

# **User Guide for GREET Fleet Footprint Calculator 2012**

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## ***Background***

Beginning in 1998, the Department of Energy's (DOE's) Clean Cities Program enlisted expertise at Argonne National Laboratory (Argonne) to develop a U.S. Environmental Protection Agency co-sponsored tool to assist metropolitan areas and Clean Cities coalitions in estimating criteria air pollutant reductions achieved by near-term introduction of alternative-fueled vehicles. Known as AirCRED, the tool was designed to be used by stakeholders of DOE's Clean Cities program to assist state and regional air quality officials with developing ozone precursor and carbon monoxide emission reduction strategies for use in State Implementation Plans.

Now in accordance with the desire to measure the petroleum displacement and greenhouse gas (GHG) emissions of medium- and heavy-duty vehicles and off-road equipment, Argonne has developed the GREET Fleet Footprint Calculator (current version is 2012) for Clean Cities stakeholders to estimate these values using simple spreadsheet inputs. The basis of this calculator is Argonne's Greenhouse gases, Regulated Emissions, and Energy use in Transportation (GREET) fuel-cycle model, which is used to generate necessary petroleum use and GHG emission co-efficients of key fuel production pathways and combustion fuel types (Argonne 2012).

Fleet managers can quickly insert their data to generate petroleum use and GHG emissions on a well-to-wheels (WTW) basis. A WTW analysis can be divided into two stages: well-to-pump (WTP) and pump-to-wheels (PTW). The WTP stage starts with the fuel feedstock recovery, followed by fuel production, and ends with the fuel available at the pump, while the PTW stage represents the vehicle's operation activities. It is important to examine transportation fuels and technologies on a WTW basis in order to properly compare alternatives, as activities upstream of vehicle operation can use significant amounts of energy and subsequently produce a large amount of emissions.

## ***Description of GREET Fleet***

There are three Microsoft Excel sheets in the calculator, which will be explained below.

### **On-Road Fleet Sheet**

The user first decides whether to calculate their WTW petroleum use and GHG emissions by either entering the fleet size, vehicle miles traveled (VMT), and fuel economy (Option 1) or entering fuel use (Option 2).

## On-Road Fleet Sheet - Table 1

### 1. Method to Calculate On-Road Fleet's Petroleum Energy Use and GHG Footprint

1

1 - Fleet size, vehicle miles traveled, and fuel economy

2 - Fuel use (skip to question 5)

A user who is trying to compare different fuels/technologies in consideration of future purchases may want to choose Option 1. This way the user can create an estimate depending on how many vehicles that are planned for purchase, how many miles the vehicles will be driven and the vehicle's fuel economy in miles per gasoline gallon equivalent (see Tables 2-4). Argonne has entered default data for VMT and fuel economy but it is highly recommended that users enter their own data.

## On-Road Fleet Sheet - Tables 2-4

### 2. The Number of Each Type of Vehicle in On-Road Fleet

	Gasoline	Diesel	Diesel HEV	Biodiesel (B20)	Biodiesel (B100)	Ethanol (E85)	Compressed Natural Gas (CNG)	Liquified Natural Gas (LNG)	Liquified Petroleum Gas/ Propane (LPG)	Electricity	Gaseous Hydrogen (G.H2)	Liquid Hydrogen (L.H2)
School Bus	0	0	0	0	0	0	0	0	0	0	0	0
Transit Bus	0	0	0	0	0	0	0	0	0	0	0	0
Shuttle/Paratransit Bus	0	0	0	0	0	0	0	0	0	0	0	0
Waste Hauler	0	0	0	0	0	0	0	0	0	0	0	0
Street Sweeper	0	0	0	0	0	0	0	0	0	0	0	0
Delivery Step Van	0	0	0	0	0	0	0	0	0	0	0	0
Transport/Freight Truck	0	0	0	0	0	0	0	0	0	0	0	0
Medium/Heavy Duty Pickup Truck	0	0	0	0	0	0	0	0	0	0	0	0
Maintenance Utility Vehicle	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0	0

