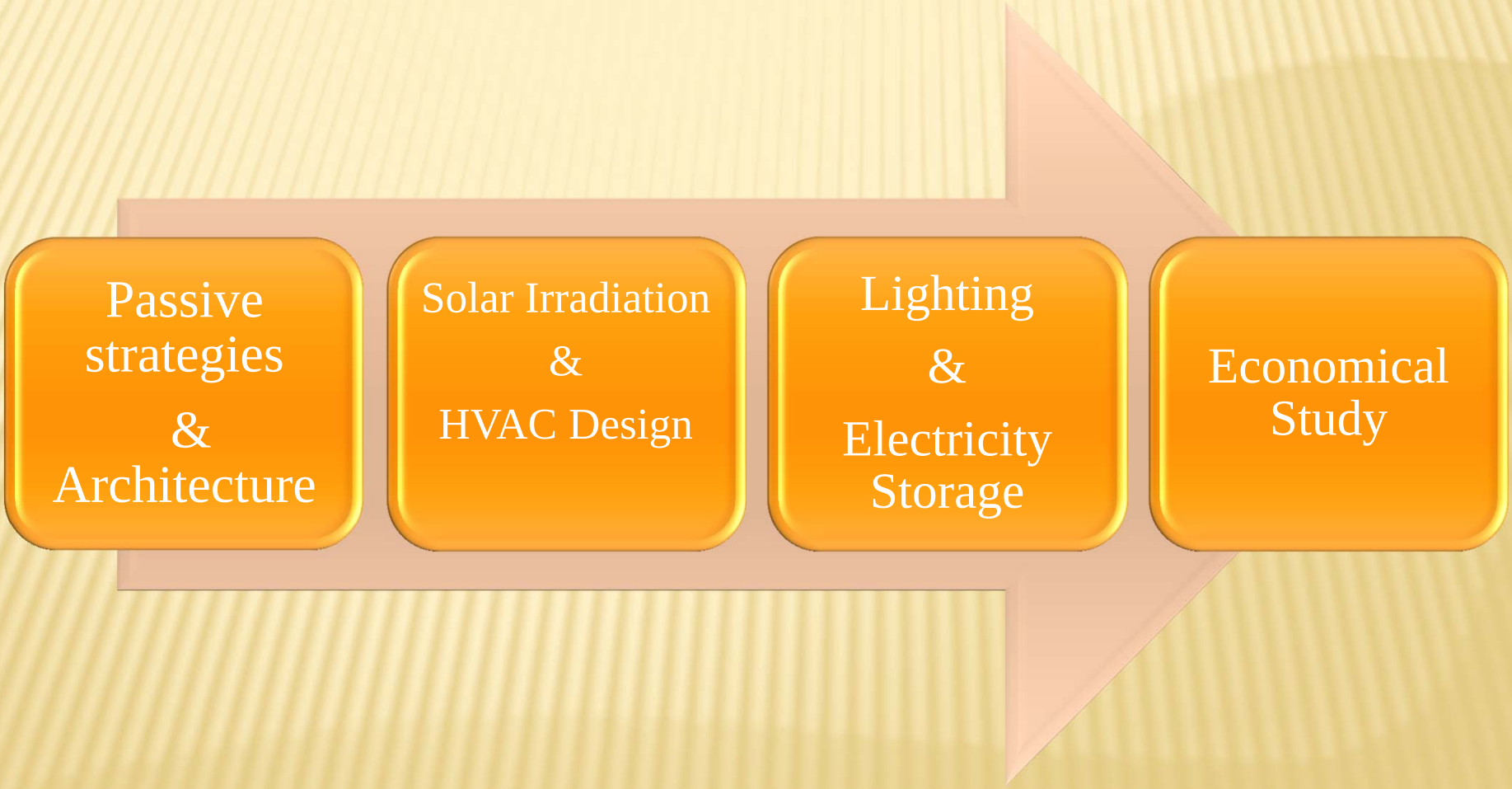
International Conference for Enhanced Building Operations ICEBO 2012

DESIGNING ZERO ENERGY BUILDING FOR TEHRAN

INTRODUCTION



PASSIVE STRATEGIES

Direct gain

- large glazed south-facing windows are used in order to gain the direct solar energy for natural lighting and thermal needs

