



<http://scienceovereverything.com/2018/04/25/carbon-budget-crunch/>

Calculating our carbon budget

Researchers have been saying for years that we must reduce usage of fossil fuels as our main source of energy. But how much time do we have before the worst effects of climate change will take effect?

Part 1: How soon will we use our carbon budget?

Directions: To start, calculate the total amount of carbon dioxide entering the atmosphere each year by taking the sum of carbon emissions from each industry. Each figure is given in Gigatons of carbon, 1 GT is equal to one billion (1,000,000,000) tons.

Industry	Gigatons of carbon per year
Transportation (cars, airplanes, ships, etc.)	10.5
Electricity production (coal, oil, natural gas power plants)	10.5
Factories and manufacturing	8.1
Commercial and residential buildings	4.0
Agriculture	3.3
Total Annual World Carbon Emissions:	

Using the total for world carbon emissions, estimate the amount of carbon burned in the next 15 years. Do this by taking the multiplying the number of years and total annual world carbon emissions.

Years	Amount of carbon burned (Gigatons)
1	
2	
3	
4	
5	
6	
7	
8	
9	

10	
11	
12	
13	
14	
15	

Graph your data in Demos by clicking the link: <https://www.desmos.com/calculator/1wlxmhneoh> Click the double arrow on the top left-hand side of the page, and enter your data with the years in the X_1 column and the carbon emissions in the Y_1 column. Once you enter the data, a purple line will appear, showing the amount of carbon enter the atmosphere over time. The horizontal red line shows limit of our carbon budget. **Find how long will it take to exceed our carbon budget by finding the x value of where the two lines intersect.**

Years to exceed our carbon budget:		Approx. month and year (from Jan. 2018)	
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Applied math: Write a linear equation in slope-intercept form for the line showing current carbon emissions.

Part 2: What if emissions increase?

As developing countries continue to become more industrialized, they require more energy to power their economies. This has meant burning more fossil fuels, causing the rate of carbon emissions to increase over time. Historically, carbon emissions have grown at about 2.5% a year. What would happen we took this increasing demand for fossil fuels into account?

Directions: On the left-hand side of the Demos graph, look for a table that shows X_2 values (an equation has already been set up in the table to estimate carbon emissions with 2.5% growth). Enter the emissions after 5, 10, 15, and 20 years in the X_2 column in Demos and the carbon emissions will appear in the column to the right. Write down the carbon emissions below.

Years	Amount of carbon burned with 2.5% growth per year (Gigatons)
5	
10	
15	
20	

Once your data has been entered, an orange line will appear, showing the growth of carbon usage. **Find how long will it take to exceed our carbon budget by finding the x value of where the two lines intersect.**

Years to exceed our carbon budget if 2.5% annual growth continues:		Approx. month and year (from Jan. 2018)	
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Analysis: How has adding growth into your calculations changed our model? Which line do you think is a more accurate forecast of our future?

Part 3: Renewable Energies

While fossil fuels emissions have increased, renewable energies have also grown. Many countries are using wind and solar for their sources of energy as well as investing in more electric vehicles and energy efficient technology. The Paris Climate Accord is a treaty involving nearly every country in the world reducing their carbon dioxide emissions. What would happen if nations and industries made a serious effort to reduce fossil fuel consumption?

Directions: On the left-hand side of the Demos graph, look for a table that shows X_3 values (an equation has already been set up to calculate a 5% reduction in carbon emissions per year). See how carbon has been burned 15 years by entering 15 in the X_3 column in Demos and write down the carbon emissions below.

Years	Amount of carbon burned with 5% annual reduction (Gigatons)
15	

Once your data has been entered, a green line will appear, showing the reduction of carbon usage. **Find how long will it take to exceed our carbon budget by finding the x value of where the two lines intersect.**

Years to exceed our carbon budget with 5% annual reduction of fossil fuels:		Approx. month and year (from Jan. 2018)	
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Analysis: Would humans be able to avoid increasing global temperatures by 2°C by the year 2100 with a 5% reduction in fossil fuels emissions?

Given historical trends and current energy demands, do you think a 5% reduction in fossil fuel usage is realistic? Why or why not?
