

Jack's Questions

I was thinking about the simulation game and the real thing that you want to know is what reduction in fossil fuel usage (being replaced by renewables) results in what reduction in temperature increase.

The carbon tax slider has many assumptions built into it, so you don't know what the reduction in fossil fuel usage is with increases in carbon tax, and how what the switch over to renewables looks like.

The issue with carbon tax is that it increases the cost of energy and that then results in a reduction in the usage of fossil fuels because they are too expensive.

So, if you subsidize the cost of energy to the consumer, then that would not result in a reduction in fossil fuel usage. While it would help people, especially low income, it would not reduce the use of fossil fuels.

A more balanced approach would be to try to keep the overall cost of energy (fossil plus renewables) lower, while switching over from fossil to renewable.

That option doesn't seem to exist in the simulation. Also I think a slider should be added that shows the decrease in temperature increase with an increasing percentage of renewables of the total usage (so it would also show the decrease in fossil fuels percent). This slider could be changed by itself and/or it would change when other actions are taken.

Analysis and Response

<https://en-roads.climateinteractive.org/scenario.html?p16=-0.03&p39=15&p41=1&p42=850&p43=2022&p44=58&g0=78&g1=86&v=2.7.37>

Global Variables to consider:

- Fossil fuel usage
- Temperature
- Renewables
- Carbon Price
- Cost of Energy

Assumption: All temperature differences are relative to the base case of 3.6°C (6.6°F) temperature increase by 2100.

Questions

1. What reduction in fossil fuel usage (being replaced by renewables) results in what reduction in temperature increase?

2. How does the increase in the cost of energy maintain a reduction in fossil fuel usage if consumers receive subsidy that offsets the increased cost of energy?
3. How do we implement a more balanced approach to keep the overall cost of energy (fossil plus renewables) lower, while switching over from fossil to renewable?

Carbon Price Assumptions:

Carbon Price	\$15/ton CO2
Year carbon price starts to phase in	2031
Years to achieve initial carbon price	1 years
Final carbon price	\$850/ton CO2
Year to start achieving final carbon price	2031
Years to achieve final carbon price	58 years
Emissions performance standard	100 ton CO2/TJ
Emissions performance standard start	2021 year

Question 1

What reduction in fossil fuel usage (being replaced by renewables) results in what reduction in temperature increase?

Part 1

A 100% reduction in coal utilization starting in 2021 and decreasing over ten years until 2031, results in a decrease in temperature in 2100 from 3.6°C (6.6°F) to 3.2°C (5.7°F) or a decrease of 0.4°C.

The same 100% reduction for oil decreases the temperature by only 0.2°F.

The same 100% reduction for natural gas decreases the temperature by 0.2°C (0.5°F).

When all of these reduction are taken at the same time, then the temperature decreases to 2.5°C (4.4°F) or a decrease of 1.1°C (2.2°F).

Result: Holding all other variables constant, a reduction of 10% per year in fossil fuel usage alone over ten years results in a reduction of 0.25°C (0.44°F) per year from the base case. However, this distorts the energy market and renewables do not increase (even if subsidized) to replace the fossil fuel energy.

Part 2

Assuming Citizens Climate Lobby carbon price reduces fossil fuel usage over time, what reduction in temperature increase results?

Carbon Price	\$15/ton CO2
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Year carbon price starts to phase in	2021
Years to achieve initial carbon price	1 years
Final carbon price	\$850/ton CO ₂
Year to start achieving final carbon price	2022
Years to achieve final carbon price	58 years

The carbon price design above results in a temperature decrease to 2.5°C (4.4°F) or a difference from the base case of 1.1°C (2.2°F). The same decrease as Part 1, the 100% fossil fuel reduction scenario above, but the decrease is exponential over 60 years.

Question 2

How does the increase in the cost of energy maintain a reduction in fossil fuel usage if consumers receive subsidy that offsets the increased cost of energy?

Using money from the carbon price to subsidize renewables reduces the peak cost of energy by \$6/gigajoule at the peak and the peak happens ten years earlier than without subsidizing renewables.

Compared to the Part 1 energy costs, this results in a significantly slower increase in energy costs over time, peaking about 2050 and then decreasing over time. The Part 1 scenario results in a significant rapid peaking and slower decrease in energy costs over time.

The carbon price impacts energy producers and distributors and applies at the source. Utilities now are forced by regulation, future carbon price and the current subsidies on renewable to shift their energy sources. Subsidies to consumers are not included in the simulation and would probably be based on income and vary by utility. Consumer subsidies would not impact a utilities energy source mix.

Question 3

How do we implement a more balanced approach to keep the overall cost of energy (fossil plus renewables) lower, while switching over from fossil to renewable?

A balanced approach as I've outlined above involves a carbon price and subsidizing renewables. Now and in the future, people need to be protected from excessive energy costs when unregulated utilities control the market like in Texas. In Stockton CA, they successfully implemented a monthly basic stipend of \$500 per household to people in need with significant results according to a followup study.

As you suggest, we can't do just one thing, we need a balanced approach that includes regulation, a carbon price and subsidies.