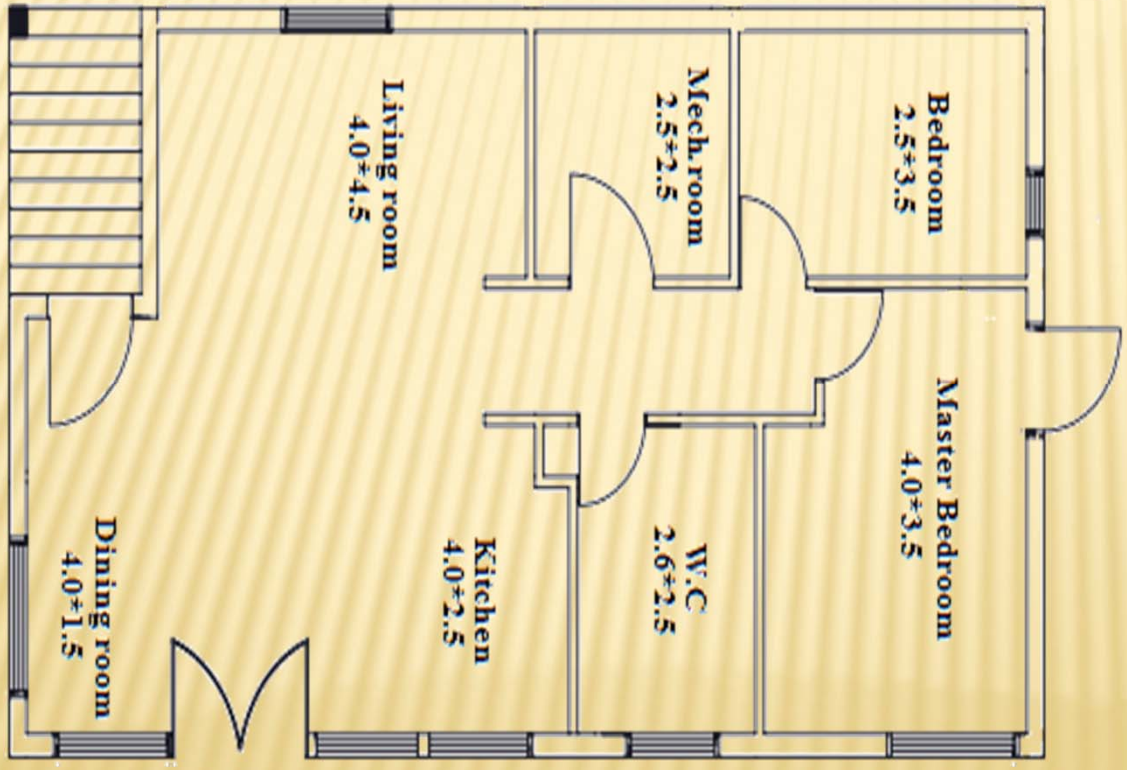
Indirect gain

- Trombe-wall which is used in the larger bedroom provides more than 40 percent of heating load required for this zone

Isolated gain

- there is a glazed room which is located at home entrance.

ARCHITECTURE



This study builds on a 96m^2 ($12^m \times 8^m$), single-story house with two bedrooms.

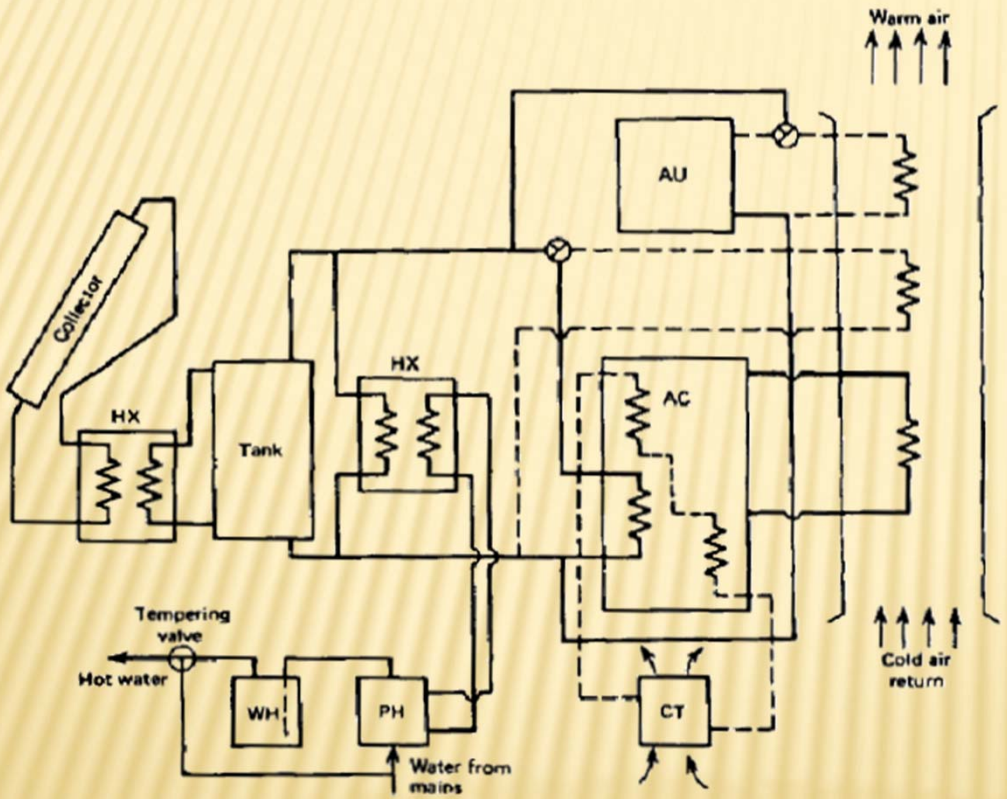
CONSTRUCTION MATERIALS

Building elements	U-Values
Exterior walls	0.02
Interior walls	0.038
Outside doors	0.067
Room doors	0.27
Glasses	0.247
Room ceiling	0.015
Tilted roof of bedrooms	0.083
Tilted roof of living room	0.015

The construction material used in the house are selected to achieve a super insulated home. The U-value of building elements are indicated in Table.

