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

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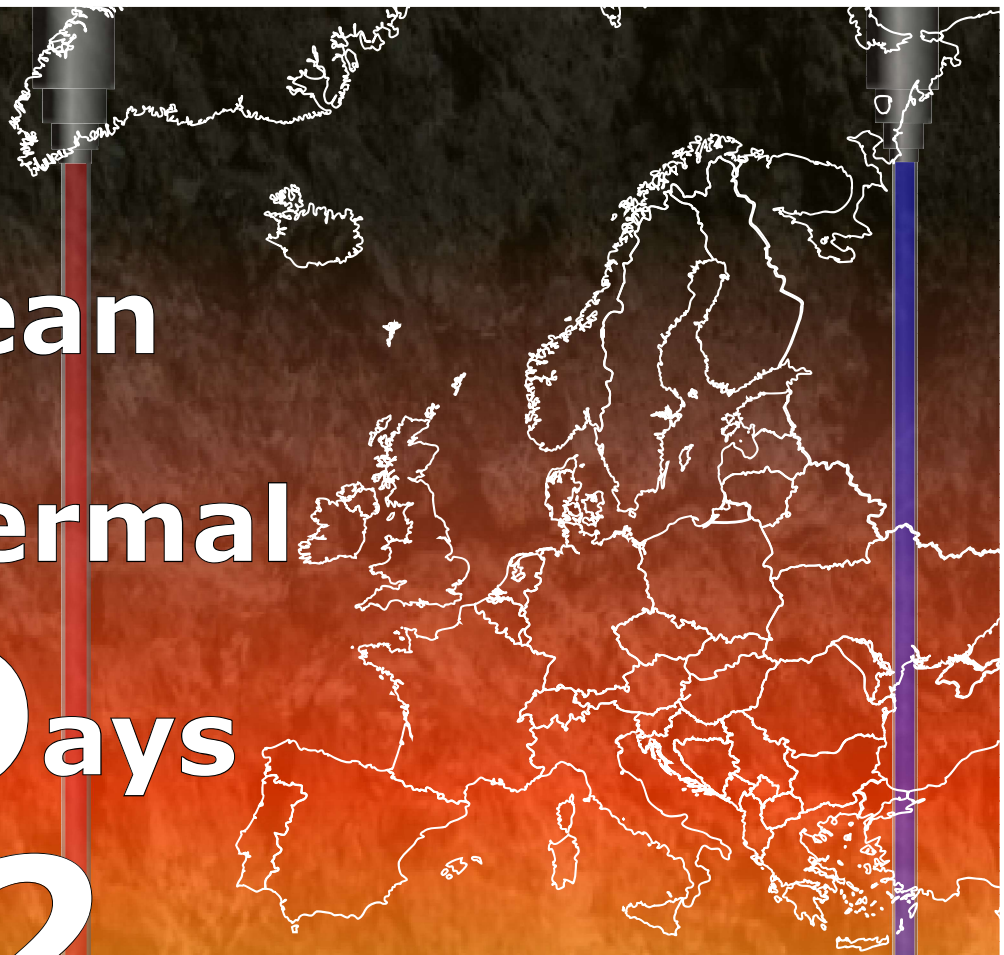

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Efficiency in Geothermal Operations

Mixtures as working fluids for ORC Power Plants

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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 thermo-economic 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.