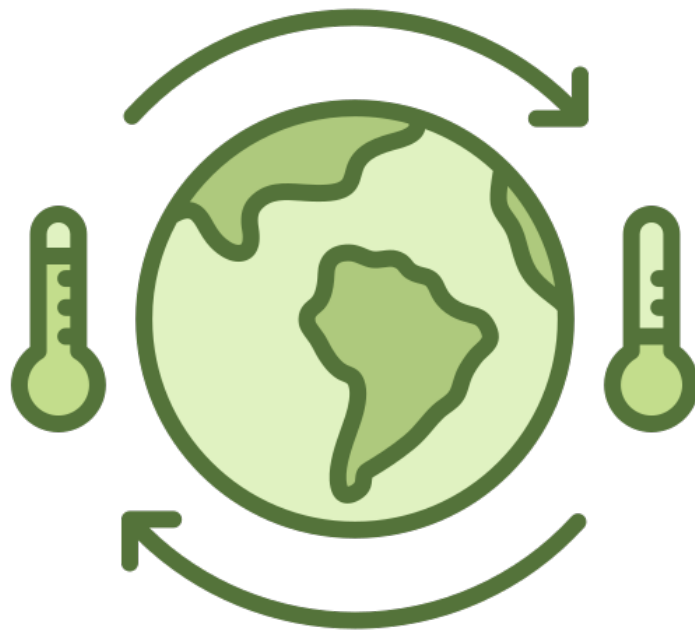


Climate Solutions Simulation Facilitators Guide

Guide to implementing a simulation workshop on strategies to solve climate change



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Provided by Presidio Graduate Center at <https://www.presidio.edu/resources/climate-solutions-simulation/>

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INTRODUCTION TO THE SIMULATION

PURPOSE

Climate change is a complex issue and one that can leave students feeling overwhelmed and helpless. This simulation is designed to expose learners to the variety of strategies available to address climate change, and compare and contrast them on several criteria including effectiveness, cost and feasibility. The overall message of the simulation is that we have the technology to solve this problem and that it is cost effective to do so.

The simulation draws upon the highly acclaimed book *Drawdown*¹ which is a compilation of the 100 most impactful carbon reduction or sequestering strategies along with their costs and benefits. Working with this information, students are asked to create a package, or legislative bill, of strategies designed to meet specific carbon reduction goals within a pre-established budget. The exercise tests their strategic thinking on the subject while revealing to them the most impactful strategies.

The simulation is appropriate to use in a variety of contexts in support of multiple learning disciplines. The most obvious applications are in environmental courses, but it is just as relevant to areas like business, public policy, urban planning, economics and social sciences.

OBJECTIVES

Upon completion of the simulation, participants will be able to ...

1. Identify the strategies and actions most effective at reducing atmospheric carbon.
2. Assess the political and social feasibility of those strategies.
3. Become familiar with new and emerging carbon reduction strategies and products.

AUDIENCE

The simulation was designed for high school, college or graduate students, but has been deployed at conferences and with civic groups as well. It is appropriate for audiences of any size, but works best with audiences that can be broken into small groups.

TIME AND MATERIALS REQUIREMENTS

The design of the simulation is intended to be flexible to apply to different situations: variable session lengths and audience sizes, and virtual or face-to-face sessions. The process is presented in multiple steps. Facilitators

¹ Hawken, Paul, ed. (2017) *Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming*. New York, New York: Penguin Books.

are encouraged to expand, shrink or skip any of the steps to fit their individual applications. The most common use is in a workshop type setting that runs from 1.5-3 hours in length.

Materials for the simulation may be downloaded for free at <https://www.presidio.edu/resources/climate-solutions-simulation/>

Included in the simulation package in addition to this guide:

Strategy cards. This file can be used to print reusable cards from which participants make their top selections. If the session is conducted virtually, these “cards” can be copied to a shared file and made accessible to participants. Shared white board applications such as Miro or Mural make it easy for groups of people to sort through the cards and collectively select the strategies they agree on.

Calculating spreadsheet. This Excel sheet contains the worksheets on which participants record their selected strategies. The worksheet is prepopulated with the necessary formulas to reveal the total cost of their package of strategies as well as the greenhouse gas reduction achieved. Additionally there is a table on each worksheet which allow participants to rate the feasibility of their strategies both individually as well as for the package as a whole. The worksheet includes two administrative tabs for the facilitator. The facilitator may choose to hide these from the participants. One tab collects all the responses from each of the participant groups to create a side-by-side comparison of their strategy sets. The final tab contains two lists for facilitator reference. The first lists all forty strategies in alphabetical order and the second lists all the strategies in order of effectiveness.

