Cogeneration

Cogeneration has the potential to increase the efficiency of any power cycle by using the same fuel source to simultaneously produce electricity and heat. This boost in efficiency can prove itself to be a worthwhile investment opportunity, according to a system’s thermo-economic structure. By analyzing the exergy use of a system, where each component of a system is measured from the same reference state, changes in exergy correlate to costs of producing, fueling, and operating a power system. There is a caveat to cogeneration: whether or not to maximize power of the system or to recover economically valuable heat or steam. By examining the thermodynamic property of exergy, a system’s overall potential to do useful work can be evaluated. Which is a more useful property to determine the economic value since of a thermal fluid system, since a basic energy balance cannot alone provide enough information. Not only does cogeneration benefit an energy system, but some disadvantages exist as well. Various areas cogenerations affects are overall system efficiency, fuel types, dependability, and environmental modifications.

Cogeneration is a process whereby waste heat energy is recycled to provide heat input to another portion of a power cycle. In a Rankine cycle, heat extracted from the turbine has the capacity to heat the working fluid in another portion of the cycle in an effort to increase thermal efficiency. Modern day power plants operating on a Rankine cycle require that the turbine stage extract as much work as possible out of the thermal fluid (Schmidt et. al, 2006). Overall system efficiency is affected by cogeneration since the system is made more self-sufficient. By extracting heat generated in the system to power another mechanism, the money used to power the system decreases and thermal pollution is reduced. A major concern with cogeneration is whether or not to maximize the thermal efficiency of the system and decrease the amount of money saved, or to regulate the temperature of the waste steam to a value that is not too costly. Usually, equilibrium between cost and thermal efficiency for a cycle is calculated so all criteria are met. By optimizing the amount of heat extracted at different stages of the power cycle, the realization is made that power system increases efficiency and minimizes exergy destruction by applying a cogeneration system.

Exergy relationship to cogeneration

* SOTA

Project Description

* What are we modeling?
* Why modeling?
* How are we modeling it?

Modeling and Analysis: Describe, use flow charts and refer to them for clarity

* How does it work?
* Algorithm?

Results and Discussion: use tables/figures

* Present results of ISO base case at full load/compare to hand calculations & to manufacturer’s data
* Present all results for case studies outlined in assignment: 1. Effect of inlet/exhaust pressure losses, 2. Part load and hot dry performance, 3. Effect of evaporative cooler, and 4. The potential value of co-generation based on exergy value of exhaust gases

References

Property Calculator Assignment

Appendix:

* Presentation of hand calculations
* Copy of Matlab script including property calculator

Extra material that we may want to include