

Anthropogenic CO2 Emissions Expectations

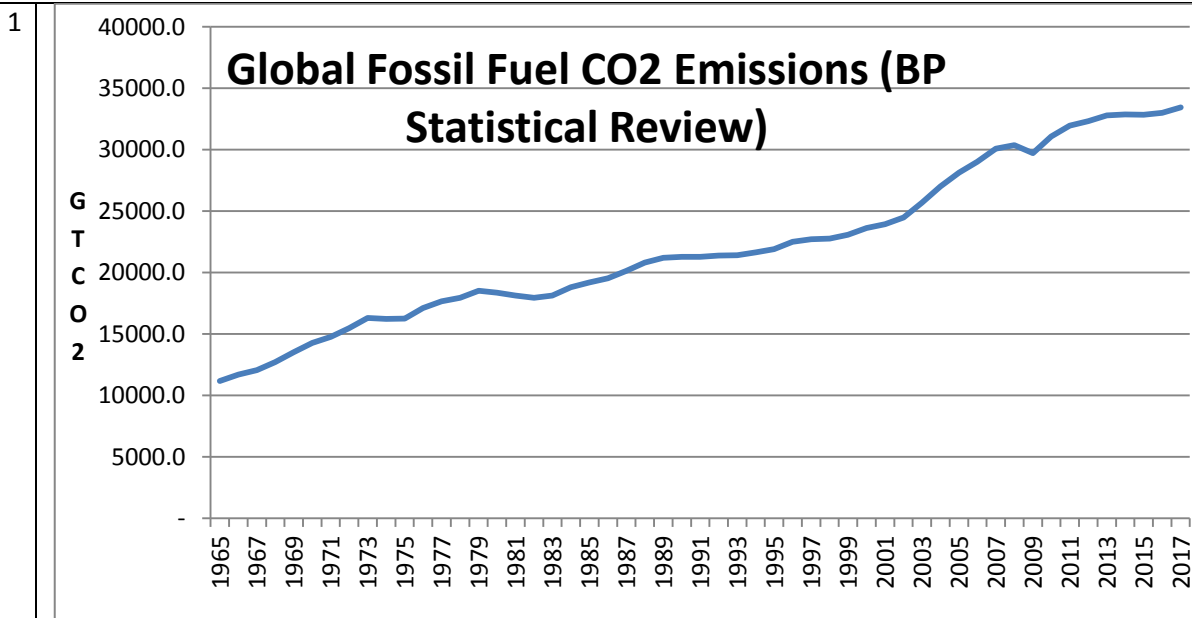
Bruce Parker

September 19, 2018

<http://ccdatacenter.org/documents/AnthropogenicCO2EmissionsExpectations.pdf>

- CO2 emissions from fossil fuels have been increasing about 1.3%/year for the last 10 years and were about 9.124 GTC in 2015¹
- CO2 emissions from cement in 2016 were 0.4 GTC²
- CO2 emissions from land use change in 2015 were about 1.32 GTC³
- Deforestation is likely to increase into the 2020's^{4,5}, but cumulative land use changes are hard to predict⁶
- Current emissions pledges ("NDCs") do not come close to meeting the objectives of the Paris agreement⁷ (*note that the emissions ranges for 1.5 and 2.0° C include natural emission, so anthropogenic emissions would need to be a lot less, making the gap even wider*)
- Global CO2 emissions from fossil fuels will likely remain the same through 2050 at about 10 GTC/year⁸ and atmospheric CO2 could reach 480 PPM by 2050⁸
- If CO2 fossil fuel emissions increase 1%/year between now and 2030 and then decline by 2%/year through 2100, total CO2 emissions through 2100 would about 625 GTC⁹, about triple the estimates for 2.0° C carbon budgets
- Global energy consumption has almost quadrupled since 1965¹⁰

Footnotes



2017 CO2 emissions from fossil fuels were about 33,444 MTCO2 (9.124 GTC) in 2017, an increase of 1.6% from 2016 (the 10-year average growth through 2017 was rate of 1.3%). (2015 fossil fuel emissions were 8.966 GTC)

Since the Kyoto Protocol was signed global carbon dioxide emissions have increased by 19%.

