

ENGG105: Carbon Footprints Tutorial Questions

1. A 915 MW power station with an electrical load factor of 72.4% (how much of the power station is actually used) and a thermal efficiency of 40% uses coal as a fuel source. The coal has properties as given in the table below.

Moisture	Ash	Carbon	Hydrogen	Nitrogen	Sulphur	Oxygen	Calorific value
8%	7.7%	77.0%	3.0%	0.2%	1.0%	2.05%	29.7 MJ/kg

How much CO₂ and NO₂ are produced by the station (assuming all N from coal converted to NO₂ with no additional NO₂ from combustion)? Using the emissions table below what is the direct hourly CO₂ equivalent (t CO₂-e) of these greenhouse gases?

2. If the same power station uses natural gas with the characteristics in the following table as fuel what is the hourly CO₂ equivalent (t CO₂-e)?

Moisture	Ash	Carbon	Hydrogen	Sulphur	Nitrogen	Calorific value
0.3%	0.4%	83.2%	11.3%	2.8%	0.1%	40.5 MJ/kg

3. Calculate the emissions generated (t CO₂-e) from Natural Gas Consumption if a Victorian Hotel uses 9000 GJ of natural gas per annum. Use the data from the following table.

Table 2 Emissions from the consumption of natural gas *

	Small user < 100,000 GJ pa		Large user > 100,000 GJ pa	
State	Point source EF (a)	Full fuel cycle EF (b)	Point source EF (a)	Full fuel cycle EF (b)
	A	B	C	D
	kg CO ₂ -e/GJ	kg CO ₂ -e/GJ	kg CO ₂ -e/GJ	kg CO ₂ -e/GJ
NSW & ACT	51.7	71.3	51.7	68.0
Victoria	51.9	63.6	51.9	63.4
Queensland	52.6	68.8	52.6	64.2
SA	51.7	73.8	51.7	71.2
WA	52.7	60.7	52.7	60.0
TAS	NA	NA	NA	NA
NT	52.0	53.6	52.0	53.5

* For reporting under the **Greenhouse Challenge and Greenhouse Friendly Certification**, *Full Fuel Cycle* emission factors should be used, (either column B or D depending on the size of the user).

Source: George Wilkenfeld 2004.

4. A New South Wales freight company consumes 2400 kL of petrol and 2400 kL automotive diesel(transport) per annum. Using data from the following table calculate the direct GHG emissions for the company.

Table 3 Fuel Combustion emission factors (Transport Fuels) *

Fuel	Energy content	Point source EF		Full fuel cycle EF	
		B	C	D	E
	A	B	C	D	E
	GJ/kL	kg CO ₂ -e/GJ	t CO ₂ -e/kL	t CO ₂ -e/GJ	t CO ₂ -e/kL
Automotive Gasoline	34.2	73.5	2.5	81.2	2.8
Automotive Diesel Oil	38.6	70.5	2.7	78.2	3.0
Aviation Gasoline	33.1	69.5	2.3	77.2	2.6
Aviation Turbine	36.8	70.4	2.6	78.1	2.9
Industrial diesel fuel	39.6	70.5	2.8	78.2	3.1
Fuel Oil	40.8	74.3	3.0	82.0	3.3
LPG	25.7	60.5	1.6	68.3	1.8
Natural gas (LV)	39.5 (a)	57.2	2.3 (b)	68.6	2.7
Natural Gas (HV)	39.5 (a)	53.8	2.1 (b)	65.2	2.6