Small scale waste heat power generation with a woody biomass boiler

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Abstract:

Woody biomass is carbon neutral by using fuel manufactured a simple process such as pellets, chip and firewood. And it is growing importance as a renewable energy. Pellets and chips are popular in Western Europe countries mainly use for house heating. In recent years, power generation is also expected. Large scale power plant by steam turbines in existing technologies has successfully introduced. However, small scale power generation from one kW to a hundred kW class is not in practical situation. Gasification generation is likely to be, but the process of the gasification is complicated, and handling of tar problem is left. As for the stirling engine, a development is performed as the candidate which is the importance with the fuel can be produced by a simple process such as the pellets or the chips.

Stirling engine was invented in the early 19th century. When it is used the combustion heat source of the high temperature directly, thermal efficiency surpass an internal combustion engine. So research and development has been continued to gain the high efficiency under the high temperature. After 200 years, however, there is a subject remains in high temperature operation. It is thermal corrosion exposed to the heat transfer part even if using modern and sophisticated materials. In the use of woody biomass have similar problems. On the other hand, Stirling engine has a feature that can operates in the low temperature heat source. Author developed a indirect heating system by using thermal oil as liquid medium and low temperature difference type Stirling engine. Test engines of 1 kW class and 10 kW class were successfully operated using thermal oil of 300degC. It is possible to avoid high temperature corrosion that is long year subject of the Stirling engine. It can also be operated by solar heat and various renewable heat source of 300degC.

Demonstration is now going on at the Osaka Expo70 Park using pruning branches for the fuel of the wood biomass boiler. The indirect heating low temperature difference Stirling engine is installed as the power generation. Hot water from the boiler goes to the foot bath for the guests of the park. Operating hours has exceeded 1000 hours. This presentation reports on the status of system overview and the status of demonstration.

Keywords:
Stirling engine, Recycling energy, Waste Heat, Woody biomass