### 3. The Average Annual Vehicle Miles Traveled by Each Vehicle Type

	Gasoline	Diesel	Diesel HEV	B20	B100	E85	CNG	LNG	LPG	Electricity	G.H2	L.H2
School Bus	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000
Transit Bus	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
Shuttle/Paratransit Bus	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
Waste Hauler	23,400	23,400	23,400	23,400	23,400	23,400	23,400	23,400	23,400	23,400	23,400	23,400
Street Sweeper	12,600	12,600	12,600	12,600	12,600	12,600	12,600	12,600	12,600	12,600	12,600	12,600
Delivery Step Van	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500
Transport/Freight Truck	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000	80,000
Medium/Heavy Duty Pickup Truck	11,400	11,400	11,400	11,400	11,400	11,400	11,400	11,400	11,400	11,400	11,400	11,400
Maintenance Utility Vehicle	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Other	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000

### 4. The Average Fuel Economy for Each Vehicle Type in the On-Road Fleet (miles per gasoline gallon equivalent)

	Gasoline	Diesel	Diesel HEV	B20	B100	E85	CNG	LNG	LPG	Electricity	G.H2	L.H2
School Bus	6.0	7.0	8.5	7.0	7.0	6.0	6.0	6.0	6.0	20.5	12.0	12.0
Transit Bus	2.5	3.0	3.8	3.0	3.0	2.5	2.5	2.5	2.5	8.5	5.0	5.0
Shuttle/Paratransit Bus	7.0	8.0	10.0	8.0	8.0	7.0	7.0	7.0	7.0	24.0	14.0	14.0
Waste Hauler	2.0	2.5	3.0	2.5	2.5	2.0	2.0	2.0	2.0	7.0	4.0	4.0
Street Sweeper	3.0	4.0	5.0	4.0	4.0	3.0	3.0	3.0	3.0	10.0	6.0	6.0
Delivery Step Van	12.0	15.0	18.5	15.0	15.0	12.0	12.0	12.0	12.0	41.0	24.0	24.0
Transport/Freight Truck	5.0	6.0	7.5	6.0	6.0	5.0	5.0	5.0	5.0	17.0	10.0	10.0
Medium/Heavy Duty Pickup Truck	9.0	11.0	13.5	11.0	11.0	9.0	9.0	9.0	9.0	31.0	18.0	18.0
Maintenance Utility Vehicle	20.0	25.0	31.0	25.0	25.0	20.0	20.0	20.0	20.0	68.0	40.0	40.0
Other	2.5	3.0	3.8	3.0	3.0	2.5	2.5	2.5	2.5	8.5	5.0	5.0

A user who is trying to calculate an existing fleet's petroleum and carbon footprint may want to choose Option 2 and will skip to Table 5. The user will likely know the amount of fuel used and can quickly enter that information (in gallons, cubic feet, or kilowatt hours of the specific fuel). After the user inputs the fuel use, the gasoline gallon equivalent for each fuel will be displayed below the table.

## On-Road Fleet Sheet - Table 5

5. The Annual Total Fuel Use by On-Road Fleet Vehicles (gallons, cubic feet, or kilowatt-hours)

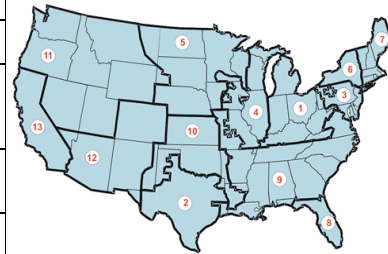
	Gasoline (gallons)	Diesel (gallons)	Diesel HEV (gallons)	B20 (gallons)	B100 (gallons)	E85 (gallons)	CNG (cubic feet)	LNG (gallons)	LPG (gallons)	Electricity (kilowatt- hours)	G.H2 (cubic feet)	L.H2 (gallons)
School Bus	0	0	0	0	0	0	0	0	0	0	0	0
Transit Bus	0	0	0	0	0	0	0	0	0	0	0	0
Shuttle/Paratransit Bus	0	0	0	0	0	0	0	0	0	0	0	0
Waste Hauler	0	0	0	0	0	0	0	0	0	0	0	0
Street Sweeper	0	0	0	0	0	0	0	0	0	0	0	0
Delivery Step Van	0	0	0	0	0	0	0	0	0	0	0	0
Transport/Drayage/Freight Truck	0	0	0	0	0	0	0	0	0	0	0	0
Medium/Heavy Duty Pickup Truck	0	0	0	0	0	0	0	0	0	0	0	0
Maintenance Utility Vehicle	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0	0
Gasoline Gallon Equivalent Total	0	0	0	0	0	0	0	0	0	0	0	0