Building elements	Materials
External walls	Concrete block and brick
Glazing	Double insulating glass (suspended film and low-E)
Internal partitions	Plasterboard and insulation
Roof construction	Concrete tiles, felt/underlay
Doors	Metal Insulating (2” w/urethane)

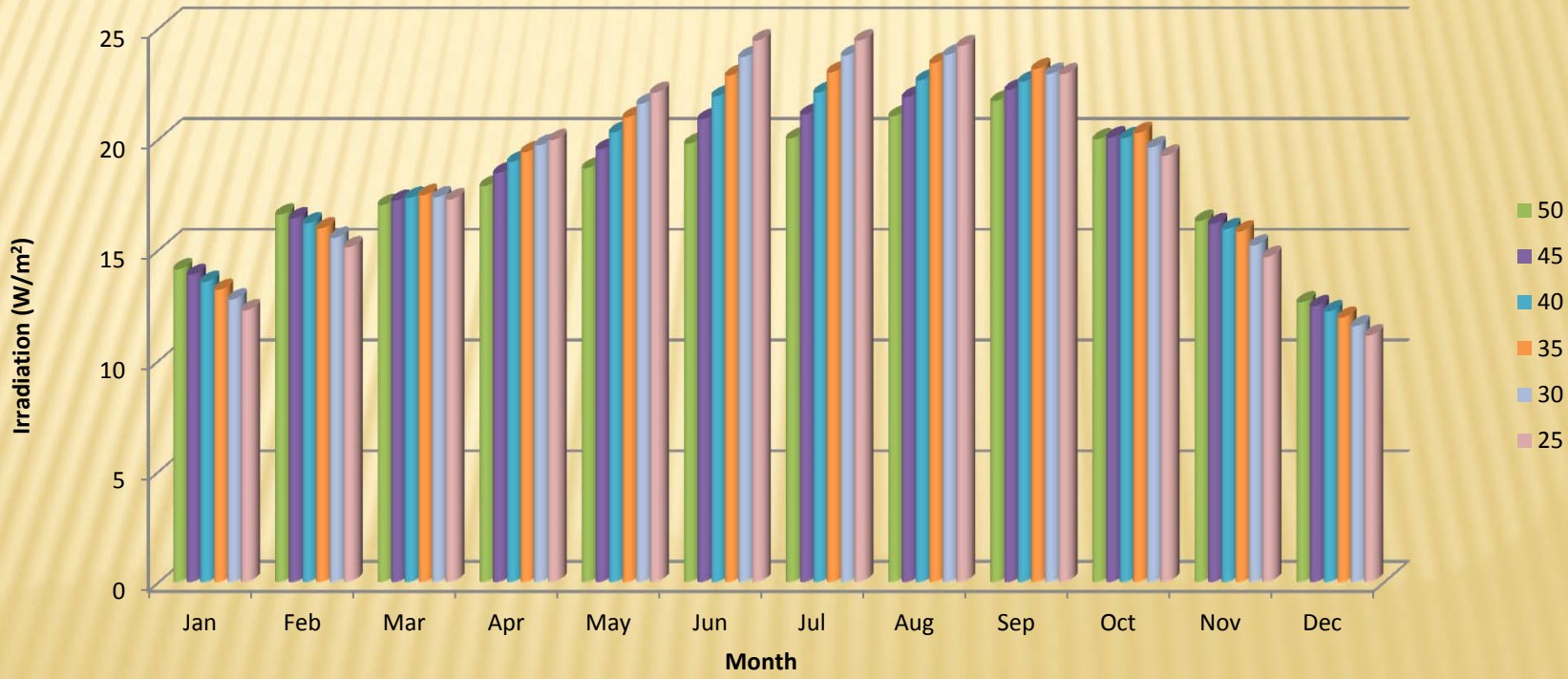
THE DESIGNED CYCLE



- In addition to thermal comfort, the designed system meets hot water demand of the house.
- Capital cost, environmental issues and intangible costs lead us to choose the absorption unit as the mechanical system.

INCIDENT RADIATION

- as the first step, hourly total solar radiation on the tilted surface is calculated. The results represent the effect of the surface orientation.

