

Efficiency in Geothermal Operations Mixtures as working fluids for ORC Power Plants

Galieti, L.; de Servi, C.M.; Colonna, Piero; Silva, Paolo; Bombarda, Paola

Publication date

Document Version Final published version

Citation (APA)Galieti, L., de Servi, C. M., Colonna, P., Silva, P., & Bombarda, P. (2022). *Efficiency in Geothermal Operations: Mixtures as working fluids for ORC Power Plants*. 31-31. Abstract from 13th European Geothermal PhD Days - 2022, Aachen, North Rhine-Westphalia, Germany.

Important note

To cite this publication, please use the final published version (if applicable). Please check the document version above.

Copyright

Other than for strictly personal use, it is not permitted to download, forward or distribute the text or part of it, without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license such as Creative Commons.

Please contact us and provide details if you believe this document breaches copyrights. We will remove access to the work immediately and investigate your claim.



Efficiency in Geothermal Operations

Mixtures as working fluids for ORC Power Plants

¹ Lorenzo Galieti, ¹ Carlo De Servi, ¹ Piero Colonna, ² Paolo Silva, ² Paola Bombarda

The use of mixtures in place of pure fluids in Organic Rankine Cycle (ORC) power plants is proposed as a possible improvement in terms of efficiency, environmental benefit and safety of the system. In particular, zeotropic mixtures exhibit a temperature variation (or glide) during phase change, because the components have different boiling points. This temperature glide improves the temperature profile matching in the heat exchangers and could in turn increase the overall thermoeconomic efficiency of the power plant, especially if it is air cooled.

Even though the solution is theoretically beneficial, its practical feasibility has still to be proven. To this scope, we developed an optimization algorithm that determines the optimal mixture composition and thermodynamic parameters of the cycle and performs the preliminary design of the air cooler of the power plant.

As initial case study we chose a heat recovery application and ran single objective optimizations to select the binary mixture that maximizes the power plants thermodynamic efficiency. Initial results show that, when the ratio between the turbine and fan power is high and the maximum temperature is constrained by fluid stability considerations, mixtures with low or no glide are the most efficient.

The optimization procedure will eventually be extended to include also the economic aspect and additional studies will be performed for the geothermal application, where mixtures are expected to be much more beneficial due to the lower temperature of the heat source.

¹ Tu Delft, Propulsion Power, Department of Aerospace Engineering

² Politecnico Di Milano, Group of Energy Conversion Systems, Dipartimento di Energia