The fuel production assumptions allow the user to customize the simulation. For instance, a user can compare their footprint of ethanol vehicles using either corn (Option 1) or cellulosic (Option 2) feedstocks. A user who wants to enter a custom electricity generation mix will need to go to Table 4 of the Specs sheet and enter it there (see Specs sheet description below).

## On-Road Fleet Sheet - Table 6

6. Fuel Production Assumptions

Biodiesel Feedstock Source	1	1 - Soy 2 - Algae
Ethanol Feedstock Source	1	1 - Corn 2 - Switchgrass
CNG Feedstock Source	1	1 - North American NG 2 - Non-North American NG 3 - Landfill Gas
LNG Feedstock Source	1	1 - North American NG 2 - Non-North American NG 3 - Landfill Gas
North American NG Feedstock Source	Conventional 77%	Shale 23%
LPG Feedstock Source	NG 60%	Petroleum 40%
Source of Electricity for On-Road Electric Vehicles and H2 Electrolysis	14	1 to 13 - EIA Regions 1 through 13 Mix (see map) 14 - Average U.S. Mix 15 - User Defined (go to 'Specs' sheet)
G.H2 Production Process	1	1 - Refueling Station SMR (On-site) 2 - Central Plant SMR (Off-site) 3 - Refueling Station Electrolysis (On-site)
L.H2 Production Process	1	1 - Refueling Station SMR (On-site) 2 - Central Plant SMR (Off-site) 3 - Refueling Station Electrolysis (On-site)



EIA - Electricity Market Model Supply Regions
1. ECAR
2. ERCOT
3. MAAC
4. MAIN
5. MAPP
6. NPCC-NY
7. NPCC-NE
8. FRCC
9. SERC
10. SPP
11. WECC-NW
12. WECC-RMP/ANM
13. WECC-CA

The results for petroleum usage are shown in barrels of oil, while those for GHG emissions are shown in carbon dioxide (CO<sub>2</sub>)-equivalent short tons. A short ton is equivalent to 2,000 pounds.

## On-Road Fleet Sheet - Tables 7-8

### 7. Results of On-Road Fleet's Petroleum Usage (barrels)

	Gasoline	Diesel	Diesel HEV	B20	B100	E85	CNG	LNG	LPG	Electricity	G.H2	L.H2	Vehicle Total
School Bus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transit Bus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shuttle/Paratransit Bus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Waste Hauler	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Street Sweeper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Delivery Step Van	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transport/Freight Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Medium/Heavy Duty Pickup Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maintenance Utility Vehicle	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fuel Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

**On-Road Fleet Total**                      **0.0 barrels of oil**

### 8. Results of On-Road Fleet's Greenhouse Gas Emissions (short tons CO2-equivalent)

	Gasoline	Diesel	Diesel HEV	B20	B100	E85	CNG	LNG	LPG	Electricity	G.H2	L.H2	Vehicle Total
School Bus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transit Bus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shuttle/Paratransit Bus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Waste Hauler	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Street Sweeper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Delivery Step Van	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transport/Freight Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Medium/Heavy Duty Pickup Truck	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maintenance Utility Vehicle	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fuel Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

**On-Road Fleet Total**                      **0.0 short tons of GHG emissions**

## Off-Road Fleet Sheet

The flow of this sheet is the same as the On-Road Fleet sheet; however for Option 1, the user will input fleet size, the hourly usage, and brake horsepower of each piece of equipment.

