



The Paris Agreement and carbon budgets

Brussels, 5 December 2019

Paris Agreement – long-term goals

Article 2

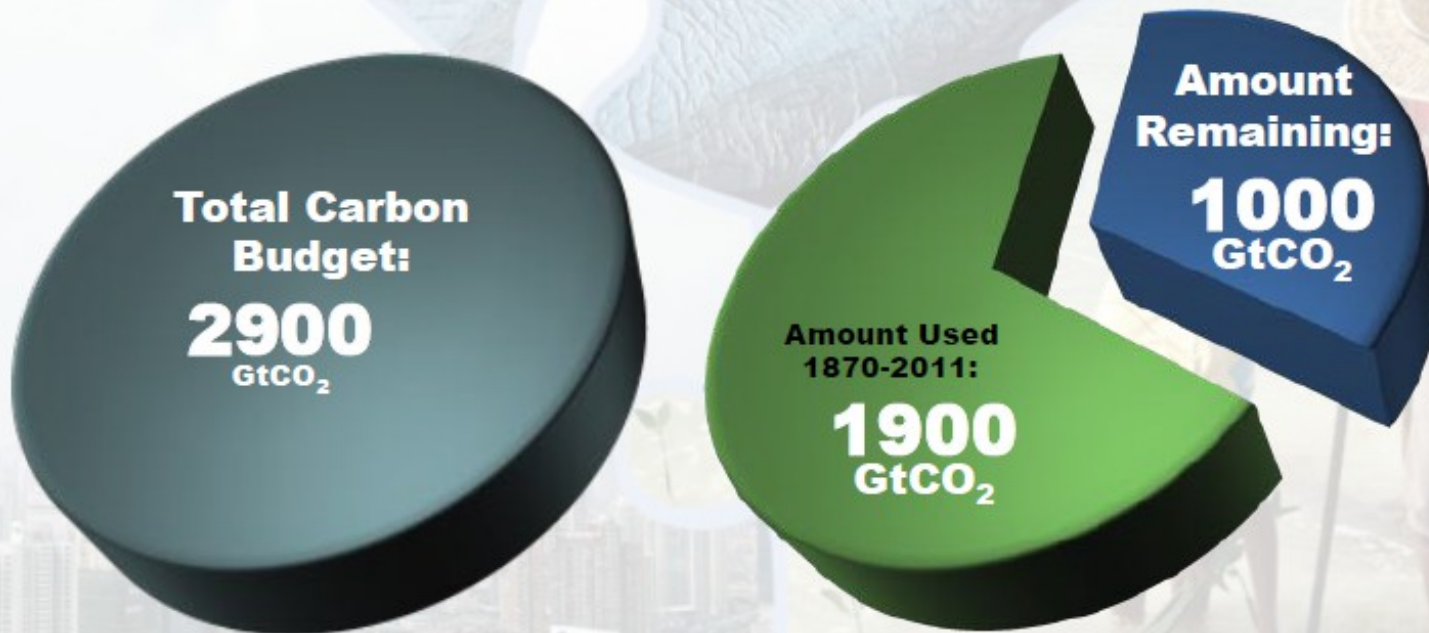
1. This Agreement, in enhancing the implementation of the Convention, including its objective, aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by:

*(a) Holding the increase in the global average temperature to **well below 2°C** above pre-industrial levels and **pursuing efforts to limit** the temperature increase **to 1.5°C** above pre-industrial levels, **recognizing** that this would significantly reduce the risks and impacts of climate change;*

Carbon budget concept

The window for action is rapidly closing

65% of the carbon budget compatible with a 2°C goal is already used
NB: this is with a probability greater than 66% to stay below 2°C



NB: Emissions in 2011: 38 GtCO₂/yr

AR5 WGI SPM

Global Warming of 1.5°C

An IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.



