VÄRMESTUGAN

Retrofitting of short boreholes with solar collectors, preliminary results from field measurements

Docent Joachim Claesson
M.Sc. Peter Hill

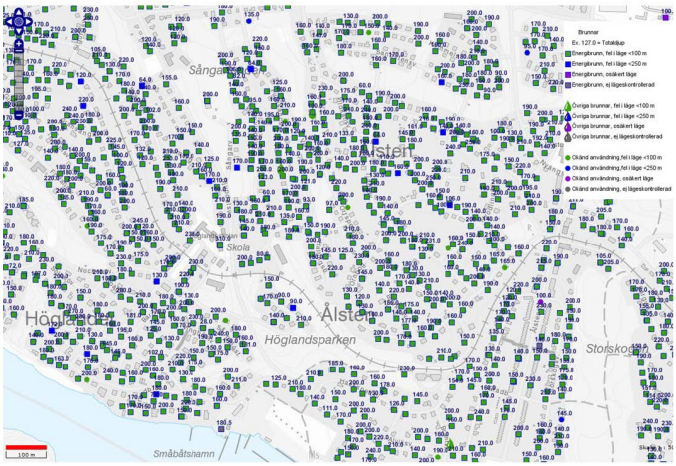
Background

Part of a larger concept project, addressing the issues of “old” ground source heat pumps utilizing “short” boreholes.

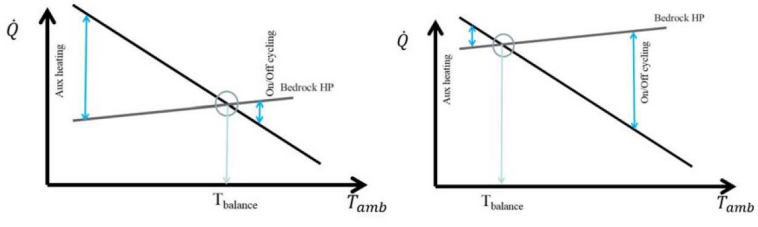
Main project run by SUST (Sustainable Innovation)

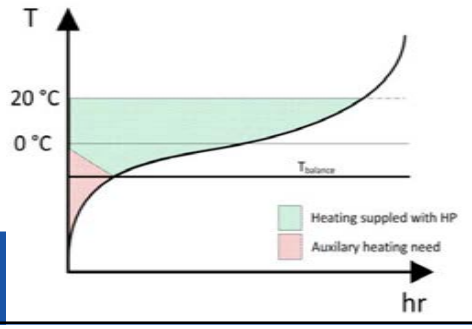
This slave/parallel project funds allocated to Prof. Folke Björk (Building Technology), work however being carried out at KTH Energy Technology

Background

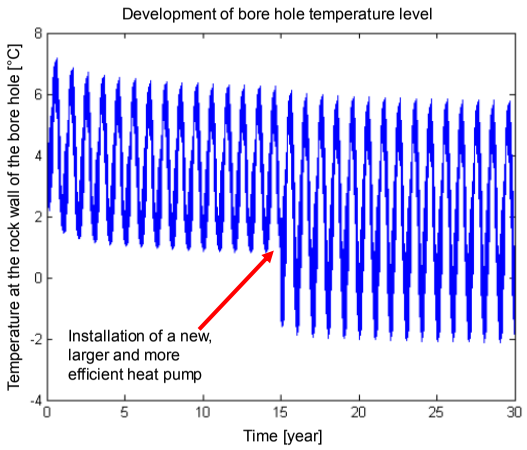


Background



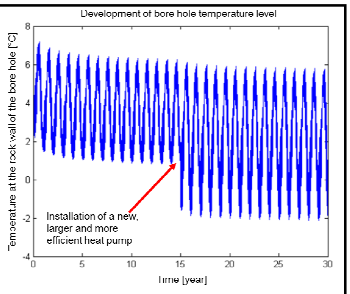


Potential problem?

