

ONE PLANET PLATE –  
VERIFICATION OF THE INDIVIDUAL EMISSIONS  
BUDGET FOR FOOD IN ACCORDANCE WITH THE  
IPCC REPORT “GLOBAL WARMING OF 1.5  
DEGREES”

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## INTRODUCTION

### BACKGROUND

The latest IPCC report includes scenarios compatible with 1.5 degrees warming in the context of sustainable development and provides a new climate budget. WWF needs to up-date the One Planet criteria document to take into account the IPCC's new figures.

### THE ASSIGNMENT

U&We has examined the various assumptions underlying the IPCC's 1.5 degree mitigation pathways and emissions budget. U&We has considered whether the One Planet Plate individual budget of 11 kg CO<sub>2</sub>e / week is still within the total emissions budget.

The analysis and the calculation model based on the IPCC's report for maximum 1.5 degree warming are described below. The calculation model is also available separately in Excel format.

## RESULTS

The One Planet Plate emissions budget of 11 kg CO<sub>2</sub>e per week for food for an individual fits within the 1.5 degree mitigation pathways.

The budget calculation for greenhouse gas emissions for food at the individual level has been reported in two tables.

In the first table we show the total allowable budget per individual per year for CO<sub>2</sub> and other greenhouse gases. First, we divided up the IPCC global budget for CO<sub>2</sub> 2018-2050 equally among the world's population (IPCC 2018, p. 108). Population growth is assumed to follow the UN forecasts, and we have calculated the average number of people expected to be living each year 2018-2050 (UN 2017). Then we produced an annual budget per person for emissions of methane and nitrous oxide and converted this into CO<sub>2</sub> equivalents. Emissions of these gases will need to be reduced to reach the 1.5-degree target, but they do not need to be reduced to zero. We have used the annual emission levels of methane and nitrous oxide that the IPCC allows in 2050 in its latest report (IPCC 2018, pp. 117-120). The annual budgets for

methane and nitrous oxide were added to the budget for CO<sub>2</sub> to give a total budget for greenhouse gas emissions per person per year (see bottom of right-hand column, table 1).

	Gt CO <sub>2</sub>		GT CO <sub>2</sub> e (estimate)	
<b>Total budget for 2018-2050</b>	420	GtCO <sub>2</sub>		GtCO <sub>2</sub>
<b>Already used in 2018</b>	42	GtCO <sub>2</sub>		GtCO <sub>2</sub>
<b>Remaining budget</b>	378	GtCO <sub>2</sub>		GtCO <sub>2</sub>
<b>Budget per year 2019-2050</b>	12	GtCO <sub>2</sub>		GtCO <sub>2</sub> e
	11 812 500 000	tCO <sub>2</sub>		tCO <sub>2</sub> e
<b>Estimated population</b>	8 766 363 636	individuals	8 766 363 636	individuals
<b>Budget per person</b>	1,35	tCO <sub>2</sub> / person/year	2,04	tCO <sub>2</sub> e/ person/year

*Table 1 Total CO<sub>2</sub>e-budget per person in accordance with IPCC 66% certainty scenario for keeping within 1.5°degrees warming. The budget is an average for 2019-2050 and should not be compared with national emissions budgets for specific years.*

Table 2 shows the calculation of individual greenhouse gases emissions budget that can be allocated to food. The table includes six different budgets, based on different assumptions.

Firstly, we make an assumption about what proportion of the emissions budget for public services and investment should be allocated to individuals. We have estimated how many tonnes of CO<sub>2</sub>e per capita today pertain to public services and investment and then deducted either the entire amount (100%), half (50%) or a quarter (25%) from the personal budget. The lower deductions reflect the expectation that emissions from public services and investment will decline in line with other emissions globally. Given that CO<sub>2</sub> emissions should drop to zero by 2050, this is a relatively conservative assumption.

Then there are two different scenarios for the proportion of the personal emissions budget to be allocated to food: today's share of about 25% and an estimated share of 50%. The higher proportion (50%) is based on a hypothesis that global use of fossil fuels will decrease. In these scenarios, transport and housing will take up a smaller proportion of the personal emissions budget and the proportion allocated to food will increase as a result.

Assumption 1	Deduction for public services and investment	100% deduction		50% deduction		25% deduction	
Assumption 2	% of individuals' budget taken up by food	25%	50%	25%	50%	25%	50%
Total budget per person per year	tCO <sub>2e</sub> /person/year	2.04	2.04	2.04	2.04	2.04	2.04
Deduction for public services and investment 2016	tCO <sub>2e</sub> /person/year	1.44	1.44	0.72	0.72	0.36	0.36
Available budget for food for individuals	tCO <sub>2e</sub> /person/year	0.15	0.3	0.33	0.66	0.42	0.84
Individual budget allocated to food	kg CO <sub>2e</sub> /person/week	2.9	5.7	6.3	12.7	8.1	16.1
Range with IPCC's ±50% uncertainty	kg CO <sub>2e</sub> /person/week	1.5 - 4.4	3 - 9	3 - 10	6 - 19	4 - 12	8 - 24
Individual budget allocated to food	kg CO <sub>2e</sub> /person/day	0.4	0.8	0.9	1.8	1.1	2.3
Range with IPCC's ±50% uncertainty	kg CO <sub>2e</sub> /person/day	0.2 - 0.6	0.4 - 1.2	0.5 - 1.4	0.9 - 2.7	0.6 - 1.7	1.2 - 3.4

Table 2 CO<sub>2e</sub>-budget for food per individual based on IPCCs 66% certainty scenario for staying within 1.5° degrees warming.

