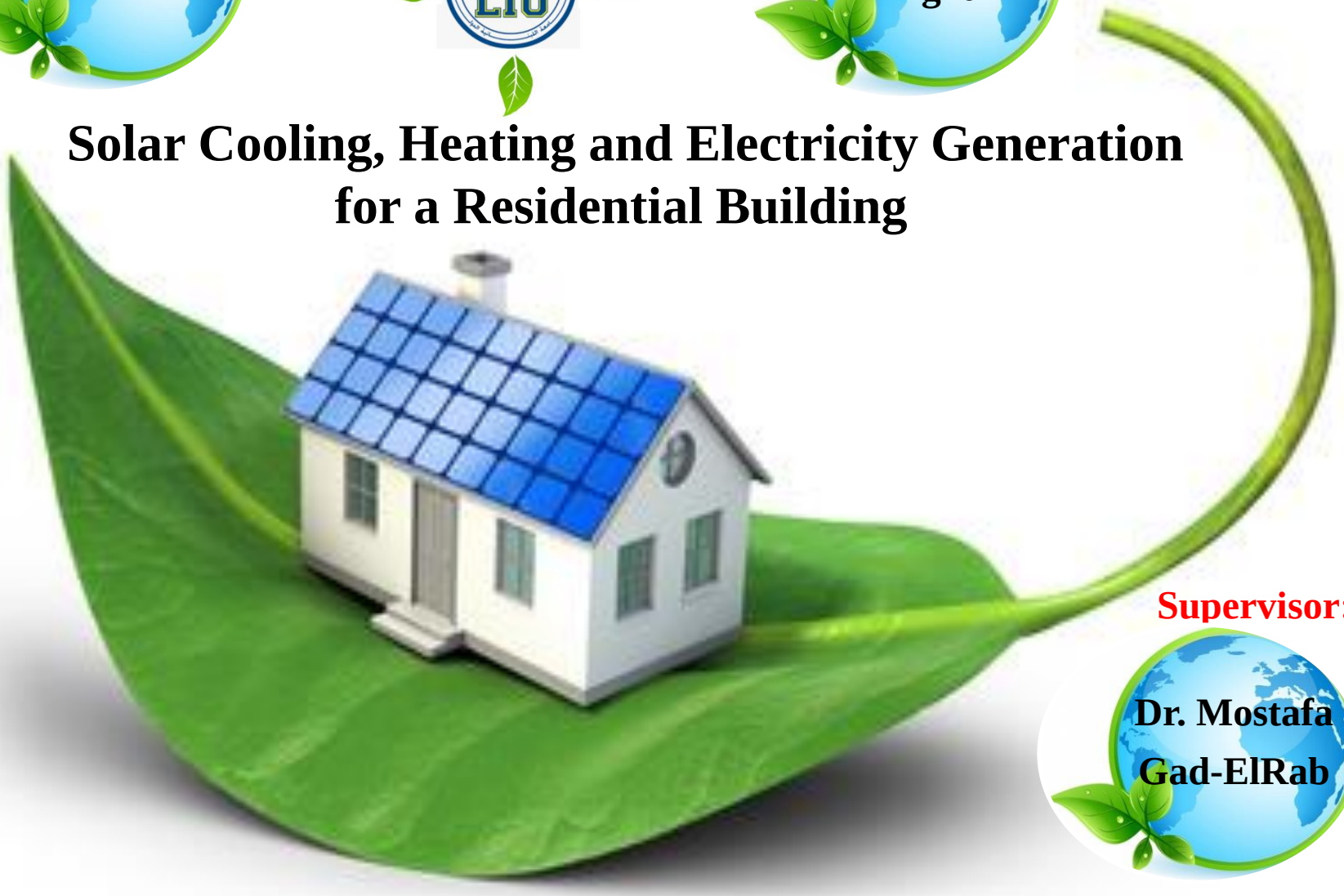
Mariam Kahloun

Dima Agha

Solar Cooling, Heating and Electricity Generation for a Residential Building



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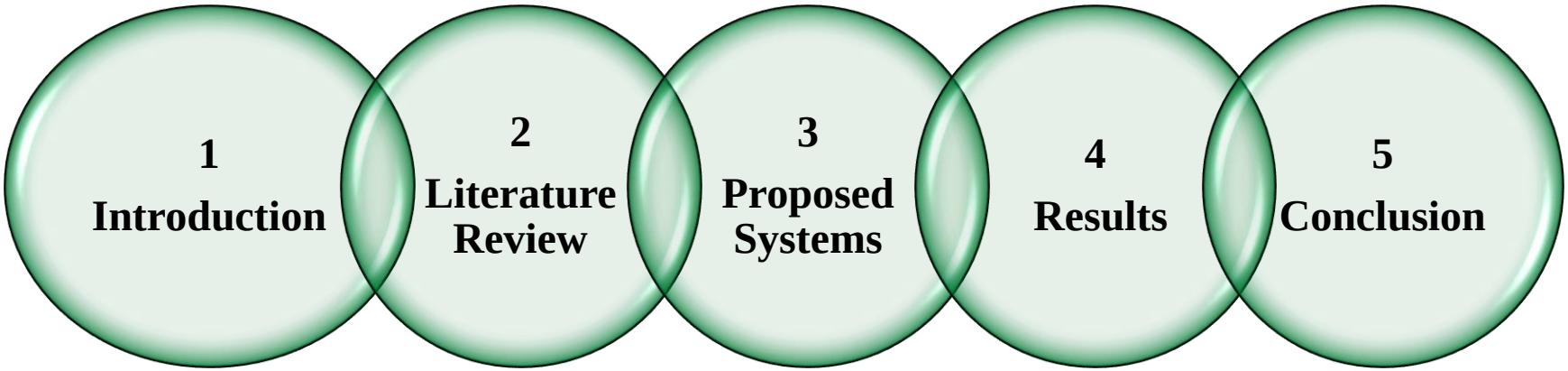
Outline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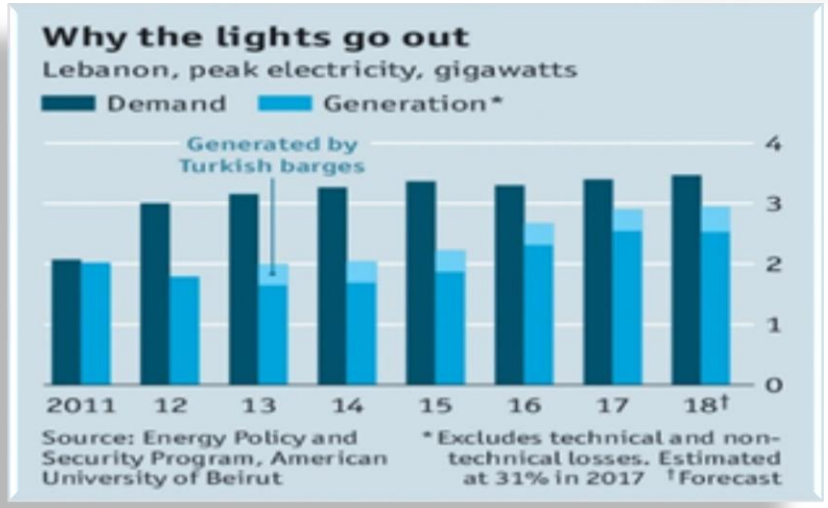
Introduction

Shortage of the non-renewable energy sources.

Thermal Non-renewable Power Plants

87% of the gas emissions are from thermal power plants.



Power demand is higher than the generation.

Energy demand (kWh/m^2) of buildings in Beirut

	Residential standard	Residential standard
Heating	3	6
Cooling	78	64
Ventilation	7	7
Lighting	13	3
DHW	10	2
Humidification	1	1
Dehumidification	36	32
Total	148	115

The First Energy Indicators Report in Lebanon, February 2018

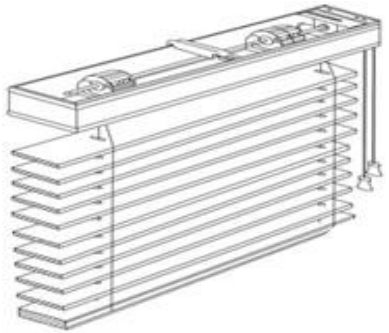
Cooling and heating systems consume the greatest power.

