ENGY4000: Tutorial Fossil – Part 2

## Task 1

### Sensitivity Analysis on existing powerplants

Construct a new NGCC plant with 2 turbines

Conduct a sensitivity analysis on the:

* Turbine inlet temperature – identify also what the impact of that might be downstream
* Combustor pressure drop
* Compressor pressure ratio

Construct a new PC plant with 1GW gross output

Conduct a sensitivity analysis on the:

* Boiler efficiency
* Gas temperature exiting the economiser

## Task 2

IGCC using a specific coal type

Construct a new IGCC plant using the Shell gasifier

1. Vary the coal type and record the impact of efficiency, net power out and CO2 emissions intensity
2. Enter a new coal type (as received basis so it should be possible to enter it straight in) using the information below. You will also need to enter new information about how the gasifier works with your type of coal.
   1. Identify whether there are any issues associated with using your own coal types for IGCC – check costs of units – and suggest a quick strategy for dealing with them.

Coal information

|  |  |  |
| --- | --- | --- |
| Higher Heating Value | Btu/lb | 11110.4 |
| Higher Heating Value | Kcal/kg | 6177 |
| Higher Heating Value | KJ/kg | 25843 |
| C | wt% | 64.43 |
| H | wt% | 3.83 |
| O | wt% | 6.35 |
| Ch | wt% | 0 |
| S | wt% | 0.46 |
| N | wt% | 1.45 |
| A | wt% | 11.98 |
| M | wt% | 11.5 |
| Total |  | 100 |

Syngas composition

|  |  |  |
| --- | --- | --- |
| Pressure | bar | 45 |
| Temp | C | 1488 |
| Syngas Mol fraction |  |  |
| WATER | mol% | 2.674% |
| H2 | mol% | 27.673% |
| N2 | mol% | 3.172% |
| O2 | mol% | 0.000% |
| CO | mol% | 63.881% |
| CO2 | mol% | 1.631% |
| CH4 | mol% | 0.031% |
| H2S | mol% | 0.162% |
| NH3 | mol% | 0.004% |
| COS | mol% | 0.013% |
| AR | mol% | 0.755% |
| Total |  | 100% |