Inverted Brayton Cycle Employment for Low-Temperature Cogenerative Applications

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Introduction

• Brayton Cycle based power generation systems are commonly used for small scale applications

• The energy recovered by the turbine can be increased by lowering the exhaust temperature.

• An inverse brayton cycle (IBV) extracts some of the energy left in the high temperature, low pressure exhaust

• An IBV may be cost effective in small scale applications, especially in cogenerative applications.
Cycle Overview

- After exiting a standard brayton cycle, hot gasses at ambient pressure are run through a second turbine to below ambient pressure, and then “compressed” back to ambient using work from this turbine.

- Result is lower exhaust temperature, slightly higher efficiency.
Effect on Cogeneration

- Since the IBV compressor requires much less power if the inlet temperature is low, an IBV is especially useful where cogeneration is employed.
- Result is lower exhaust temperature, higher efficiency.
- In a typical commercial turbine ($T_1=600$) specific work of over 20 kJ/kg can be achieved.
Conclusion

• An IBC can increase overall efficiency by 2-5%.

• Electrical efficiency increases by 20%.

• A larger plant is needed to produce the same amount of thermal power. Ex. - a 4.2 MW plant instead of a 3.6 MW plant.