Literature Review

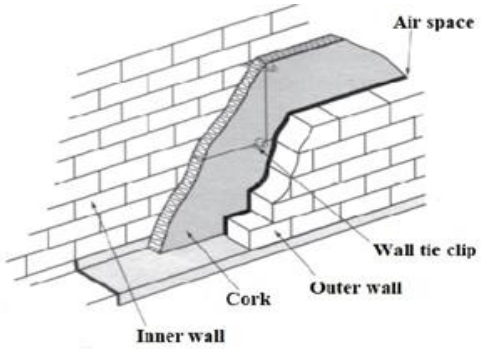
Passive Cooling and Heating Systems

Double Glazing

Shading



Blinds and Curtains



Heat Resistive Wall

Applied Cooling and Heating Systems

- Comfort conditions in **summer** season are 24 ºC and 50%RH
- Comfort conditions in **winter** season are 22°C and 30%RH

Cooling Systems

- Vapor Compression Refrigeration Cycle
- Absorption Refrigeration Cycle
- Adsorption Refrigeration Cycle
- **Desiccant Refrigeration Cycle**

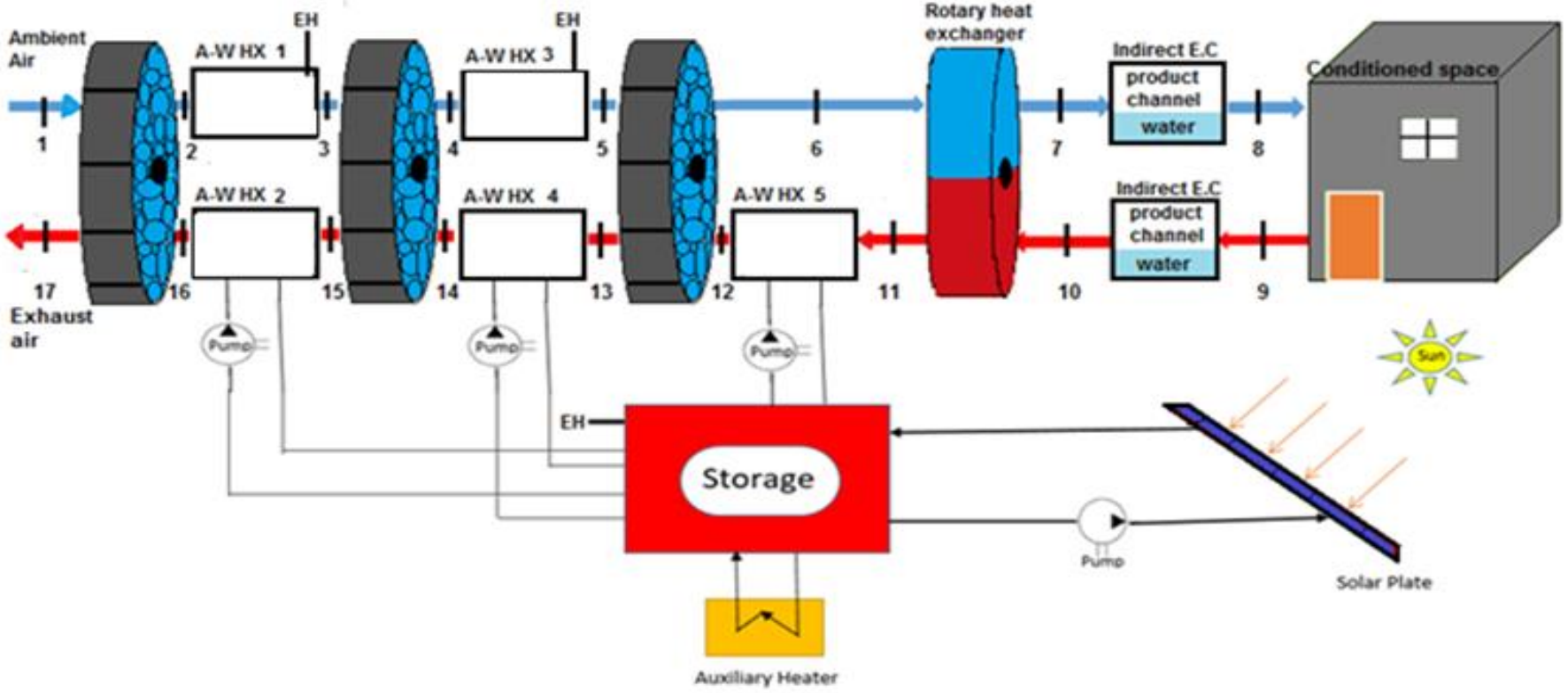
Heating Systems

- Furnaces
- Boilers
- Heat pumps
- Electric heating
- **Solar heating system**

Proposed Systems

Lebanon is located in the high irradiance region

RELATIVE HUMIDITY REACHES 90% IN THE COASTAL REGION IN SUMMER

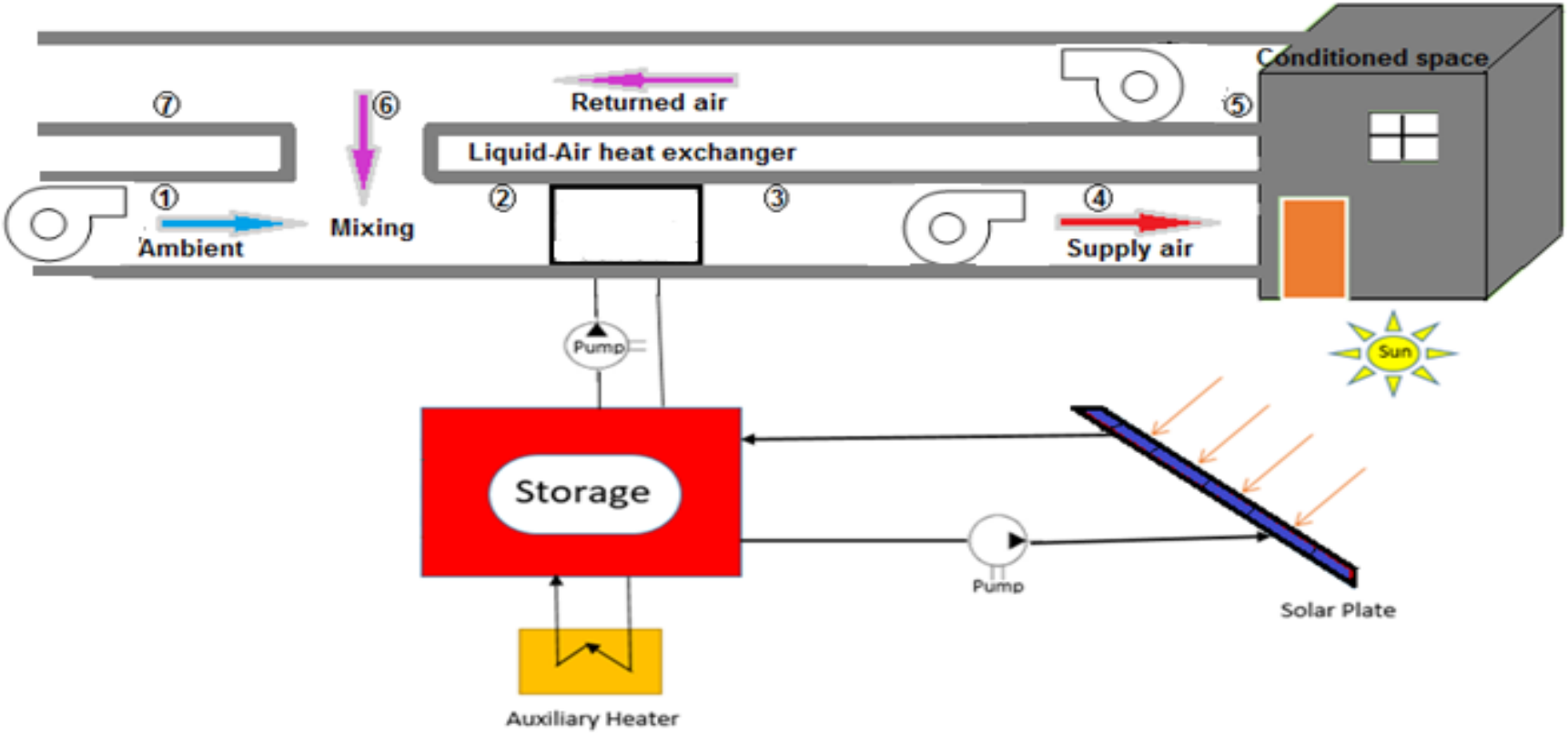


Schematic Diagram of the Desiccant Cooling System

