

6) Open the spreadsheet template on your disk that is labeled “transportation” and insert the corresponding values into the 2nd and 3rd columns (“Total kWh per fuel” and “Total fuel consumed”). Since this template already contains all the formulas, you do not need to do any calculations. Below the table are the equations used to calculate the values for the next to last column (“kWh per new fuel unit”). You can use these equations below the table to understand what was done or do these calculations by hand if you do not have access to the spreadsheet template:

Fuel used	Total kWh per fuel	Total fuel consumed	kWh per unit fuel	Original fuel unit	Unit conversion	kWh per new fuel unit	New fuel unit
coal				per ton	2000 lbs/ton		per lb
oil				per barrel	42 gal/bbl		per gallon
gas				per ft ³	N/A		per ft ³

Coal: [(total kWh from coal) ÷ (total tons consumed)] ÷ 2000 lbs/ton = ___ kWh/lb

Oil: [(total kWh from petroleum) ÷ (total bbl. consumed)] ÷ 42 gal/bbl = ___ kWh/gal.

Gas: (total kWh from gas) ÷ (total ft³ consumed) = ___ kWh/ft³

7) The second table is used to calculate the amount of fuel indirectly consumed by a 2014 electric Ford Focus. Since the second table on your spreadsheet template is already set up to incorporate the values from the first table, there should be no need to do anything. Below the table are the equations used to calculate the values for the next to last column (“Miles per unit fuel”). These calculations are based on an average of 94% of electricity generated making it from the power plant to its point of use (2) a vehicle battery efficiency of 81% (3), and a combined city and highway mileage of 3.1 miles per kWh for a 2014 electric Ford Focus (3):

Fuel used	kWh per new fuel unit	Transmission efficiency	Charging efficiency	Miles per kWh	Miles per unit fuel	Fuel unit
coal		0.94	0.81	3.1		per lb
oil		0.94	0.81	3.1		per gallon
gas		0.94	0.81	3.1		per ft ³

Coal: (___ kWh/lb) × (0.94 trans. effic.) × (0.81 charg. effic.) × (3.1 miles/kWh) = ___ miles/lb

Oil: (___ kWh/gal.) × (0.94 trans. effic.) × (0.81 charg. effic.) × (3.1 miles/kWh) = ___ miles/gal.

Gas: (___ kWh/ft³) × (0.94 trans. effic.) × (0.81 charg. effic.) × (3.1 miles/kWh) = ___ miles/ft³

Questions:

1) Given that a gasoline powered 2012 Ford Focus gets a combined average of 33 miles per gallon of gasoline (2), how does this compare with an electric Ford Focus when the electricity is obtained entirely from oil?

2) The oil that is used to generate electricity (or heat in New England) is usually referred to as “residual” oil because it is left over after extraction of the other fractions that are used mostly in transportation. What is the problem with equating miles per gallon of gasoline used in conventional cars with miles per gallon of residual oil used in generating electricity for electric cars?