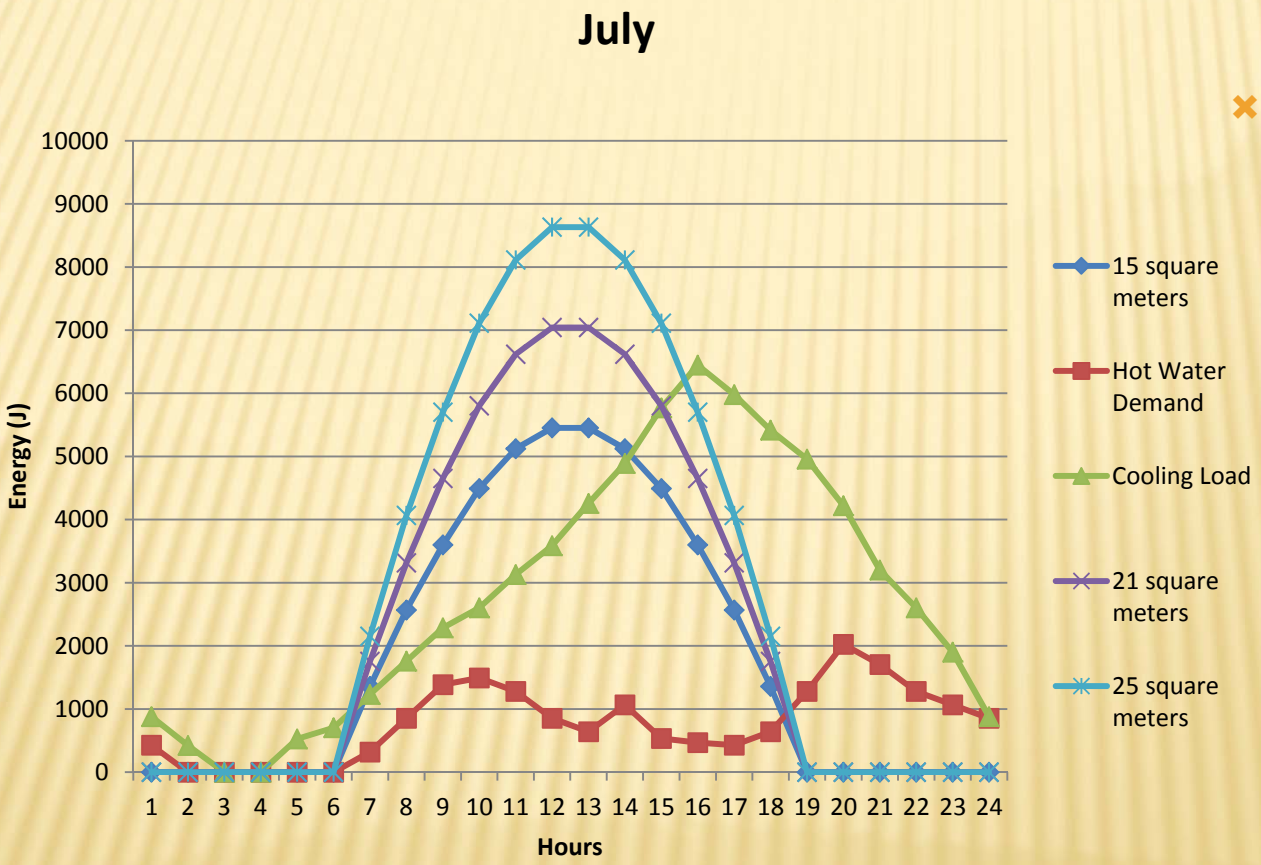


UTILIZABLE ENERGY

- monthly average hourly utilizable energy in the daylight hours for Tehran in calculated which represents a cold and a warm month. The data is symmetrical after the solar noon.