Proposed Systems

Lebanon is located in the high irradiance region

Eco-friendly

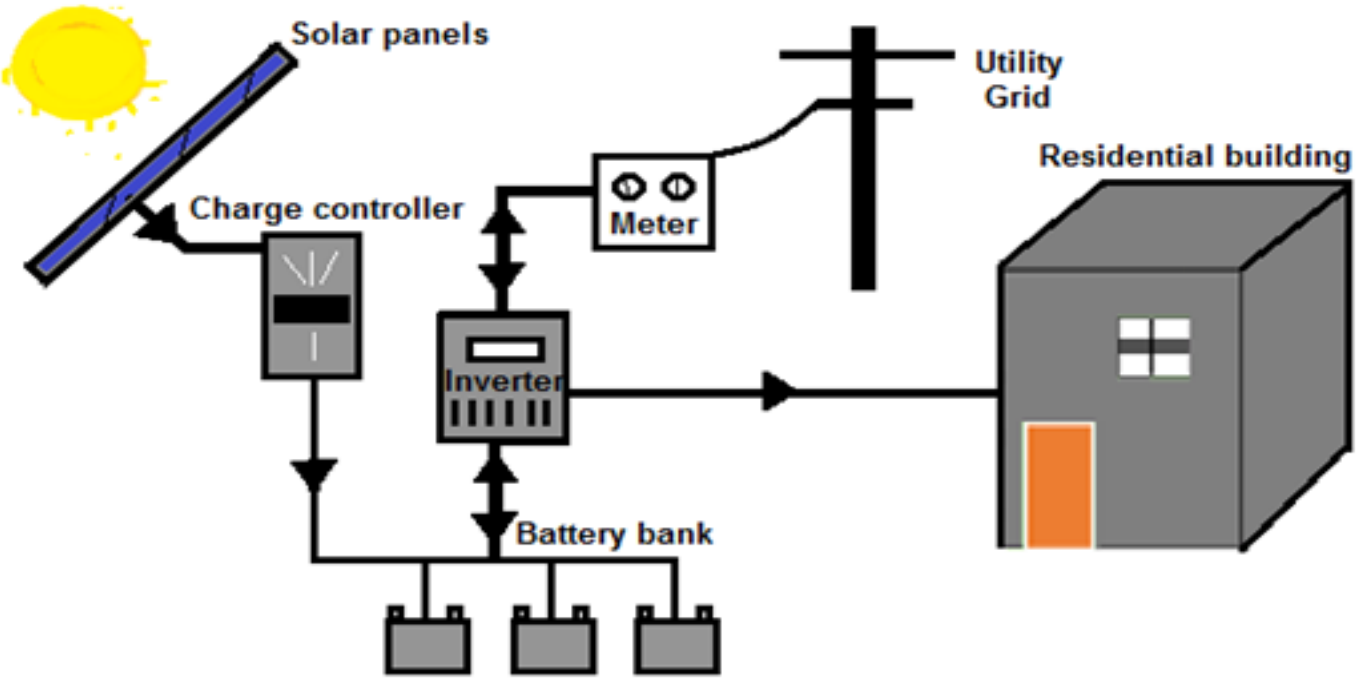


Schematic Diagram of the Solar Heating System

Proposed Systems

Lebanon is located in the high irradiance region

Eco-friendly



Schematic Diagram of the Solar Electricity Generation System

Results

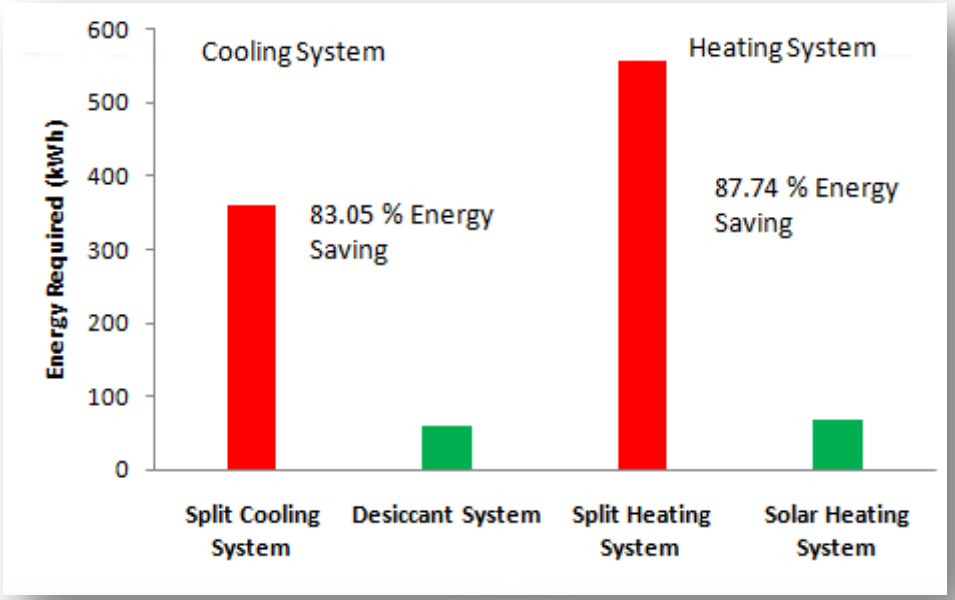
Desiccant Cooling System	
Number of desiccant wheels(1.5 meter diameter)	3
