

Today I Learned About the City of the Future

Description:

What will the future look like? More importantly, what do we want it to look like? In this highly flexible culminating project, students work as a whole class to plan, design, evaluate, construct, and present their vision for a City of the Future.

Skills & Objectives

SWBAT

- Explain how choices in energy, electricity, design, planning, zoning, and more reduce a city's CO₂ and other heat-trapping gas emissions.
- Understand that municipal and community leaders make choices that shape a city's future for its residents.
- Name some solutions to climate change that they are excited about.

Skills

- Teamwork
- Critical Thinking
- Research

This activity is a culminating project for a unit on climate change. It is not a standalone activity.

Standards Alignment:

HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

Disciplinary Core Ideas:

ESS2.D Weather and Climate

ESS3.A Natural Resources

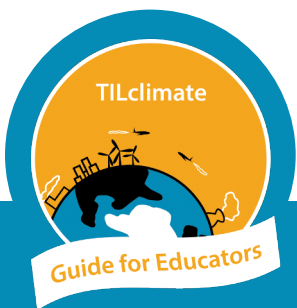
ESS3.C Human Impacts on Earth Systems

ESS3.D Global Climate Change

ETS1.A Defining and Delimiting an Engineering Problem

ETS1.B Developing Possible Solutions

LS4.D Biodiversity and Humans



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How To Use These Activities:



Pages with the circular “TILclimate Guide for Educators” logo and dark band across the top are intended for educators. Simpler pages without the dark band across the top are meant for students.

Season 2 Collection

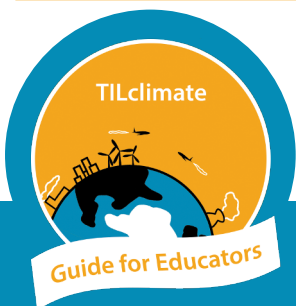
Season 2 of TILclimate from MIT covers a series of interrelated energy subjects. The associated teacher guides are structured for maximum flexibility. Each episode’s activities could be done as a whole class or as small-group work while other teams work on other topics and share back in a jigsaw. Some activities also can be enrichment or homework, and many as asynchronous assignments for remote work. Activities of similar length could also be set up as rotating stations, with a group discussion at the end of class.

- Introductory activities are quick (15-25 minutes) and require no internet.
- Dive Deeper activities are longer (30-60 minutes) and require internet access.

The City of the Future overall project is flexible in terms of time, space, and materials. It will be engaging whether students have completed all activities in the collection, or just one. If teams of students have been working on one topic each, the City of the Future process will help them share their learning with the rest of the class.

Podcasts in the Classroom: Throughout these Guides for Educators, we invite students to think about how they would share their learning with family and friends. One way to do this is to encourage your students to create their own podcasts - they’re shareable, creative, and have multiple options for embedded assessment. We would love to hear any podcasts or see any other projects you or your students create! Email us at tilclimate@mit.edu, Tweet us @tilclimate, or tag us on Facebook @climateMIT.

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How To Do This Activity

What do your students imagine for the future? Helping youth today envision the world they want to create can be empowering and uplifting. By describing and imagining a future that is exciting, beautiful, and engaging, students can see a place for themselves. The future needs people with every kind of skill – engineers, scientists, artists, nurses, musicians, entrepreneurs, mechanics, and many, many more..

The City of the Future is meant to be a culminating project. Students may have done multiple activities from the TILclimate Season 2 Collection, or they may have been learning about climate change through other means. The goal of The City of the Future is to combine all students' climate learning into a solutions-oriented, future-thinking, and hopeful celebration of the possibilities in a climate-aware future.

It would help if students know that they will be working toward the City of the Future as a final project as they work through their other climate-related activities and learning. This will help to inform the kinds of ideas, solutions, and thoughts that they collect throughout their learning process.