### Off-Road Fleet Sheet - Table 1

#### 1. Method to Calculate Off-Road Fleet's Petroleum Energy Use and GHG Footprint

1

1 - Fleet size, annual hourly usage, and brake horse power

2 - Fuel use (skip to question 5)

Argonne has entered default data for annual hourly usage and rated brake horsepower but it is highly recommended that users enter their own data. A user who wants to modify a default load factor, which is the proportion of the rated horsepower used, will need to go to Table 9 of the Specs sheet (see Specs sheet description below).

## Off-Road Fleet Sheet - Tables 2-4

### 2. The Number of Each Type of Equipment in Off-Road Fleet

	Gasoline	Diesel	Diesel HEV	Biodiesel (B20)	Biodiesel (B100)	Ethanol (E85)	Compressed Natural Gas (CNG)	Liquefied Natural Gas (LNG)	Liquefied Petroleum Gas/ Propane (LPG)	Electricity	Gaseous Hydrogen (G.H2)	Liquid Hydrogen (L.H2)
Commercial Turf Mower	0	0	0	0	0	0	0	0	0	0	0	0
Forklift	0	0	0	0	0	0	0	0	0	0	0	0
Skid-steer Loader	0	0	0	0	0	0	0	0	0	0	0	0
Front-end Loader	0	0	0	0	0	0	0	0	0	0	0	0
Crane	0	0	0	0	0	0	0	0	0	0	0	0
Backhoe/Loader	0	0	0	0	0	0	0	0	0	0	0	0
Excavator	0	0	0	0	0	0	0	0	0	0	0	0
Bulldozer	0	0	0	0	0	0	0	0	0	0	0	0
Asphalt Paver	0	0	0	0	0	0	0	0	0	0	0	0
Asphalt Roller	0	0	0	0	0	0	0	0	0	0	0	0
Compactor	0	0	0	0	0	0	0	0	0	0	0	0
Woodchipper/Spreader	0	0	0	0	0	0	0	0	0	0	0	0
Grader/Maintainer	0	0	0	0	0	0	0	0	0	0	0	0
Landfill Tipper	0	0	0	0	0	0	0	0	0	0	0	0
Catch Basin Cleaner	0	0	0	0	0	0	0	0	0	0	0	0
Hydraulic Concrete Breaker	0	0	0	0	0	0	0	0	0	0	0	0
Concrete Mixer	0	0	0	0	0	0	0	0	0	0	0	0
Air Compressor	0	0	0	0	0	0	0	0	0	0	0	0
Other 1	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	0	0	0	0	0	0	0	0	0	0	0	0

### 3. The Average Annual Hourly Usage by Each Equipment Type

	Gasoline	Diesel	Diesel HEV	B20	B100	E85	CNG	LNG	LPG	Electricity	G.H2	L.H2
Commercial Turf Mower	875	875	875	875	875	875	875	875	875	875	875	875
Forklift	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750	1,750
Skid-steer Loader	560	560	560	560	560	560	560	560	560	560	560	560
Front-end Loader	640	640	640	640	640	640	640	640	640	640	640	640
Crane	345	345	345	345	345	345	345	345	345	345	345	345
Backhoe/Loader	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Excavator	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150	1,150
Bulldozer	900	900	900	900	900	900	900	900	900	900	900	900
Asphalt Paver	610	610	610	610	610	610	610	610	610	610	610	610
Asphalt Roller	690	690	690	690	690	690	690	690	690	690	690	690
Compactor	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Woodchipper/Spreader	475	475	475	475	475	475	475	475	475	475	475	475
Grader/Maintainer	730	730	730	730	730	730	730	730	730	730	730	730
Landfill Tipper	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400
Catch Basin Cleaner	6,100	6,100	6,100	6,100	6,100	6,100	6,100	6,100	6,100	6,100	6,100	6,100
Hydraulic Concrete Breaker	200	200	200	200	200	200	200	200	200	200	200	200
Concrete Mixer	180	180	180	180	180	180	180	180	180	180	180	180
Air Compressor	650	650	650	650	650	650	650	650	650	650	650	650
Other 1	280	280	280	280	280	280	280	280	280	280	280	280
Other 2	200	200	200	200	200	200	200	200	200	200	200	200
Other 3	175	175	175	175	175	175	175	175	175	175	175	175
Other 4	130	130	130	130	130	130	130	130	130	130	130	130
Other 5	100	100	100	100	100	100	100	100	100	100	100	100

