

Sustainable lake-cooling

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WHAT?

This project was developed in the course 'Thermodynamic modeling' with Brian Elmegaard as our supervisor and the basic idea is to use the difference in temperature from the underground or in this case, a lake, and the surroundings above, to cool a container and its contents. The concept was developed with use at the Roskilde Festival in mind, since there is a large, deep lake, which is a relic of the area's time as a gravel pit. A limited part of the lake serves as bathing lake and with 20,000 daily bathers a huge success. However, we believe that the lake has even more potential.

The cooling of canned beer is done today, by large refrigerated containers connected to the grid; the single most energy-consuming activity at the Roskilde Festival. This can be done smarter - with a solution that uses the festival environment, for a more energy-efficient cooling, based on the cold water from the lake's bottom.

How?

Instead of immersing the beers down in to the lake, we will bring the cold water up to the beer. We intend to do this by pumping the cold water, into a well insulated container using a submersible pump. In the container the water will circulate in a pipeline and the surface of the tubes would then provide for a heat exchange. Finally the heated water will flow down into the lake again.

It should be noted that we are working on the assumption that the container must be able to cool twenty degrees warm beer to about ten degrees.

CONCLUSION

So far, we have determined our cooling need required to cool down a container full of beer (69000 beers), the necessary mass flow of water, the necessary length and dimensions of the pipes to attain the needed heat transmission, and the necessary power and type of pump required for this (a Grundfos Magna 3 (50/100)).

All things considered, this way to create refrigeration, should be upwards ten times more energy efficient than the currently used method (standard refrigeration containers).

The calculations for the above have all been approved by our supervisor.