waste-heat-power-generation

4/20/2024

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Cruising Review

Waste Heat to Power

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## PDF Version of the webpage (first pages)
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Waste Heat to Power Generation: Infinity Turbine Looks at New Techniques for Power Generation from Low Quality Heat Sources

The interest in utilizing waste heat (or low grade heat) for power generation has been around since the industrial age, but is gaining steam with the massive amounts of waste heat that is being generated by cloud (server farms), industrial, and potential solar sources. The inherency of low-grade heat to power generation is the low efficiencies and return on investment. Unless you are paying more than $.50 per kwh for your power, the average 6-10 percent power generation efficiency will have a very long (if any) payback. This poor return on investment is why ORC power is not prevalent in the USA.

Infinity has been reviewing and developing many potential power generation technologies since 2008. This review is focussed on low-grade heat sources.

Power generation methodology:

Pressure: Using the Rankine Cycle (or Organic Rankine Cycle), liquid is phase-changed in a cycle to generate power from a heat source that can vaporize the liquid working fluid. With any phase change working fluid, some type of condenser must be used to take advantage of the pressure differential and to accomplish the phase change between liquid and gas. The exception is the Brayton Cycle, which is used with gas turbines, and uses high-grade (high temperature) heat. All equipment using pressure as the working fluid for motive power, involves rotary or piston equipment (i.e. moving parts). The Brayton Cycle uses a combination of both pressure and flow.

Flow: Using variations of the pelton wheel, pistons, vanes, or other devices can take flow and turn that into power. Generally, these devices have a lower power density generation result, when compared to using pressure as the primary motive force for the working fluid. A common flow device would be a wind turbine (using foils) or hydroelectric turbine. This method uses flow to generate torque, and generate power. Once again, flow is used to move a foil or piston (i.e. moving parts).

Tribo-Effect: The third technique is using static electricity. Small scale research has suggested that the tribo-effect can obtain efficiencies in the 15-25 percent range. With the tribo-effect, static DC electricity can be generated with no moving parts when using CO2 as the working fluid (http://tribogen.com). In this case, simply expanding CO2 over a nonconductive hybrid material, will generate a static charge. Since CO2 goes supercritical at 31 C, low grade heat sources can be used (e.g. server waste heat and solar thermal). The biggest benefit of tribo-effect power generation is no moving parts. Not only does this reduce overall complexity of design, but also results in a huge reduction of cost and footprint.

Working Fluids: There is a great deal of scientific literature regarding ORC working fluids (alkanes, fluorinated alkanes, ethers and fluorinated ethers), but the most promising is CO2.

4/20/2024