

En-ROADS Climate Simulator

Introduction

Are you curious about what it will actually take to start slowing and even reversing the impacts of climate change? Complex problems like climate change require multi-prong solutions. En-ROADS is an interactive online simulation portal created by Climate Interactive, an independent, not-for-profit think-tank that grew out of MIT Sloan with guidance from Dr. John Sterman at MIT. Using the most up-to-date available science, En-ROADS allows you and your friends to be decision-makers to help solve the climate crisis.

Materials needed: Computer or tablet, paper, and pens for writing down ideas.

Checklist

The reference sheet included below will give you a better initial understanding of the various levers and their role in lowering the possible catastrophic temperature rise. We would suggest sharing these with the entire group as a reference guide.

Procedure

- The goal is to keep the global temperature at or below 3.5°F.** In the En-ROADS simulator, multiple levers move to attain your goal. Each lever, backed by thousands of equations, is based on the most current science. The simulation is divided into multiple categories and has levers that manipulate energy supply, transport, buildings and industry, growth, land and industry emission, and carbon removal. Within these categories, you can change everything from carbon tax amount to afforestation and better diets. Each lever on the simulation comes with an information button to better understand the issue. Here are two ways that you can go about using the En-ROADS model depending on the number of participants:
 - Suggested for less than 15 participants: Work collectively as a whole group to think of multiple solutions to keep the temperature rise at or below 3.5°F. As people state their suggestions, move the levers and watch the impact on global temperatures. Once you have achieved lower temperatures, move on to the discussion.
 - Suggested for 15+ participants: Break into smaller groups. Each group will decide one action that they believe will be the most effective at lowering the future global temperature. When participants come back, have each group present their solution. One at a time, show what effect their solution has on global temperature. After each group has participated individually, enter all of their solutions in the simulator at one time to see what the collective change is. Continue brainstorming until the temperature is at or below 3.5°F. Once you have achieved a lower temperature continue on to the discussion.
- Discuss and comment on the impacts and findings that you see when pulling these levers. Here are some potential discussion questions:
 - Which solution surprised you the most?
 - What solutions could your community implement?
 - Why might some solutions meet resistance?
 - Which factors have the most impact on the global rise in temperature?
 - How much responsibility should China and the US assume based on their levels of contribution to the climate crisis?

