

# Energy Within Environmental Constraints Conversion Sheet

	Heat of Combustion		Mass Density		Carbon Intensities		
	GJ/kg	GJ/m <sup>3</sup>	kg/m <sup>3</sup>	kg/GJ	kg CO <sub>2</sub> /kg	kg CO <sub>2</sub> /m <sup>3</sup>	kg CO <sub>2</sub> /GJ
Coal	.027	x	x	37	2.2	x	90
Crude Oil	.046	39	850	22	3.3	2800	71
Diesel	.046	38	840	22	3.2	2600	69
Gasoline	.047	35	740	21	3.2	2400	68
Hydrogen	.14	.013	.09	7	0	0	0
Natural Gas	.052	.04	0.78	19	2.6	2	50

$$\frac{.0036 \text{ GJ}}{\text{kWh}} \text{ or } \frac{278 \text{ kWh}}{\text{GJ}} \quad \frac{28 \text{ m}^3}{\text{Mcf}} \text{ or } \frac{.035 \text{ Mcf}}{\text{m}^3} \quad \frac{42 \text{ gallons}}{\text{barrel}} \text{ or } \frac{.024 \text{ barrels}}{\text{gallon}}$$

$$\frac{3412 \text{ BTU}}{\text{kWh}} \text{ or } \frac{.000293 \text{ kWh}}{\text{BTU}} \quad \frac{.0038 \text{ m}^3}{\text{gallon}} \text{ or } \frac{264 \text{ gallons}}{\text{m}^3} \quad \frac{2.78 \text{ \$/GJ}}{\text{c/kWh}} \text{ or } \frac{.36 \text{ c/kWh}}{\text{\$/GJ}}$$

$$\frac{.1 \text{ c/kWh}}{\text{\$/MWh}} \text{ or } \frac{10 \text{ \$/MWh}}{\text{c/kWh}}$$

Useful metric to imperial conversions: 1 mile = 1.61 km. 1 pound = 0.454 kg.

Heats of combustion are HHV's ([higher heating values](#)). All quantities are as measured at 1 atm and 25° C

Mcf – thousand cubic feet

“Carbon intensity” is for combustion only (not lifecycle); adapted from from [the EIA](#)

Coal properties vary with rank; we use the average of bituminous and sub-bituminous [which constitute 90+% of US production](#)

Mass- and energy-density data adapted from [Argonne Nat'l Labs' GREET Project](#)

Numbers have few significant digits for convenience; not intended for extremely precise calculation

Please report errors to Daniel Thorpe @ [daniel.thorpe01@gmail.com](mailto:daniel.thorpe01@gmail.com) or David Keith @ [david\\_keith@harvard.edu](mailto:david_keith@harvard.edu) Updated 04/03/2016