### 4. The Rated Brake Horsepower for Each Equipment Type

	Gasoline	Diesel	Diesel HEV	B20	B100	E85	CNG	LNG	LPG	Electricity	G.H2	L.H2
Commercial Turf Mower	15	30	24	30	30	15	36	36	36	10	18	18
Forklift	35	70	56	70	70	35	84	84	84	23	42	42
Skid-steer Loader	35	73	58	73	73	35	88	88	88	24	44	44
Front-end Loader	87	174	139	174	174	87	209	209	209	58	104	104
Crane	50	100	80	100	100	50	120	120	120	33	60	60
Backhoe/Loader	58	115	92	115	115	58	138	138	138	38	69	69
Excavator	83	165	132	165	165	83	198	198	198	55	99	99
Bulldozer	150	300	240	300	300	150	360	360	360	100	180	180
Asphalt Paver	28	56	45	56	56	28	67	67	67	19	34	34
Asphalt Roller	25	50	40	50	50	25	60	60	60	17	30	30
Compactor	263	525	420	525	525	263	630	630	630	175	315	315
Woodchipper/Spreader	75	150	120	150	150	75	180	180	180	50	90	90
Grader/Maintainer	63	125	100	125	125	63	150	150	150	42	75	75
Landfill Tipper	50	100	80	100	100	50	120	120	120	33	60	60
Catch Basin Cleaner	115	230	184	230	230	115	276	276	276	77	138	138
Hydraulic Concrete Breaker	50	100	80	100	100	50	120	120	120	33	60	60
Concrete Mixer	50	50	40	50	50	50	60	60	60	17	30	30
Air Compressor	15	30	24	30	30	15	36	36	36	10	18	18
Other 1	18	35	28	35	35	18	42	42	42	12	21	21
Other 2	25	50	40	50	50	25	60	60	60	17	30	30
Other 3	50	100	80	100	100	50	120	120	120	33	60	60
Other 4	75	150	120	150	150	75	180	180	180	50	90	90
Other 5	125	250	200	250	250	125	300	300	300	83	150	150

Option 2 is the same as the user will skip to Table 5 and directly enter the fuel use of the off-road equipment.

### Off-Road Fleet Sheet - Table 5

5. The Annual Total Fuel Use by Off-Road Equipment (gallons, cubic feet, or kilowatt-hours)

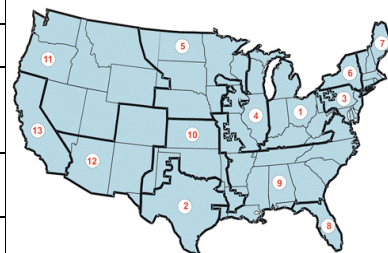
	Gasoline (gallons)	Diesel (gallons)	HEV (gallons)	B20 (gallons)	B100 (gallons)	E85 (gallons)	CNG (cubic feet)	LNG (gallons)	LPG (gallons)	Electricity (kilowatt- hours)	G.H2 (cubic feet)	L.H2 (gallons)
Commercial Turf Mower	0	0	0	0	0	0	0	0	0	0	0	0
Forklift	0	0	0	0	0	0	0	0	0	0	0	0
Skid-steer Loader	0	0	0	0	0	0	0	0	0	0	0	0
Front-end Loader	0	0	0	0	0	0	0	0	0	0	0	0
Crane	0	0	0	0	0	0	0	0	0	0	0	0
Backhoe/Loader	0	0	0	0	0	0	0	0	0	0	0	0
Excavator	0	0	0	0	0	0	0	0	0	0	0	0
Bulldozer	0	0	0	0	0	0	0	0	0	0	0	0
Asphalt Paver	0	0	0	0	0	0	0	0	0	0	0	0
Asphalt Roller	0	0	0	0	0	0	0	0	0	0	0	0
Compactor	0	0	0	0	0	0	0	0	0	0	0	0
Woodchipper/Spreader	0	0	0	0	0	0	0	0	0	0	0	0
Grader/Maintainer	0	0	0	0	0	0	0	0	0	0	0	0
Landfill Tipper	0	0	0	0	0	0	0	0	0	0	0	0
Catch Basin Cleaner	0	0	0	0	0	0	0	0	0	0	0	0
Hydraulic Concrete Breaker	0	0	0	0	0	0	0	0	0	0	0	0
Concrete Mixer	0	0	0	0	0	0	0	0	0	0	0	0
Air Compressor	0	0	0	0	0	0	0	0	0	0	0	0
Other 1	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	0	0	0	0	0	0	0	0	0	0	0	0
Gasoline Gallon Equivalent Total	0	0	0	0	0	0	0	0	0	0	0	0