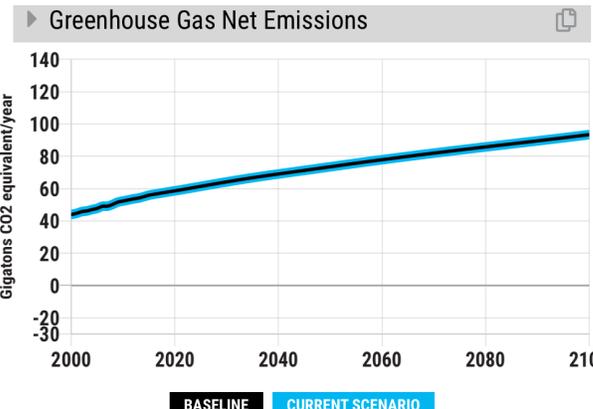
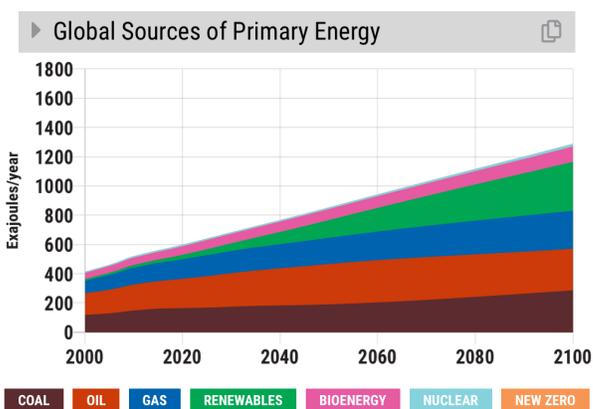
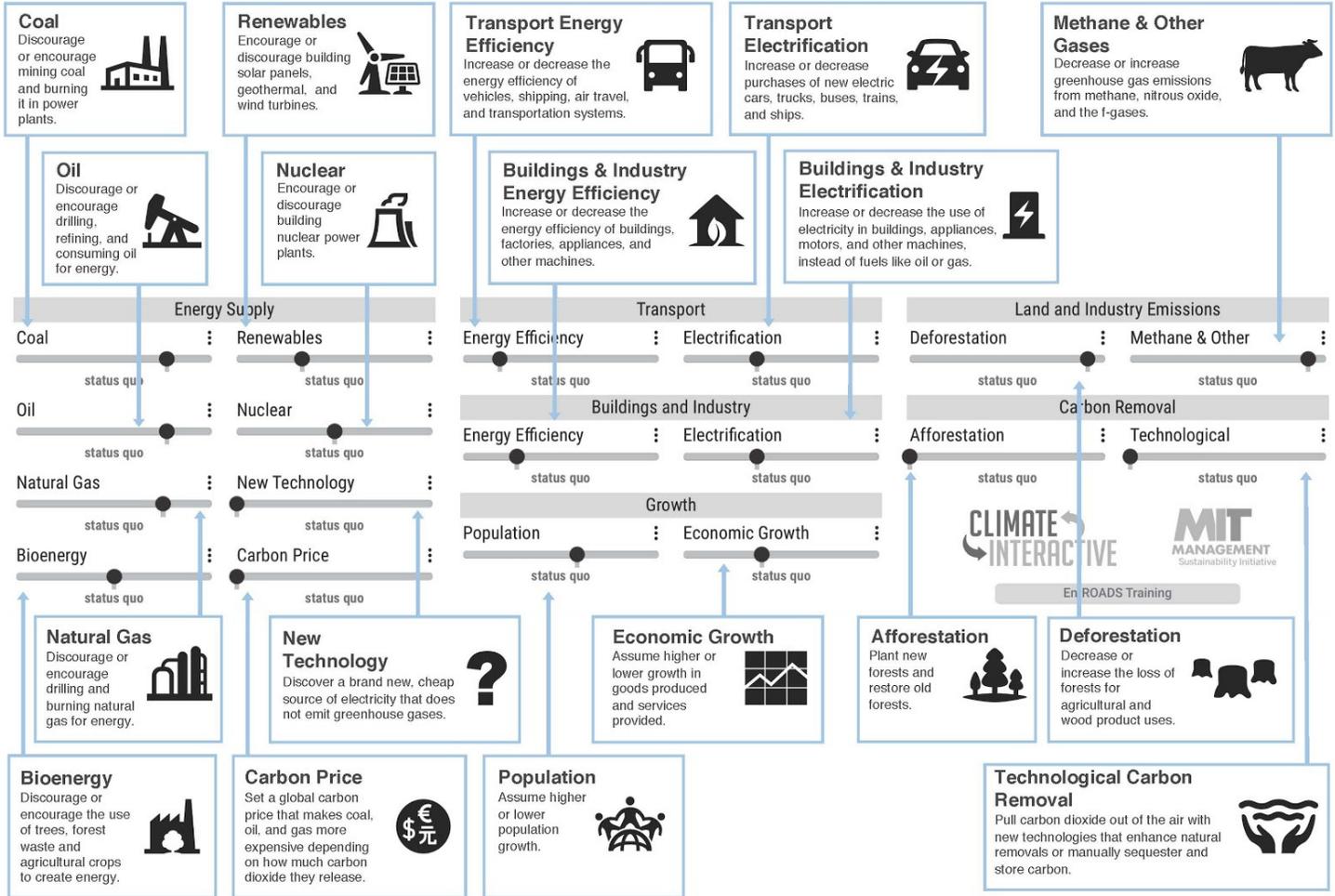
3. Post and share your solution online through the En-ROADS website and share your experience online. Make sure to tag TCI!