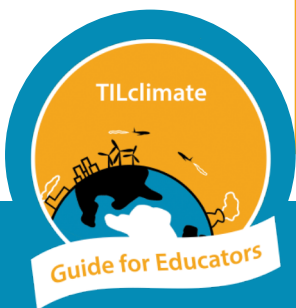
We know that not all classrooms will use activities from all portions of TILclimate podcast's Season 2. A document is included with resources from all parts of the season. During the Planning Board meeting phase, the other committees could use some of these resources to collect more solution ideas.

Presentation Ideas

Share the students' visions for the future! Students may want to share their learning with friends and family, the school community, or municipal decision-makers. Student excitement about climate solutions can inspire and motivate the adults around them. The mode of this presentation will vary, depending on the audience chosen, but ideas include:

- Podcast episode – tell the story of how the class developed the City of the Future, or imagine a day in the life of a student in the City of the Future
- Traditional presentation – create a slide-deck with images, statistics, and proposals
- Website – sell the idea of the City of the Future!
- Social media – document your process or share your completed City.

We would love to hear any podcasts or see any other projects you or your students create! Email us at tilclimate@mit.edu, Tweet us @tilclimate, or tag us on Facebook @climateMIT.



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Collecting Solutions

The City of the Future is a celebration of possibilities. Therefore, the more possibilities students know about, the better. As your students are learning about climate change, they can be collecting climate-related solutions that inspire or excite them. These could be collected on an anchor chart, shared digital document, or sticky notes on a whiteboard.

Solutions come in many shapes and sizes. Students may learn about projects as big as a city's carbon-neutral goals, or as small as a local community garden. The City of the Future needs them all. As much as possible, these ideas should be at the community level – that is, not individual actions. When individual actions are presented, consider: What would need to change to make this action the easy default for everyone, instead of a hard choice?

A resource guide including articles and data links for all Season 2 Episodes is on p. ix-xii. For more guidance on collecting solutions, see pages 1 and 2.

Organizing Solutions

While the Planning Board meets to create their rubric, the other committees should organize collected solutions. One method for sorting is the Snowball.

1. Write collected solutions on index cards or similar.
2. Divide index cards among committees.
3. Committees read through index cards and sort into categories. These may be pre-assigned categories, or the categories may become clear as the cards are read. Write the category on a blank index card and stack the cards together.
4. Category stacks that clearly connect with the mission of a particular committee are given to that committee. Other stacks may be assorted at random or by the teacher.



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Construction

The Construction Phase will vary depending on physical space, time constraints, and teacher goals. Some ideas include:

- 3D: Use clean recycling materials (yogurt cups, paper towel rolls, etc.) or building blocks (LEGO or similar.)
- 2D: Large sheets of paper, either in a single piece or smaller pieces that are then joined together to form a map of the City. Images could be drawn, painted, printed out, collaged, etc.
- Digital: A shared digital whiteboard, digital portfolio or folder, or another platform.

Students may work in their committees or may form new groups to work on specific sectors of the City. It may help to also establish a few new roles:

- Project Management: For longer projects, a Project Manager makes sure that construction is happening on a timeline and that deadlines will be met. They may also circulate among groups and make sure that work is not being duplicated or in conflict.
- Journalism: Journalists document the process, from planning to construction. Photographs, videos, and interviews help tell the story.
- Design Support: Some students may have trouble translating a selected solution into a 3D or 2D representation. Design Support Team members can help create understandable representations.
- Research Librarians: As students are constructing solutions, they may run into research questions that will help them with their representation.



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Community Goals

The most important step in planning the City of the Future is the establishment of Community Goals. These are the guiding vision that will determine the shape, function, and future of your City. While the Community Goals may be determined ahead of time by the teacher to save time, the process to determine Community Goals can be extremely rewarding for students.

In small groups:

- Students write a few key takeaways they have learned from their climate change investigations so far.
- For each takeaway, students write a goal or vision that would solve a related problem or challenge.
- Students look for connections between and among their goals.
- Each group rewrites one goal. Goals should be relatively broad (e.g., 'carbon-neutral city' instead of 'everyone has solar panels') and applicable to the topic at hand (i.e., if your focus has been on energy, the goals should all clearly connect to energy shift and energy efficiency.)

