SUSTAINABLE CAPSTONE PROJECTS (SCAP)
SPRING 2023-2024

Sustainable tiny house design and construction (Heating)

CYPRUS INTERNATIONAL UNIVERSITY

GROUP MEMBERS

- Ahmed Mohamed 22017722 (mechatronics engineering)
- Lumiere Tunakiese 22118977 (biomedical engineering)
- Yasmine Lyazghi 22014855 (energy system engineering)
- Zineb Rahib 22314238 (biomedical engineering)
- Divine Danga 22008893 (electrical and electronics engineering)

Figure 4

INTRODUCTION

Heating systems are used to keep our homes and buildings warm and comfortable, especially during colder seasons. They are different types of heating systems, such as solar air heater, solar water heater, radiant heater, electric heater…

The project explores the design and construction of a heating system using solar air heater and another one using solar water heater in conjunction with a radiant heating system. This last is obtained by circulating hot water through a coil to transfer heat to the surrounding area; it's an innovative approach that can provide efficient and comfortable heating. Plus, it's an ecofriendly system.

The objectives of this project were to:

- To learn about the different environment friendly heating system,
- Test the solar air and water heater and to implement them to the house,
- Identify recycled materials in order to install the systems and
- To create a water+ coil heating system.

MATERIALS USED IN CONSTRUCTION

Materials Used in the Construction

Re-Used/Recycled Materials:

- Plastic bottle: to serve as the receiving hot water tank.
- Metallic oil recipient: to serve as the donating tank
- Aluminium PVC: to direct the air from the fan to the room
- Coil from behind the refrigerator
- Glass from an old door : to cover the air heater
- All our house is made by recycled materials, from the structure to the finishes.(*the construction of the tiny house was done by 3 teams).

Other Materials:

- Screws: Standard metal screws
- Battery : to power the fan
- Glue: to stick some part together

FINAL PRODUCT

The final product of this project is a heating system composed of a solar air heater and a solar water heater in conjunction with a radiant heating system.

A solar air heater

The device uses sunlight to heat up air and distribute it throughout a space.
The device is composed of black aluminium foil on top of which there is a fan, the all thing covers with a glass. **Figure 1**
The fan, powered by a battery will produce air which will be warmed by the heat captivated by the aluminium and this warm air we go all over the room by a channel.
this heating method is a great way to utilize renewable energy and lower the energy costs.

A solar water heater in conjunction with a radiant heating system.

Solar water heater absorbs sunlight and transfers it to the water in order to heat it.
Radiant heating system transfers warmth to objects and surfaces in space. This is done through underfloor heating. The heat radiates from there, creating a comfortable and cozy environment. A solar water heater in conjunction with a radiant heating system is the combination of the above two systems. As said in the introduction, this system works by sending hot water inside a coil in the radiant to provide efficient heating . **Figure2 and 3**

Figure 1

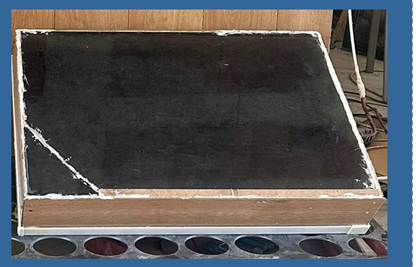

Figure 2

Figure 3

RESULTS AND DISCUSSION

Testing

The solar air and water heaters were tested and they were able to generate hot air and hot water.

The solar air heater, after being placed under the sun, was able to produce warm air in less than 5 minutes. The air coming out was less hot but the heat increased by time.

The solar water heater, produced hot water in about 5-10 minute interval and the water was really hot…

Those results were really amazing and exciting.

Future Directions

Challenges were encountered during the realization of the project, one of which was to ensure that the water coming from the tank enter and can exit the solar water heater in order to enter the coil. The effect of gravity was used to solve this problem but the power of water was still not excellent.

The use of a pump in the future will be a considerable addition to the project.

CONCLUSIONS

The project was successfully designed and constructed. **Figure 4.**

Considering the heating systems, they both are ecofriendly alternatives to traditional heating systems. The integration of recycled materials tilts the scales even more in this direction and contributes to money saving.

The project was an excellent opportunity to gain precious hands-on experience in designing, constructing ,fixing, creating, and in material choosing process which helped to develop a deeper understanding of sustainable engineering principles.

The SCAP program provided a supportive and collaborative environment for learning and doing our work; an environment where jokes where shared as well as lessons and where teamwork was present above all else.

REFERENCES

- Tiny house systems demystified book by L.Brian woodroof
- https://youtu.be/-OGcKE4tuNw?si=g4qh_7MofSyHNmO7
- https://youtu.be/aAHcsl07soM?si=r4UzCfEk8WksKbVP
- …