Number of Rotary heat Exchanger	1
Number of air water heat Exchangers	5
Number of I.D.E.C	2
Number of fans	4
Number of circulating pumps	5
Number of driving motors	4
Area of solar collectors needed (m^2)	5.35

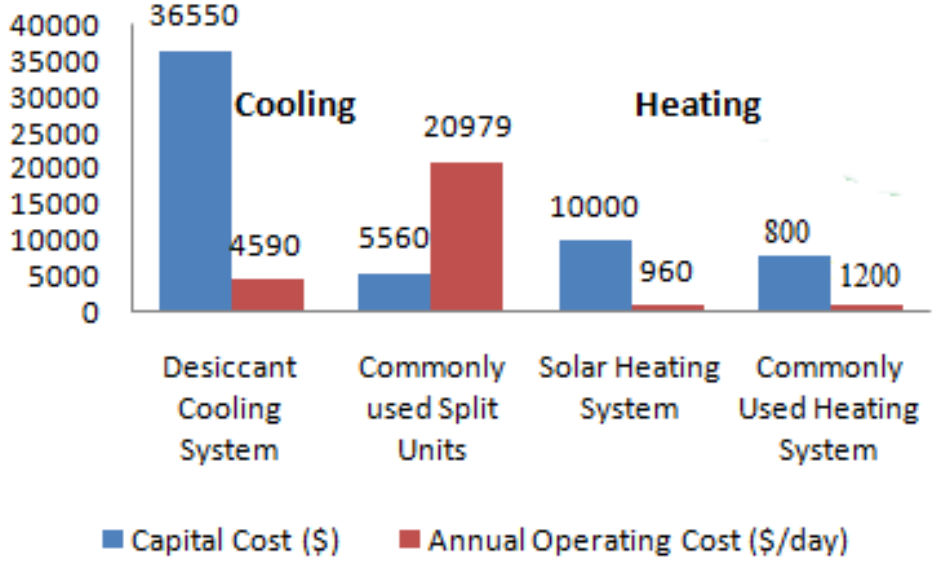
Solar Heating System	
Number of air water heat Exchangers	1
Number of fans	3
Number of circulating pumps	1
Area of solar collectors needed (m^2)	10.71