<https://www.forbes.com/sites/rrapier/2018/06/29/global-carbon-dioxide-emissions-set-new-record/#18c1feab43a9>

2 **Global CO2 emissions from cement production**

We show that global process emissions in 2016 were 1.45 ± 0.20 GtCO₂ [0.40 GTC], equivalent to about 4 % of emissions from fossil fuels. Cumulative emissions from 1928 to 2016 were 39.3 ± 2.4 GtCO₂, 66 % of which have occurred since 1990. Emissions in 2015 were 30 % lower than those recently reported by the Global Carbon Project. The data associated with this article can be found at <https://doi.org/10.5281/zenodo.831455>.

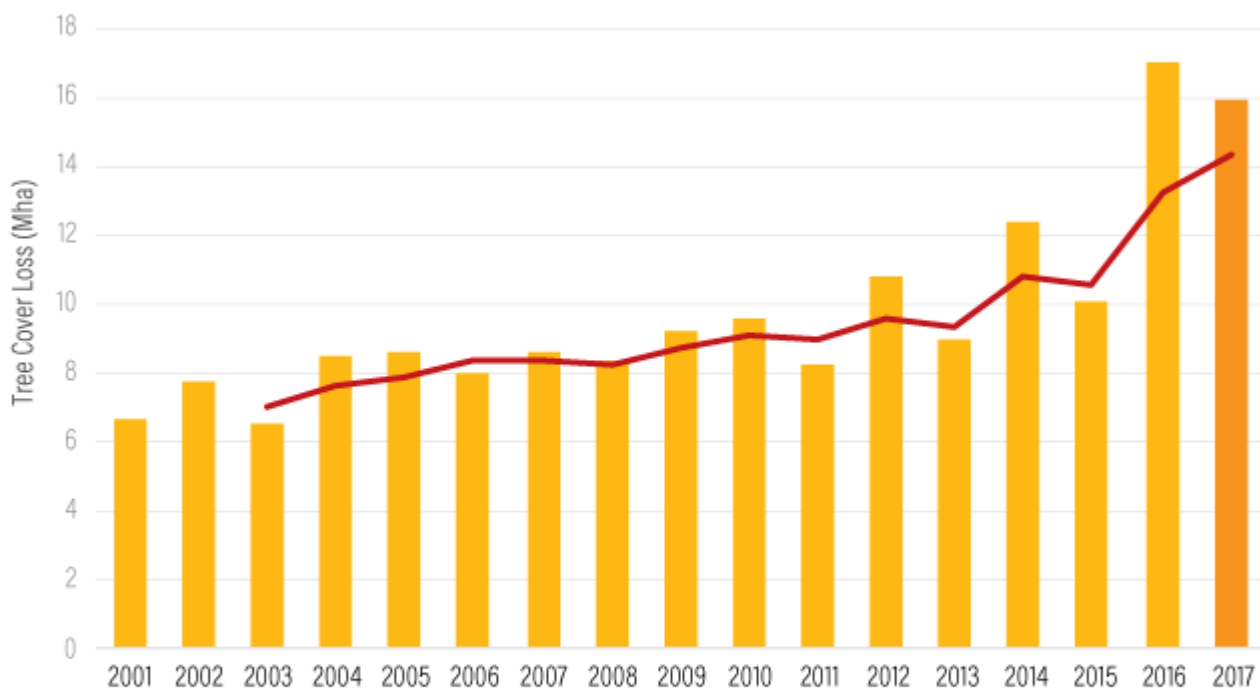
<https://www.earth-syst-sci-data.net/10/195/2018/essd-10-195-2018.pdf>

3 *Global_Carbon_Budget_2016_v1.0.xlsx* (from <http://cdiac.ornl.gov/GCP/>) has fossil fuel +cement CO2 emissions at 9.90 GTC and land use change emissions at 1.32 GTC (for a total of 11.22 GTC) in 2015

4 **Terrifying Trends Collide as Surging Deforestation 'Making World a Hotter, Drier Place'** , June 2018

New data shows climate goals and biodiversity threatened as tropics continue to lose "alarming" number of trees

