

# Energy Consumption Using HOMER Software

Ramya Sarvani Yemineni, Anand Vineel Gandhi, Hari Kiran Vege, Kolla Bhanu Prakash

**Abstract:** *The present and future of power industries rely on effective usage of electric grids integrated with Information and communication technology which are called as smart grids. These grids provide better quality of service in terms of better resource and asset management, finding out faults in the system, efficient energy consumption by decreasing demand and supply gap. The present work throws light on preliminary investigation on energy and power consumption from the real time data collected from a higher education institution. Analysis is done using HOMER software.*

**Keywords:** Power, Energy, Grid, Photo-voltaic array, Fuzzy.

## I. INTRODUCTION

In the contemporary world we have a huge extent for the evolution in power generating systems in a view of eco-friendly technology such as using non-conventional energy sources for generating of power. [7] This is technically tenable and environmentally amiable. All over the globe, there is made an effort to study the viability of non-conventional energy which includes hybrid system as a substitute of diesel generator.[8] This hybrid power generation works with foremost non-conventional source in collateral union of a stand by secondary conventional energy module and storage capacity. [9]

Several countries all over the world still deficient in having the opportunity of using electricity, even though there is an effort for electrification. [10] Moreover, in numerous places people with electricity can only count on irregular and low-grade electric power. [11]

Statistical analysis say 66.98% of the world which is still developing moves with not having household electric power. Many countries like Tanzania, Malawi, Chad, South Sudan and a few other countries supply the electricity to less than 15% of its population. [12,13]

Africa has made an initiative in putting renewable energy systems into the scene like solar, wind, and geothermal generators to supply electricity to the rural African areas like listed above. [14,15]

Nigeria has a rich supply of non-conventional energy sources, where the important one being wind, solar energy, large and small hydropower with capability for hydrogen fuel, biomass, geothermal and ocean energies. [16, 17, 18]

The major limitations in the swift development and proliferate of technologies for the utilization of non-conventional energy

sources in the country are the truancy of market and the dearth of appropriate policy, institutional framework with regulation to galvanize the demand and attract investors. [19, 20] The relative low quality of the systems evolved and the high initial in advance cost also constitute barriers to the development of markets.[1]

HOMER is an abbreviation of Hybrid Optimization Model for Electric Renewable. It is a software developed by NREL (National Renewable Energy Laboratory, USA) which is used widely. [21, 22] It has been deployed to design favorably and to estimate the viability of hybrid wind/solar system. This software plays a powerful role in designing, sizing and planning hybrid renewable energy systems. [23, 24] Models made by HOMER are off-grid and grid comprising hydro, wind, biomass, solar, connected power systems and non-renewable power sources. [25,26]

## II. RELATED WORK

K.R.Ajao et al. performed on analyzing the price benefit of a wind-solar power hybrid system and regulate the pay-back period which when compared to the cost per Kilowatt of utility power supply. [27, 28] This study conducts an analysis of current state utilization of renewable energy where in Nigeria there is an abundant source of renewable energies but are in a state of not completely utilizing it. [29] This study was performed for around ten households with the same power consumption figure showed that the standard consumption for household is 400 units using the HOMER software [1].

Mohammad Saad Alam et al. designed a hybrid electricity generation system suitable for remote area application by using solar energy, wind energy and Fuel cell. In this study a fuzzy logic controller has been introduced to yield continuous electricity based on the economic electricity generation for analysis. Later on finding the results after the simulation, it is found that non-conventional energy sources would be feasible solution for distributed generation of electric power for stand-alone application at remote location. By using the HOMER software it is found that the price will be steeped-down than the considered value [2].

M.Kashif Shahzad et al. proposed an economically and optimized design for power generation by making use of hybrid energy resources like Solar energy and Biomass which is performed in a district of Layyah in Punjab focused on agricultural farm and a residential community. The electric power load data of irrigation and residential needs were collected. Input details such as electric or heat consumption loads are used to perform simulations based on different systems parameters or hybrid union of components and leads in the generation of the optimized

**Revised Manuscript Received on October 17, 2019.**

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system parameters which are listed under the terms of Cost of electricity (COE) and Net present cost (NPC). This illustrates the impact of non-conventional energy received and storage on COE and NPC using HOMER software [3].