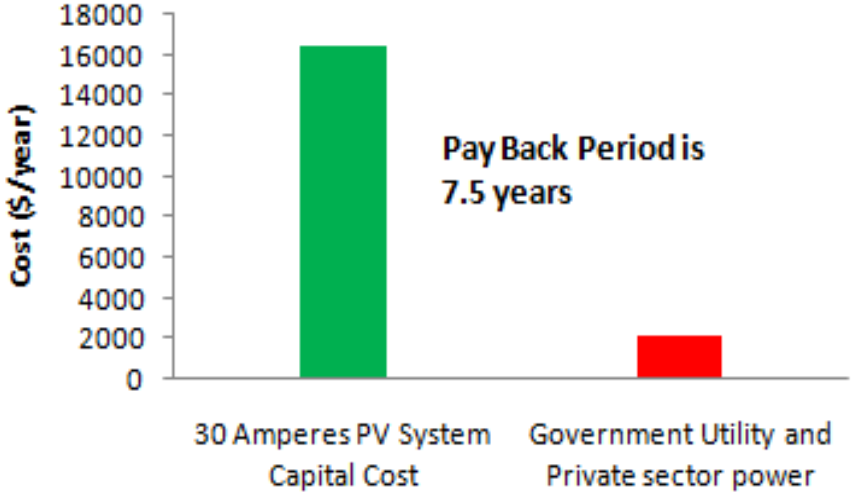
Solar Electricity Generation System	
Area of solar collectors needed (m^2)	180.5
Inverter Capacity (kW)	55.2
Number of Batteries with rating of 24 v 1000Ah	9

Results

ENERGY SAVINGS AND ECONOMICAL VALIDITY $







Conclusion

DEMAND IS GREATER THAN THE GENERATION → **ALTERNATIVE TO THE PUBLIC AND PRIVATE SECTOR ELECTRICITY GENERATION**

SHORTAGE OF THE NON-RENEWABLE ENERGY → **AVAILABILITY OF THE SOLAR RENEWABLE ENERGY**

High Temperatures and pressures for thermal power plants. → **Operates on atmospheric pressure.**

HIGH POLLUTED GAS EMISSIONS → **ECO-FRIENDLY SOLAR POWER.**

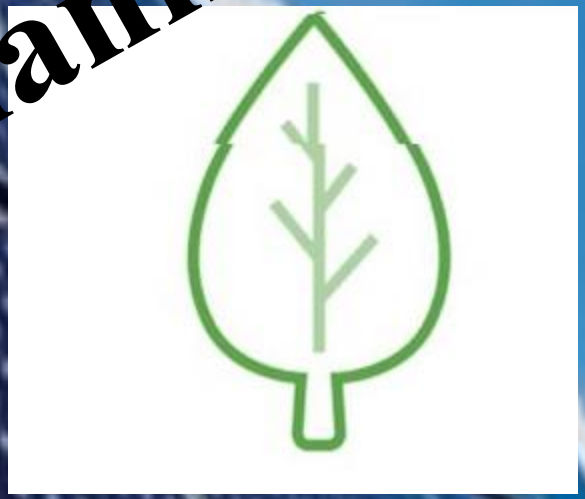
HIGH ENERGY CONSUMPTION AND HIGH OPERATION COSTS → **LOW ENERGY CONSUMPTION AND LOW OPERATION COSTS**

Think SMART:
Increase the value
of your home

Think about LEBANON

Think Affordable

Thank You



Think Green