Sample slide deck. The final file is a Power Point deck that provides slide to facilitate the simulation. There are three sections to the deck that follow the flow of the session:

Phase 1: Setting the stage which introduces information on why there is a climate problem, the countries representing the biggest contributors, and support the determination of the budget the US should adopt

Phase 2: Instructions for the run of the simulation in four steps

- Step 1: Reviewing and selecting the climate reduction strategies
- Step 2: Entering the strategies and recalibrating
- Step 3: Testing the feasibility of the chosen strategies
- Step 4: Comparing the teams’ results

Phase 3: Sharing the future

A listing of new and emerging carbon reduction strategies that show promise for accelerating the process of drawing down atmospheric carbon.

In addition to the materials provided in this package, participants will need laptops (or at least one laptop per team) and internet access. The facilitator will need the ability to project or share a screen to show the provided slides.

SET UP OF THE ACTIVITY

Familiarize yourself with the strategies in the book *Drawdown*. This simulation makes use of the top forty strategies. Participants may have questions about some of the strategies so be prepared to explain them as described in the book.

Make a copy of the spreadsheet for each session to protect the master file from over-writes. The master worksheet is designed to accommodate 7 groups. Assuming a group size of 3-6 people, the existing file can handle workshops of 20-40 people. If your crowd is larger, simply duplicate the team tabs. You will also need to copy and update with the appropriate worksheet name, the cells in the comparison worksheet to assure all the teams results are recorded. The budget and target reductions are currently set based on the Inflation Reduction Act. Feel free to reset those numbers based on current events or situations. Once the file is set, upload it to a sharable folder such as a Google folder so that participants may access it.

A note about the spreadsheet. Participants should be made aware of the color coding of the cells. Participants are to interact with the light blue cells only. The other cells – including the name of the worksheet tabs – contain formulas that complete the calculations and link the responses to the "Initiative Comparison" worksheet. An exception can be made for those strategies that have no cost associated with them. Should one of those be chosen, participants are encouraged to enter a dollar value to reflect their recommended budget for that strategy. This is one reason why it is important to use a copy of the worksheet with each run to protect the master file from these changes as well as from other changes participants may make.

Gather or print the strategy cards. Create one set for each anticipated breakout group.

If the session is to be delivered all online, set up online white boards that allow for group interaction and post the 40 strategies.

Arrange the room (if in person) to accommodate collaboration among small groups and test internet access. If done online, prepare break out rooms for each group. Optimal group size is four people.

PHASE 1: SETTING THE STAGE

OVERVIEW OF THE CLIMATE SITUATION

This simulation presumes that participants have a fundamental understanding of what climate change is and what causes it. Setting the stage for this simulation involves quantifying the problem by explaining what the carbon burden in the atmosphere currently is, how and at what rate carbon is being sequestered, what the reduction goal is per the recommendations of the IPCC as well as the implications of continued accumulation of greenhouse gases. It further covers where emissions come from and who the primary emitters are. This sets up the conversation about the level of responsibility the US should assume

DETERMINING RESPONSIBILITIES

While the world frequently points to China as the world's largest emitter, their level of responsibility may not be all it seems. Because Carbon hangs in the atmosphere for 100+ years, it's important to consider the history of carbon emissions. When you take into account the fact that the US has been emitting large amounts of greenhouse gases for over 100 years, the U.S. accumulative impact is greater than any other country. Added to that the fact that we (and Europe as well) effectively 'export' our emissions (sending our energy consuming manufacturing needs overseas), one could argue that the US is responsible for the largest share of atmospheric greenhouse gases. The simulation materials conclude that while it currently only accounts for 15% of global emissions, that US should perhaps more realistically be responsible for drawing down 20% of the total global carbon load. You may choose to engage participants in this discussion and let them agree on a percentage of the responsibility they feel the US should shoulder. If they set a different target, be sure to change the responsibility number on the Admin Data worksheet so that it populates correctly on the team worksheets.

