Name: Date: Class:

Alternative fuel: Propane

Instructions: Read this webpage https://afdc.energy.gov/vehicles/propane_emissions.html and then answer the questions below.

Propane Vehicle Emissions:

Summarize how propane compares to gasoline and diesel fuel?

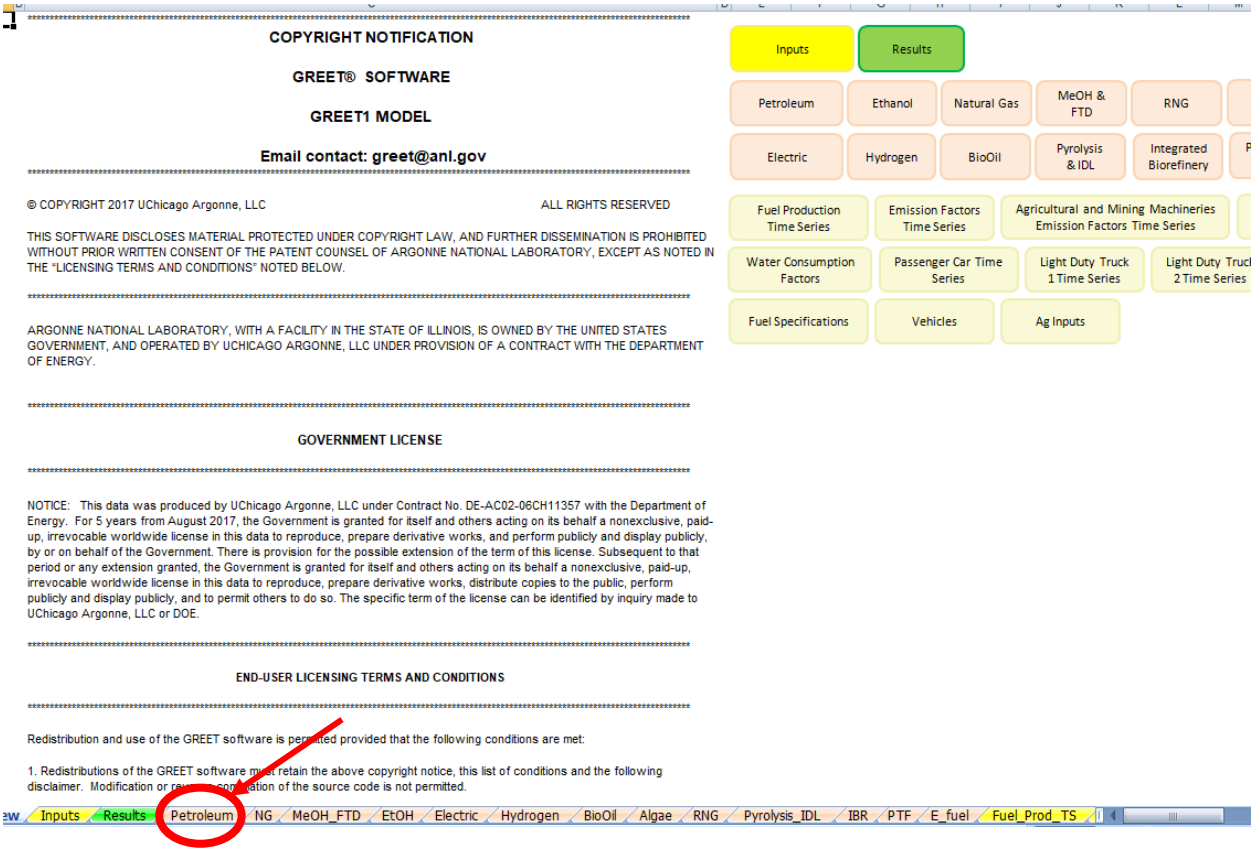
Life Cycle Emissions:

What is a life cycle analysis?

