Title
MEASUREMENT AND MODELLING OF ICE RINK HEAT LOADS

Background and the problem
A path towards sustainable society requires continuous development in energy sector: both production of energy and its consumption. While the production constantly developing towards more energy efficient and less-carbon emissive technologies, the consumption of energy resources tends to increase, especially in northern countries.

Ice rinks operation requires significant amounts of energy. It has been seen that a typical ice rink consumes about 1000 MWh/year. Moreover, the number of ice rinks in Sweden is about 340 and many were built more than 30 years ago indicating that they may not operate inefficiently. Thus the total amount of consumed energy by ice rinks in Sweden is estimated to be more than 300 GWh. Hence, there is a huge potential for energy saving measures.

There are a number of promising technologies to minimize energy consumption of ice rinks. However, the exact technical and energy related data should be collected to estimate real saving potential and justify the choice of effective technologies to implement.

Reports and presentations are available on www.stoppsladd.se.

Aim
The aim of this thesis is to evaluate the saving potential in Swedish ice rinks energy consumption. The estimation is to be based on the inventory results from a number of ice rinks and a few deeper relevant studies.

The deep studies in this context are:

- Study literature on measurements and models on heat load in ice rinks or similar applications.
- Evaluation of two ice rinks with ClimaCheck instrumentation enabling monitoring the cooling capacity/ice rink heat load.
- Build a simulation model with an appropriate tool for simulating the ice rink heat load.
- Experimentally develop a method to measure and evaluate the conductivity of ice.
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Methodology

The thesis work will start with literature review of ice rink design technique and existing energy saving technologies used in this area. The obtained theoretical information will be complemented with the Swedish ice rinks’ inventory results, obtained during the realization of “StoppSladd” project.

All the acquired information will be analyzed using qualitative methods. The analysis results will be supplemented with the experimental studies in order to define most promising energy saving methods. Finally both the experimental data and analysis results will be used to identify the energy saving actions and potential.

Expected outcomes

The elaborated ice rinks inventory will reveal the energy saving potential in Swedish ice rinks operation. These data will further develop the knowledge on ice rinks operation and will serve as a basis for further measures to increase their energy effectiveness. A research paper on this topic will be produced together with J. Rogstam in February 2011 for a conference in Prague, June 2011.

Work plan

<table>
<thead>
<tr>
<th>Week</th>
<th>Planned work</th>
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<tbody>
<tr>
<td>1-4</td>
<td>Literature review on relevant ice rinks literature</td>
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<tr>
<td>3</td>
<td>Preparing and presenting a draft outline of the final report</td>
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<tr>
<td>2-18</td>
<td>Evaluation of field measurement data</td>
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<td>Compiling “Stoppsladd”-data and extend the database</td>
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<td>Select and develop simulation tool/model</td>
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<td>Experimental tests and other deep studies</td>
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<td>15</td>
<td>Preparing and presenting the first draft of the final report</td>
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<td>15-18</td>
<td>Continued analysis</td>
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<td>18-20</td>
<td>Final report preparing; presenting of final results</td>
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Compensation

The student will receive a financial compensation.

Supervisor

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Supervisor at KTH – to be decided.