Tropical Tree Cover Loss



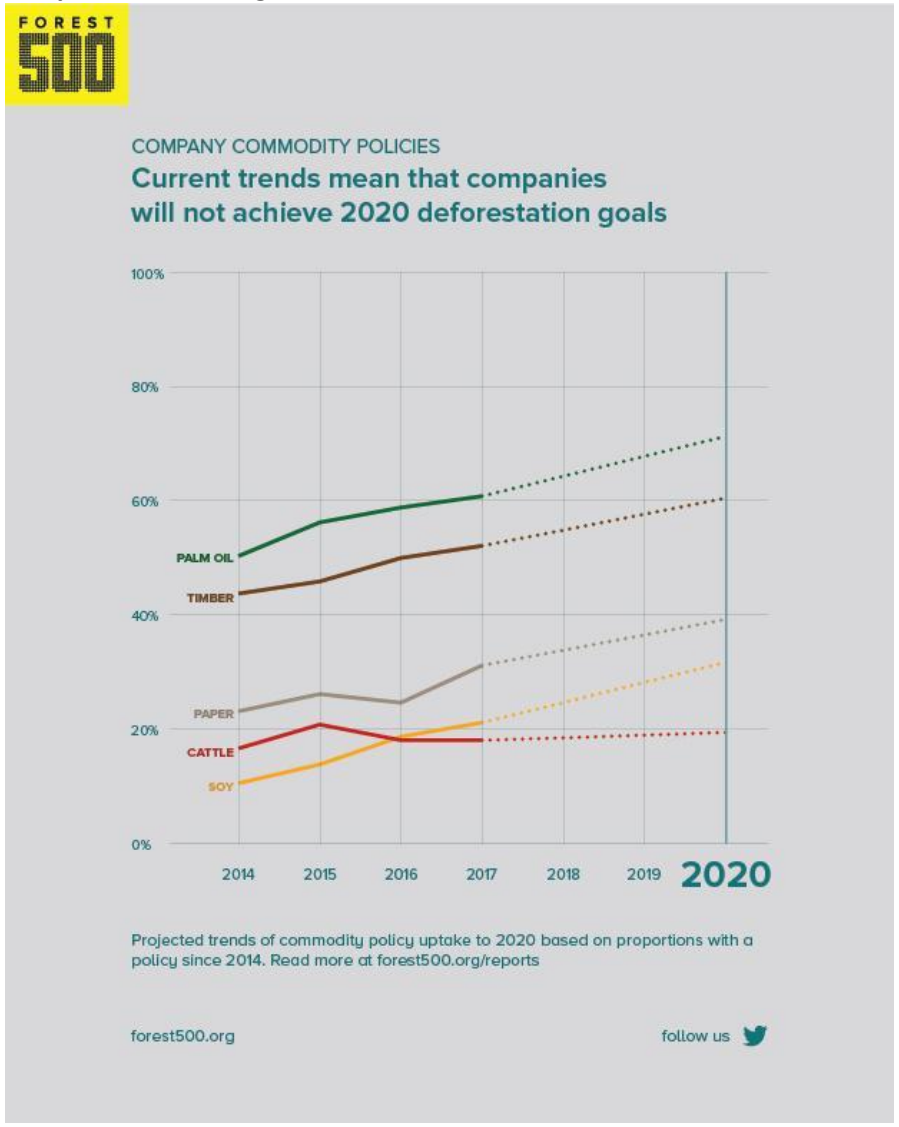
— Three-year moving average. The three-year moving average may represent a more accurate picture of the data trends to uncertainty in year-to-year comparisons. All figures calculated with a 30% minimum tree cover canopy density.



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Last year alone, tropical forests lost 39 million acres of trees—which could cover an area roughly the size of [Bangladesh](#)—according to new findings that have conservationists concerned about failing efforts to protect trees and the vital role forests play in battling anthropogenic global warming.

<https://www.commondreams.org/news/2018/06/27/terrifying-trends-collide-surgingly-deforestation-making-world-hotter-drier-place>



