ENGR 3203 Project

Remote Power Generation

Background

You and one other design engineer have been charged with ensuring an air separation plant in desert (southwestern US) has sufficient power – 20 MW average power and 30 MW max. power. Your design should consider the power requirements, but also environmental impact, availability of fuel supply, health and safety issues, and any social considerations that may be involved.

Requirements

Design a Steam Power Plant to supply a nominal power of 20 MW average power and 30 MW max. power.

1. *Choose a fuel to supply to heat the steam* – at a minimum consider energy delivery rate, environmental factors, local community acceptance.
    1. Coal – traditional coalfired plant (like http://en.wikipedia.org/wiki/Mohave_Power_Station)
    2. Solar – concentrated solar plant (like http://en.wikipedia.org/wiki/Nevada_Solar_One)
    3. Nuclear – (like http://en.wikipedia.org/wiki/Susquehanna_Steam_Electric_Station)

2. *Choose components* – at a minimum consider basic components required to run the steam cycle. Ideally consider additional components that will cause plant to run more efficiently.
    1. Evaporator/Boiler
    2. Turbine – consider a realistic *isentropic* efficiency
    3. Condenser – consider inlet/outlet temperatures of steam and inlet/outlet temps of cooling water (available from nearby reservoir at 10 degrees C).
    4. Pump – consider realistic *isentropic* efficiency
    5. Additional Components (at least one required)-- economizer, open feedwater heater, etc...

3. Analyze the components you have chosen
    1. Component analysis
        1. Mass flow rates, pressures, temperatures, heat exchange rates, power generation and consumption rates, entropy generation rates, etc...
    2. Overall Plant Analysis
    3. Overall thermal efficiency
    4. Overall plant effects on surroundings
    5. Overall ability to supply needed power

6.Overall public acceptance of plant and its effects (short term versus long term)

4.Documentation – Each two person group will need to submit a group report. The report is due by May 4, 2009 by 11:59 p.m. The report will need to turned into a *pdf* and submitted by each group to Dr. Lemley via email by the deadline.

(See http://evan.lemley.org/courses/engr4123_fall_2008/report_template.doc for a report template, and http://www.asme.org/Publications/ConfProceedings/Author/Formatting_Paper.cfm for paper formatting)

1.*Introduction* – the basics of the design problem and your basic objectives.
2.*Background* – this should include relevant background theory.
1.In this case this includes governing equations from thermo or other disciplines. These equations should be properly formatted. Use of an equation editor is generally required to make things appear properly.
2.You may need to work some equations down to a more usable form (e.g. steady-state and ignoring heat generation). These can be referred to later when you show the analysis of the plant in section 5.
3.*Problem Description* – What problem are you tasked with solving (graphics are nice). You may be tempted to reuse the handout that describes the project, but that would be plagiarism, so you will need to rework the description. Also you need to research the problem and lay the groundwork for your choice of fuel. What are the positives and negatives of the different fuel choices?
4.*Choice of Fuel and Components*. Details! Look up some data on typical public feeling about these issues. What part of the country is the plant in? What fuel is typically available in that part of the country. ***There is no right answer to this part!!!***
1.A "good" drawing of the plant should be included. This should follow the standards of piping and instrumentation drawings given to you in class. Piping details (including diameters) should be specified according to the piping standards handed out in class.
5.Analysis of Plant / Calculation Results
Need some sample calculations here – the details of these can go in the appendix, but you need a summary table here to show the state of steam at all points in the cycle. I would expect many will want to set things up in a spreadsheet. That is fine and I would like you to refer to the spreadsheet in the report and to submit an electronic copy with the report.
1.Component Analysis
2.Plant Overall Analysis
6.Conclusions

7.Appendices

8.*References* – see the links above for the correct format.