Today I Learned What It Costs

"I think there is a lot of focus just on the costs and on the burden. And I think we just have not been very good at communicating that it's not more expensive. It's not more burdensome. I think there's a real need to change the narrative from it being a burden, to being a real opportunity that is good for the people and the planet."
Dr. Barbara Buchner, Climate Policy Initiative
TILclimate podcast: Today I Learned What It Costs

Envisioning the Future

When we burn fossil fuels like coal, oil, and natural gas, and cut down forests, we release carbon dioxide (CO_2) into the atmosphere. This CO_2 acts like a blanket, trapping heat – and trapped heat is changing our climate. We are already seeing more intense storms, flooding, droughts, and heat waves. To slow the impacts of climate change, communities all over the world are switching towards energy sources that don't release as much CO_2, and they are adapting their homes, businesses, roads, and cities to the effects of climate change.

It is easy to focus only on how much these shifts cost. Our brains tend to see change as a disruption, or as something we must give up. What if we look ahead to see what might be exciting about a future that is climate-adapted and lower-carbon?

Often, climate solutions feature something called *multisolving*. Multisolving is when one solution solves many problems at once. For example: a park that provides space for outdoor gatherings, a splash pad to cool off during a heat wave, and a place for water to go during heavy rains so that streets are not flooded.

On the following pages, find some multisolving ideas from around the world. As you read about them, consider:

- Which idea excites you the most? Why?
- Would you like to have a project like this in your neighborhood?
- How does the idea solve more than one problem?

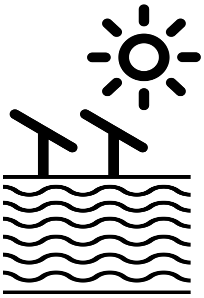
In groups, discuss these ideas and any you may have seen elsewhere. Imagine your group is tasked with inspiring your community to adopt one of these solutions:

- How would you get people excited about it?
- Who do you think might have objections? How could you overcome them?
- How does your project multisolve? Not all solutions need to be climate-related. They may also solve social, economic, physical, or logistical challenges for your community.

MIT Environmental Solutions Initiative

Today I Learned What It Costs

Solar Panels and Canals



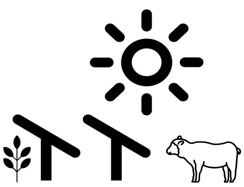
In many places around the world, open canals are used to bring water from a source (like a lake or underground aquifer) to a dry area.

The village of Gujarat in western India installed solar panels over water canals. The panels shade the water in the canals, reducing evaporation. The water cools the panels from below, making them work better. No new land needs to be bought or taken out of use to put in solar panels. The solar panels produce low-carbon, local energy.

A 2021 study suggested that the same strategy could be used in California, where there are over 4,000 miles of open water canals.

https://climate.mit.edu/ed/IndiaCanals https://climate.mit.edu/ed/CACanals

Solar Farming



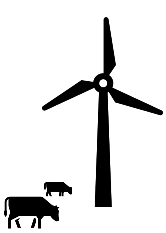
Communities often install large solar panel arrays on open fields or former farmland so they can generate as much energy from the sun as possible. However, the plants in fields can get so tall that they shade the bottom of the solar panels.

Instead of using gas-powered lawnmowers, many places are turning to sheep. The sheep eat the grasses and shrubs that would otherwise shade the solar panels. The shepherds get good grazing for their sheep, and the solar panel owners get more effective solar panels.

Farmers are also experimenting with planting crops under solar panels. This saves good growing land for food production. As average temperatures get hotter, the shade from the panels can extend growing seasons and protect farm workers as they harvest vegetables.

https://www.coagrivoltaic.org/ https://solargrazing.org/

Community Wind



Wind turbines need space around their tops (no tall buildings to block the wind), but they are small at the bottom.