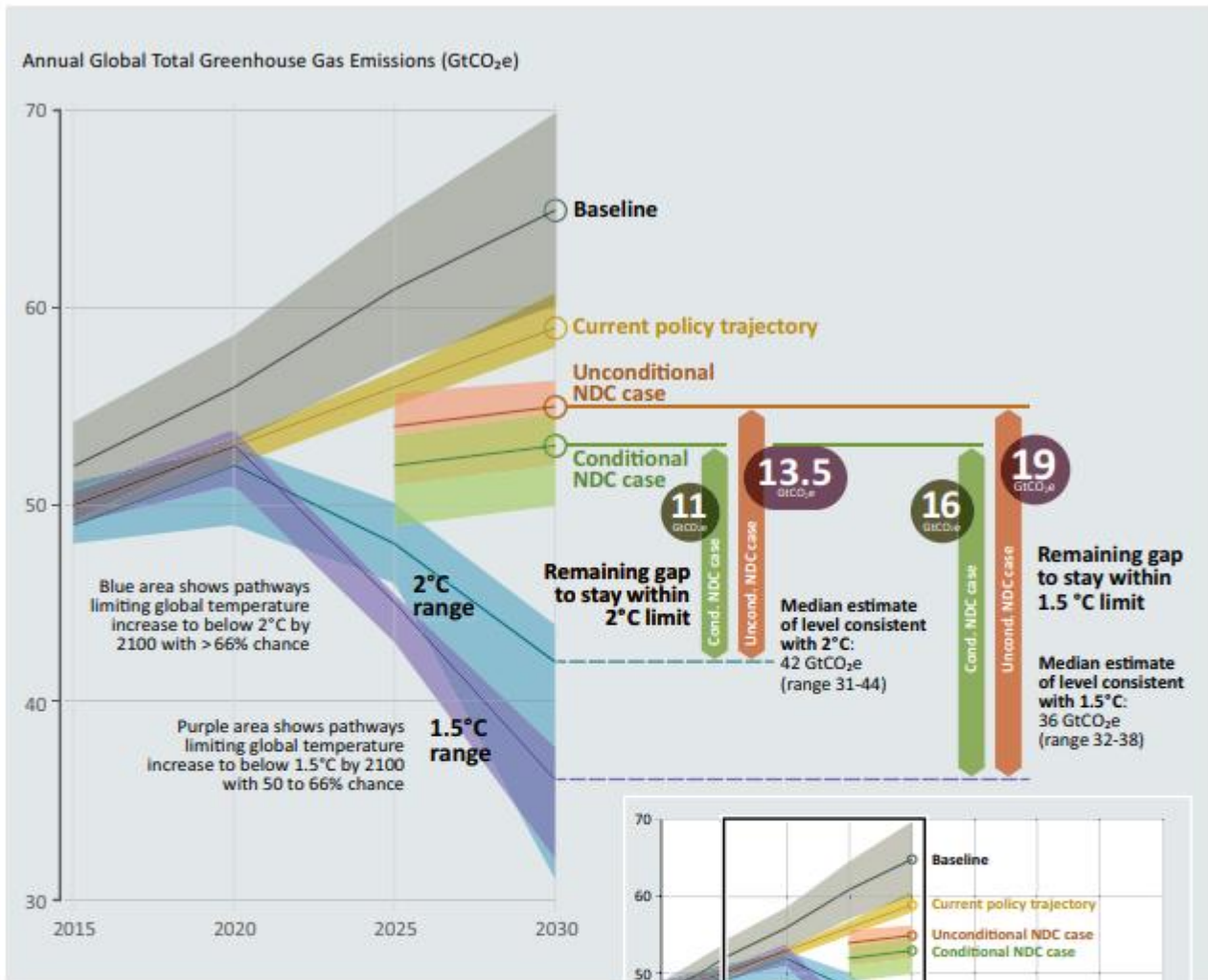
Our 2017 analysis of company commitments shows that at current rates of policy uptake, the 2020 goals to eliminate commodity driven deforestation will not be met. At current rates, the 250 most influential companies will not have introduced, let alone implemented, policies covering the key forest risk commodities by 2020.

<https://forest500.org/analysis/insights/companies-still-falling-short-deforestation-more-action-needed>

6 **Anthropogenic CO2 emissions from agriculture, forestry, land use for IPCC RCP scenarios**

Year	Anthropogenic CO2 emissions from agriculture, forestry, land use (AFOLU) (PgC yr ⁻¹)			
	RCP2.6	RCP4.5	RCP6.0	RCP8.5
2010	1.09	0.94	0.93	1.08
2020	0.97	0.41	0.38	0.91
2030	0.79	0.23	-0.43	0.74
2040	0.51	0.21	-0.67	0.65
2050	0.29	0.23	-0.48	0.58
2060	0.55	0.19	-0.27	0.50
2070	0.55	0.11	-0.04	0.42
2080	0.55	0.02	0.20	0.31
2090	0.59	0.03	0.24	0.20
2100	0.50	0.04	0.18	0.09
Total 2016-2100	50.73	17.85	-6.46	46.96

Figure 3.1: Global greenhouse gas emissions under different scenarios and the emissions gap in 2030 (median estimate and 10th to 90th percentile range).



