

# TOWARDS SUSTAINABLE ENERGY TO PROTECT THE ENVIRONMENT AND SAVE ENERGY. CASE STUDY (TRIPOLI- LIBYA)

Khayri M. M. Mousay<sup>\*a,1</sup>, Abdurahman B. Harari<sup>b,2</sup>,  
M.F.M. Alkbir<sup>c,3,4</sup>.

\*Corresponding author's  
email:  
<sup>a</sup>khair.mosa.km@gmail.com

<sup>1</sup>Higher Institute for Science and Technology Qasr Bin Ghashir  
Mechanical Technologies /Tripoli/Libya

<sup>2</sup>Higher Institute for Science and Technology, Qasr Bin Ghashir  
Department of Mechanical Technologies /Tripoli/Libya

<sup>3</sup>Facilities Maintenance Engineering Section (FAME),  
Universiti Kuala Lumpur (UniKL MITEC), Persiaran Sinaran Ilmu,  
Bandar Seri Alam, 81750, Johor, Malaysia

<sup>4</sup>Advance Facilities Engineering Technology Research  
Cluster (AFET-RC) Malaysian Institute of Industrial  
Technology.

<sup>a</sup>khair.mosa.km@gmail.com

<sup>b</sup>harari899@gmail.com

<sup>c</sup>munir@unikledu.my

## ABSTRACT

Energy is one of the major components of society, the backbone of life, and one of the economic pillars influencing the global economy. The problem of environmental pollution is threatening the world as a major climate problem due to the discovery of oil and other energy sources (such as energy and related gas emissions), rising global temperatures, melting ice, drowning in coastal cities, increased drought threatening food security is caused by. It is the biggest problem faced by countries around the world. All countries, including Arab countries, must achieve their goal of reducing greenhouse gas emissions by moving from environmentally friendly natural resources to energy production. Renewable energy can help reduce greenhouse gases and cope with climate change. The current study aims to investigate the factors that affect energy consumption in Tripoli – Libya. The Psychrometric chart issue by ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) used to point out the actual and recommended comfort zone for house residents. The result showed that traditional energy has High energy consumption and the design house is playing the main rule to reduce the energy consumption compared with the natural energy course.

**Keywords:** Alternative energy - Sustainable development - Environmental pollution - Traditional fuels

## 1.0 INTRODUCTION

Energy is consumed in all its forms to promote economic and social growth, and these goals are aspired to be achieved by all countries of the

world without exception. On the other hand, this consumption may cause harm to the environment, energy and water sources.

Concerns about the environment have become a worldwide concern, and the environment has been linked to economic development with a new

concept of sustainable development. In addition, global concern for the environment is an important tool for achieving human prosperity, either directly or indirectly, as the environment provides the rest of the production elements and raw materials involved in the production process, such as minerals, Water and oxygen, as well as genetic sources and resources. The environment also provides a suitable living space in which the quality of life is determined, and this quality not only is greatly influenced by the characteristics of the world around us, but the environment provides the medium in which the rest of the species live. The environment contributes to providing the function of the ecosystem, especially the metabolic capacity. Because the more human consumption of substances and goods increases the amount of waste (waste) in air, water or land, it is an environment for decomposing and dividing important products of our activities, and sometimes this process is very slow. It is one of the environmental issues, Climate change highlights an important issue of increasing electricity usage: air conditioning 60%, lighting and other electrical equipment 40% [1].

Buildings consume about one-third of the total primary energy resource, making it a prime target for energy efficiency measurement applications. Building energy consumption worldwide accounts for 30% of CO<sub>2</sub> emissions [2].

Osama Omar *et al*, studied the effects of daylight on the human body the result showed that the daylight design is proposed based on a hollow prism light guide tube. These designs act as lighting fixtures, increasing the guiding efficiency and evenly distributing natural light into the library space [3].

Tarek Abdel Salam *et al*. studied the two issues the first one first is housing design and the second was second assessment and analysis of the impact of these trends on the formation of identity in Arab countries [4].



Fig. 1. Structures of modern equipment developments in houses [4].

There are few factors that affect the environment urban environment in the Gulf area, particularly in the U.A.E such as religious factors, social factors, and environmental factors [5], [6].

The purpose of this study is to find the best solutions to reduce energy consumption and to encourage society to use renewable energy as sustainable energy to protect the environment.

## 2.0 METHODOLOGY

One of the main applications of psychometric charts is air conditioning. Most people feel comfortable when the temperature is between 22°C and 27°C and the relative humidity  $\phi$  is between 40 and 60%. This defines the "comfort" area depicted in the psychology chart as shown in Figure 2. The psychology chart is considered a key tool for figuring out the necessary treatment, such as heating or cooling, adding or dehumidifying moisture as needed to bring air in to