Prashant Kumar et al. presented a concept about design, simulation and analysis of stand-alone hybrid non-conventional energy resources for ATM machine in unreachable locations.

This paper gives a study about viability of Wind-Solar-Diesel hybrid electricity generation system with maximizing the use of renewable power generation system while abating the total system cost which is done using HOMER software [4].

N.K.Roy et al. performed analysis for the economic viability of grid connected hybrid electricity generation system to meet load essentials. Designed an on-grid and off-grid hybrid power system models using HOMER software and need to input data to evolve optimization results.

This study shows that comparative analysis between on-grid and off-grid is that grid connected is more efficient than compared to conventional hybrid system [5].

Hassan A I Garni et al. presented an optimal design of solar PV grid connected system to achieve technical and economic feasibility with passable use of solar energy at lower investment. This system presents optimal design considering techno-economic factors includes Net present cost(NPC), Cost of energy(COE), generation of electricity using solar power and photovoltaic array tracking.[6].

### III. METHODOLOGY

The hybrid non-conventional energy we considered contains of Solar (Photovoltaic) array, wind turbine, energy storage device (battery) and a converter. For emergency cases battery storage is used as aid for the system that we have considered which acts as a power storing material.

The system which has considered is drafted for an off-grid case for a university to supply on daily basis. The required data is taken from the university load supply which are used for wind and solar resources.

The initial step is to take the electric loads as input and perform simulations based on the configuration of hybrid system that has been considered. The tasks done by HOMER are simulating data, analyzing, optimizing.

Even before performing analysis using HOMER software for hybrid wind/solar system, a pre-HOMER evaluation is presented by considering the load data of the university. After taking the load used data in to the HOMER software the analysis is performed using the existed equipment in the software.

For this study, the capacity of the HOMER modelled equipment is modulated according to the requirement. After

the analysis is done a final decision is made based on the market energy costs.

This generates the COE (cost of electricity) and NPC (net present cost).HOMER helps in the balance of making energy by simulating the electric loads for every hour of each day throughout the year that a system can supply.

### IV. RESULTS AND DISCUSSION

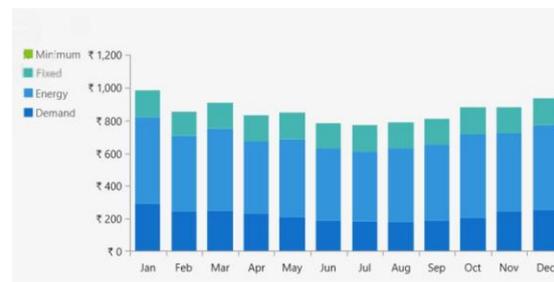
#### Annual Utility Bill:

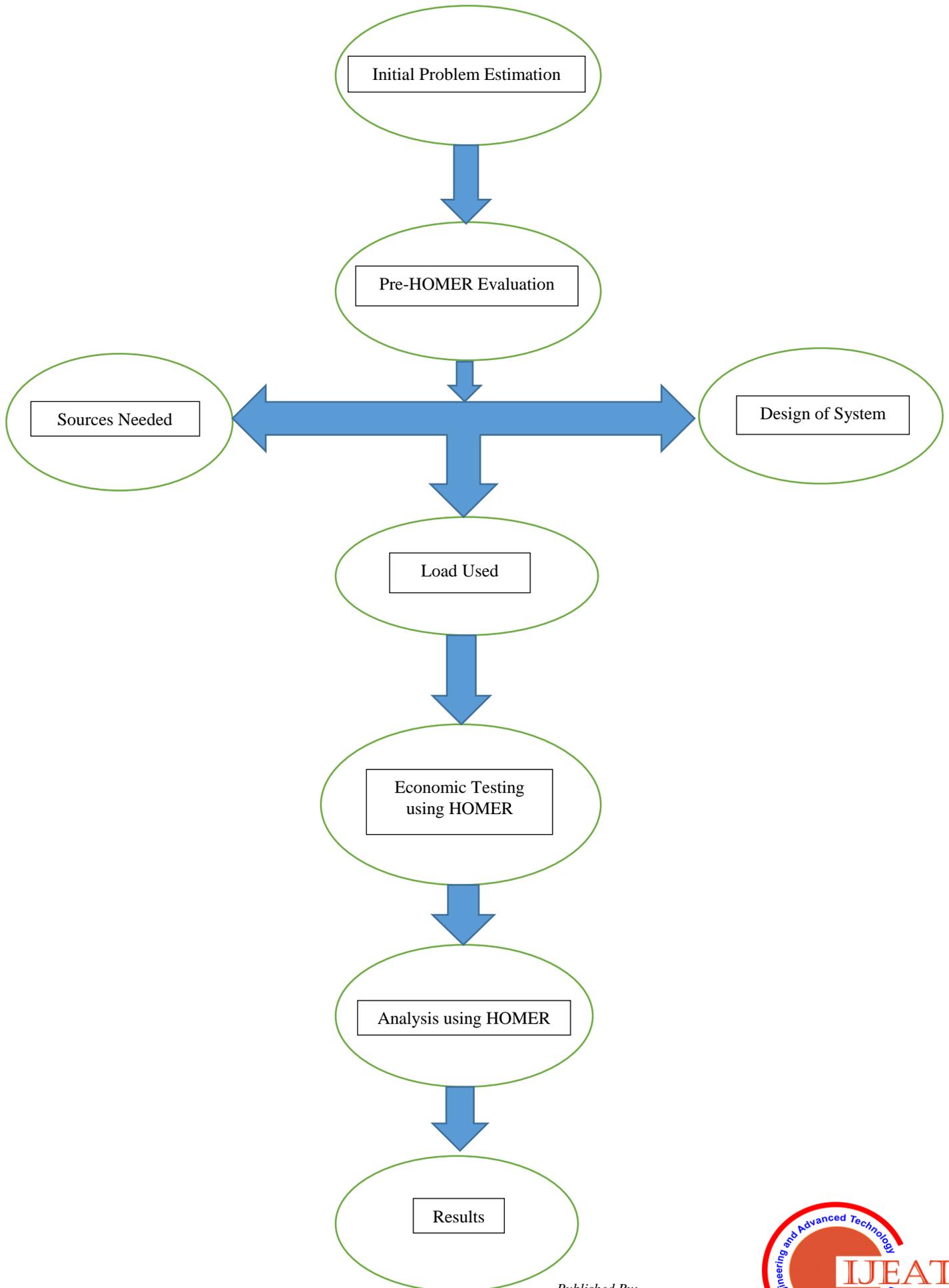
The considered hybrid system with Photovoltaic array ,Wind turbine and battery. A consumption charge of 5,686 rupees and demand charge of 2,674 rupees have been in the annual utility bill.

Consumption Charge	₹ 5,686
Demand Charge	₹ 2,674
Fixed Rate	₹ 1,902
Minimum Rate	₹ 0.00
Taxes	₹ 0.00
Total	₹ 10,263

#### Cost of Electricity:

The cost varies with the demand of the power a particular system requires. We can see the Fixed cost,Energy cost and the Demand cost separately for each month in the graph below.





## Temperature rates:

Each month have been set with average temperature and graph goes like below:



## Loads Monthly:

Each have been given a particular load data by giving load data of each hour in a day for every day in a month. The graph shows the loads and radiation.



## Demand Rates:

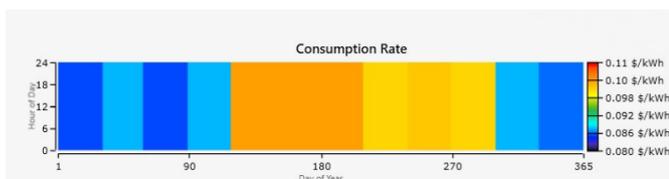
The demand rates for nearly first 160 days is higher than the rest of the days in the year.

The graph is shown below:



## Consumption Rates:

The consumption rate in a year varies periodically and repeatedly from low to high and then to low at the end of the year. The graph is shown below:



## V. CONCLUSION

This paper focuses on energy consumption, payload, and demand responses in smart grid environments. Results for all parameters are well identified and studied in detail to give clear comparison. Analysis using HOMER software provided very good satisfactory results.