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**
3. Open the GREET folder

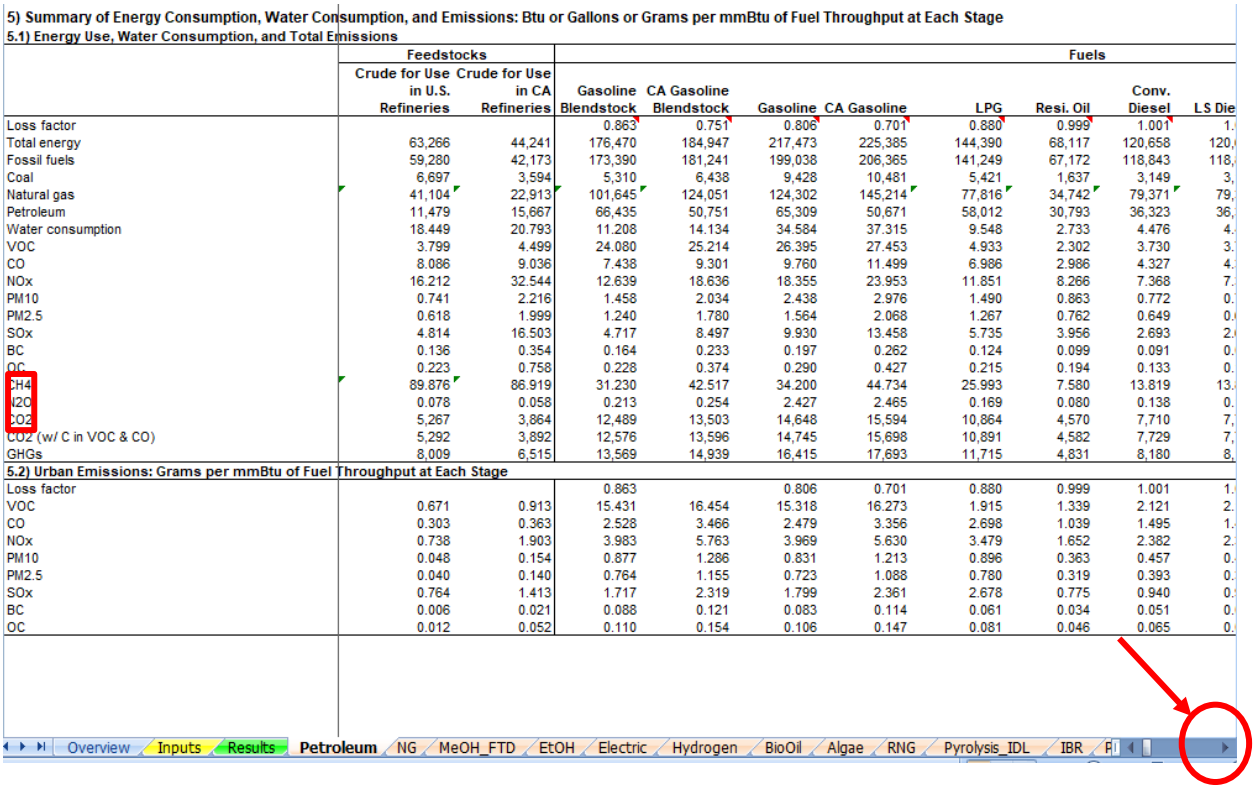
Name: **Date:** **Class:**



4. Select "GREET1-2020"

5. To use the GREET database, you have to click on the tab at the bottom of the screen. Propane is liquified petroleum gas, so to get data about propane, click the tab at the bottom labeled "petroleum". The red arrow above is pointing to it.
6. There is a lot of information on this database. Scroll all the way down to 5) Summary of Energy Consumption, Water Consumption, and Emissions. Record the data listed in table 5.1 for the fuel type LPG (liquified petroleum gas). You are looking at 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.

