

GEB NEWSLETTER

Issue 7: July 2024

Innovative BSc Graduation Thesis in Mechanical Power Engineering by Ain Shams University Students: Findings and Contributions to the GEB Initiative

The Ain Shams University's Energy Technology and Climate Change Laboratory hosted a graduation project (2023-2024) for the second year as a step for geothermal energy capacity building, research and development and preparing the graduate mechanical engineers for the utilization of geothermal energy and the driving of sustainability in Egypt.



The project 'Deploying Egypt's shallow geothermal potential for a more sustainable air conditioning and cooling of emerging real estate developments' aims to study the thermal performance, economic feasibility, energy efficiency gains and environmental impact of the use of such technology, not only in Egypt but also, serving as a blue print that could be replicated in similar contexts globally to help achieve the SDGs.

The thesis includes various case studies which include literature reviews, cooling load estimations, geotechnical surveys, thermal response testing, ground heat exchanger designing, feasibility studies, numerical modelling using computational fluid dynamics and life cycle assessments.

A lab-scale prototype of a geothermal based cooling system is implemented to do an experiment in the backyard of the house of one of the students, Mark Badeer.

A conventional vapor compression cycle is modified by adjusting the cooling method of the condenser. A full energy analysis of the system is carried out for the air cooled cycle, the geo-cooled system and the effect of soil moisture is further explored. With applying various modifications to the system, experimental data were collected and the system's performance was assessed from the perspective of thermodynamics and heat transfer.

The results are promising of a new highly effective and sustainable refrigeration and air conditioning solution. The project's files can be viewed on: <https://lnkd.in/d/FkeuFub> Additionally, the students have given a seminar on their accomplishments and findings to various guests from the collaborating entities and site visits were done to the pilot project.



Prototype Building



Measurement Process



Experimental Modifications

Geothermal Energy Capacity Building in Egypt

A conference paper is published at the 2nd International Conference on Smart Cities 4.0

The GEB (Geothermal Energy Egypt) project is excited to announce the publication of its latest research on ground source heat pumps at the 2nd International Conference on Smart Cities 4.0 in October 2023. The paper, titled "Life Cycle Assessment for a Ground Source Heat Pump in Comparison with Traditional Heat Pumps: A Case Study in Egypt," was presented at the conference and subsequently published in an IEEE journal.

This research was conducted as part of a graduation project within the GEB initiative during the 2022-2023 academic year. The study aimed to evaluate the environmental impact of ground source heat pumps compared to traditional air-to-air heat pumps in the Egyptian context.

The study found that ground source heat pumps have significantly lower carbon emissions (0.1943 kgCO₂eq./kWh) compared to air-to-air heat pumps, in line with European standards. Additionally, the research identified the highest emission sources in each process, noting that the toxic emissions from the heat pump itself accounted for more energy production than the geothermal well by 34%.

The GEB project's publication at the prestigious 2nd International Conference on Smart Cities 4.0 underscores the team's commitment to driving sustainable energy solutions for Egypt and the region. The full paper is available through the IEEE Xplore digital library.

DOI: 10.1109/SmartCities4.056956.2023.10525884

Life Cycle Assessment for a Ground Source Heat Pump in Comparison with Traditional Heat Pumps: A Case Study in Egypt

Publisher: IEEE [Cite This](#) [PDF](#)

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14 Full Text Views

Abstract

Abstract:
The world is facing the threat of climate change, the promise is to limit the changing rate by generating the required energy with alternative resources. Egypt moved toward this purpose and set a goal to increase the renewable energy mixture to 42 % by the year 2030 then reduce Greenhouse gas emissions. Egypt has valuable potential for geothermal energy, the authors in this research use the Life cycle assessment tool LCA to judge the environmental impact of the ground source heat pumps compared to the traditional air-to-air heat pumps. The research approved the potentiality of geothermal resources in reducing emissions. The carbon emissions produced from ground-source heat pumps (0.1943 kgCO₂eq./kWh) were less than air-to-air heat pumps according to the European standard. Moreover, the study indicated the highest emission sources in each process. In the ground source heat pump, the toxic emissions released from the heat pump produced more energy than the geothermal well by 34%.

Document Sections

- I. Introduction
- II. Results
- IV. Discussion
- V. Conclusion

Authors

Figures

References

Keywords

Metrics

Published in: 2023 2nd International Conference on Smart Cities 4.0

Date of Conference: 22-24 October 2023 **DOI:** 10.1109/SmartCities4.056956.2023.10525884

Date Added to IEEE Xplore: 16 May 2024 **Publisher:** IEEE

ISBN Information: **Conference Location:** Cairo, Egypt

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Advertising GEB

The project members have been keen on advertising the project to attract potential students, and to attract partners from the industry that are willing to adopt this technology and apply it commercially. This has been through the regular posts on the Facebook page (<https://www.facebook.com/gebproject>) that aim to increase people's knowledge and interest in Geothermal Energy and its potential as a clean and sustainable source of energy. Additionally, the participating institutions have mentioned the project and its potential on their respective websites, links to these websites can be found on the project website (<https://www.geb-project.info/pages/Partners>). The tools being developed for the project, such as the pilot plant and the lab-scale model, will also be a powerful tool in showing the potential stakeholders the power of Geothermal Energy.

Disclaimer

This Project has been funded with support from the European Commission. This publication (communication) reflects the view only of the author, and commission cannot be held responsible for any use which may be made of the information contained therein.