The fuel production assumptions are independent of those chosen in the On-Road Fleet sheet, so users must change them on the Off-Road Fleet sheet to do the intended simulation for the equipment. In addition, a user who wants to enter a custom electricity generation mix will need to go to the Table 6 of the Specs sheet for the off-road fleet mix (see Specs sheet description below). An important note is that there are separate electricity tables in the Specs sheet for the on-road fleet (Table 4) and the off-road fleet (Table 6).

### Off-Road Fleet Sheet - Table 6

6. Fuel Production Assumptions

Biodiesel Feedstock Source	1	1 - Soy 2 - Algae
Ethanol Feedstock Source	1	1 - Corn 2 - Switchgrass
CNG Feedstock Source	1	1 - North American NG 2 - Non-North American NG 3 - Landfill Gas
LNG Feedstock Source	1	1 - North American NG 2 - Non-North American NG 3 - Landfill Gas
North American NG Feedstock Source	Conventional 77%	Shale 23%
LPG Feedstock Source	NG 60%	Petroleum 40%
Source of Electricity for Off-Road Electric Equipment and H2 Electrolysis	14	1 to 13 - EIA Regions 1 through 13 Mix (see map) 14 - Average U.S. Mix 15 - User Defined (go to 'Specs' sheet)
G.H2 Production Process	1	1 - Refueling Station SMR (On-site) 2 - Central Plant SMR (Off-site) 3 - Refueling Station Electrolysis (On-site)
L.H2 Production Process	1	1 - Refueling Station SMR (On-site) 2 - Central Plant SMR (Off-site) 3 - Refueling Station Electrolysis (On-site)



EIA - Electricity Market Model Supply Regions
1. ECAR
2. ERCOT
3. MAAC
4. MAIN
5. MAPP
6. NPCC-NY
7. NPCC-NE
8. FRCC
9. SERC
10. SPP
11. WECC-NW
12. WECC-RMP/ANM
13. WECC-CA

The results are in the same format as those on the On-Road Fleet sheet.

### Off-Road Fleet Sheet - Tables 7-8

7. Results of Off-Road Fleet's Petroleum Usage (barrels)

	Diesel												Vehicle Total
	Gasoline	Diesel	HEV	B20	B100	E85	CNG	LNG	LPG	Electricity	G.H2	L.H2	
Commercial Turf Mower	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forklift	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Skid-steer Loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Front-end Loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Backhoe/Loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Asphalt Paver	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Asphalt Roller	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Compactor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Woodchipper/Spreader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grader/Maintainer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Landfill Tipper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Catch Basin Cleaner	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydraulic Concrete Breaker	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Mixer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Air Compressor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other 3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other 5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fuel Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

**Off-Road Fleet Total 0.0 barrels of oil**

8. Results of Off-Road Fleet's Greenhouse Gas Emissions (short tons CO2-equivalent)

	Diesel												Vehicle Total
	Gasoline	Diesel	HEV	B20	B100	E85	CNG	LNG	LPG	Electricity	G.H2	L.H2	
Commercial Turf Mower	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forklift	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Skid-steer Loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Front-end Loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crane	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Backhoe/Loader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Excavator	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bulldozer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Asphalt Paver	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Asphalt Roller	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Compactor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Woodchipper/Spreader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grader/Maintainer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Landfill Tipper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Catch Basin Cleaner	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydraulic Concrete Breaker	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Mixer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Air Compressor	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other 3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other 4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other 5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fuel Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