Level of responsibility assumes that that is the portion of the strategy US should bear. The price given on the strategy takes a global rather than national position. The Drawdown estimates assume *global* application and

come with appropriate price tag. Since it seems unrealistic that the US would bear the burden of the full cost, the simulation takes the position that if the US is responsible for – say – 20% of the solution, that they should expect to budget 20% of the cost on the chosen Drawdown strategies. Therefore, the worksheets have been program to display a US cost commensurate with the responsibility level chosen. Participants should be clear, that if the US responsibility rate is 20%, then they should budget 20% of the cost shown on the card.

In addition to setting the level of responsibility, you need to determine a budget for how much the US would be willing to invest in any set of draw down efforts. NOTE: At the writing of this guide, President Biden's Inflation Reduction Act is law. It might be necessary to update that number to reflect any current legislation. If there is no money dedicated or you are unaware of any, work with you group to establish a plausible number as a budget limit. The IRA set a ten-year budget of \$555 billion. You might argue that since Congress passed this much before, it might be a reasonable figure to use. If you and the group decide to alter that, be sure to enter the new budget number on the Admin Data sheet as well.

	B	C	D	E	F	G	H	I	J
Strategy		Net Cost	Co2 Reductio	Savings			Step 0 (As a group): agree on # of strategies to drawdown		
No Selection									
Alternative Cement		\$29.44	18.06	\$392.33			Step 1 (As a Group): Agree on level of US Responsibility	20%	
Bamboo		\$23.79	7.22	\$264.80			Step 2 (as a group): Budget for the package		\$550
Biomass		\$402.31	7.5	\$519.35					
Clean Cookstoves		\$72.16	15.85	\$166.28					
Concentrated Solar		#####	10.9	\$413.85					
Conservation Agriculture		\$37.53	17.35	#####					
District Heating		\$457.10	9.38	#####					
1 Educating Girls			59.6						
2 Electric Vehicles		#####	10.8	#####					
3 Family Planning			59.6	\$0.00					
4 Farmland Restoration		\$72.24	14.08	#####					
5 Forest Protection			6.2						
6 Geothermal		(\$155.48)	16.6	#####					
7 Improved Rice Cultivation			11.34	\$519.06					
8 Indigenous Peoples' Land Management			6.19						
9 Insulation		\$3,655.92	8.27	#####					
10 LED Lighting (Household)		\$333.52	7.81	#####					
11 Managed Grazing		\$50.48	16.34	\$735.27					
12 Mass Transit			6.57	#####					
13 Methane Digesters (Large)		\$201.41	8.4	\$148.83					

Admin Data worksheet

Level of responsibility the US should assume

Total budget for a 10 legislative package

PHASE 2: IMPLEMENTING THE SIMULATION

STEP 1: REVIEWING AND SELECTING THE CLIMATE REDUCTION STRATEGIES

Once the setup is complete, introduce participants to *Drawdown* and the general gist of the book. Explain that they will play the role of legislators or NGO lobbyists who are crafting a bill to fund a package of "drawdown" strategies. Explain that they will be given the top 40 strategies from the book *Drawdown*. Their job is to select a set of the strategies they think will work best within the budget given.

Take some time to explain what is included in the information for each strategy:

- The name and a short description of the strategy
- The cost (spread over thirty years) and what you get for the price.

Remind participants that the actual cost they will incur will be reduced by the percentage of responsibility agreed upon earlier. If, for example, it is decided that the US should shoulder 20% of the responsibility, the cost that will be counted toward the budget is 1/5 of what is show on the card.

A word about the costs...These figures were created by trusted experts in various fields. That said, they are rough estimates that will vary over time as markets and technologies change. The costs also assume a 30 period of operation while this simulation is building a package with a ten-year horizon. The exercise should not suffer from any imprecision in these values as the primary point is to understand the relative impact both financially and environmentally.

Some cards show a negative number! This means that the strategy actually has a positive return on investment over time. For the purposes of the simulation, this will count as a straight deduction from the total budget.

A few cards do not list a cost because the implementation of the strategy varies too widely. Be sure to explain that this doesn't mean it is free. Instead encourage participants to think about what they would do to implement the strategy and estimate a cost. For example, if the strategy is to get citizens to eat less meat, make them determine how that might be achieved: through a media campaign; distributed teaching materials to schools; putting a sales tax on meat? Once they've chosen a strategy, they should estimate a cost for implementing it.

Once participants understand the task, distribute the cards. If printed cards are used, print each set of 40 on a different color of card stock for easy sorting. If the session or some of the participants are virtual, create a shared white board for each team with copies of the strategy cards on the board so that teams can move and sort them as shown.