Community wind projects allow schools, hospitals, farms, and ranches to become sources of electricity for their local area. In a community wind project, the turbine is locally owned – helping the economy, providing jobs, and keeping the electricity local. Farmers and ranchers can make money selling the electricity to the local utility, which helps balance losses from changes in growing or weather patterns.

https://climate.mit.edu/ed/CommWind

Images from The Noun Project by Alice Design, Nithinan Tatah, Sadaf, Bernd Lakenbrink, IronSV, and Symbolon

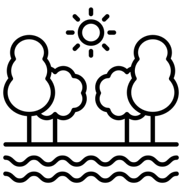
Today I Learned What It Costs

Green Roofs

Because cities contain a lot of dark surfaces, asphalt, concrete, stone, and other materials, cities tend to be much warmer than the surrounding area – an effect called the Urban Heat Island. City Hall in Chicago, IL replaced their dark, heat-absorbing roof with a green roof of grasses, flowers, vines, and trees. The green roof reflects heat, keeping City Hall cooler and cooling the air around the building. The plants and soil absorb rainwater, reducing flooding. It provides habitat for insects, birds, and other wildlife.

https://climate.mit.edu/ed/ILGreenRoof

Stormwater Parks



During rainstorms, hard surfaces such as roads, roofs, and sidewalks do not absorb water, which can cause flooding. Stormwater parks are parks designed to absorb the rain that falls on them as well as rain from the surrounding hard surfaces. In dry weather, they are places for people to relax, exercise, and enjoy nature, as well as habitat for wildlife. During storms, they protect the neighborhood around them from flooding. Coastal parks can be designed to absorb ocean water during extreme high tides and storms.

https://climate.mit.edu/ed/StormwaterParks

Cultural Burning

For thousands of years, Indigenous people managed fire-prone areas with cultural burning. More frequent, smaller, planned fires reduce the fuel for larger, damaging, unplanned fires. Cultural burns increase the biodiversity of plant life, supporting diverse and healthy ecosystems. Starting in the 1800s, these cultural burns were banned, leading to larger and more damaging fires.

Cultural burning is slowly being re-introduced to the California landscape as well as other places. Indigenous people are reclaiming their traditions, supporting wildlife habitat, and preventing extreme forest fires.

https://climate.mit.edu/ed/CulturalBurn

Images from The Noun Project by Denis Sazhin, JC Werly, Made by Made, and Teewara Soontorn

Today I Learned What It Costs

"The most expensive aspects of climate change are likely property damages that are caused by extreme weather events. This is already today costing us in excess of hundred billion dollars a year in the U.S. with the cost rising each year."
Dr. Barbara Buchner, Climate Policy Initiative
TILclimate podcast: Today I Learned What It Costs

Extreme Weather Costs

As we burn fossil fuels like coal, oil, and natural gas and cut down forests, we release carbon dioxide (CO_2) into the atmosphere. This CO_2 acts like a blanket, trapping heat – and trapped heat is warming our Earth, air, and oceans. Warmer oceans drive stronger tropical storms and hurricanes. Warmer soil and air cause longer and more intense droughts and wildfire seasons. Warmer air leads to more severe rainstorms and flooding. And at the same time, more Americans are moving into fire- and flood-prone areas across the nation.

The National Centers for Environmental Information (part of the National Oceanic and Atmospheric Administration) tracks weather events that cause over $1,000,000,000 (one billion dollars) in damage (adjusted for inflation to make years comparable).

Get to Know the Data

1. Visit https://www.ncdc.noaa.gov/billions/time-series/US. Using the buttons across the top of the graph, answer the following questions:

    a. Which year since 1980 has had the highest combined disaster cost?

    b. Describe the trend of the line "5-Year Average Costs".

    c. Which category of disaster has had the largest growth since 1980?

2. Visit https://www.ncdc.noaa.gov/billions/mapping. Using the buttons and drop-down menus across the top of the map, answer the following questions:

    a. Which states or territories have been the hardest-hit in costs by billion-dollar-plus tropical cyclones (hurricanes and tropical storms) since 1980?

    b. Not all states or territories have the same number of residents. Which states have been hardest-hit in cost per 1 million residents since 1980?

    c. Which states or territories have had the highest frequency of droughts since 1980? The highest frequency of flooding events?

