Energy Resources and Policy

Assignment:
Hydro power

First, find the value of N, the position in the English alphabet of the letter which begins your family name (for Anderson N = 1, for Brown N = 2 etc.).

A low-head hydro-electric scheme located on a river uses two identical turbines running in parallel. These are governed to rotate at a constant speed of 250 rev/min. The characteristics of each turbine are given in the chart on the next page. The head H (m) and volume flow rate Q (m^3/s) at the site are given by the equations

$$H = 10 + 0.15N$$
$$Q = 5 + 0.2N.$$

If each turbine takes half the flow, estimate the gate opening required and calculate the total power output.

Is this the best operating strategy for these conditions? Investigate whether allowing the turbines to take different proportions of the flow would increase the power output.

The estimated capital cost of the turbine, including the foundations and electrical connections, is given by

$$£(1.6 + 0.12N)x10^6.$$

If this money is borrowed from a bank, the annual repayment required is given by the formula

$$\frac{C\, r\, (1 + r)^n}{(1 + r)^n - 1}$$

Where C is the value of the capital loan, n the number of years to complete the repayment, and r the rate of interest on the loan.

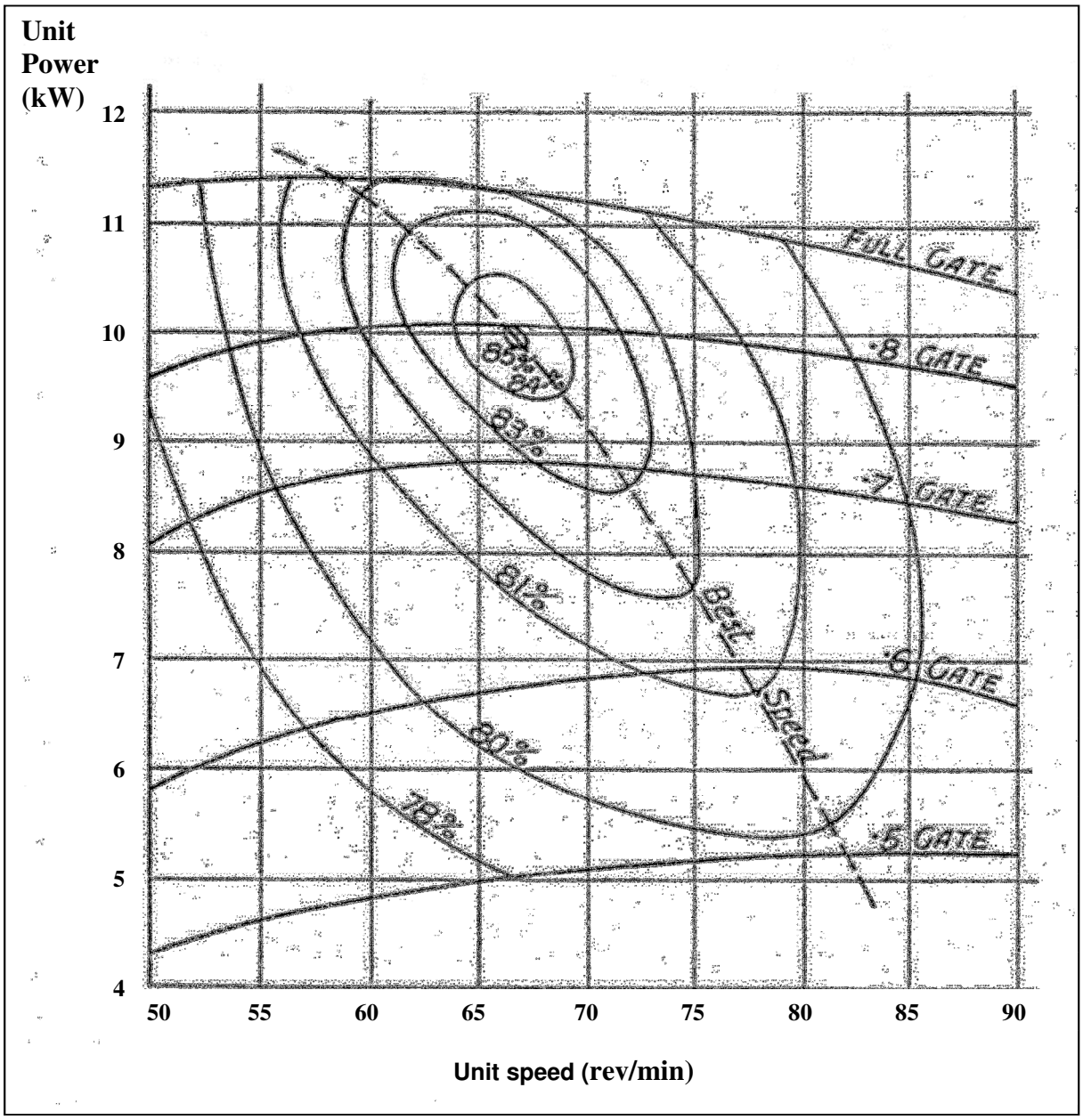
Assuming an annual maintenance costs of 2% of the capital cost of the turbine, calculate the cost of energy production in pence per kWh (use n = 15 years and r = 8%).

Discuss:

1. How competitive is the cost of the energy produced?
2. For a study of this kind at a real hydro site, what are the issues which might cause uncertainties in the prediction of energy costs?
3. The general nature, present status and future potential for hydro power.

The report should contain full details of all calculations. A discussion of at least 600 words is required, in response to the questions posed above. The submission deadline will be announced in class.

External sources of information should be referenced in the usual way. You are reminded of our regulations about plagiarism – by all means refer to published articles on the subject, and quote from them if you wish. But this article must be your own work.



where:

Unit speed = actual speed/ $H^{½}$

Unit power = actual power/$H^{1.5}$