As a class:

- Refine proposed goals down to a list of 3-5 visions for the City of the Future.

Committee Descriptions

Planning Board (p 4) (made up of one member from each other committee)

- Devises a tool to evaluate whether proposed solutions fulfill the Goals.

Energy Commission (p 5)

- Determines how and where energy and electricity will be produced.

Building Department (p 6)

- Develops a Building Code for residential, commercial, and industrial buildings.

Zoning Board (p 7)

- Designates where in the city different kinds of buildings can be built.

Public Outreach (p 8)

- Creates an advertising and communications plan to explain the Goals.

Public Health (p 9)

- Ensures that the city is healthy for residents, including food, water, etc.



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Phases

Phase	Title	Description
Prep p. iv	Introduction & Collecting Solutions	Before beginning a unit on climate change, students are introduced to the plan to design the City of the Future. Over the course of a unit of study, students collect climate-related solutions, ideas, and designs.
One p. vi	Community Goals	At the beginning of the project, the class agrees on 3-5 visions for their City of the Future.
Two p. vi	Establish Committees & Nominate Planning Board	Members of the five committees are decided, either by the teacher or by student choice. Committees should be roughly equal in size. Each committee then nominates one member to sit on the Planning Board.
Three p. 4 p. iv p. ix-xii	Planning Board Meeting Solutions Organization	The Planning Board meets to create the evaluation rubric. This rubric will help assess whether the plans from the other committees meet the Community Goals. Meanwhile, committees meet and work to collect and organize solutions. If necessary, they may use <i>TILclimate Season 2 Resources</i> .
Four p. 4-9	Committee Meetings	With the Planning Board's rubric in hand, the five committees meet to complete their planning worksheets. For classes with limited time, the activity may end here, with the teacher assessing the planning worksheets using the rubric.
Five	Committee Presentations & Evaluation	Each committee presents their planning document to the rest of the class. Students use the Planning Board's rubric to evaluate plans. If necessary, committees may meet again to revise their work to better match the Community Goals.
Six p. v	Optional: Construction	3D, 2D, or digital representation of the City will vary based on physical space, time, and teacher goals. See <i>Construction</i> .
Seven p. iii	Optional: Presentation	Who needs to know about the City of the Future? Students may present their learning to the appropriate audience.

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A Note About Timing

All TILclimate Educator Guide activities are meant to be flexible and adaptable, but City of the Future may be the most flexible of them all. Timing, therefore, is highly variable depending on your class's needs and schedule. Some possible plans:

- Planning Only, Teacher-Directed: 1-2 Class Periods
 - Introduce the City of the Future with pre-established Community Goals (5-10min)
 - Introduce pre-chosen Committees and Planning Board (5-10min)
 - Planning Board creates rubric while other committees collect solutions (20-30min)
 - Committees meet (30+min)
 - Committee worksheets are assessed by teacher
- Planning Only, Student-Chosen: 2-3 Class Periods
 - Introduce the City of the Future (5-10min)
 - Develop Community Goals (10-15min)
 - Form Committees, nominate Planning Board (5-10min)
 - Planning Board creates rubric while other committees collect solutions (20-30min)
 - Committees meet (30+min)
 - Committee worksheets are assessed by teacher
- Planning and Construction: 3-5+ Class Periods
 - Introduce the City of the Future (5-10min)
 - Develop Community Goals (10-15min)
 - Form Committees, nominate Planning Board (5-10min)
 - Planning Board creates rubric while other committees collect solutions (20-30min)
 - Committees meet (30+min)
 - Committees present worksheets (10-15min)
 - Students use Planning Board rubric to assess committee plans. Committees revise plans according to feedback. (20+min)
 - Construction of City – 2D, Digital, or 3D (45+min)
- Planning a Presentation: 1+ Class Periods in addition to time above
 - Identify audience (10-15min)
 - Choose presentation mode (podcast, traditional presentation, website, social media, etc.) (10-15min)
 - Gather images, stories, etc. (20-30min)
 - Create presentation (variable depending on mode)
 - Present to chosen audience (variable depending on audience and mode)