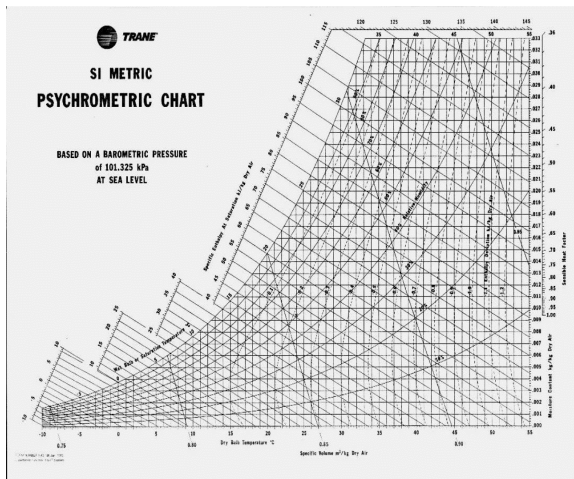


Fig. 2. Psychrometric chart

find the comfort zone of the home occupants understudy in Tripoli-Libya. furthermore, to identify the important factors influencing energy consumption and hazardous environmental risks. Several houses in Tripoli\_ Libya are considered case studies that determine the value of energy costs and influence designs to reduce energy consumption.

### 3.0 RESULT AND DISCUSSION

#### 3.1. The Approach of Sustainable Development

Sustainability has become an inevitable trend in the region as a result of the socio-cultural and economic changes of the Arab society over the past decades. In architecture, different expressions were applied to the application of the principles of sustainability to the design of modern houses, and these expressions have created architectural trends that have the same principles and content but differ in form and character. Based on the energy-saving and the sustainable energy laws the house design becomes very important deepened on the location of the country or house place. The factors that impact the energy-saving and sustainability such as temperature deference and wind energy and value of sun.

#### 3.2. Influence of Air Properties on Energy Consumption

As can be seen in Figure 3, the average temperature in Libya. All climate diagrams on this site are taken from data collected by an official weather station in Tripoli at 63 m above sea level [7].

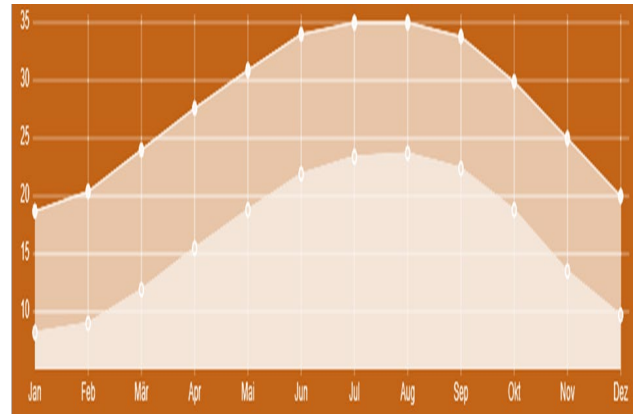


Fig. 3. Average daytime and nighttime temperatures in Libya [7]

Depending on the collected results, you can draw the comfort zone as shown below according to the highest and lowest temperatures and relative humidity. In Libya, the comfort zone and the remedies that people need to feel at ease are air conditioning, dehumidification and heating along with humidification. This will be in northern Libya.

Central air conditioners are commonly used in homes to provide cooling by circulating cold air through the air conditioning ducts outside the home. Energy use of central air conditioners varies widely depending on the region's climate, and central air conditioners operate 3 to 7 months a year depending on the outside temperature. The average central AC uses 3,000 to 5,000 watts of power for about 9 hours per day during the hot months. When the air conditioning system brings 60% of the air to the comfort zone at 22° C, it is necessary to use an electric heater to heat the air, so the power consumption is moderate.

Libya electricity prices	Household, kWh	Business, kWh
Libyan dinar	0.020	0.031
U.S. dollar	0.015	0.023

Table 1. Libya electricity prices are shown in table 1 as last March 2020 recorded

Prices (kWh) Prices are listed in Table 2.

Cost	Household, kWh	Business, kWh
Cost Per Hour	0.0525	0.0805
Cost Per Day	0.4725	0.7245
Cost Per Month	14.37	22.04
Cost Per Year	172.48	264.47

Table 2. Energy consumption in Libya by using traditional energy used 9 h/day by USD for 3500- kWh for water or air heat heater.

As can be seen in Figure 4, the actual air properties are not aggregated with the comfort zone, especially at temperature. The temperature must be raised to 22 ° C. For this reason, the heater is used for more than 9 hours a day, the natural energy reduces energy consumption by more than 50%. Natural renewable energy such as solar and wind energy.

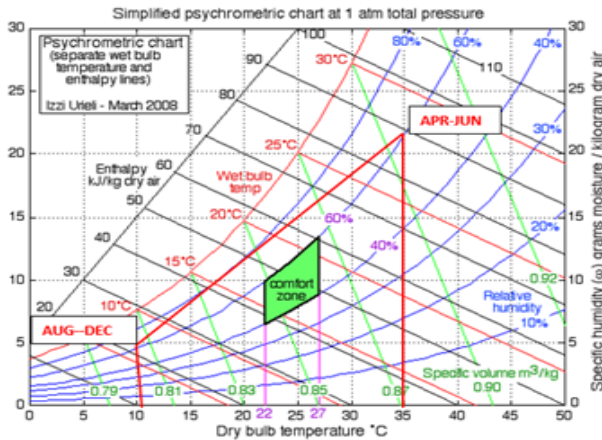


Fig. 4. Comfort zone chart with actual and ideal areas in Libya

From the above results, it can design the farm work on the difference between renewable energy and traditional energy as shown in Figure 5. The difference between the two types of energy in terms of cost and energy consumption. Renewable energy shows not only the cost but also low energy consumption compared to traditional energy.