INSTRUCTIONS
Review each of the strategies to the left. (Suggest that each person take one color) Then together decide which strategies you want to include in your solution package and drag those chosen strategies into the box below.

STEP 2: ENTERING THE STRATEGIES AND RECALIBRATING

Before moving on to the next step, it is worth taking a moment to ask if any questions arose from the strategy selection process. Sometimes participants have questions about the strategies. It's useful, therefore, to review these in the source document so that you are ready to answer their questions.

When they are ready, you can prepare them to test their ideas. Display an image of the spreadsheets they will be working with and review its format. There are three sections to the spreadsheet:

Drawdown Strategy Package Worksheet

The U.S. level of responsibility

NOTE: Gray cells contain formulas. Light blue cells are for your use.

	US Responsibility	20%
The 10 year budget for a draw down effort		
	10-Year Budget	\$550 Billion
	Total cost of proposed package	\$0.00 Billion

The strategies selected for inclusion in a carbon draw down package

The feasibility of each of your ideas base on the criteria below using a scale of 0-3; 3 meaning it scores highly positive on the criteria

Select Strategy	US Cost*	CO2 Reduction	How likely would it be supported by congress?	How well would it be accepted by citizens?	How acceptable would it be to power players?	How much does it provide co-benefits?	How well does it support social equity?	Total feasibility score	Average feasibility score for the package
No Selection	\$0.00	0.00	0	0	0	0	0	0	0
No Selection	\$0.00	0.00	0	0	0	0	0		
No Selection	\$0.00	0.00	0	0	0	0	0		
No Selection	\$0.00	0.00	0	0	0	0	0		
No Selection	\$0.00	0.00	0	0	0	0	0		
No Selection	\$0.00	0.00	0	0	0	0	0		
No Selection	\$0.00	0.00	0	0	0	0	0		
No Selection	\$0.00	0.00	0	0	0	0	0		
No Selection	\$0.00	0.00	0	0	0	0	0		
No Selection	\$0.00	0.00		0		0		0	
No Selection	\$0.00	0.00						0	
No Selection	\$0.00	0.00						0	
No Selection	\$0.00	0.00						0	
No Selection	\$0.00	0.00						0	
No Selection	\$0.00	0.00						0	
No Selection	\$0.00	0.00						0	
No Selection	\$0.00	0.00						0	
No Selection	\$0.00	0.00						0	
No Selection	\$0.00	0.00						0	
No Selection	\$0.00	0.00						0	
(Must not exceed 10-Year Budget)	\$0.00	0.00						0	

* you may hand enter an amount for those strategies that do not have one.
Use your judgement to estimate what it would take to implement the idea.
Express the amount in billions of dollars

Top section. Here they will find the agreed upon portion of responsibility as well as the total budget for the package. Additionally, there is a cell that will total their own package and compare it to the budget limit.

Strategy list. Below and on the left of the top section are rows for entering the chosen strategies. The cells contain drop down menus listing all the strategies in alphabetical order for easy entry. Usually, one person reads off the strategy while another selects it from the menu. The cells immediately to the right auto populate with the percentage of the cost the US has agreed to and the proportionate amount of carbon reduction.

Feasibility. The third section to the right – the feasibility tests - is completed in step 3.

BE SURE TO WARN THEM THAT THEY CAN ONLY ENTER DATA INTO THE LIGHT BLUE CELLS. The only exception is that they can hand enter a dollar value into the gray cost cell associated with any strategy that is returning N/A.

Allow them 10-15 minutes to enter their data. At this point they can see how their total compares to the budget and whether they have gone over or under. They also learn how impactful their strategies are at lowering the carbon load. If time allows, given them another 10-15 minutes to adjust their strategies.

STEP 3: TESTING THE FEASIBILITY OF THE CHOSEN STRATEGIES

This test is a reality check on the chosen set of strategies. Meeting the budget is a base line requirement, but it is additionally important to test whether or not these ideas will fly with various stakeholder groups. The table to the right of the strategy list gives participants a chance to consider multiple aspects of their selections to see which, if any, might not be feasible to implement at this time.

There are five criteria again which each strategy should be measured. Participants are asked to assign a “score” of 0-3 from the pull-down menus to indicate how well each strategy fulfills each criterion. 0 means it does not meet it at all and 3 means that it fully meets it.

