

Absorption Refrigeration Unit (ARU) for Sustainable Cooling



CHE DEPARTMENT
Abdulaziz Bajamal
Mohammed altwajri

ME DEPARTMENT
Osama Aseyed
Talal Alsubaihi

ISE DEPARTMENT
Bader Alahmadi
Faisal Bin Hussain

INTRODUCTION

•Problem Statement

The project aims to design an enhanced ARU system that overcomes these challenges, leveraging advancements in sensor technology and material science to ensure energy efficiency, environmental sustainability, and operational reliability.

•Constraints

- 6k SAR budget
- Government regulation
- 4 months
- Constant heat generation

•Target Specifications

Target specification	Justifications	Boundaries	Units
Input Heat	The quantity of input heat to the system	[1000,6000]	KW
Water Pipe Input Temperature	The water pipe temperature input should be maintained within the range	[10,20]	C
Water Pipe Output Temperature	The water pipe temperature output should be maintained within the range	[7,17]	C
Failure Time	The mean time before failure	[20,000,30,000]	Hours
Cost	The initial cost investment based on the requirement within range	[200k, 2 million]	\$
Inhibitor/Alcohol	Using it in the absorber to prevent the corrosion	[0.5,1.5]	%

•Project Impact

The implementation of Absorption Refrigeration Units (ARUs) enhances environmental sustainability by using non-toxic materials and boosts operational efficiency due to their energy-conserving design.

SYSTEM DIAGRAM

This innovative system not only offers efficient cooling but also significantly reduces energy consumption and carbon footprint compared to traditional refrigeration methods. Designed to meet the specific needs of industries seeking sustainable alternatives, our ARU promises not just to cool our spaces but to do so in a way that respects our planet future. Join us in leading the change towards more sustainable cooling solutions

MATHEMATICAL MODEL

We aim to minimize the number of sensors used to reduce costs while ensuring comprehensive monitoring under various conditions. Additionally, sensor placement will be optimized to facilitate easy access for maintenance and enhance system reliability. Minimize

$$\text{St. } \sum_i^N \sum_j^M C_{i,j} X_{i,j} - \lambda * (\sum_i^N \sum_j^M R_{i,j} X_{i,j} + \sum_i^N \sum_j^M A_{i,j} X_{i,j})$$

$$\sum_i^N X_{i,j} \geq 1 \quad \forall j$$

$$D_{k,j} * X_{k,j} - D_{i,j} * X_{i,j} \leq S \quad \forall i, k, j \quad i \neq k$$

$$A_{i,j} (1 - X_{i,j}) \geq A_{min} \quad \forall i, j$$

$$\sum_i^N \sum_j^M R_{i,j} X_{i,j} \geq R_{req}$$

COST ANALYSIS

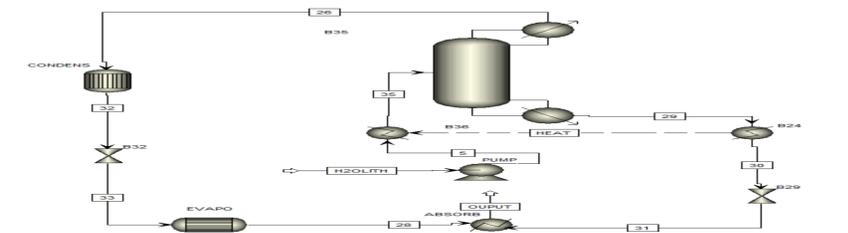
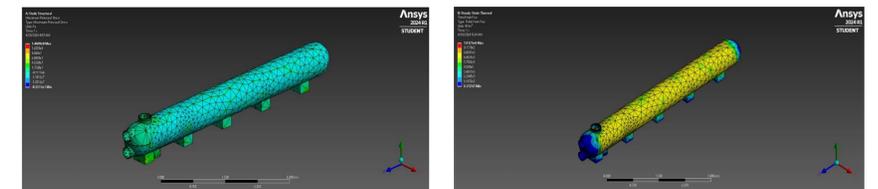


Total cost:
5400SAR

PROTOTYPE DESIGN



TESTING / VALIDATION



CONCLUSIONS

This project presents the design and development of an innovative Absorption Refrigeration Unit (ARU) enhanced with an Integrated Corrosion Inhibitor Monitoring System, aimed at promoting sustainable cooling solutions. The project addresses critical needs for energy efficiency, environmental sustainability, and system longevity in refrigeration technology.