**Off-Road Fleet Total 0.0 short tons of GHG emissions**

## Specs Sheet

This sheet contains the software copyright notice and the background data/calculations for GREET Fleet. The information for each fuel type in the calculator is taken from the GREET model and put into the corresponding tables. As previously mentioned, the user can input custom electricity mixes on this sheet, in Table 4 for the on-road fleet and Table 6 for the off-road fleet. The average generation mix for the 13 Energy Information Administration Electricity Market Model supply regions is provided for as defaults for charging in these areas (EIA 2010). To improve a user's estimate, the user should use the

Specs Sheet - Table 4

	East Central Area Reliability Coordination Agreement (ECAR)	Electric Reliability Council of Texas (ERCOT)	Mid-Atlantic Area Council (MAAC)	Mid-America Interconnected Network (MAIN)	Mid-Continent Area Power Pool (MAPP)	Northeast Power Coordinating Council/ New York (NPCC-NY)	Northeast Power Coordinating Council/ New England (NPCC-NE)	Florida Reliability Coordinating Council (FRCC)	Southeastern Electric Reliability Council (SERC)	Southwest Power Pool (SPP)	Western Electricity Coordinating Council/ Rocky Mountain Power Area and Arizona Southern Nevada Power Area (WECC-NW/ WECC-RMP/ANM)	Western Electricity Coordinating Council/ California (WECC-CA)	U.S. Average Mix	User Mix
Residual oil	0.3%	0.1%	1.6%	0.2%	0.5%	2.8%	1.9%	6.8%	0.5%	0.3%	0.1%	0.1%	1.0%	1.0%
Natural gas	8.7%	41.2%	9.1%	7.2%	3.5%	35.9%	37.7%	42.7%	17.2%	26.8%	15.9%	30.2%	20.2%	20.2%
Coal	79.3%	36.7%	44.0%	51.4%	67.3%	9.6%	14.4%	33.0%	46.8%	63.1%	26.5%	11.3%	46.7%	46.7%
Nuclear power	10.7%	13.5%	41.2%	36.6%	14.4%	32.7%	27.3%	14.7%	31.6%	4.3%	3.3%	21.2%	21.0%	21.0%
Biomass	0.3%	0.2%	1.5%	0.4%	0.9%	1.2%	4.7%	1.8%	0.3%	0.1%	0.5%	2.2%	0.3%	0.3%
Others (Wind, Solar, Hydro, etc)	0.7%	8.3%	2.6%	4.1%	13.5%	17.8%	14.0%	1.1%	3.6%	5.4%	53.7%	9.0%	10.7%	10.7%

	East Central Area Reliability Coordination Agreement (ECAR)	Electric Reliability Council of Texas (ERCOT)	Mid-Atlantic Area Council (MAAC)	Mid-America Interconnected Network (MAIN)	Mid-Continent Area Power Pool (MAPP)	Northeast Power Coordinating Council/ New York (NPCC-NY)	Northeast Power Coordinating Council/ New England (NPCC-NE)	Florida Reliability Coordinating Council (FRCC)	Southeastern Electric Reliability Council (SERC)	Southwest Power Pool (SPP)	Western Electricity Coordinating Council/ Northwest Power Pool Area (WECC-NW)	Western Electricity Coordinating Council/ Rocky Mountain Power Area and Arizona-New Mexico-Southern Nevada Power Area (WECC-RMP/ANM)	Western Electricity Coordinating Council/ California (WECC-CA)	U.S. Average Mix	User Mix
Residual oil	0.3%	0.1%	1.6%	0.2%	0.5%	2.8%	1.9%	6.8%	0.5%	0.3%	0.1%	0.1%	0.1%	1.0%	1.0%
Natural gas	8.7%	41.2%	9.1%	7.2%	3.5%	35.9%	37.7%	42.7%	17.2%	26.8%	15.9%	27.7%	30.2%	20.2%	20.2%
Coal	79.3%	36.7%	44.0%	51.4%	67.3%	9.6%	14.4%	33.0%	46.8%	63.1%	26.5%	52.9%	11.3%	46.7%	46.7%
Nuclear power	10.7%	13.5%	41.2%	36.6%	14.4%	32.7%	27.3%	14.7%	31.6%	4.3%	3.3%	10.2%	21.2%	21.0%	21.0%
Biomass	0.3%	0.2%	1.5%	0.4%	0.9%	1.2%	4.7%	1.8%	0.3%	0.1%	0.5%	0.2%	2.2%	0.3%	0.3%
Others (Wind, Solar, Hydro, etc)	0.7%	8.3%	2.6%	4.1%	13.5%	17.8%	14.0%	1.1%	3.6%	5.4%	53.7%	9.0%	35.0%	10.7%	10.7%