- Congressional support. Depending on the political climate of the time, would this be a strategy that Congress members could support or would it likely be met with pushback from various factions?
- Citizen support. Would the citizens of the US back this idea? If it requires citizen action (such as eating less meat), how likely do you think it would be adopted?
- Power player support. Is this an idea that is likely to be killed by powerful, monied entities? Would big business or well-funded nonprofits lobby against it?
- Co-benefits. This is an intriguing criterion because while some of the strategies seem tame or not that impactful with regard to carbon, there could be other benefits that make them good choices. Educating girls, for example, has multiple, life-long benefits. Eating less meat would reduce health care costs and reduce lost work time both of which have significant economic impacts.
- Social justice. This is an important and often overlooked criteria that merits consideration. Care should be taken not to ignore those in our population who will not benefit from a strategy because of their position in society. Roof top solar is a good example. While adding solar power to a home lowers utility bills and makes the dwelling more valuable and more resilient in emergencies, few lower income citizens can afford the cost leaving them behind in the renewable transition.

Having entered all the scores, the worksheet calculates an average feasibility score as well as an overall average for the package as a whole.

STEP 4: COMPARING THE TEAMS' RESULTS

All the entries made by each participating team are automatically collected and recorded in the “Initiative Comparison” worksheet. Step 4 involves projecting this page on your own laptop and sharing the results of each team. The summary table from the worksheet (shown below) shows how much each team spent, how feasible they consider their ideas and how much carbon they have removed. These are suggested debrief questions:

- Who among the teams came in closest to budget with the highest carbon impact?
- How does the feasibility score influence impact?
- What recommendations would you change if we ran this a second time?
- What primary lessons do you take away from this?

Comparison of results across teams

Team	Total cost to US over ten years	Average Feasibility Score	US Carbon impact	US Benefit
Team 1	\$0	0	#N/A	#N/A
Team 2	\$0	0	#N/A	#N/A
Team 3	\$0	0	#N/A	#N/A
Team 4	\$0	0	#N/A	#N/A
Team 5	\$0	0	#N/A	#N/A
Team 6	\$0	0	#N/A	#N/A

After the group comparison, display the Drawdown prioritized list on the Admin Data tab. Participants are often surprised by the list and take away some good learning about which are the most impactful strategies. Part of the surprise is that some of the strategies are low cost (e.g. less meat consumption, food waste reduction) and have multiple side benefits as well. Others, like educating girls and providing reproductive health care, are things that the world should just be doing anyway.

88	All strategies in order of effectiveness			
89	Strategy	Net Cost	Co2 Reduction	Savings
90	1 Refrigerant Management	N/A	89.74	(\$902.77)
91	2 Wind Turbines (Onshore)	\$1,225.37	84.6	\$7,425.00
92	3 Reduced Food Waste	N/A	70.53	N/A
93	4 Plant-Rich Diet	N/A	66.11	N/A
94	5 Tropical Forests	N/A	61.23	N/A
95	6 Educating Girls	N/A	59.6	N/A
96	7 Family Planning	N/A	59.6	N/A
97	8 Solar Farms	-\$80.60	36.9	\$5,023.84
98	9 Silvopasture	\$41.59	31.19	\$699.37
99	# Rooftop Solar	\$453.14	24.6	\$3,457.63
100	# Regenerative Agriculture	\$57.22	23.15	\$1,928.10
101	# Temperate Forests	N/A	22.61	N/A
102	# Pasturelands	N/A	21.57	N/A

PHASE 3: SHARING THE FUTURE

WHAT THE FUTURE HOLDS AND THE REASON FOR CAUTIOUS OPTIMISM

All the strategies included in the Drawdown research are tested and, in many cases, already in use. The message here is that we have the technology to fix this problem and for the most part do it in a cost-effective way. But the future promises newer and better technologies. This last part of the workshop presents technologies and strategies that are just emerging. Some are still on the drawing board while others are being deployed in pilot tests around the world. The PowerPoint file contains a long list (we keep adding as we discover new ones) along with the source article that provides explanatory information.

KEY TAKEAWAYS

The simulation is designed to inform audiences of the possibilities and convey a sense of hope. Many of the strategies, like eliminating food waste and eating less meat, are easily adopted at the individual level which should imbue participants with a sense of empowerment. The larger takeaway is that as a society, we understand the problem, we know what causes it, and we have the technology and the financial incentive to fix it. The only thing holding us back is collective will.