1 NCEI: Climate Monitoring: Time Series https://www.ncdc.noaa.gov/billions/time-series/US

Today I Learned What It Costs

Ask Your Own Questions

Now that you are familiar with the kinds of data available on the NCEI site, work with your group to develop questions you are interested in investigating. Consider:

- On the Time Series tab, you can use the drop-down menu to compare regions or states.
- On the Disaster and Risk Mapping tab, you can use the drop-down menu to compare years or decades.
- The buttons across the top of each tab allow you to narrow down to one kind of event (Drought, Flooding, Freeze, Severe Storm, Tropical Cyclone, Wildfire, or Winter Storm.)

Investigate the questions you developed.

1. Does anything surprise you?
2. How could decision-makers use this information to plan for the future?

Extension: Weather Changes

The NCEI data only track extreme weather events that cause over $1 billion in damages. How has the climate changed in your area in general? The US Environmental Protection Agency (EPA) tracks the changes in average weather and climate patterns across the US, even if they do not cause extreme damage. Examine one or more of the following graphs and maps to give more context to the data you explored from NCEI.

Visit https://www.epa.gov/climate-indicators/weather-climate and click on the following terms on the left side of the screen to investigate:

- **Seasonal Temperature:** How have average temperatures in the four seasons changed? (5 graphs, 4 maps)
- **High and Low Temperatures:** How have unusually high and unusually low temperatures changed? (2 graphs, 2 maps)
- **Heat Waves:** How have heat waves changed in frequency, duration, season, and intensity? (5 graphs, 4 maps)
- **Heavy Precipitation:** How have one-day rain/snow events changed? (2 graphs)
- **Tropical Cyclone Activity:** How have the number of hurricanes changed? (3 graphs)
- **River Flooding:** How has flooding changed in frequency and/or size? (2 maps)
- **Drought:** How have patterns of drought changed? (3 graphs, 1 map)

Today I Learned About What It Costs

"It's a complicated issue to measure the true cost of not adapting to climate [change]."

Dr. Barbara Buchner, Climate Policy Initiative

TILclimate podcast: Today I Learned About What It Costs

Climate Adaptation

When we burn fossil fuels like coal, oil, and natural gas, and cut down forests, we release carbon dioxide (CO_2) into the atmosphere, where it acts like a blanket and traps heat. Trapped heat is warming our Earth, air, and ocean. A warmer Earth is changing weather patterns, causing more extreme droughts, storms, heat, and more.

Some solutions to climate *reduce* the amount of carbon dioxide released into the atmosphere. These include switching fuel types and energy sources, using less energy, capturing carbon, and protecting forests. Other solutions *adapt* places and activities to the changes that are already happening, and that will continue to happen for decades to come.

Communities all over the world are using both strategies: reducing carbon dioxide emissions to slow climate change while also adapting buildings, roads, and entire cities to be more resilient in the face of extreme weather, sea level rise, and other challenges.

Case Studies: Each One, Teach One

On the next page, find descriptions of actions people in the US have taken to adapt to climate and weather events. Each member of your group should choose one case study. Read the full case study in the link, and then answer the questions below. (The full link and a shortened version are listed for each article.)

1. Describe the problem that needed to be solved. How is it related to climate change?
2. How did they solve the problem? What *strategies* were involved: engineering, design, collaboration, data collection, policy/law, or others?
3. How do you think they balanced the cost of the strategy with future costs if they did nothing? Who was involved in the decision?

In your group, take turns describing the case study you read. Then discuss:

1. What are some common strategies used?
2. Which projects do you think did the best job of predicting and planning for future climate change challenges?
3. Do you know of, or can you find, any projects in your area that are adapting to or addressing climate change?
4. What other questions do you have about adapting to climate change? How might you answer these questions?

