














# TILclimate Season 2 Resources

## Energy Definitions

	Energy Source	Where it comes from and how it is used	Renewable	Low CO <sub>2</sub> *
	Natural Gas	Pumped from deposits underground. Refined & burned to create steam for electricity or used directly to create heat.	✗	✗
	Petroleum	Pumped from deposits underground. Refined into oil, diesel, and gasoline and burned for electricity, heat, and transportation.	✗	✗
	Coal	Mined and burned to create steam for electricity or used directly to create heat.	✗	✗
	Nuclear	Uranium is mined and refined. Atoms are split to create heat and steam to generate electricity.	✗	✓
	Biomass	Burning trees, plants, and other organic matter for heat or to generate electricity.	✓	✗
	Wind	Using wind power to turn a turbine and generate electricity.	✓	✓
	Hydro-power	Using flowing water to turn a turbine and generate electricity.	✓	✓
	Solar	Materials mined from underground are used to capture light from the sun and generate electricity	✓	✓
	Geothermal	Using the natural heat and water below Earth's surface to heat & cool buildings or generate electricity.	✓	✓

\*without carbon capture technology

## Sector Definitions

	Industrial	Manufacturing, agriculture, forestry, mining, oil & gas extraction, and construction. Energy use is mostly heat for manufacturing processes, powering machinery, and heating and cooling buildings.
	Transportation	Cars, trucks, buses, trains, airplanes, and ships that are used to transport people and/or goods. Energy use is mostly fuel for engines.
	Residential	Houses, apartments, condominiums, etc. Energy use is mostly heating, cooling spaces and water, lighting, refrigeration, cooking, etc.
	Commercial	Businesses, restaurants, hotels, stores, government buildings, religious or social organization buildings, institutional living spaces. Energy use is mostly heating, cooling spaces and water, lighting, refrigeration, cooking, etc.

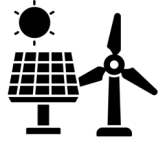
Images from the Noun Project Becris, Koson Rattanaphan, Hamel Khaled, Nawicon, ArmOkay, Jacqueline Fernandes, Tom Fricker, Ivan, Eragon, Ben Davis, Monkik, and Charif Deffa

# Today I Learned About the City of the Future

## The City of the Future Needs Climate Solutions

As you work on climate-related topics, collect solutions that fit into the following categories. This collection could be on an anchor chart, a shared digital document, or sticky notes on a white board. What kinds of solutions excite you the most?

## Four Categories of Climate Solution



### Energy Shift

Technologies, policies, and behaviors that reduce or eliminate heat-trapping emissions from fossil fuel use, like coal, oil, and natural gas.

- In the City of the Future, how will energy be made and used? What sources will we use?



### Energy Efficiency

Technologies, policies, and behaviors that reduce overall energy use.

- In the City of the Future, how will we design our buildings and infrastructure to use less energy?



### Adaptation

Technologies, policies, and behaviors that protect people and places from the impact of climate change.

- In the City of the Future, how will we design our buildings and infrastructure to be resilient to changes in precipitation, heat, and sea level?



### Communication

In order to reach the City of the Future, we need more people on board.

- How do we share what we are learning outside our classroom?

## Three Styles of Climate Solution



### Technology

We are innovators. We invent new technologies, processes, and systems to generate energy, move people, and support our communities.



### Policy

We are leaders. We create laws, taxes, and plans that make it easier for people and communities to choose a future that is healthy for people and the planet.



### Behavior

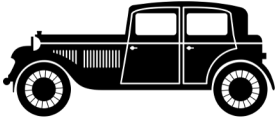
We are community members. We change the way we do things to make our communities healthier, safer, and more just.

# Today I Learned About the City of the Future

## Community-Level Solutions

Solutions have the highest impact when they are more than an individual action. Any time solutions can happen at the level of policy, design, easy availability, and default choice, those actions are much more likely to have large and long-lasting effects.

### Community-Level Solutions – A Story



When cars were first invented, they had no seatbelts, no collapsing steering columns, no airbags – no safety mechanisms at all. The commonly-held wisdom was that ‘the nut behind the wheel’ was the only cause of vehicle accidents. Public service announcements focused on being a good driver and watching out for other drivers. This is an example of a focus on individual actions instead of community-level solutions.

After decades and thousands of deaths, technological changes to cars began to make driving somewhat safer – but even these didn’t become a default setting until more than 60 years after the first cars.



Today, we know that being a good driver is important. But we also know that accidents (and bad drivers, bad roads, etc.) happen – so cars are designed to protect you.

### Community-Level Solutions – A Metaphor

Making an individual choice to change a behavior can be very difficult. We are often told that walking or riding a bike is better for us and for the environment than driving in a car. However, making that decision as an individual can feel like swimming upstream. There might not be sidewalks, bike lanes, crosswalks, or any of the other infrastructure that would make walking or biking safe and easy.

To make actions like this community-level, we can change the infrastructure so that walking and biking becomes just as easy (if not easier) than driving. This will make it feel like floating downstream with the current.



If one of the solutions you have collected seems like an individual action, consider: What would need to change to make this action the easy default, instead of a hard choice?

# Today I Learned About the City of the Future

“Energy is the lifeblood of our society. It fuels the production of our food, and things we use every day, and powers our homes, cars, and workplaces. The cost of energy impacts the price of pretty much everything. A world without the cheap and abundant energy that we have today, well, we wouldn’t recognize it.

And yet, generating energy for electricity and heat is our society’s number one source of greenhouse gas emissions. And as those emissions cause global temperatures to rise, coastlines to recede, and natural disasters like wildfires, floods, and hurricanes to intensify, the world we’re creating is one we won’t recognize either.”

