	Estimate based on "Cost-effective" mitigation potential by 2030 from Griscom et al. (2017).	Griscom et al. (2017) *Natural Climate Solutions.*	0.8 $GtCO_2$ Assessed as 50% of technical potential.
Enhanced soil sequestration in agriculture, biochar (Removals)	1.3 $GtCO_2$	Estimate based on "Plausible scenario" from Hawken (2017) adopting regenerative agriculture practices on 407Mha by 2050 to sequester carbon.	Hawken, P (2017), *Project Drawdown: The most comprehensive plan ever proposed to reverse global warming.*	0.3 $GtCO_2$ Assessed as 33% of technical potential realised by 2030.
BiCRS and DACCS (Removals)	0.16 $GtCO_2$	Estimate based on 2030 scale-up of technical potential assessed in ETC ongoing workstreams on scaling CCS and Carbon Dioxide Removals	Forthcoming SYSTEMIQ analysis for the Energy Transitions Commission (2021).	0.10 $GtCO_2$ Estimate based on 2030 scale-up feasible potential assessed in ETC ongoing workstream on scaling CCS and CDR.

3. Decarbonising the power sector (coal phase out)

Action	2030 emissions reductions vs BAU (Technical Potential)	Methodology	Source	2030 emissions reductions vs BAU (Feasible Potential)
No new coal	1.1 $GtCO_2$	Assuming zero emissions from current new coal pipeline (defined as announced, pre-permit and permitted), based on Global Energy Monitor Coal Plant Tracker (July 2021).	Global Energy Monitor Coal Plant Tracker (July 2021).	0.9 $GtCO_2$ Assessed as 100% of technical potential for China and India and 50% for ROW.
OECD unabated coal phase out by 2030	1.2 $GtCO_2$	Assuming full elimination of coal power emissions from OECD remaining in 2030 in BAU scenario, 2030 BAU power emissions based on BNEF Economic Transition Scenario.	BloombergNEF (2020) *New Energy Outlook*.	1.2 $GtCO_2$ Assessed as 100% of technical potential.
Phase out existing older coal in non-OECD (>20 years in 2030)	2.7 $GtCO_2$	Assuming zero emissions from existing coal fleet that is over 20+years in 2030, calculations based on fleet age derived from Global Energy Monitor Coal Plant Tracker (July 2021). Assuming emissions displaced under 40% capacity factor.	Global Energy Monitor Coal Plant Tracker (July 2021).	2.4 $GtCO_2$ Assessed as 100% of technical potential for China and India and 50% for ROW.
Phase out of newer unabated coal assets (via CCS)	2.7 $GtCO_2$	Assuming 10% residual emissions from remaining existing coal fleet, calculations based on fleet age derived from Global Energy Monitor Coal Plant Tracker (July 2021). Assuming emissions displaced under 40% capacity factor.	Global Energy Monitor Coal Plant Tracker (July 2021).	0.1 $GtCO_2$ Assessment based on ongoing ETC CCS workstream identified feasible potential for CCS in power sector by 2030.

4. Decarbonising road transport

Action	2030 emissions reductions vs BAU (Technical Potential)	Methodology	Source	2030 emissions reductions vs BAU (Feasible Potential)
20% improvement in HDV ICE fuel efficiency	0.6 $GtCO_2$	Assuming 20% reduction in BNEF's 2030 BAU emissions from heavy duty transport[16]	BNEF (2021) *Long Term Energy Vehicle Outlook.*	0.6 $GtCO_2$ Assessed as 100% of technical potential.
Accelerated ICE phase out (global)	1.95 $GtCO_2$	Based on estimate in IEA Net Zero trajectory of road transport electrification emissions reductions vs 2030 BAU, and derived regional split. IEA Net Zero trajectory assumes that in 2030 EVs are 20% of global car stock, 54% 2/3W stock, 23% bus stock, 22% van stock, 8% truck stock.	IEA (2021) *Net Zero by 2050: A Roadmap for the Global Energy Sector.*	1.7 $GtCO_2$ Assessed as ~85% of technical potential.
Accelerated EV sales in light commercial fleets	0.3 $GtCO_2$	Based on estimate from SYSTEMIQ for The Climate Group on emissions reductions vs 2030 BAU (from BNEF) for accelerated EV sales in specific fleets. Assuming trajectory to 100% EV sales by 2030 in 'leader' countries, and 80% in 'laggard' countries for relevant fleets; equates to total 24% LDV EV stock by 2030 (vs 15% EV stock in 2023 in BAU).	SYSTEMIQ for The Climate Group; BNEF (2021) *Long Term Energy Vehicle Outlook.*	0.3 $GtCO_2$ Assessed as 100% of technical potential.
Accelerated EV sales in ride-hailing fleets	0.2 $GtCO_2$	Based on estimate from SYSTEMIQ for The Climate Group on emissions reductions vs 2030 BAU (from BNEF) for accelerated EV sales in specific fleets. See further details above.	SYSTEMIQ for The Climate Group; BNEF (2021) *Long Term Energy Vehicle Outlook.*	0.2 $GtCO_2$ Assessed as 100% of technical potential.