Name: **Date:** **Class:**



5) Summary of Energy Consumption, Water Consumption, and Emissions: Btu or Gallons or Grams per mmBtu of Fuel Throughput at Each Stage

5.1) Energy Use, Water Consumption, and Total Emissions

	Feedstocks		Fuels							
	Crude for Use in U.S. Refineries	Crude for Use in CA Refineries	Gasoline Blendstock	CA Gasoline Blendstock	Gasoline	CA Gasoline	LPG	Resi. Oil	Conv. Diesel	LS Die
Loss factor			0.863	0.751	0.806	0.701	0.880	0.999	1.001	1.
Total energy	63,266	44,241	176,470	184,947	217,473	225,385	144,390	68,117	120,658	120,
Fossil fuels	59,280	42,173	173,390	181,241	199,038	206,365	141,249	67,172	118,843	118,
Coal	6,697	3,594	5,310	6,438	9,428	10,481	5,421	1,637	3,149	3,
Natural gas	41,104	22,913	101,645	124,051	124,302	145,214	77,816	34,742	79,371	79,
Petroleum	11,479	15,667	66,435	50,751	65,309	50,671	58,012	30,793	36,323	36,
Water consumption	18.449	20.793	11.208	14.134	34.584	37.315	9.548	2.733	4.476	4.
VOC	3.799	4.499	24.080	25.214	26.395	27.453	4.933	2.302	3.730	3.
CO	8.086	9.036	7.438	9.301	9.760	11.499	6.986	2.986	4.327	4.
NOx	16.212	32.544	12.639	18.636	18.355	23.953	11.851	8.266	7.368	7.
PM10	0.741	2.216	1.458	2.034	2.438	2.976	1.490	0.863	0.772	0.
PM2.5	0.618	1.999	1.240	1.780	1.564	2.068	1.267	0.762	0.649	0.
SOx	4.814	16.503	4.717	8.497	9.930	13.458	5.735	3.956	2.693	2.
BC	0.136	0.354	0.164	0.233	0.197	0.262	0.124	0.099	0.091	0.
OC	0.223	0.758	0.228	0.374	0.290	0.427	0.215	0.194	0.133	0.
CH4	89.876	86.919	31.230	42.517	34.200	44.734	25.993	7.580	13.819	13.
N2O	0.078	0.058	0.213	0.254	2.427	2.465	0.169	0.080	0.138	0.
CO2	5,267	3,864	12,489	13,503	14,648	15,594	10,864	4,570	7,710	7,
CO2 (w/ C in VOC & CO)	5,292	3,892	12,576	13,596	14,745	15,698	10,891	4,582	7,729	7,
GHGs	8,009	6,515	13,569	14,939	16,415	17,693	11,715	4,831	8,180	8,
5.2) Urban Emissions: Grams per mmBtu of Fuel Throughput at Each Stage										
Loss factor			0.863		0.806	0.701	0.880	0.999	1.001	1.
VOC	0.671	0.913	15.431	16.454	15.318	16.273	1.915	1.339	2.121	2.
CO	0.303	0.363	2.528	3.466	2.479	3.356	2.698	1.039	1.495	1.
NOx	0.738	1.903	3.983	5.763	3.969	5.630	3.479	1.652	2.382	2.
PM10	0.048	0.154	0.877	1.286	0.831	1.213	0.896	0.363	0.457	0.
PM2.5	0.040	0.140	0.764	1.155	0.723	1.088	0.780	0.319	0.393	0.
SOx	0.764	1.413	1.717	2.319	1.799	2.361	2.678	0.775	0.940	0.
BC	0.006	0.021	0.088	0.121	0.083	0.114	0.061	0.034	0.051	0.
OC	0.012	0.052	0.110	0.154	0.106	0.147	0.081	0.046	0.065	0.

Overview | Inputs | Results | Petroleum | NG | MeOH_FTD | EtOH | Electric | Hydrogen | BioOil | Algae | RNG | Pyrolysis_IDL | IBR

7. If you would like to move through the data table to see the other data that is collected, use the arrow that has the red circle around it in the picture above.

Propane	
Type of emission	Total amount of emission for LPG
CH_4	
N_2O	
CO_2	

The abbreviations in GREET are defined below:

VOC = volatile organic compounds

CO = carbon monoxide

NO_X = 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

SO_X = sulfur oxides

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

OC = organic carbon (respiratory effects)

CH_4 = methane

Name: **Date:** **Class:**

N_2O = nitrous oxide
CO_2 = carbon dioxide

8. In the table below, fill in the row for propane.
9. 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..
10. 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:

Evidence and reasoning for this recommendation:

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