*Laur Hesse Fisher, MIT Environmental Solutions Initiative*

*TILclimate podcast: Today I Learned About The Electric Grid*

## A Warming Planet

When we burn fossil fuels like coal, oil, and natural gas, we release carbon dioxide (CO<sub>2</sub>) into the atmosphere. Carbon dioxide and other gases act like a blanket, trapping heat on Earth. This trapped heat is changing our climate, causing dramatic changes in extreme weather and other effects all over the world.

## Imagining the Future

Our cities today have grown over centuries, the result of choices made by generations of builders, planners, and policies. Looking toward the future, we can reimagine our cities as we change our use of energy and the way our cities support the lives of those who live, work, and play in them.

Your class will be imagining a city of the future. You will choose how it is planned, powered, and organized. As you make your choices, think about what you have learned about energy, electricity, efficiency, and the climate.

Planning for the City of the Future takes everyone. Designers, artists, and entrepreneurs can work with engineers, scientists, and builders. Anyone can have a good idea that is worth working towards.

Community Goals are the visions that will help shape your City of the Future. They should be broad enough to apply to many different aspects of life in a city. Describe what you want your city to feel like, look like, sound like, and provide for the people who live, work, and play there. Many goals are ‘multisolving,’ meaning that they solve more than one problem. For example, a city with a lot of walkable green space is cooler (urban heat island effect), has less air pollution, and encourages residents to spend time outside.

# City of the Future: Planning Board

## Instructions

The goal of the Planning Board is to develop a rubric to evaluate whether a plan from one of the other Committees fits the Community Goals.

For each Community Goal, describe what criteria you would use to determine if a plan does not meet the goal, meets the goal partially, or meets the goal.

An example has been provided.

Community Goal	Does Not Meet Goal	Partially Meets Goal	Meets Goal	Notes
Walkable green space for all.	Fewer than 75% of residents live within a safe 10-minute walk of a high-quality park.	75% of residents live within a safe 10-minute walk of a high-quality park.	Every resident lives within a safe 10-minute walk of a high-quality park.	Walk safety includes sidewalks, crossings, and public safety.

# City of the Future: Energy Commission

## Instructions

The goal of the Energy Commission is to decide how energy and electricity will be produced and used by each sector of the economy. Keeping your Community Goals in mind, how would you want electricity and energy to be used in each sector?

	<b>Residential</b> (houses & apartments)	<b>Commercial</b> (offices, stores, schools, etc.)	<b>Industrial</b> (factories, farms, mines, etc.)	<b>Transportation</b> (buses, trains, cars, trucks, etc.)
How is electricity used?				
How is non-electricity energy used?				

Given what you have learned about all the ways that we can produce, store, and use energy, which technologies will you promote for the City of the Future?

Keep in mind:

- Heat-trapping gas emissions
- Other emissions
- On-demand vs variable generation
- Energy storage and transmission
- Fuel extraction, transportation, and disposal

	<b>Residential</b> (houses & apartments)	<b>Commercial</b> (offices, stores, schools, etc.)	<b>Industrial</b> (factories, farms, mines, etc.)	<b>Transportation</b> (buses, trains, cars, trucks, etc.)
Electricity Generation				
Non-Electricity Energy Production				

# City of the Future: Building Department

## Instructions

The goal of the Building Department is to develop a Building Code for residential, commercial, and industrial buildings.

Keeping in mind your Community Goals, what elements will you look for in buildings? Examples could include technologies or designs. Keep in mind that some solutions may have benefits in more than one category.

	<b>Residential</b> (houses & apartments)	<b>Commercial</b> (offices, stores, schools, etc.)	<b>Industrial</b> (factories, farms, mines, etc.)
<i>Energy Shift Technologies and designs that reduce or eliminate carbon-producing energy uses.</i>			
<i>Energy Efficiency Technologies and designs that reduce overall energy use.</i>			
<i>Adaptation and Resilience Technologies and designs that reduce the impact of climate change.</i>			

# City of the Future: Zoning Board

## Instructions

The goal of the Zoning Board is to designate where in the city different kinds of buildings can be built. Keeping in mind your Community Goals, which kinds of buildings should be near one another, and which should be kept at a distance?

Factors to consider:

- Emissions and pollutants (health risks from one kind of building to another?)
- Transportation efficiency (how far do you have to travel for school, work, and daily life?)

	<b>Residential</b> (houses & apartments)	<b>Commercial</b> (offices, stores, schools, restaurants, etc.)	<b>Industrial</b> (factories, farms, mines, construction, etc.)
Near			
Far From			
Other Issues			



# City of the Future: Public Outreach

## Instructions

The goal of Public Outreach is to create an advertising and communications plan to explain the Goals. For all community members to be full civic participants, they need to know the goals and how they can be involved in making the goals a reality. For each Community Goal, describe how each sector of the population could be involved. An example has been provided.

Community Goal	School-Age Children	Teens & Young Adults	Adults & Elders	Community Leaders
Walkable green space for all.	Walking school bus within each neighborhood.	Park design competition.	Park design meetings, with a particular focus on disability and accessibility.	Walking tours to areas that currently do not have high-quality parks.

# City of the Future: Public Health

## Instructions

The goal of Public Health is to make sure that the City is healthy and safe for all residents. This includes clean air and water and access to health care, healthy food, green space, and more. For each Community Goal, consider how public health can be improved.

Community Goal	Public Health Impacts
Walkable green space for all.	<ul style="list-style-type: none"><li>• People can use green space for walking, playing games, and getting together with family and friends.</li><li>• Local parks can host farmers markets, community gardens, and food festivals.</li><li>• Green space keeps the area around it cooler in the summer and has cleaner air.</li></ul>