**Alternative fuel: Electricity**

**Instructions:** Read this webpage <https://afdc.energy.gov/vehicles/electric_emissions.html> and then answer the questions below.

**Emissions from Hybrid and Plug-In Electric Vehicles:**

Besides the emission from the car’s tailpipe, what else needs to be considered?

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**Electricity Sources and Emissions:**

Summarize the data presented in the Annual Emissions per Vehicle graph:

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**Direct and Well-to-Wheel Emissions:**

What are direct emissions?

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How are direct emissions different for different types of electric vehicles?

EV (all-electric vehicles):

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| --- |
|  |

PHEV (Plug-In Hybrid Electric Vehicle) in all electric mode:

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PHEV, when using ICE (internal combustion engine):

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What are Well-to-wheel emissions?

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Why are well-to-wheel emissions important to consider with electric vehicles?

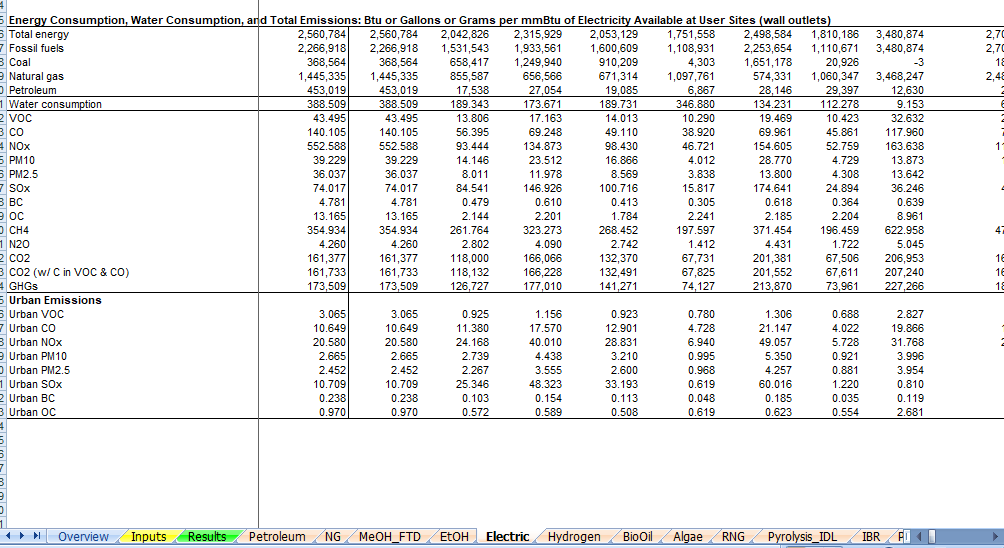
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Use the GREET excel database to complete the chart below:

1. Open this link: <https://greet.es.anl.gov/greet_1_series>
2. Click the link underneath “GREET 1 Series (Fuel-Cycle Model) or this link [**GREET\_2020rev1.zip**](https://greet.es.anl.gov/files/greet-2020rev1)
3. Open the GREET folder
4. Select “GREET1-2020”



1. To use the GREET database, you have to click on the tab at the bottom of the screen. Click the “Electric” tab. The red arrow above is pointing to it.
2. There is a lot of information on this database. Scroll all the way down to 12) Fuel-Cycle Energy Use, Water Consumption, and Emissions. Scroll down to the second half of the table. The data you are recording is the Energy Consumption, Water Consumption, and Total Emissions for what are the units? Each gallon of ethanol? (it says Btu or Gallons or Grams per mmBtu of electricity available)
3. Because we are interested in reducing carbon emissions and climate change, record the values for methane (CH4), carbon dioxide (CO2), and nitrous oxide (N2O). There are other variables in this chart, but we will focus just on these three. There is a red box around them in the table below.



1. Look through the data table and find the emissions for Illinois. To move through the data table, use the arrow that has the red circle around it in the picture above. Record the data in the table below. This is what you will share when the group comes back together.

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| --- | --- |
| Gas emission | State of IL |
| CH4 |  |
| N2O |  |
| CO2 |  |

The abbreviations in GREET are defined below:

VOC = volatile organic compounds

CO = carbon monoxide

NOX = nitric oxide

PM10 = particulate matter with a diameter of 10 micrometers or less

PM2.5 = particulate matter with a diameter of 2.3 micrometers or less

SOX = sulfur oxides

BC = black carbon (particulate matter/ soot & contributes to climate change)

OC = organic carbon (respiratory effects)

CH4 = methane

N2O = nitrous oxide

CO2 = carbon dioxide

1. Fill in the row below for electric energy.
2. When everyone is finished learning about the energy sources, share what you have learned with the group. Each individual should summarize the questions they answered and share the GREET emissions that were calculated. Notes should be taken in the table below so that the information can be shared with your poster group.
3. Circle the energy source you will use to heat your building (remember that we are assuming that the technology for this will be in place) and complete the information below the table.

|  |  |  |
| --- | --- | --- |
| Energy Source | Information about energy source | GREET values |
| Ethanol |  |  |
| Electric |  |  |
| Biodiesel |  |  |
| Natural Gas |  |  |
| Propane |  |  |
| Hydrogen |  |  |

Type of fuel that will be recommended for use in heating your building structure:

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Evidence and reasoning for this recommendation:

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1. Return to the “Energy Source” document and continue to step 2.