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En-ROADS Control Panel

CLIMATE INTERACTIVE

MIT MANAGEMENT Sustainability Initiative



Goal of En-Roads: Create a list of **actions** (above graph) that will change the **outcome** (left graphs). The hope is to get Greenhouse Gas Net Emissions to only rise up to 2°C, or better around 1.5°C.

What approaches will you take?

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Your group will think about one action that YOU believe will have the most effect on lowering the future global temperature. Once you collaborate and decide on your groups' top action, come back to the larger group to see how you did! The goal is to get the Greenhouse Gas Net Emissions to only rise to 3.5°F (2°C) or better around 2.7°F (1.5°C).

Coal:

Coal is a non-renewable energy source that is the most harmful fossil fuel. It is responsible for the most carbon emissions and also has harmful health impacts for humans. However, the world still has a lot of coal, and as other energy supplies dwindle, coal will still be numerous.

Natural Gas:

Natural gas is a non-renewable energy source used for heating and energy. It is less damaging than other non-renewables. However, it will also run out or dwindle at the end of this century.

Nuclear:

Whether to call nuclear energy renewable or nonrenewable is debatable. However, this energy does not produce carbon. Nuclear reactions (splitting atoms) cause energy and heat. Most Nuclear reactors use Uranium.

New-Zero Carbon:

This is a not yet created technology that we are all waiting for, a new renewable energy source that emits not carbon, or can take carbon out of the atmosphere.

Other Terms You Need To Know

Carbon Price:

A strategy to lower greenhouse gas emissions by putting a price on carbon emissions (taxing) to discourage using carbon-emitting energy sources.

Energy Efficiency:

Seen here in two places: Transportation- which could be mass transit, fewer cars on the roads, more efficient vehicles (plane, train, automobile, boat), and Buildings- creating more efficient buildings and homes, including mitigating energy loss through appliances and lack of insulation.

Electrification:

Seen in both Transportation and Buildings and Industry. Electrification is powering our transportation, our industries, and homes through electric sources. Battery storage solutions, electric vehicles, and Hydro-Powered Planes are all examples of this.

Oil:

Oil is a non-renewable energy source used for things such as planes, cars, ships, heating, and creating energy. Oil will eventually start to dwindle at the end of the century.

Bioenergy:

Bioenergy is energy created by burning biomass/biofuel such as; trees/wood, crops, farms, and even animal waste. Some countries have even burned things such as overpopulated animal populations, and chicken feathers.

**There are many pros and cons for bioenergy and varying levels of renewable and nonrenewable options. However you are still releasing carbon.

Renewables:

Renewable energy comes from natural sources or processes that are constantly replenished such as wind, solar, geothermal and hydropower, and causes no air pollutants or carbon output...It does not include bio energy or nuclear energy.

Other Terms You Need To Know

Economic Growth:

Gross Domestic Product (GDP), or how much people consume in products and resources, is how economic growth is measured.

Deforestation:

Cutting down of forests, many times for agriculture, or resources.

Afforestation:

Planting trees to rebuild forests

Methane & Other:

Methane, nitrous oxide, and the f-gases trap carbon in the atmosphere and contribute to the temperature rise in climate change. These gases come from things such as agricultural practices, cows, Permafrost thaw, and drilling.

**Methane is 84 X more potent at trapping heat in our atmosphere than CO2!!!

Accounting for Human Health!

You can choose a Vegetarian diet. But that would mean the entire world would have to go more vegetarian (not impossible) if this is a choice- You would move the Ag and Waste (-20), Transportation Efficiency (+.5), and Deforestation (-1.5)

***Reason: Methane produced by cows both their living (burps and farts) and processing, as well as refrigerated vehicles to transport, and the forests cleared for pasture.