Note: the emissions range for 1.5°C is smaller than for 2°C, as a smaller number of studies for 1.5°C are available. For current policy, the minimum-maximum across all assessed studies are provided.

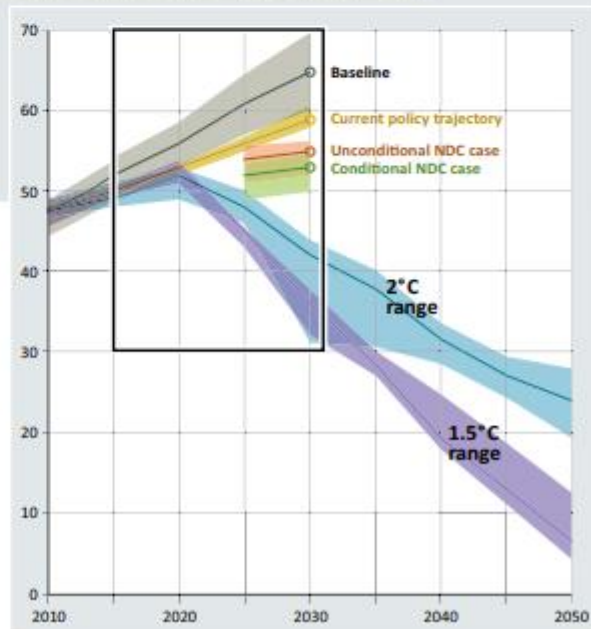
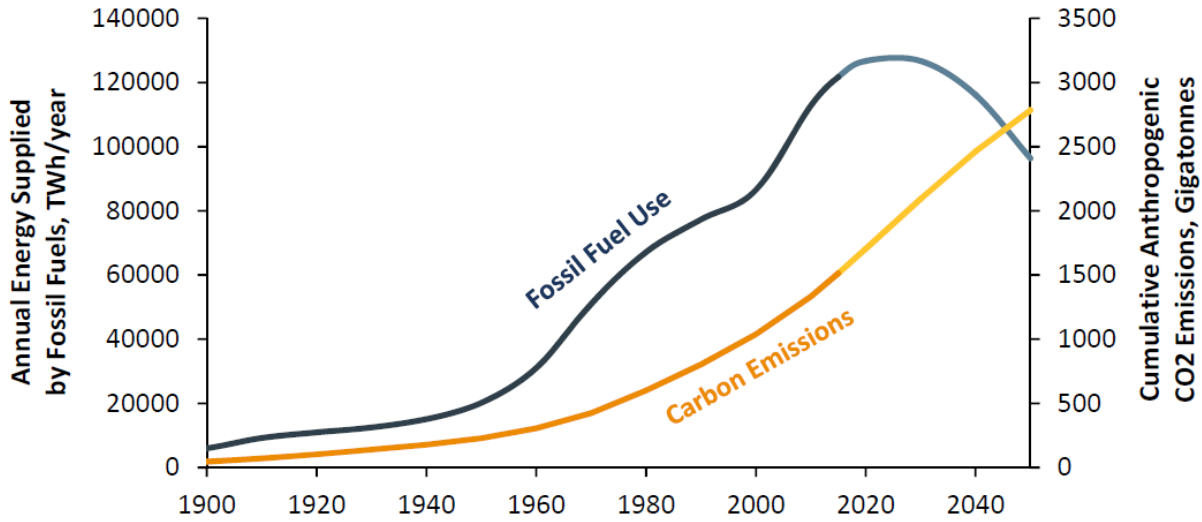


