

Teaching Notes

Operational Reactor Safety Course

Lecture: 8 – Power Cycles for Nuclear Plants - Rankine and Brayton Cycles

Objective:

To develop an understanding of how Rankine and Brayton cycles work in power production. Key concepts will be the use of TS diagrams, superheat, multi-fluid cycles and the use of pressure ratios in Brayton cycles.

Key Points to Bring Out:

<u>Slide number</u>	<u>Points</u>
3	Review basic definitions and units which are very important in thermal analysis calculations.
4	Review the governing equations for heat transfer - first and second law of thermodynamics - describe how steam tables work introduce concept of steam quality.
4-7	Review details of Rankine cycle using the TS diagram and thermal efficiency calculation - repeat explanation of how important equations are used.
7-8	Spend time on these slides which show a Rankine cycle with superheat. Review TS plot since it has many important features of thermal efficiency calculations.
9-10	These slides provide examples of different power cycles with superheat and supercritical cycles to understand options for steam power conversion. Binary cycles should be explained since these are used to appreciate how to calculate overall thermal efficiency.
22-21	Review fundamentals of gas Brayton power cycles - spend time on the perfect gas law relationships which are needed in efficiency and cycle analysis.
22-23	Key points are to show how gas systems can be combined with

steam systems to maximize efficiency. Explain how each cycle works in terms of extracting heat for power. Topping and bottoming cycles should be discussed in this context.

24

A good slide that summarizes Brayton, Rankine and Carnot cycles in the temperature - entropy context.

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