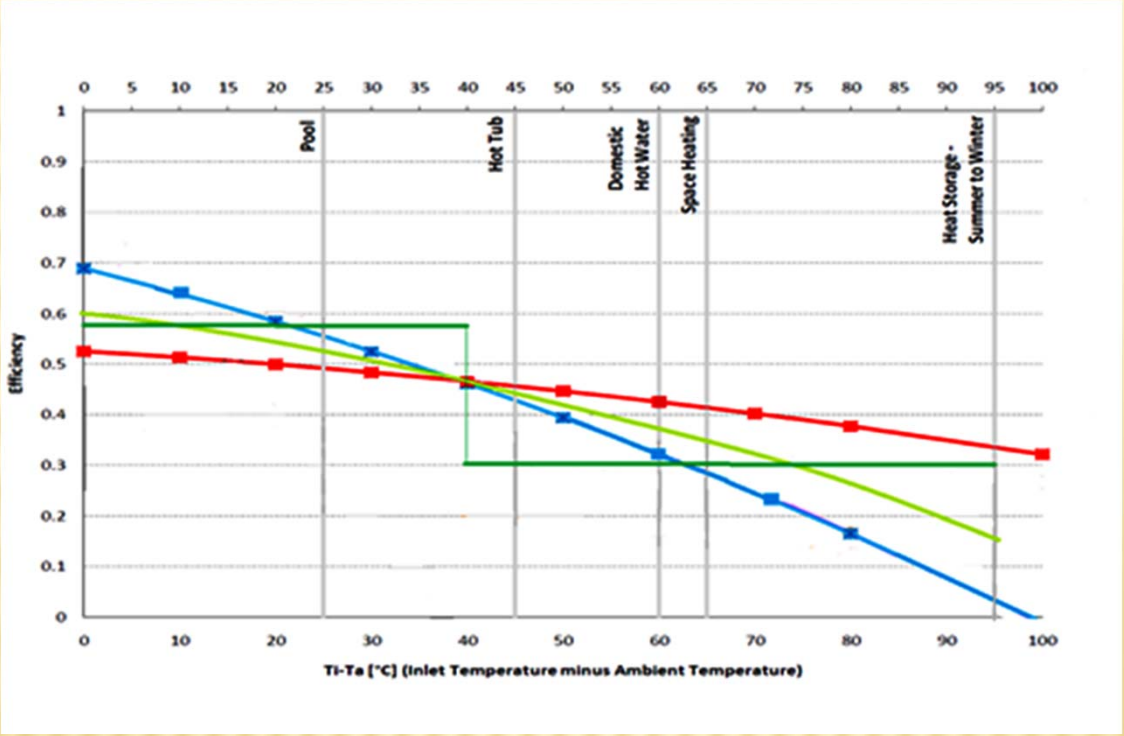
	6-7	7-8	8-9	9-10	10-11	11-12
January	0	0.2649	0.7041	0.7959	0.8317	0.8456
July	0.6348	0.7553	0.8096	0.8382	0.8536	0.8604

USEFUL ENERGY



- results for three different collector surface areas are shown. The available energy from collectors is a design parameter which has to meet the average demand for all of months.