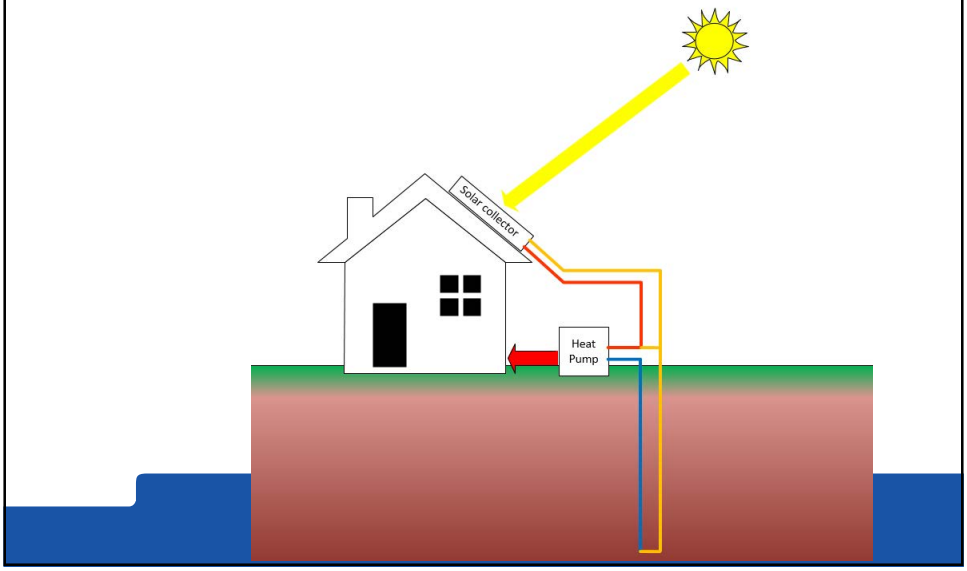


Potential problem?

- A shorter borehole requires (and generate) larger temperature differences
- A larger heat pump requires (and generate) larger temperature differences
- Larger temperature differences decrease COP (and SCOP).
- Neighbors may also harvest geoenergy in the vicinity.

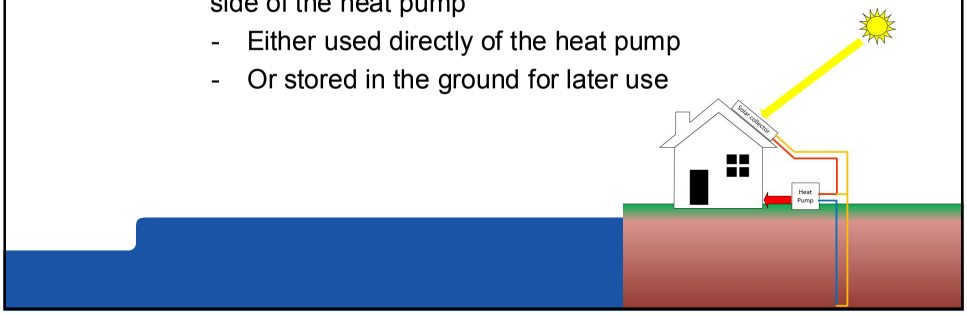


Potential solution? (on of several possible)



Installed system

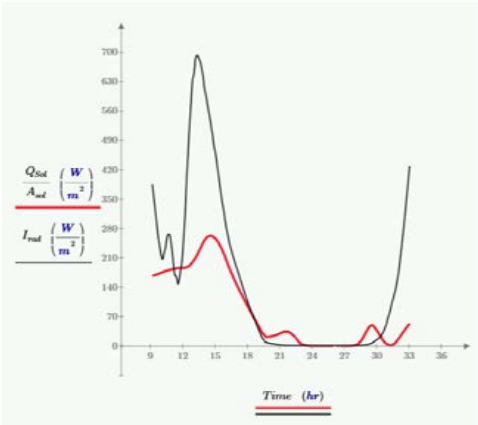
- A typical good heat pump replacing typical fair old heat pump
- An existing borehole without alterations
- Adding a “cheap” solar collector
- Solar heat is, when available, always supplied on cold side of the heat pump
  - Either used directly of the heat pump
  - Or stored in the ground for later use



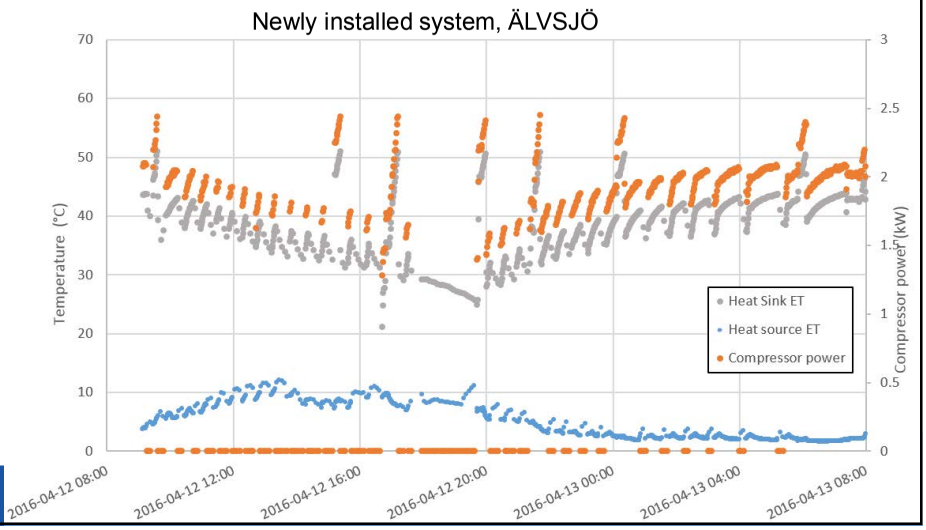
The energy (solar) collector (“bare tube”)

The energy collector

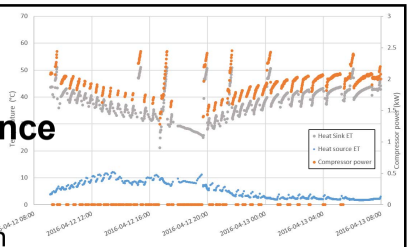
Comparison between the solar irradiation between the morning of the 12th of April to the morning of the 13th of April.