	<b>Diesel</b>											
	Gasoline	Diesel	HEV	B20	B100	E85	CNG	LPG	Electricity	G.H2	L.H2	
Commercial Turf Mower	0.60	0.43	0.43	0.43	0.43	0.60	0.60	0.60	0.60	0.60	0.60	
Forklift	0.30	0.59	0.59	0.59	0.59	0.30	0.30	0.30	0.30	0.30	0.30	
Skid-steer Loader	0.58	0.21	0.21	0.21	0.21	0.58	0.58	0.58	0.58	0.58	0.58	
Front-end Loader	0.71	0.59	0.59	0.59	0.59	0.71	0.71	0.71	0.71	0.71	0.71	
Crane	0.47	0.43	0.43	0.43	0.43	0.47	0.47	0.47	0.47	0.47	0.47	
Backhoe/Loader	0.48	0.21	0.21	0.21	0.21	0.48	0.48	0.48	0.48	0.48	0.48	
Excavator	0.53	0.59	0.59	0.59	0.59	0.53	0.53	0.53	0.53	0.53	0.53	
Bulldozer	0.75	0.59	0.59	0.59	0.59	0.75	0.75	0.75	0.75	0.75	0.75	
Asphalt Paver	0.66	0.59	0.59	0.59	0.59	0.66	0.66	0.66	0.66	0.66	0.66	
Asphalt Roller	0.62	0.59	0.59	0.59	0.59	0.62	0.62	0.62	0.62	0.62	0.62	
Compactor	0.55	0.43	0.43	0.43	0.43	0.55	0.55	0.55	0.55	0.55	0.55	
Woodchipper/Spreader	0.78	0.43	0.43	0.43	0.43	0.78	0.78	0.78	0.78	0.78	0.78	
Grader/Maintainer	0.64	0.59	0.59	0.59	0.59	0.64	0.64	0.64	0.64	0.64	0.64	
Landfill Tipper	0.41	0.21	0.21	0.21	0.21	0.41	0.41	0.41	0.41	0.41	0.41	
Catch Basin Cleaner	0.69	0.43	0.43	0.43	0.43	0.69	0.69	0.69	0.69	0.69	0.69	
Hydraulic Concrete Breaker	0.48	0.59	0.59	0.59	0.59	0.48	0.48	0.48	0.48	0.48	0.48	
Concrete Mixer	0.59	0.43	0.43	0.43	0.43	0.59	0.59	0.59	0.59	0.59	0.59	
Air Compressor	0.56	0.43	0.43	0.43	0.43	0.56	0.56	0.56	0.56	0.56	0.56	
Other 1	0.48	0.43	0.43	0.43	0.43	0.48	0.48	0.48	0.48	0.48	0.48	
Other 2	0.48	0.43	0.43	0.43	0.43	0.48	0.48	0.48	0.48	0.48	0.48	
Other 3	0.48	0.43	0.43	0.43	0.43	0.48	0.48	0.48	0.48	0.48	0.48	
Other 4	0.48	0.43	0.43	0.43	0.43	0.48	0.48	0.48	0.48	0.48	0.48	
Other 5	0.48	0.43	0.43	0.43	0.43	0.48	0.48	0.48	0.48	0.48	0.48	



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