**First Assignment: Gas-powered electricity generation BN2230 Business Analytics in practice**

A large energy company is considering investing in a new Combined-cycle gas turbine power station (plant), which uses natural gas to produce electricity. The new generation plant will have a useful life of 15 years and a utilisation rate of 70% (ie, it will be producing electricity 70% of the time). The energy company already has a contract with a large energy customer that guarantees that all electricity produced will be bought at a standard price of £0.08 per kW, before taking inflation into account (ie the selling price of electricity produced is fixed at £0.08 per kW in real terms). The most important cost element for the new generation plant is determined by the price of natural gas. The energy company has put together two possible scenarios for future gas prices; based on these scenarios, the cost to generate 1 kW of electricity is given in the following table.

**Table 1: Variable Electricity generation costs, based on forecasted gas prices**

|  |  |  |
| --- | --- | --- |
| **Year** | **Low Gas prices** | **High gas prices** |
| 1 | 0.055 | 0.054 |
| 2 | 0.062 | 0.066 |
| 3 | 0.059 | 0.068 |
| 4 | 0.049 | 0.069 |
| 5 | 0.065 | 0.078 |
| 6 | 0.061 | 0.076 |
| 7 | 0.057 | 0.068 |
| 8 | 0.054 | 0.069 |
| 9 | 0.055 | 0.067 |
| 10 | 0.055 | 0.067 |
| 11 | 0.055 | 0.067 |
| 12 | 0.055 | 0.067 |
| 13 | 0.055 | 0.067 |
| 14 | 0.055 | 0.067 |
| 15 | 0.055 | 0.067 |

Note: The above costs are expressed in real terms

The energy company believes that the probability of gas prices being ‘low’ in the next 15 years is equal to 40%.

The energy company is considering three options:

1. Build a Large capacity generation plant now.
2. Build a Medium capacity generation plant now and if gas prices follow the ‘Low’ scenario, consider the option of expanding the current plant to Large capacity in 5 years.
3. Become a member of an off-shore gas exploration consortium, which provides its members access to natural gas at low prices if new gas reserves are found. Overall, this increases the probability that gas prices follow the ‘Low’ scenario. After joining, the company still needs to decide whether to build a Medium of Large Capacity plant, using relevant information provided.

The Large capacity plant will cost £54.7m to build, will be in full operation after one year and will be able to produce a maximum of 100 MW/h (1 MW/h = 1000 kW/h), ie it will be able to generate 100MW of electricity each hour it operates. Each year, it will incur operational costs of £2.38m and the plant and the land used for this site will have a residual value of £8.5m after the end of the project’s useful life. All prices are in real terms, ie they are expressed in today’s value of money.

The Medium capacity plant will cost £22.1m to build, will be in full operation after one year and will be able to produce a maximum of 40 MW/h. Each year, it will incur operational costs of £0. 86m and the plant and the land used for this site will have a residual value of £7.1m after the end of the project’s useful life. To expand the Medium plant, the energy company would need to invest an additional £40m in Year 5; in Year 6 and all subsequent years until Year 15, the expanded plant will have all the characteristics of the Large plant, as presented above (ie Production capacity, Operating costs and residual value). Again, all prices are in real terms, ie they are expressed in today’s value of money.

Membership in the gas exploration consortium would incur a payment of £10m that needs to take place at the same time as the investment (ie in Year 0); no other payments are required after that. The energy company expects that joining the consortium will increase the probability that gas prices will be ‘low’ from 40% to 60%.

The energy company has calculated its cost of capital to be 5.3% per year, again expressed in real terms.

Given the information above, what would you advice the energy company to do?

Additionally, the energy company would also like to see how the following changes in its initial estimates affect the results:

1. Plant Utilisation increases to 75% for both Medium and Large options
2. The fee for membership in the gas exploration consortium increases to £14m
3. The probability that gas prices being ‘low’ in the next 15 years is equal to 30% instead of 40%.
4. Operational costs for the Large capacity plant increase from £2.38m per year to £2.85m per year.

**Notes:**

This assignment has two outputs: the Excel model that you used to set out and explore the decision problem and a report that summarises your findings.

Of the two, the output that carries the most weight is the Excel model. The model should be clear to follow and have a clear audit trail. Remember to use best practice (clear formatting, label your inputs and outputs, don’t be afraid to add notes, no hardcoded values, document your assumptions and your logic, keep your data separate from your calculations).

The report should either be a Word document or a PowerPoint presentation (I have no preference). The written output should describe and analyse the decision problem, briefly summarise your modelling process and the criteria you used for the analysis, and focus more on the findings of your analysis and your recommendations. This is a technical piece of writing, so the use of tables and/or charts to summarise and present data is required. Use a readable font and neutral colours and always keep readability in mind. There is no word limit for the report but it should not exceed 4 pages (including tables and graphs, but excluding title page and table of contents); if you opt to produce a PowerPoint presentation instead, it should not go above 6 pages (again, including tables and graphs, but excluding title page and table of contents).