TILclimate Season 2 Resources

MIT Resources

- TILclimate Podcast: Quick episodes give you the what, why, and how on climate change — from real scientists and experts — to help us make informed decisions for our future. <https://tilclimate.mit.edu>
- Climate Science, Risk & Solutions: An interactive introduction to the basics of climate change. <https://climateprimer.mit.edu/>
- MIT Climate Portal Explainers: One-page articles describing a variety of climate topics. <https://climate.mit.edu/explainers>

The Electric Grid

MIT Climate Explainers:

- Cities and Climate Change
- Energy Storage
- Renewable Energy

Energy Information Administration:

- Energy Maps <https://atlas.eia.gov/pages/energy-maps>
- Electric Grid Maps <https://www.epa.gov/egrid/data-explorer>

Fossil Fuels

MIT Explainers:

- Mining and Metals
- Greenhouse Gases
- Carbon Pricing

Energy Information Administration:

- Energy Maps <https://atlas.eia.gov/pages/energy-maps>

Is It Energy or Electricity?

MIT Explainers:

- Greenhouse Gases
- Nuclear Energy
- Biofuel
- Renewable Energy

Energy Information Administration:

- Energy Consumption <https://www.eia.gov/beta/states/data/dashboard/consumption>



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ENVIRONMENTAL
SOLUTIONS
INITIATIVE

TILclimate Season 2 Resources

Wind & Solar Power

MIT Explainers:

- Renewable Energy
- Energy Storage

National Renewable Energy Laboratory:

- Solar maps <https://www.nrel.gov/gis/solar-resource-maps.html>
- Wind maps <https://www.nrel.gov/gis/wind-resource-maps.html>

Energy Information Administration:

- Energy Infrastructure and Resources map <https://atlas.eia.gov/apps/all-energy-infrastructure-and-resources/explore>

Energy Storage Articles

- MIT Explainer: Energy Storage <https://climate.mit.edu/explainers/energy-storage>
- Solar-Plus-Storage <https://www.energy.gov/eere/solar/articles/solar-plus-storage-101>
- An introduction to the state of energy storage in the U.S. <https://yaleclimateconnections.org/2019/12/an-introduction-to-the-state-of-energy-storage-in-the-u-s/>
- EPA: Electricity Storage <https://www.epa.gov/energy/electricity-storage>

Energy Efficiency

MIT Explainers:

- Greenhouse Gases
- Carbon Offsets
- Renewable Energy

Nuclear Power

MIT Explainers:

- Greenhouse Gases
- Nuclear Energy

Our World In Data:

- Safest Sources of Energy <https://ourworldindata.org/safest-sources-of-energy>
- Country Energy Profiles <https://ourworldindata.org/energy#energy-country-profiles>
- CO₂ Emissions <https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions>

International Atomic Energy Agency:

- Power Reactor Information System <https://pris.iaea.org/PRIS/>



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TILclimate Season 2 Resources

Carbon Capture

MIT Explainers:

- Concrete
- Mining and Minerals
- Carbon Pricing
- Carbon Capture

Ask MIT Climate:

- How efficient is carbon capture and storage? <https://climate.mit.edu/ask-mit/how-efficient-carbon-capture-and-storage>
- Do we have the technology to go carbon neutral today? <https://climate.mit.edu/ask-mit/do-we-have-technology-go-carbon-neutral-today>

Biomimicry: a practice that learns from and mimics the strategies found in nature to solve human design challenges

- <https://asknature.org/>

Global CCS Institute

- Carbon Capture and storage facility data <https://co2re.co/FacilityData>

Fusion Energy

MIT Explainers:

- Fusion Energy

Cleaning Up Clean Tech

MIT Explainers:

- Mining and Metals
- Greenhouse Gases
- Freight Transportation
- Renewable Energy

United Nations Sustainable Development Goals

- <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>

Supply chain: all the materials and activities that go into making, transporting, using, and disposing of something