16 Assuming 40% of road transport emissions in 2030 come from heavy duty, in line with current share.

5. Accelerating supply decarbonisation in buildings, heavy industry, and heavy transport

Action	2030 emissions reductions vs BAU (Technical Potential)	Technical Potential Assessment: Methodology and source	2030 emissions reductions vs BAU (Feasible Potential)	Feasible Potential Assessment: Key Assumptions
Accelerated electrification of building heating and industry	1 $GtCO_2$	Additional electricity demand relative to BNEF's 2030 BAU (excluding road transport sector); calculation based on emissions displaced by additional clean electricity use vs fossil use	BloombergNEF (2020) *New Energy Outlook.*	1 $GtCO_2$ Assessed as 100% of technical potential.
Steel	1.4 $GtCO_2$	Estimate based on analysis from the Net Zero Steel Initative under the Mission Possible Partnership, under the "Carbon Cost" scenario, assuming a carbon price of $70/ton CO_2 by 2030	SYSTEMIQ analysis for the Net Zero Steel Initative, Mission Possible Partnership (2021).	0.8 $GtCO_2$ Assessed as ~55% of technical potential.
Aviation	0.1 $GtCO_2$	Estimate based on analysis from the Mission Possible Partnership under a scenario for a 10% share of sustainable aviation fuel by 2030.	SYSTEMIQ analysis for the Clean Skies for Tomorrow Initiative, Mission Possible Partnership (2021).	$GtCO_2$ Assessed as 100% of technical potential.
Shipping	0.1 $GtCO_2$	Estimate based on analysis from the Mission Possible Partnership under a scenario for a 5-7% share of zero emissions shipping fuel by 2030.	SYSTEMIQ analysis for the Getting to Zero Coalition, Mission Possible Partnership (2021).	0.1 $GtCO_2$ Assessed as 100% of technical potential.
Cement and concrete	0.4 $GtCO_2$	Estimated based on preliminary analysis from the Global Cement and Concrete Association.	SYSTEMIQ analysis for the Energy Transitions Commission (2021).	0.2 $GtCO_2$ Assessed as 50% of technical potential.