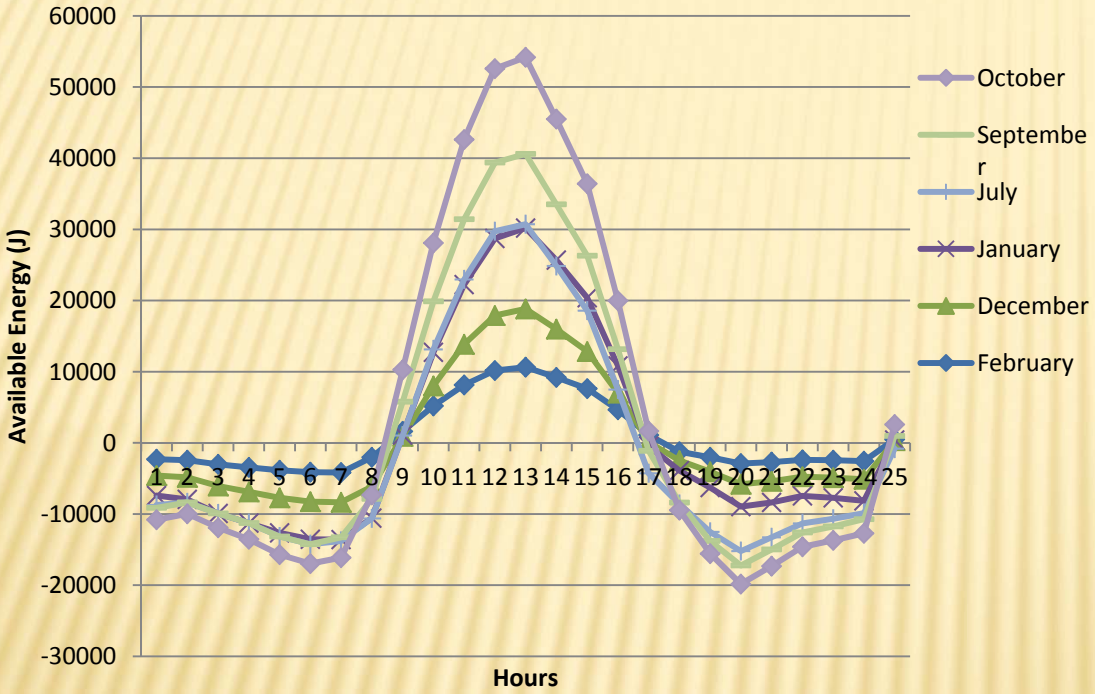
CHOOSING COLLECTORS



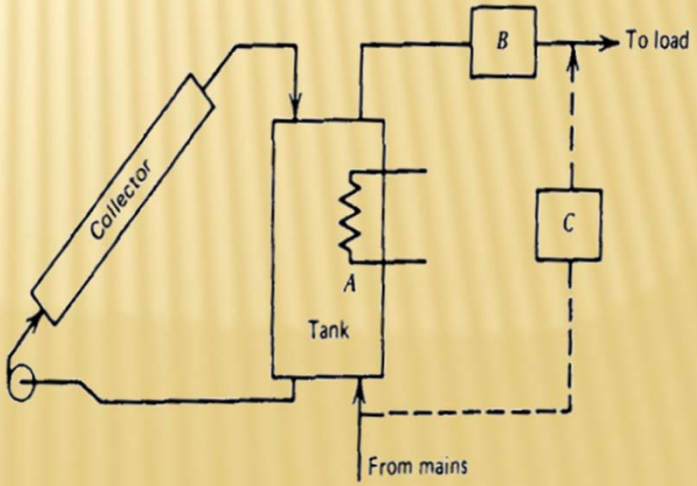
- flat-plate collectors cannot be a logical choice because of the remarkable drop in efficiency in these seasons
- So the light green curve is the result and the final calculations are based on the light green curve discretized to two constant values for warm and cold seasons.

three evacuated collectors with each area of 3m has been utilized along with four flat-plate collectors with 4m surface area to supply the space heating and cooling and DHW needs simultaneously.

AUXILIARY SYSTEM

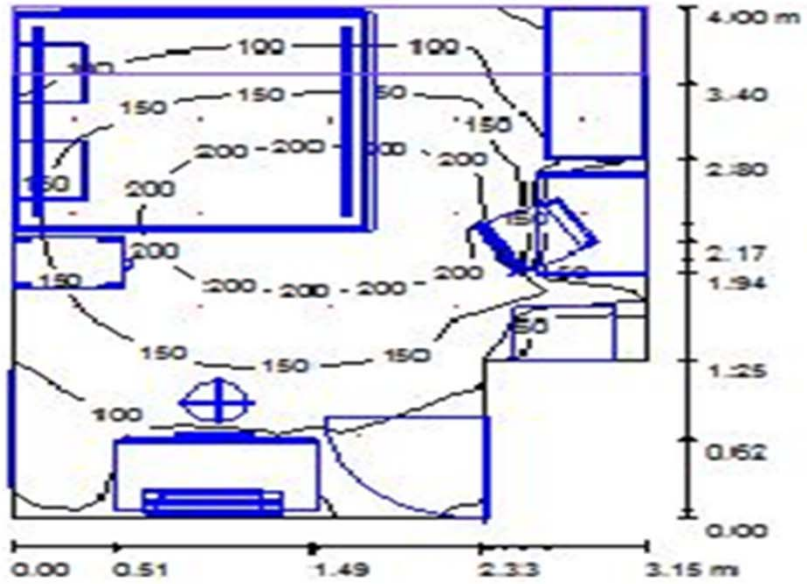


The existence of an auxiliary system is essential in the days in which the amount of sunlight is not sufficient or the duration is short.



LIGHTING

- lighting system uses fiber optics and LEDs instead of other common lighting tools
- “DIALux” 4.1 is utilized for modeling this lighting system. The lighting model for the master bedroom obtained by “DIALux” software is shown below



