DRAG Reduction in Geothermal & District Heating Systems to LOWer Investment and Operational Costs

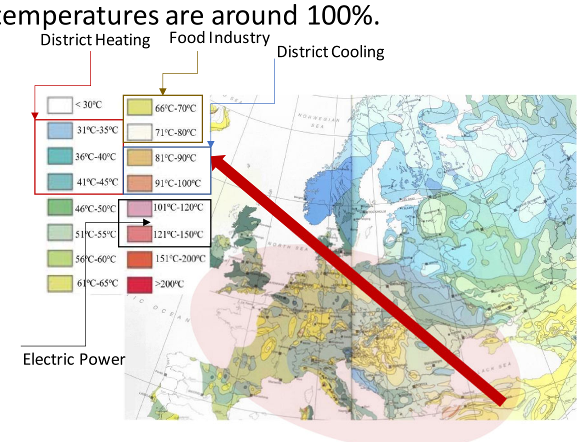
DRAGLOW

Polar Project Critical Thinking Institute TURKEY

DRA increases the environmental rationality of low to-medium enthalpy geothermal resources

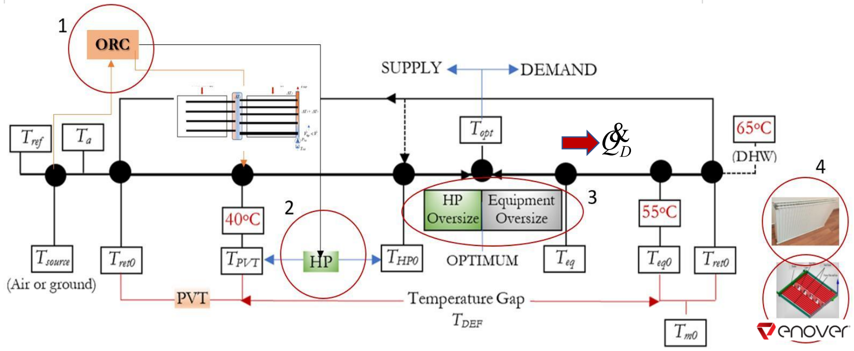
Introduction

According to the Geothermal Atlas for Europe, most of the geothermal reservoirs are around 80ºC, which means that district heating (or cooling with single-stage absorption or adsorption-cycles) may be the only two available options. There are few exceptions for organic-cycle (ORC) power generation, when the geothermal temperatures are around 100%.



Limitations and Solution Alternatives

Current building heating and cooling equipment require supply temperatures up to 70ºC in heating and down to 7ºC in air conditioning for comfort cooling. It is almost impossible to satisfy these temperatures within the decarbonization strategies of EU. EU targets district heating temperatures down to 35ºC. These temperatures enable the utilization of waste heat of power plants (replacing most of the cooling towers) and very-low geothermal resources, which are the most abundant shallow reservoirs. However, this strategy faces a very important temperature gap, if the current heating systems and equipment are kept in use.



There are four alternative solutions:

1- For medium-enthalpy geothermal sources use ORC+its waste heat at 35~40ºC,

2- Use heat pumps for temperature peaking. Also limited to 40~45ºC to preserve the HP performance.

3- Optimal heat pump and conventional equipment oversizing share, which is expensive. Therefore the same limit of 40~45ºC applies.

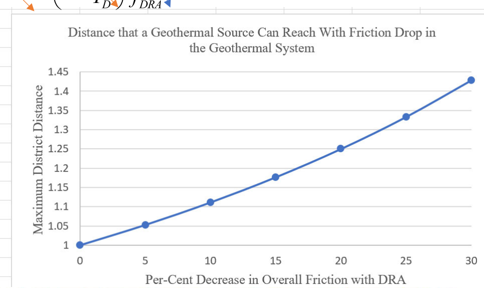
4- Use innovative low-temperature heating equipment with heat pipe technology (35ºC).

DRAGLOW comes to the rescue

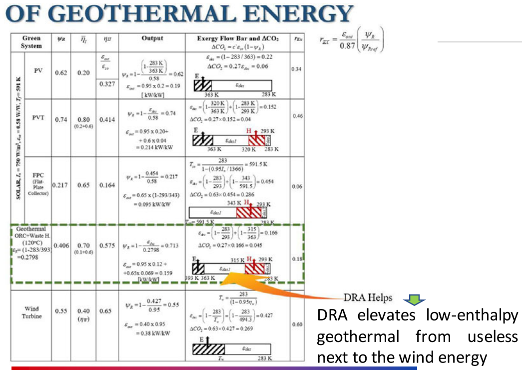
According to the second law of thermodynamics, the maximum transport distance, L_{max} for low-temperature heat, Q_D at T_D (≤45ºC) is limited:

$$L_{max} \propto c\left(a-\frac{b}{T_D}\right)\frac{\dot{Q}_D^{0.5}}{f_{DRA}}$$

f_{DRA} is the reduced pipe friction with DRA



MARKET PENETRATION POTENTIAL OF GEOTHERMAL ENERGY



RESULT

Draglow, coupled with low-exergy heating equipment, cost-effectively supports EU decarbonization by facilitating the utilization of low-enthalpy geothermal resources, by reaching to farther and wider markets by increasing L_{max}, without ORC, heat pumps, and equipment oversizing. Drag reduction substantially reduces district pumping power, thus need for electricity and associated emissions. At low temperatures heat losses from the district piping are reduced.

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