6. Energy and resource efficiency improvements

Action	2030 emissions reductions vs BAU (Technical Potential)	Technical Potential Assessment: Methodology and source	2030 emissions reductions vs BAU (Feasible Potential)	Feasible Potential Assessment: Key Assumptions
Buildings efficiency (new builds) and appliance standards	1.4 $GtCO_2$	For new builds: Based on estimates from Climate Action Tracker (2016), cited in 2017 UN Emissions Gap Report.[17] Assumes all new buildings in OECD countries are near-zero energy from 2020 onwards, and from 2020 to 2025 onwards also in non-OECD countries, assumes near-zero energy buildings have 90% lower emissions than the current standard. For appliance standards: Based on estimates from the Super-Efficient Equipment and Appliance Deployment (SEAD) Initative and Product Efficiency Call to Action (PECA)	Climate Action Tracker (Climate Analytics, Ecofys, NewClimate Institute) (2016) *Constructing the future: Will the building sector use its decarbonisation tools?*, Super-Efficient Equipment and Appliance Deployment (SEAD) Initative, Product Efficiency Call to Action (PECA)	1.4 $GtCO_2$ Assessed as 100% of technical potential.
Buildings efficiency (existing)	0.9 $GtCO_2$	Based on estimates from Climate Action Tracker (2016), cited in 2017 UN Emissions Gap Report. Assumes annual renovation rates from 2020 onwards of 5% in OECD countries and of 3% in non-OECD countries, with 90% direct emissions reduction per retrofit	Climate Action Tracker (Climate Analytics, Ecofys, NewClimate Institute) (2016) *Constructing the future: Will the building sector use its decarbonisation tools?*.	0.2 $GtCO_2$ Assessed as ~20% of technical potential.
Modal shift	0.7 $GtCO_2$	Based on estimate in IEA Net Zero trajectory of transport sector efficiency and behaviour change emissions reductions vs 2030 BAU. Assumes eco-driving and motorway speed limits of 100km/h introduced, use of ICE cars phased out in large cities.	IEA (2021) *Net Zero by 2050: A Roadmap for the Global Energy Sector.*	0.2 $GtCO_2$ Assessed as ~30% of technical potential.
Reduced business travel	0.15 $GtCO_2$	Estimate based on reducing current business class flights by 50%, aviation sector emissions data from IEA	IEA (2021) *Net Zero by 2050: A Roadmap for the Global Energy Sector.*	0.15 $GtCO_2$ Assessed as 100% of technical potential.
Air travel – Changing consumer attitudes	0.05 $GtCO_2$	Estimate based on reducing current air travel by 5%, aviation sector emissions data from IEA	IEA (2021) *Net Zero by 2050: A Roadmap for the Global Energy Sector.*	0.05 $GtCO_2$ Assessed as 100% of technical potential.
Energy productivity in industry	1.8 $GtCO_2$	Based on linear trajectory to 2050 potential for industrial energy productivity from ETC and Materials Economics analysis for ETC (2018), *Mission Possible* and ETC (2020), *Making Mission Possible*.	Materials Economics analysis for ETC (2018), *Mission Possible* and ETC (2020), *Making Mission Possible*.	0.9 $GtCO_2$ Assessed as 50% of technical potential.

17 Isolates the impact of energy efficiency on buildings, rather than the gains from electrification vs fossil use captured in fuel switch. Consistent with C40 estimates on potential from energy efficiency in buildings.

3. Additionality - Scaling down NDC impact by sector

To assess the potential for additional reductions in the 2020s beyond current commitments, ETC analysis required avoiding double counting between the actions identified, and the abatement already included in current NDCs.

Quantifying what is included in NDCs for each sets of actions is challenging. NDCs vary greatly in their detail and specificity and are not submitted in a consistent format with an easily quantifiable link between emissions targets and sectoral actions. Indeed, a 2016 ETC assessment of the NDCs submitted under the 2015 Paris Agreement suggested that 60% of the abatement in the NDCs was unspecified, with no indication of how the emissions reduction target would be achieved.[18]

To adjust for the potential already included in NDCs across the six groups of action, we therefore make a high-level assessment of the likely overlap of current NDCs for each action quantified. Assessment of NDC overlap has been defined as either 'high', 'moderate' or 'low', based on a literature review of analysis considering NDC commitments. The following criteria were considered when assessing the content of NDCs:

- Number of parties who indicated key mitigation areas by sector, and frequency of mention,
- Number of parties who have set quantitative targets for key mitigation areas.

Having assessed the overlap, emission reductions potentials were scaled back sector-by-sector by percentage:

- Accelerating emissions reductions from methane: **moderate**, scaled back by ~10-15%
- Nature Based Solutions: **moderate**, scaled back by ~10-15%
- Decarbonising the power sector: **high**, scaled back by ~20-30%
- Decarbonising road transport: **moderate**, scaled back by ~10-15%
- Supply-side decarbonisation in other sectors: **low**, scaled back by ~5%
- Energy and resource efficiency: **moderate**, scaled back by ~10-15%

The central source used for this assessment was the UNFCCC (Feb. 2021) Nationally Determined Contributions under the Paris Agreement: Synthesis Report by the Secretariat, which synthesised information contained in the 48 new or updated NDCs communicated by 75 Parties with decision 1/CP.21 and recorded in the interim registry of nationally determined contributions as of 31 December 2020. These 75 Parties represent about 40% of Parties to the Paris Agreement and account for about 30% global GHG emissions. This version was prepared for 28 February 2021 in advance of COP26.[19]

