WHAT IS OCEAN THERMAL ENERGY CONVERSION?

Ocean Thermal Energy Conversion (OTEC) is a technology for generating electricity using the temperature difference between the hot surface water and the cold deep water in the ocean. OTEC has the potential to become one of the leading renewable energy technologies in the near future.

- Renewable energy source
- Baseload energy supply
- Cogeneration of multiple products
- Limitless availability

PROJECT DESCRIPTION

The OTEC DEMO project aims to design and build a room size demo of an Ocean Thermal Energy Conversion (OTEC) power plant based on the Kalina cycle as a proof of concept. It is also for ultimately providing a comparative analysis between OTEC with a Kalina based cycle and one with ORC based cycles. Fluidprop [1] and Cycle-Tempo [2] software were used to carry out the presented simulations.

TYPES OF ORGANIC FLUIDS

The vapor saturation curve of the T-S diagram is the most crucial characteristic of an organic working fluid in an ORC cycle. Based on the vapor saturation curve, they can be categorized into three categories: namely, Dry fluid, Wet fluid and Isentropic fluid. The following are addressed:

- R114 (Dry)
- R12 (Wet)
- R134a (Isentropic)

WORKING FLUID

The Organic Rankine cycle is a modified Rankine cycle which uses organic fluids like ammonia, alkanes, alcohols or other refrigerants as working fluids instead of water as in a steam Rankine cycle. The organic fluids have a lower boiling point compared to water and can be used in systems where the hot source temperature is less than the conventional Rankine cycle operating temperatures. Since the hot source temperature is lower, directly implies that the net efficiency obtained from these systems are generally lower.

CONCLUSION

A comparative study between Kalina based OTEC and ORC based OTEC was performed. It can be observed that the gross efficiencies are more or less the same for ORC and Kalina cycles.

- R-32 wet fluid has the highest gross efficiency whereas the net efficiency for the Kalina cycle is much higher than ORC cycle. Losses for ORC are higher, hence lower net efficiency
- Temperature profile match in heat exchanger is better for Ammonia-water mixture than organic fluid. Hence less losses in heat exchangers
- Lower losses in heat exchangers imply smaller size of heat exchanger; hence lower cost of heat exchangers.
- The prototype of 150W is being constructed as a proof of concept to support the results of the analysis

Therefore based on the prototype could prove Kalina based OTEC has certain advantage over the ORC based OTEC system.

REFERENCES

2. Delft University of Technology, Cycle Tempo, www.cycletempo.nl

For more information

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