Exhibit 14: Annual Energy Supplied by Fossil Fuels, and Cumulative CO2 Emissions

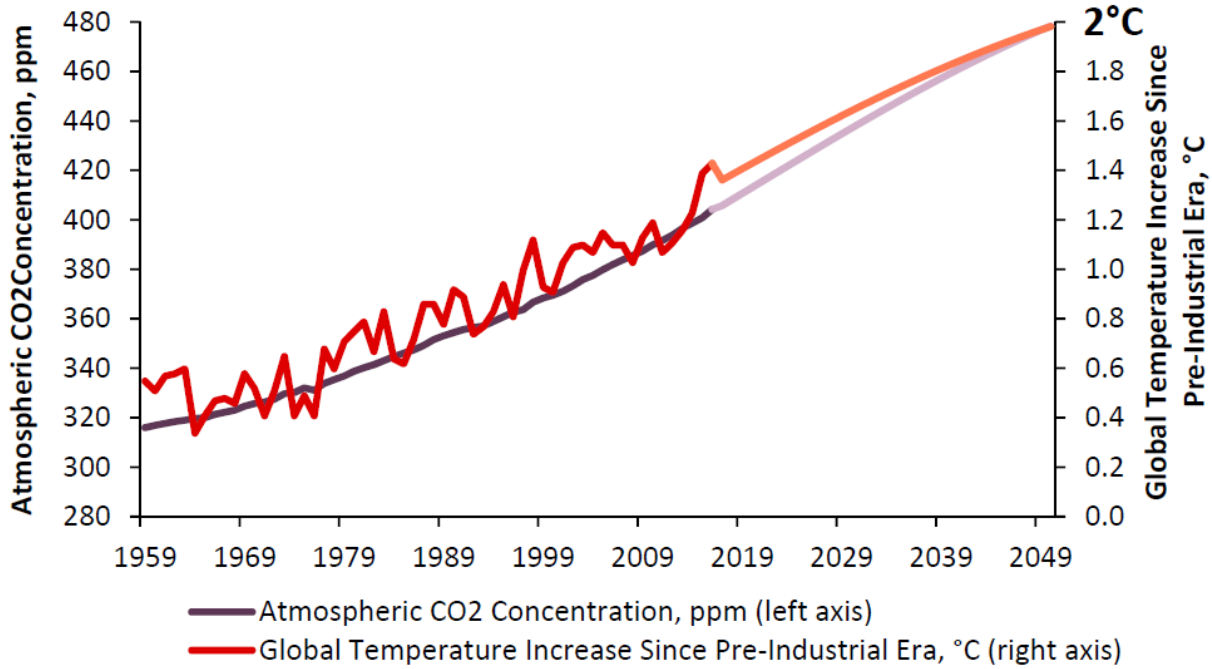


As of 9/30/17

Source: OurWorldinData.org, Vaclav Smil, Carbon Dioxide Information Analysis Centre, GMO

Data from 2015-2050 is estimated or forecast.

Exhibit 15: Atmospheric CO2 and Temperature Increase since Pre-Industrial Era



As of 9/30/17

Source: National Oceanic and Atmospheric Administration, GMO

Data from 2016-2050 is estimated or forecast.

<https://www.advisorperspectives.com/commentaries/2018/08/09/the-race-of-our-lives-revisited>

(Note: the rate of CO2 emissions is about 37 GTCO2 (10 GTC) per year from 2015 through 2050)

9 The following tables show cumulative CO2 emissions from 2016-2100 for fossil fuel , cement, and land use changes for various combinations of emission reductions (without BECCS, CCS, or CDR) based on the following values:

9.86 **2015 Fossil Fuel Emissions (GTC)**

1.6 **2015 land use emissions (GTC)**

2070 **Year when land use emissions reach zero**

0.029 **Land use decline/year (GTC)**

43.00 **Land use emissions 2016-2070 (GTC)**

	Peak Yr:	2020		
	Pct Chg to Peak Yr:	0	1	2
Annual	0	881	923	966
Percent	-1	632	661	691
Change	-2	480	501	523
After	-3	383	400	417
Peak Yr	-4	320	333	347
		Emissions 2016-2100		

2025		
0	1	2
881	964	1055
659	718	783
519	564	613
428	464	502
367	397	428
Emissions 2016-2100		

2030		
0	1	2
881	1005	1146
684	776	881
557	628	709
472	530	595
414	462	517
Emissions 2016-2100		

	Peak Yr:	2020		
	Pct Chg to Peak Yr:	0	1	2
Annual	0	868	910	953
Percent	-1	548	574	600
Change	-2	321	334	349
of Peak	-3	238	248	258
Yr After	-4	197	205	213
Peak Yr		Emissions 2016-2100		

