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ABSOLICON
SOLAR COLLECTOR AB

Absolicon – The obvious choice for your Master Thesis Project

Global warming is the biggest threat to society as we know it and the dominant cause for this is our consumption of fossil fuels. The hype around electric cars and solar cells suggests that most people are open to the idea of change towards more renewable options.

However, what is often overlooked is the fact that the energy usage for heating and cooling (thermal energy) equals that of electricity and transport combined[1]. You can help solve this part of the climate challenge!

Absolicon Solar Collectors is a stock market listed company in Härnösand with 25 employees working towards changing heat production in industry from fossil to solar. We sell the Absolicon T160 the most efficient solar concentrating collector in the world, producing heat up to 160°C. This makes it suitable for industrial process heat and district heating. Industrial process heat below 150°C constitutes roughly 7 % of the total energy demand, making it an immense market.

Absolicon's business plan is however not to sell solar collector fields across the globe. It is rather to sell production lines for licensed mass production of our solar collectors. The production line is robotized and capable of producing 50 MW (100 000 m^2) solar collectors per year. For a short introduction of the production line, see the link below.

https://vimeo.com/absolicon

Solar energy projects in an international environment

Considering that we have developed our products from scratch, it should come as no surprise that we put a lot of effort into research and development. Our work up until today has given us the best solar collector in the world, and we strongly believe that continued efforts in this area is the key to staying one step ahead of our competitors. As a result, we have many active or planned R&D projects in which a master thesis project could be conducted.

As we are expanding our sales and marketing department rapidly, we also offer projects towards marketing and market analysis. We have a long history of supervising master thesis projects and have found that the best way of defining a project is in discussion with the student.

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Solar cooling systems: Leveraging the new developments for industries using a techno-economic approach (30 cr)

Introduction and research problem

The decarbonisation of cooling is of critical importance to meet climatic goals. Cooling demand in most of the buildings and industries is currently met by compression chillers, driven by electricity imported from the grid. To increase the renewable energy fraction in cooling demand, several technological options are available. For e.g, few researchers have proposed to transform existing cooling infrastructure into the solar cooling system. Solar energy penetration in cooling systems can be majorly achieved by 2 methods a) solar PV cooling b) solar thermal (ST) cooling. In a solar PV cooling system, the electricity generated by PV is used to drive an electric compression chiller. In the ST cooling system, thermal collectors are used to drive an absorption/adsorption cooling system. Several researchers have tried to compare both solar PV and ST cooling systems, however, there are no standard guidelines available for a fair comparison. The reason is that comparative results are highly affected by boundary conditions of the system such as building typologies, temporal variation in cooling demand, and solar resource availability etc. A comprehensive work on the comparison of 2 cooling systems is done by Ursula eicker from University of Stuttgart, and she compared the systems from an energetic, and economic perspective for office buildings across several climates Worldwide [1]. The major conclusion of work established that both solar PV, and ST systems are comparable energetically, and economically. PV systems are more economically attractive if Feed-In tariff Is available and paid for. However, the analysis in this paper was only restricted to a single-effect absorption chiller.

This thesis intended to carry analysis for solar cooling systems, while capturing the following developments:

1. Recently, industries are more active to transform their HVAC system to have minimal carbon emissions. Intuitively, The solar thermal cooling system seems appropriate for industrial applications, due to simultaneous heating, and cooling demand. This can allow to use of excess heat from the solar thermal system to be used in process heating, and thus allowing a higher utilisation factor. Therefore, it is of interest to see if the conclusion of research done by [1], also applies to industrial systems. Moreover, there is very little research conducted for industrial cooling systems with simultaneous heating and cooling demand

2. The solar thermal collectors for medium temperatures have reached a good level of commercial implementation, and the learning curve has helped to reduce the overall system cost. The high-efficiency collectors can operate a double-effect chiller, which is energetically more efficient compared to single-effect chiller, and can provide an economic advantage for the solar thermal cooling system. No comparative analysis for solar PV, and solar thermal double-effect chiller is available.

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3. Photovoltiac thermal (PVT) technology has seen a significant interest in market, and several reseachers have projected a possible cost reduction in the next few years. This could be an interesting option to evaluate especially for solar cooling sytsem, where the heat from PVT collectors can be used in thermal chillers, and electricity can be used in compression chillers, thus increasing the self-consumption of the PV electricity.

Therefore, this thesis addresses the above research gaps, and aim to do a techno-economic comparison of solar PV, solar PVT, and ST cooling systems for industrial applications.

Approach
•A good starting point can be a literature review with a specific focus on solar cooling systems(both PV, and ST).

•A solar cooling model can be developed in TRNSYS for various configurations. The thesiswould address a typical industrial system. The heating and cooling load are available for a realcase study. The technologies specifics for PV, PVT, ST, and chillers are available based onexperience, and previous research.

•More specifics can be defined based on discussion with the student, and supervisor.

More information
•Prior knowledge of TRNSYS is preferred, as most of the modeling will be done on TRNSYS.

•The thesis will be mainly supervised by Absolicon solar and ErgSol. Ergsol is a US-baseddeveloper for solar cooling systems with vast experience in installation and design. Thecollaboration with other technological suppliers is also foreseen.

•The thesis aims are designed within the framework of IEA SHC task 65 on solar cooling forsunbelt regions. If the research problem is addressed well in the thesis, then the results can befurther disseminated in the Task meeting.

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[1]https://www.sciencedirect.com/science/article/pii/S0038092X15002674
IEA SHC task 65 https://task65.iea-shc.org/
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