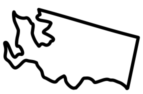
Today I Learned About What It Costs

Case Studies

Drought: Las Vegas, NV

The water utility in the Las Vegas area used climate models to project water challenges in the future. Using this information, they can focus improvement projects on the most vulnerable parts of their system.

https://www.epa.gov/arc-x/southern-nevada-water-authority-assesses-vulnerability-climate-change **https://climate.mit.edu/ed/NVdrought**



Drought: Yakima River Basin, WA

With droughts happening more often, water resources for farming, fishing, and drinking water are reduced. A group including the Yakima Tribal Nation, farmers, and environmental organizations created a Water Resource Management Plan. **https://climate.mit.edu/ed/YakimaDrought**

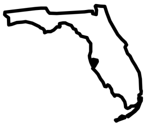
https://www.epa.gov/arc-x/yakima-river-basin-plans-future-water-availability

Storms/Sea Level Rise: San Francisco, CA

The city is cleaning up an old industrial site and turning it into a public park, with designs that help protect the neighborhood from sea level rise and storms.

https://climate.mit.edu/ed/SFindiabasin

https://www.epa.gov/arc-x/san-francisco-cleans-india-basin-waterfront-brownfield-site-part-greenspace-development



Storms/Sea Level Rise: Tampa Bay, FL

The water utility in Tampa Bay redesigned their system to use a combination of groundwater, surface water, and desalinated ocean water. They are now investigating their future risk from storms and flooding.

https://www.epa.gov/arc-x/tampa-bay-diversifies-water-sources-reduce-climate-risk **https://climate.mit.edu/ed/Fltampa**

Storms/Sea Level Rise: Maryland Coastal Wetlands

Coastal wetlands in Maryland are important for wildlife, fishing, and recreation, but sea level rise is happening at almost twice the global average. Data was collected to identify the wetlands that most needed protection and space.

https://www.epa.gov/arc-x/maryland-analyzes-coastal-wetlands-susceptibility-climate-change **https://climate.mit.edu/ed/MDwetland**

Images from The Noun Project by Mohamed Mb

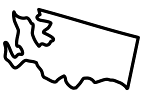
Today I Learned About What It Costs

Case Studies

Storms/Flooding: Augusta, GA

The city is cleaning up an old industrial site to be rebuilt as a mixed-use business and data center. They factored in climate models to make sure that future flooding would not release pollutants from the area.

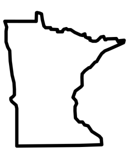
https://www.epa.gov/arc-x/augusta-georgia-brownfield-cleanup
https://climate.mit.edu/ed/GAbrownfield



Storms/Flooding: Anacortes, WA

The wastewater treatment plant is in the flood zone of the Skagit River. It would cost too much to move the plant out of the flood zone, so the city upgraded the system to protect against flooding, saltwater, and storms.

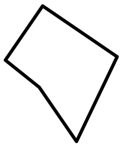
https://www.epa.gov/arc-x/anacortes-washington-rebuilds-water-treatment-plant-climate-change **https://climate.mit.edu/ed/WAriverfloo**d



Storms/Flooding: Minnehaha, MN

The Minnehaha Creek watershed includes Minneapolis and many of its western suburbs. Climate models predict increases in very heavy precipitation, leading to flooding. The Watershed District developed a guidebook to help other communities plan for flooding.

https://www.epa.gov/arc-x/minnehaha-mn-creek-watershed-district-assesses-stormwater-management-climate-vulnerability **https://climate.mit.edu/ed/MNwatershed**



Storms/Flooding: Washington, DC

The sewer and stormwater systems are connected, leading to sewage being released during storms. The city is using green infrastructure to reduce the impact of flooding and tunnels to hold overflow during big storms.

https://www.epa.gov/arc-x/dc-utilizes-green-infrastructure-manage-stormwater
https://climate.mit.edu/ed/DCSewers

Storms/Flooding: Iowa City, IA

After major flooding in 2008, Iowa City decommissioned their wastewater plant, expanded another plant, and converted the land into a public park that will help absorb and prevent future flooding.

https://www.epa.gov/arc-x/iowa-city-iowa-closes-vulnerable-wastewater-facility
https://climate.mit.edu/ed/IAflooding

Images from The Noun Project by Mohamed Mb