Action area	Assessment of overlap	Rationale	Key sources
Accelerating emissions reductions from methane	Moderate (10-15%)	All NDCs cover carbon dioxide emissions in their GHG mitigation areas, almost all cover methane. 97% of Parties in their updated NDCs mention methane emissions. However, only 13 countries, including Russia and Canada, have set quantitative methane emission targets. In relation to reducing methane emissions in the fossil fuel supply chain, NDCs regularly refer to carbon dioxide capture and storage, but not in the context of methane emissions in the oil and gas industry. In relation to reducing emissions in the waste and AFOLU sectors, adaptation actions and economic diversification plans mention reducing food waste and climate-smart agriculture, but there is a lack of explicit linkage to methane emissions.	UNFCCC (Feb. 2021) *Nationally Determined Contributions under the Paris Agreement: Synthesis Report by the Secretariat*, Clean Air Task Force, Network for Greening the Financial System (NGFS)

18 Energy Transitions Commission (2016), *Pathways from Paris, Assessing the INDC Opportunity.*

19 Note, general findings are consistent with conclusions from recently published update, UNFCCC (Sept. 2021) *Nationally Determined Contributions under the Paris Agreement: Synthesis Report by the Secretariat.*

Action area	Assessment of overlap	Rationale	Key sources
Nature Based solutions (including carbon removals)	Moderate (10-15%)	There has been a positive trend in the integration of nature-based solutions (NBS) in NDCs, with the majority of the 55 updated NDCs clearly referencing NBS in their mitigation measures. However, only 28 have quantified numerical targets, which are mostly focused on the forest sector. NDCs are in the early stages of setting numerical targets for other key ecosystems such as oceans or coastal wetlands. Enhanced NDCs lack the identification of key NBS co-benefits such as desertification, food security and livelihoods of local communities. Only 13 NDCs explicitly refer to the role of indigenous people and other local communities in the implementation of NBS. Key G20 countries yet to submit updated NDCs and identified as needing to increase their ambitions include Indonesia, South Africa, Canada, China, India, Saudi Arabia and Turkey. Furthermore, Brazil and Indonesia – two key contributors in this space – have not upwardly revised ambition in the latest round of NDCs.	WWF (2021), *NDCs: A Force for Nature?*, UNFCCC (Feb. 2021) *Nationally Determined Contributions under the Paris Agreement: Synthesis Report by the Secretariat.*
Decarbonising the power sector	High (20-30%)	Renewable energy generation was the most frequently indicated mitigation option in NDCs, mentioned by 87% of parties. A few Parties communicated quantitative targets for renewable energy share (ranging from 13-100%) in the electricity mix by 2030. NDCs also contained significant consideration of economic diversification as part of NDCs linked to lowly diversified economy and impact of response measures on sectors of high economic importance such as extraction of fossil fuels.	UNFCCC (Feb. 2021) *Nationally Determined Contributions under the Paris Agreement: Synthesis Report by the Secretariat*, IRENA (2019), *NDCs in 2020*
Decarbonising road transport	Moderate (10-15%)	Frequent references to improved energy efficiency in transport in current NDCs, including adaptation actions with mitigation co-benefits include fuel switch and fuel price reforms in the transport sector. Adaptation components described efforts to adapt key economic sectors and services in particular for transportation, with adaptation measures including enhancing risk evaluation, such as by using geographic information systems and developing green road infrastructure. However, there is a distinct lack of quantitative targets, for example ICE sales bans.	UNFCCC (Feb. 2021) *Nationally Determined Contributions under the Paris Agreement: Synthesis Report by the Secretariat.*
Supply-side decarbonisation in other sectors	Low (5%)	A lack of a significant overlap with the scaling of low-carbon fuels, such as hydrogen. Specific technology needs to be mentioned including hydrogen technologies. Although building energy efficiency improvement was mentioned by 69% of NDCs, a shift to low or zero carbon fuels in buildings was mentioned by 16% of NDCs.	UNFCCC (Feb. 2021) *Nationally Determined Contributions under the Paris Agreement: Synthesis Report by the Secretariat*
Energy and resource efficiency	Moderate (10-15%)	Though improving energy efficiency was indicated by a high percentage of parties in relation to buildings and transport, improvement in industry was only indicated by 24% of parties. Additionally, behavioural change was partially covered but not explicit and concepts of circularity were linked but without ambitious action set. Replacement of assets and overall reduction of use through behavioural change is partially covered by NDCs but not explicit. Energy efficiency of buildings, appliances, transport and industrial equipment was covered by the majority of NDCs. Although a high proportion of NDCs covered energy efficiency in buildings, (69%) and in transport (59%), energy efficiency improvement in industry was covered by a significantly lower proportion of NDCs at 24%.	UNFCCC (Feb. 2021) *Nationally Determined Contributions under the Paris Agreement: Synthesis Report by the Secretariat.*

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