C.1.3 Limiting global warming requires limiting the total cumulative global anthropogenic emissions of CO₂ since the pre-industrial period, that is, staying within a total carbon budget (*high confidence*).¹³ By the end of 2017, anthropogenic CO₂ emissions since the pre-industrial period are estimated to have reduced the total carbon budget for 1.5°C by approximately 2200 ± 320 GtCO₂ (*medium confidence*). The associated remaining budget is being depleted by current emissions of 42 ± 3 GtCO₂ per year (*high confidence*). The choice of the measure of global temperature affects the estimated remaining carbon budget. Using global mean surface air temperature, as in AR5, gives an estimate of the remaining carbon budget of 580 GtCO₂ for a 50% probability of limiting warming to 1.5°C, and 420 GtCO₂ for a 66% probability (*medium confidence*).¹⁴ Alternatively, using GMST gives estimates of 770 and 570 GtCO₂, for 50% and 66% probabilities,¹⁵ respectively (*medium confidence*). Uncertainties in the size of these estimated remaining carbon budgets are substantial and depend on several factors. Uncertainties in the climate response to CO₂ and non-CO₂ emissions contribute ±400 GtCO₂ and the level of historic warming contributes ±250 GtCO₂ (*medium confidence*). Potential additional carbon release from future permafrost thawing and methane release from wetlands would reduce budgets by up to 100 GtCO₂ over the course of this century and more thereafter (*medium confidence*). In addition, the level of non-CO₂ mitigation in the future could alter the remaining carbon budget by 250 GtCO₂ in either direction (*medium confidence*). {1.2.4, 2.2.2, 2.6.1, Table 2.2, Chapter 2 Supplementary Material}

Budgets

- * *depends on likelihood*
- * *depends on temperature measurement*
- * *uncertainties, including on non CO2 emissions*

	66%	50%
GMT (AR5)	420	580
GSMT	570	770

Additional Warming since 2006–2015 [°C] ^{*(1)}	Approximate Warming since 1850–1900 [°C] ^{*(1)}	Remaining Carbon Budget (Excluding Additional Earth System Feedbacks ^{*(5)}) [GtCO ₂ from 1.1.2018] ^{*(2)}			Key Uncertainties and Variations ^{*(4)}					
					Percentiles of TCRE ^{*(3)}			Earth System Feedbacks ^{*(5)}	Non-CO ₂ scenario variation ^{*(6)}	Non-CO ₂ forcing and response uncertainty
		33rd	50th	67th	[GtCO ₂]	[GtCO ₂]	[GtCO ₂]	[GtCO ₂]	[GtCO ₂]	[GtCO ₂]
0.3		290	160	80	Budgets on the left are reduced by about –100 on centennial time scales	±250	–400 to +200	+100 to +200	±250	±20
0.4		530	350	230						
0.5		770	530	380						
0.53	~1.5°C	840	580	420						
0.6		1010	710	530						
0.63		1080	770	570						
0.7		1240	900	680						
0.78		1440	1040	800						
0.8		1480	1080	830						
0.9		1720	1260	980						
1		1960	1450	1130						
1.03	~2°C	2030	1500	1170						
1.1		2200	1630	1280						
1.13		2270	1690	1320						
1.2		2440	1820	1430						

Notes:

Global budget

source	treshold	likelihood	temperature measurement	GtCO2 2018-2100	GtCO2-e 2018-2100*
IPCC SR1.5	1.5°C	66%	GMT (AR5)	420	525
IPCC SR1.5	1.5°C	66%	GMST	570	712

EU budget per capita

	population	Net CO2 emissions	net GHG emissions	GtCO2	GtCO2-e
	WB 2017	CAIT 1990-2014	CAIT 1990-2014	2018-2100	2018-2100
	%/world	%/world	%/world	per capita	per capita
EU28 (GMST)	6,805	12,304	11,465	38,8	48,5
EU28 (AR5)	6,805	12,304	11,465	28,6	35,7

Global sharing of the budget

“The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities.” (Art 3.1 of the 1992 UNFCCC)”

EU budget “equity”