Impact of performance on the heat pump performance, SPRING performance



Impact on HP performance



It is indicative shown, at a certain supply temperature to the heating system, that the compressor operates shorter times.

This implies that for a given heat requirement of the building (kWh/hr) less compressor work is required

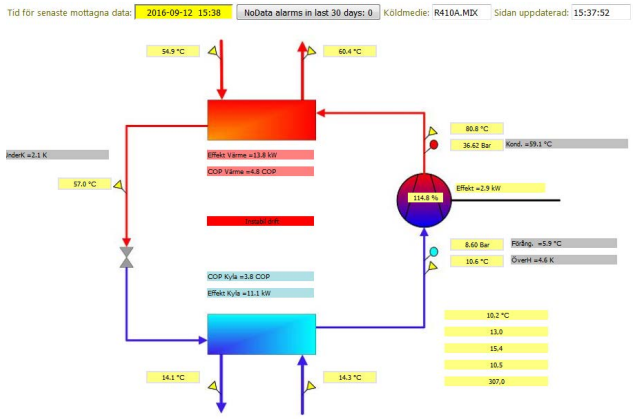
It the follows that the effectiveness of the heat pump increased

BIG QUESTION!!!

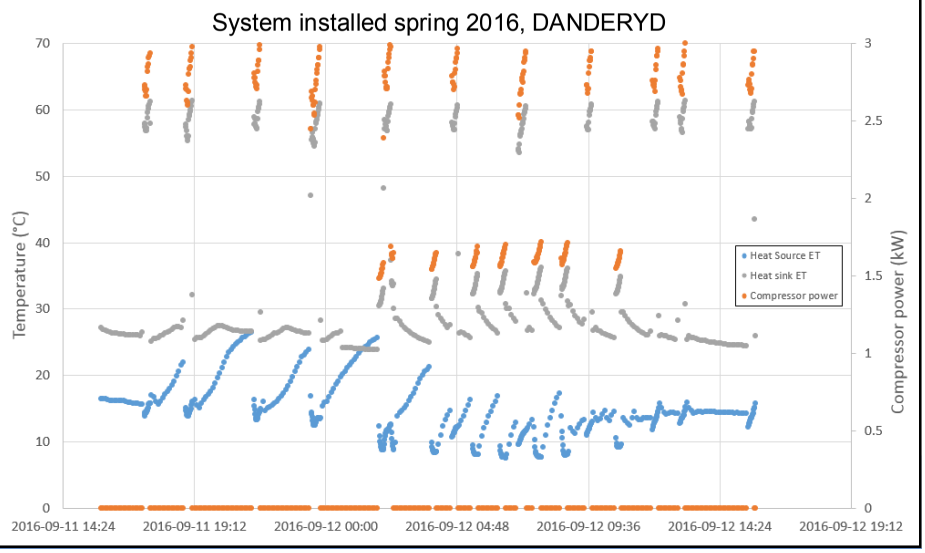
Will the summer solar energy supplied to the ground “still be there” during the fall and winter to be able to harvest by the heat pump???

- Depends on the property of the ground, mainly ground water movement

Seasonable storage and recharge of boreholes



From Sunday to Monday (this week)

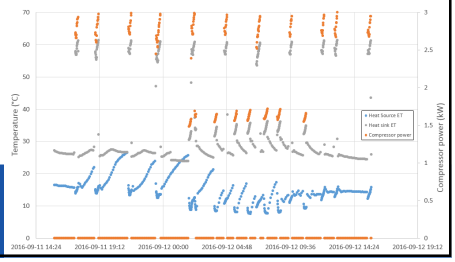


September performance

Warm September, little need of space heating!

Temperature during daytime into the evaporator significantly above annual average air temperature of Stockholm

During night some space heating occurs, temperature into the evaporator some degree above annual average temperature



Summary/Conclusion

It is clear that the system boosts the performance of the heat pump during sunny days

The temperature entering the heat pump during night time in September (period of the most stored solar energy in the ground) is above the annual average temperature, indicating some storage

First winter is approaching (?), interesting to see the performance of the system when prolonged running times of the heat pump occurs.