To whom it may concern:

The submitted manuscript describes an optimization of an organic regenerative transcritical Rankine cycle with methanol as a working fluid, used in a mid-temperature application. This is a difficult optimization problem due to design constraints which cannot be formulated as explicit functions of the design parameters. Known as hidden constraints, these constraints complicate the process of sampling points from the design space, greatly increasing computational expense. The primary focus of this work is an economic optimization of the secondary power cycle and a characterization of the region of the parameter space surrounding the optimal design point. This design point is also compared to the design point obtained by performing an equivalent optimization of the cycle for first-law efficiency, and the significant differences in the way these design points operate is shown. The economically-optimal design point lies near the boundary of one of the hidden constraints. An explicit formulation of this constraint was developed that is locally valid around this point.

This work is novel in a number of ways. First, the literature on applications of organic Rankine cycles for mid-temperature applications is very sparse; previous studies have focused nearly exclusively on waste heat recovery, while entirely different cycle designs are often chosen for high-temperature applications. Furthermore, none of the previous studies reviewed used methanol as a working fluid. Also, the inclusion of hidden constraints in the optimization problem as a way to enforce bounds on certain fluid states has not been seen in past works in this field, to our knowledge.

We believe these novel aspects of our study are important for designing cost-effective thermodynamic cycles for mid-temperature applications. This is a temperature regime which has seen relatively little study, yet further work in this area could help energy producers reduce costs by providing a more specialized design for this temperature range. It is also our hope that the method of using hidden constraints in optimization will see more use in this field because of the flexibility this technique provides to practitioners for specifying design constraints while designing and optimizing a power cycle and allowing design parameters to vary over a wide range of values.

This paper is primarily meant to appeal to a scientific audience. However, the results may also be of interest to the larger community of energy providers, given the emphasis on cost effectiveness in the optimization process.

Thank you for your consideration of our work.

Regards,

Jacob Bryan (Corresponding Author)
Yili Zhang
Hailei Wang
Geordie Richards