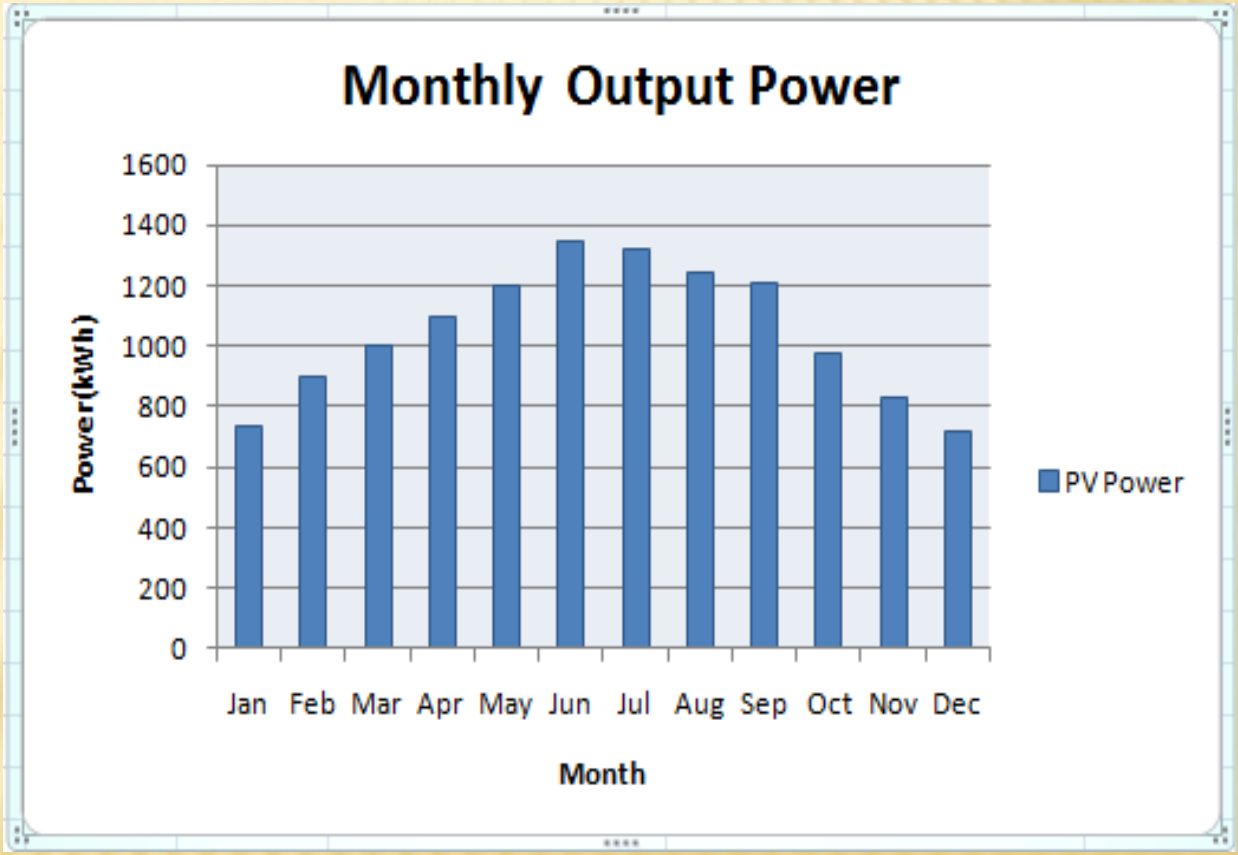
POWER DISTRIBUTION

Annual electricity	kWh
Lighting	310.23
Appliances	2079.72
Controller	240.00
HVAC	2043.59
Total	**4673.54**

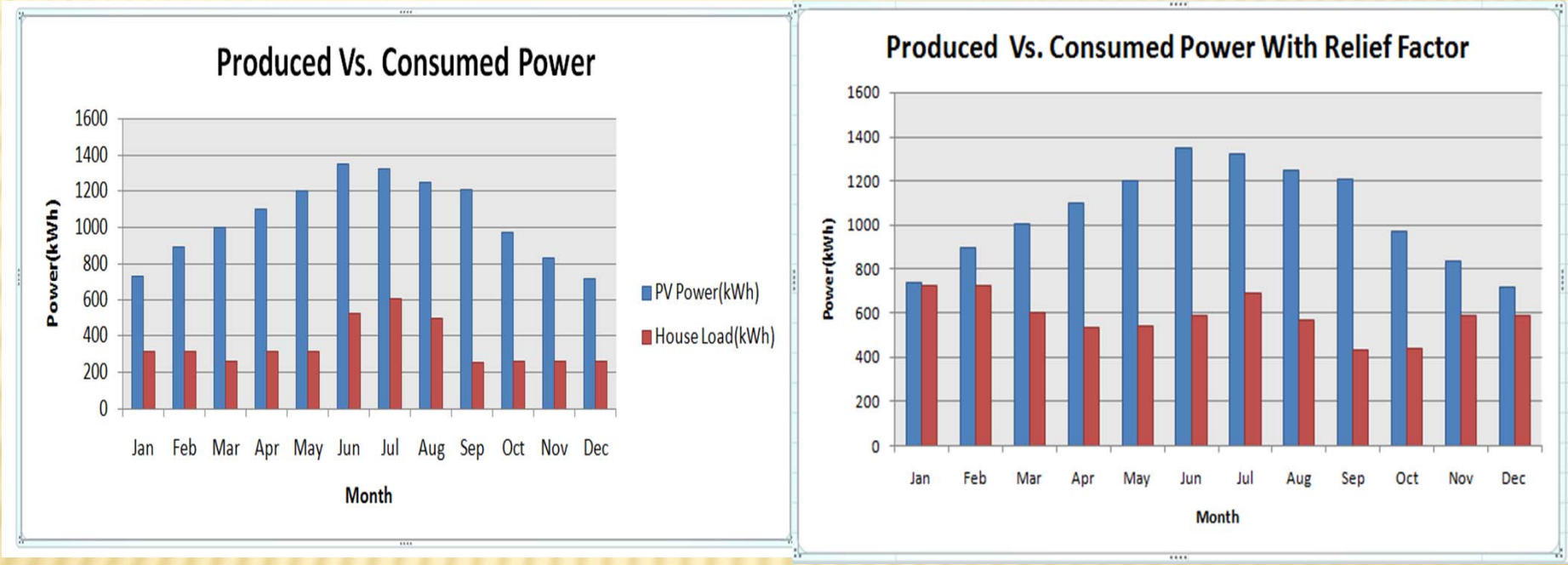
Annular electric demand for house electrical appliances, lighting, controllers and HVAC auxiliary systems are achieved for this typical home