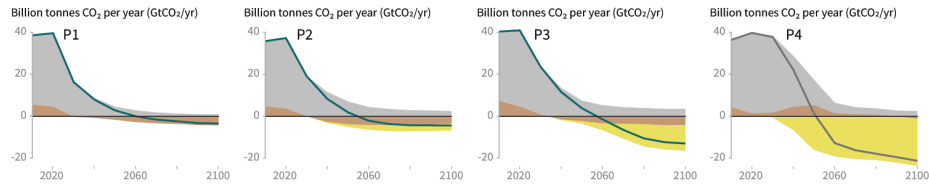
	population	equity	equity	GtCO2	GtCO2-e
	WB 2017	CO2	CO2-e	“equity”	“equity”
	%/world	%/world	%/world		
EU28 (GMST)	6,805	5,156	5,407	29,4	38,5
EU28 (AR5)	6,805	5,156	5,407	21,7	28,4

Characteristics of four illustrative model pathways

Different mitigation strategies can achieve the net emissions reductions that would be required to follow a pathway that limits global warming to 1.5°C with no or limited overshoot. All pathways use Carbon Dioxide Removal (CDR), but the amount varies across pathways, as do the relative contributions of Bioenergy with Carbon Capture and Storage (BECCS) and removals in the Agriculture, Forestry and Other Land Use (AFOLU) sector. This has implications for emissions and several other pathway characteristics.

Breakdown of contributions to global net CO₂ emissions in four illustrative model pathways

● Fossil fuel and industry ● AFOLU ● BECCS



P1: A scenario in which social, business and technological innovations result in lower energy demand up to 2050 while living standards rise, especially in the global South. A downsized energy system enables rapid decarbonization of energy supply. Afforestation is the only CDR option considered; neither fossil fuels with CCS nor BECCS are used.

P2: A scenario with a broad focus on sustainability including energy intensity, human development, economic convergence and international cooperation, as well as shifts towards sustainable and healthy consumption patterns, low-carbon technology innovation, and well-managed land systems with limited societal acceptability for BECCS.

P3: A middle-of-the-road scenario in which societal as well as technological development follows historical patterns. Emissions reductions are mainly achieved by changing the way in which energy and products are produced, and to a lesser degree by reductions in demand.

P4: A resource- and energy-intensive scenario in which economic growth and globalization lead to widespread adoption of greenhouse-gas-intensive lifestyles, including high demand for transportation fuels and livestock products. Emissions reductions are mainly achieved through technological means, making strong use of CDR through the deployment of BECCS.

Global indicators	P1	P2	P3	P4	Interquartile range
	No or limited overshoot	No or limited overshoot	No or limited overshoot	Higher overshoot	
CO ₂ emission change in 2030 (% rel to 2010)	-58	-47	-41	4	(-58,-40)
↳ in 2050 (% rel to 2010)	-93	-95	-91	-97	(-107,-94)
Kyoto-GHG emissions* in 2030 (% rel to 2010)	-50	-49	-35	-2	(-51,-39)
↳ in 2050 (% rel to 2010)	-82	-89	-78	-80	(-93,-81)
Final energy demand** in 2030 (% rel to 2010)	-15	-5	17	39	(-12,7)
↳ in 2050 (% rel to 2010)	-32	2	21	44	(-11,22)
Renewable share in electricity in 2030 (%)	60	58	48	25	(47,65)
↳ in 2050 (%)	77	81	63	70	(69,86)
Primary energy from coal in 2030 (% rel to 2010)	-78	-61	-75	-59	(-78,-59)
↳ in 2050 (% rel to 2010)	-97	-77	-73	-97	(-95,-74)
from oil in 2030 (% rel to 2010)	-37	-13	-3	86	(-34,3)
↳ in 2050 (% rel to 2010)	-87	-50	-81	-32	(-78,-31)
from gas in 2030 (% rel to 2010)	-25	-20	33	37	(-26,21)
↳ in 2050 (% rel to 2010)	-74	-53	21	-48	(-56,6)
from nuclear in 2030 (% rel to 2010)	59	83	98	106	(44,102)
↳ in 2050 (% rel to 2010)	150	98	501	468	(91,190)
from biomass in 2030 (% rel to 2010)	-11	0	36	-1	(29,80)
↳ in 2050 (% rel to 2010)	-16	49	121	418	(123,261)
from non-biomass renewables in 2030 (% rel to 2010)	430	470	315	110	(245,436)
↳ in 2050 (% rel to 2010)	833	1327	878	1137	(576,1299)
Cumulative CCS until 2100 (GtCO ₂)	0	348	687	1218	(550,1017)
↳ of which BECCS (GtCO ₂)	0	151	414	1191	(364,662)
Land area of bioenergy crops in 2050 (million km ²)	0.2	0.9	2.8	7.2	(1.5,3.2)
Agricultural CH ₄ emissions in 2030 (% rel to 2010)	-24	-48	1	14	(-30,-11)
↳ in 2050 (% rel to 2010)	-33	-69	-23	2	(-47,-24)
Agricultural N ₂ O emissions in 2030 (% rel to 2010)	5	-26	15	3	(-21,3)
↳ in 2050 (% rel to 2010)	6	-26	0	39	(-26,1)