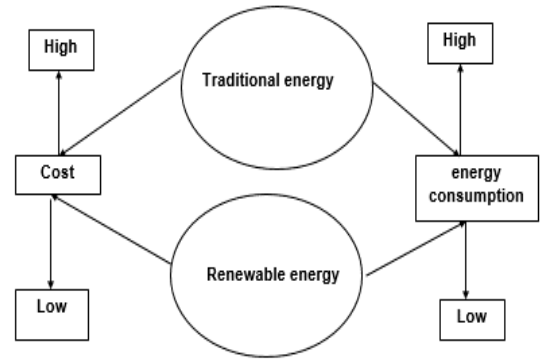


Fig. 5. Farm work for the deference renewable and traditional energy

#### 4.0. IMPACT OF THE DESIGN ON THE ENERGY CONSUMPTION

The location and design of the house are very important to reduce energy consumption and is suitable for renewable energies such as solar energy and wind energy. Green buildings should be designed to reduce energy consumption as much as possible. Figure 6 shows a leak in the design leading to a leak of sunlight per day. Figure 7 shows a good design that reduces energy consumption by looking at the figure it can be seen that the window is very broad and facing the sunshine for almost 6 hours/Day. As well as the natural ventilation by using the grilles in the high part of the building.

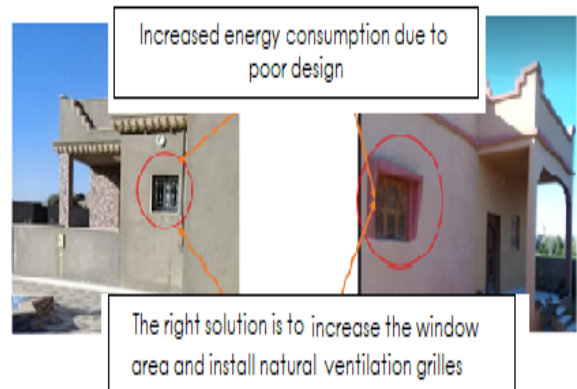


Fig. 6. Wrong houses design



encouragement of the Institute of Advanced Science and Technology, Qasr Bin Gnasher.



Good design towards sustainable energy development

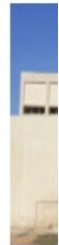


Fig. 7

Libya electricity prices	Household, kWh	Business, kWh
Libyan dinar	0.020	0.051
U.S. dollar	0.015	0.023

## References

- [1] Pina, A., P. Ferrão, J. Fournier, B. Lacarrière, and O. Le Corre. 2017. "ScienceDirect ScienceDirect Experimental Study of a Solar Wall Collector with PCM towards the Natural Ventilation of Model House Assessing the Feasibility of Using the Heat Demand-Outdoor 2 Demand Forecast Temperature Function for a Long-Term Heat and Pre." *Energy Procedia* 138:32–37.
- [2] Paone, Antonio. 2018. "The Impact of Building Occupant Behavior on Energy Efficiency and Methods to Influence It: A Review of the State of the Art."
- [3] Antonio, A., Osama Omar, and Berta Garci. 2018. "Optimization of Daylight Utilization in Energy Saving Application on the Library in Faculty of Architecture, Design and Built Environment, Beirut Arab University." 3921–30.
- [4] Abdelsalam, Tarek. 2013. "The Impact of Sustainability Trends on Housing Design Identity of Arab Cities." *HBRC Journal* 9(2):159–72.
- [5] Franco, Andrea, Marjan Shaker, Dikolela Kalubi, and Silvia Hostettler. 2017. "A Review of Sustainable Energy Access and Technologies for Healthcare Facilities in the Global South." *Sustainable Energy Technologies and Assessments* 22:92–105.
- [6] Al-Mebayedh, Hamad. 2013. "Climate Changes and Its Effects on the Arab Area." *APCBEE Procedia* 5:1–5.
- [7] America, Europe and Asia Africa. 2020. "The Climate in Libya." 1–3.

## 5.0. CONCLUSION

With the power crisis in Libya, heating and cooling power will face serious problems, leading to high costs and environmental risks. In addition, the home design according to this study showed design leaks and did not follow the natural resources available to reduce energy consumption.

The conclusion can be stated as follows:

1. The two factors have emerged in the Tripoli-Libyan city of sustainable energy, such as the design and location of their homes and the use of green technology to reduce energy consumption.
2. The results confirm that natural ventilation reduces energy consumption.
3. As a result, renewable energy a good an option to safe environment.

## Acknowledgement

Many thanks to The First International Maghreb Conference for giving the authors the opportunity to participate in the First International Conference and the financial support given to publishing this work. Moreover, Authors would like to express our gratitude to University Kuala Lumpur-Malaysian Institute of Industrial Technology (UniKL MITEC), thanks for the