MONTHLY ENERGY CONSUMPTION

Month	Power (kWh)
January	734.86
February	897.26
March	1004.56
April	1099.68
May	1200.02
June	1352.56
July	1322.4
August	1249.32
September	1210.46
October	973.24
November	834.04
December	716.3
Total	**12594.7**

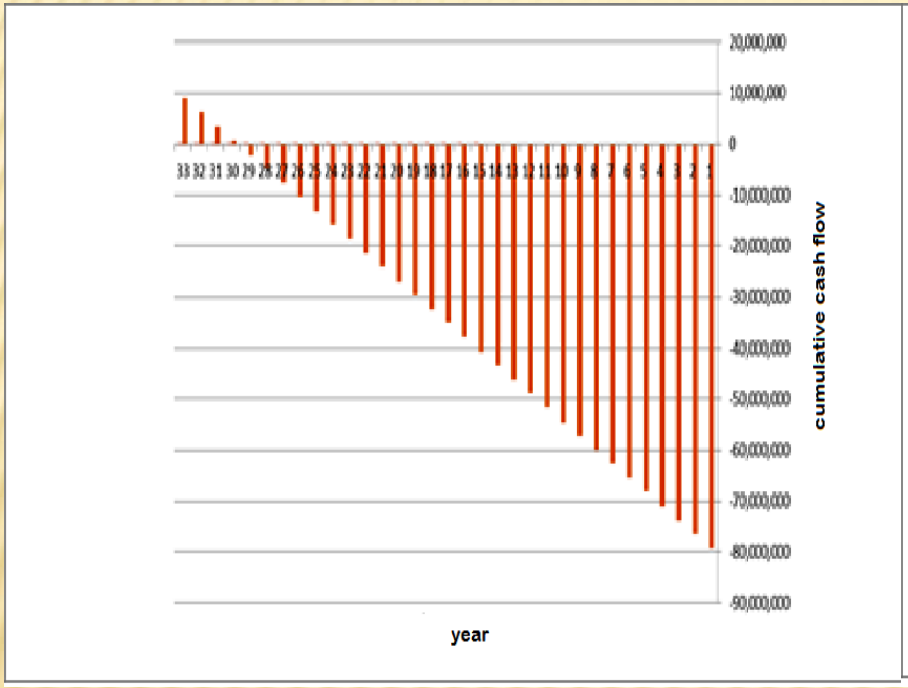


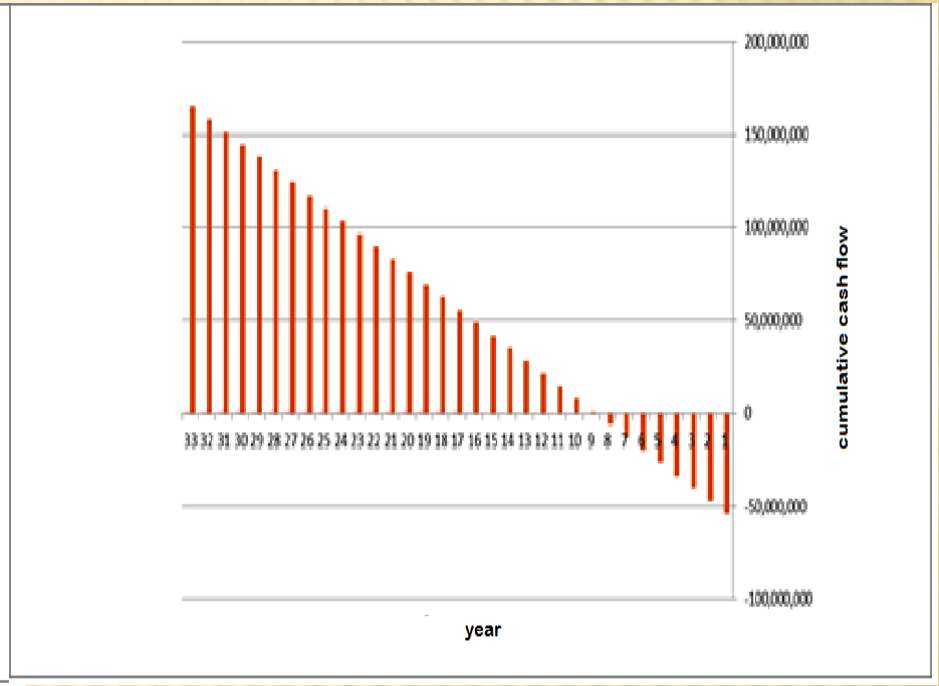
MONTHLY POWER SUPPLY AND DEMAND



we are able to compare the total output power with the total electric loads to come to a conclusion on whether we have a net zero system or not. Relief factor for energy consumption in months is assumed and the final diagram is achievd.

ECONOMICAL STUDY





the rate of return is calculated based on two approaches, the present cost of energy and the actual cost with no subsidies from the government. it is not economically justified for a private entrepreneur to invest in such a project unless the investment is supported with the government.

ACKNOWLEDGEMENT

Thank You for Your Attention

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