NOTE: Indicators have been selected to show global trends identified by the Chapter 2 assessment. National and sectoral characteristics can differ substantially from the global trends shown above.

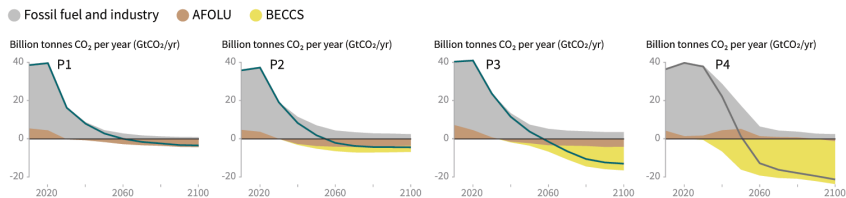
* Kyoto-gas emissions are based on IPCC Second Assessment Report GWP-100
 ** Changes in energy demand are associated with improvements in energy efficiency and behaviour change

SR1.5 Pathways

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P3: A middle-of-the-road scenario in which societal as well as technological development follows historical patterns. Emissions reductions are mainly achieved by changing the way in which energy and products are produced, and to a lesser degree by reductions in demand.

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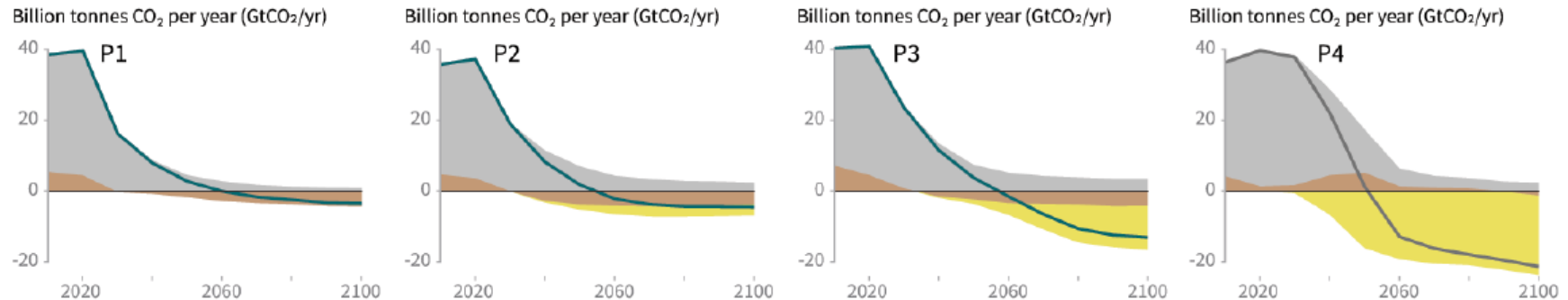
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CAN

CLIMATE ACTION NETWORK

Europe