### ESTIMATE OF EMISSIONS FROM PUBLIC SERVICES AND INVESTMENT

The Swedish Environmental Protection Agency provides statistics on the greenhouse gas emissions that can be linked to public services and investment in Sweden (the Swedish Environmental Protection Agency 2018), but it has not been possible to find corresponding global statistics. We have therefore made an estimate.

According to the IMF, Sweden allocates about 44% more of GDP to public services than the average for the rest of the world (IMF, 2018). We have therefore assumed that the proportion of climate emissions linked to public services and investment will also be approximately 44% higher in Sweden than in the rest of the world. Based on this assumption, the share of emissions that can be linked to public services and investment for the rest of the world on average would be about 26% of GDP, compared to Sweden's share of 38% (see full calculation in the excel file, sheet 2).

## UNCERTAINTIES IN THE IPCC BUDGET

There are significant uncertainties in the CO<sub>2</sub> budget for meeting the 1.5-degree target with 66% probability according to the IPCC (IPCC 2018, pp. 105–107). The budget is currently set at 420 Gton CO<sub>2</sub> (see table below) but it can vary up or down by as much as 50%. So it must be assumed that the emissions budget per person can also vary by 50%. The columns at the far right of Table 3 below list the factors that may cause the global budget to go up or down:

- The budget has not taken into account feedback mechanisms such as melting permafrost. If feedback mechanisms are included, the budget should be reduced by 100 Gton CO<sub>2</sub> on a 100 year time-scale.
- Emissions of other greenhouse gases such as methane and nitrous oxide affect the emissions budget for CO<sub>2</sub>. For example, in the 420 Gton CO<sub>2</sub> scenario methane emissions are assumed to be greatly reduced, but if this does not happen the emissions budget for CO<sub>2</sub> will be further reduced.
- The effect of emissions of greenhouse gases other than CO<sub>2</sub> on the earth's temperature is another uncertainty, with the impact of aerosols being the most uncertain.
- There are uncertainties about how much the earth's temperature will increase as a result of a certain volume of CO<sub>2</sub> being emitted into the atmosphere.
- The level of global warming since pre-industrial times has not been precisely determined, which also contributes to uncertainties.
- The volume of CO<sub>2</sub> emissions since 2011 has not been precisely determined, which may also affect the remaining budget.

Additional Warming since 2006–2015 [°C] <sup>(1)</sup>	Approximate Warming since 1850–1900 [°C] <sup>(1)</sup>	Remaining Carbon Budget (Excluding Additional Earth System Feedbacks <sup>(5)</sup> ) [GtCO <sub>2</sub> from 1.1.2018] <sup>(2)</sup>			Key Uncertainties and Variations <sup>(4)</sup>					
		Percentiles of TCRE <sup>(3)</sup>			Earth System Feedbacks <sup>(5)</sup>	Non-CO <sub>2</sub> scenario variation <sup>(6)</sup>	Non-CO <sub>2</sub> forcing and response uncertainty	TCRE distribution uncertainty <sup>(7)</sup>	Historical temperature uncertainty <sup>(1)</sup>	Recent emissions uncertainty <sup>(8)</sup>
		33rd	50th	67th	[GtCO <sub>2</sub> ]	[GtCO <sub>2</sub> ]	[GtCO <sub>2</sub> ]	[GtCO <sub>2</sub> ]	[GtCO <sub>2</sub> ]	[GtCO <sub>2</sub> ]
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						
<b>0.53</b>	<b>~1.5°C</b>	<b>840</b>	<b>580</b>	<b>420</b>						
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						
<b>1.03</b>	<b>~2°C</b>	<b>2030</b>	<b>1500</b>	<b>1170</b>						
1.1		2200	1630	1280						
1.13		2270	1690	1320						
1.2		2440	1820	1430						

The uncertainties presented in Table 2.2 cannot be formally combined, but current understanding of the assessed geophysical uncertainties suggests at least a ±50% possible variation for remaining carbon budgets for 1.5°C-consistent pathways. By the end of 2017,

Table 3 Shows Table 2.2 (IPCC 2018, s 108)

## CONCLUSIONS AND RECOMMENDATIONS

- According to our calculations, the One Planet Plate individual budget of 11 kg CO<sub>2</sub>e / week is compatible with the IPCC CO<sub>2</sub> budget for limiting global warming to 1.5 degrees. We recommend that the budget that has been communicated to consumers is retained.
- Our recommended scenario is shown in shown in the lower part of Table 2, in which food can contribute up to half of the remaining individual budget and emissions from public services and investment are assumed to be halved by 2050. This is because we believe it is reasonable to assume that emissions from fossil fuels will decrease over time across society due to the target of zero CO<sub>2</sub> emissions by 2050.
- Due to uncertainties in the IPCC's CO<sub>2</sub> budget, we recommend that the individual emissions budget be given as a range.

- A CO<sub>2</sub>e budget is a tool for communication and awareness-raising rather than an absolute truth. Our recommendation is that the uncertainties are described in the background information online.
- Set the dates for regular up-dating of the budget since new information is becoming available all the time, which affects the assumptions. We recommend up-dates are done annually.

## ABOUT U&WE

U&We is one of Sweden's leading sustainability consultancies, consisting of fourteen consultants with a broad range of expertise in environmental and climate strategies.

U&We has been active in sustainability-driven business development since 1995. The company has in-depth expertise in both environmental and social sustainability. We describe ourselves as "Catalysts for Good Business" since we consider that sustainability should be integral to business growth.



## REFERENCES

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## APPENDIX 1 ASSUMPTIONS