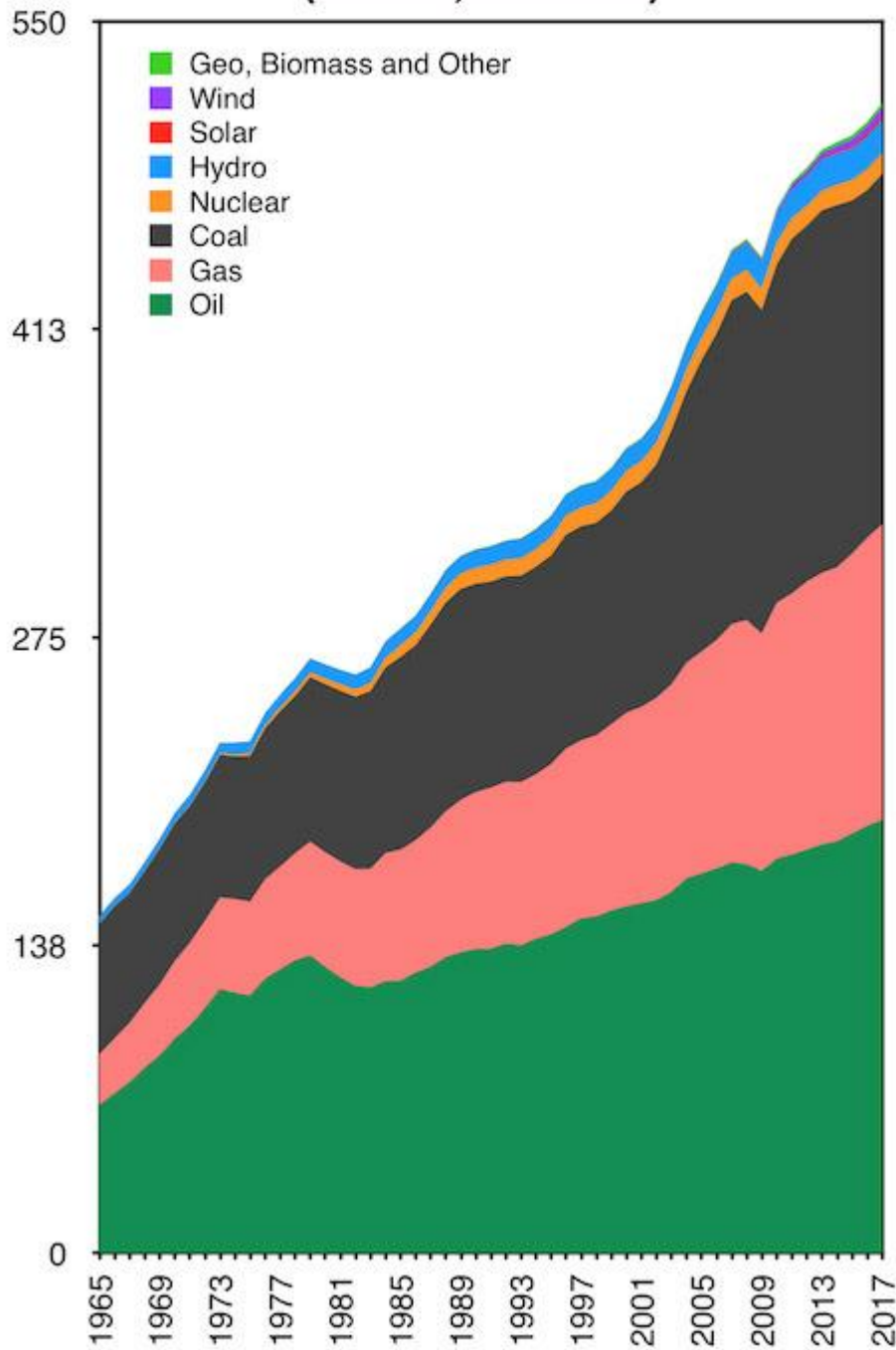
2025		
0	1	2
868	951	1041
587	655	731
370	415	466
288	319	355
247	272	300
Emissions 2016-2100		

2030		
0	1	2
868	991	1133
623	734	862
419	500	601
337	395	467
296	342	399
Emissions 2016-2100		

(See worksheets EmmDecPctPeak and EmissDeclPctPrev in <http://www.cdatacenter.org/documents/FormulasAndTables.xlsx> for calculations)

Note: Based on footnotes 1 and 2, CO2 emissions from fossil fuels and cement were about 9.366 GTC (=8.966 +0.40), a bit lower than the 9.86 GTC used in this footnote)

Global energy consumption (stacked, exaJoules)



<https://www.resilience.org/stories/2018-06-18/our-energy-challenge-in-6-eye-popping-charts/>