## REFERENCES

1. Ajao.,O.A.Oladosu & O.T. Popoola., "Using HOMER Power Optimization Software for Cost Benefit Analysis of Hybrid-Solar Power Generation Relative to Utility Cost in Nigeria",2011,IJRRAS.
2. Ohammad Saad Alam.,David W.Gao.,"Modeling and Analysis of a Wind/PV/Fuel Cell Hybrid Power System in HOMER ",2007,IEEE.
3. Kashif Shahzad.,Adeem Zahid.,Tanzeel ur Rashid.,Mirza Abdullah Rehan.,Muzaffar Ali.,Mueen Ahmad.,"Techno-economic feasibility analysis of a solar-biomass off grid system for the electrification of remote rural areas in Pakistan using HOMER",2017,ELSEVIER.
4. rashant Kumar.,Rahul Pukale.,Nilesh Kumabhar.,Utkarsh Patil.,"Optimal Design Configuration Using HOMER",2015,ELSEVIER.
5. D.Nurunnabi.,N.K.Roy.,"Grid Connected Hybrid Power System Design Using HOMER",2015,ICAAE.
6. Assan Al Garni.,Anjali Awasthi.,"Techno-Economic Feasibility Analysis of a Solar PV Grid-Connected System with Different Tracking Using HOMER Software",2017,IEEE
7. Prakash, K.B. & Rajaraman, A. 2016, "Mining of Bilingual Indian Web Documents", Procedia Computer Science, 89, pp. 514-520.
8. Prakash, K.B. & Rangaswamy, M.A.D. 2016, "Content extraction of biological datasets using soft computing techniques", Journal of Medical Imaging and Health Informatics, vol. 6, no. 4, pp. 932-936.
9. Kavuri, M. & Prakash, K.B. 2019, "Performance comparison of detection, recognition and tracking rates of the different algorithms", International Journal of Advanced Computer Science and Applications, vol. 10, no. 6, pp. 153-158.
10. Kolla, B.P., Dorairangaswamy, M.A. & Rajaraman, A. 2010, "A neural network model for documents containing multilingual Indian texts", 2010 International Conference on Computer and Communication Technology, ICCCT-2010, pp. 451.
11. Kolla, B.P. & Raman, A.R. 2019, "Data Engineered Content Extraction Studies for Indian Web Pages, Advances in Intelligent Systems and Computing, 711, pp. 505-512.
12. Naga Pawan, Y.V.R. & Prakash, K.B. 2019, "Variants of particle swarm optimization and onus of acceleration coefficients", International Journal of Engineering and Advanced Technology, vol. 8, no. 5, pp. 152-153.
13. Pradeep Kumar, V. & Prakash, K.B. 2019, "QoS aware resource provisioning in federated cloud and analyzing maximum resource utilization in agent based model", International Journal of Innovative Technology and Exploring Engineering, vol. 8, no. 8, pp. 2689-2697.
14. Prakash, K.B. 2018, "Information extraction in current Indian web documents", International Journal of Engineering and Technology(UAE), vol. 7, no. 2, pp. 68-71.
15. Prakash, K.B. 2017, "Content extraction studies using total distance algorithm", Proceedings of the 2016 2nd International Conference on Applied and Theoretical Computing and Communication Technology, iCATccT 2016, pp. 673.
16. Prakash, K.B. 2015, "Mining issues in traditional indian web documents", Indian Journal of Science and Technology, vol. 8, no. 32, pp. 1-11.
17. Prakash, K.B., Ananthan, T.V. & Rajavarman, V.N. 2014, "Neural network framework for multilingual web documents", Proceedings of 2014 International Conference on Contemporary Computing and Informatics, IC3I 2014, pp. 392
18. Prakash, K.B. & Dorai Rangaswamy, M.A. 2019, "Content extraction studies for multilingual unstructured web documents, Advances in Intelligent Systems and Computing, 749, pp. 653-664.
19. Prakash, K.B. & Dorai Rangaswamy, M.A. 2016, "Content extraction studies using neural network and attribute generation", Indian Journal of Science and Technology, vol. 9, no. 22, pp. 1-10.
20. Prakash, K.B., Dorai Rangaswamy, M.A. & Ananthan, T.V. 2014, "Feature extraction studies in a heterogeneous web world", International Journal of Applied Engineering Research, vol. 9, no. 22, pp. 16571-16579.
21. Prakash, K.B., Dorai Rangaswamy, M.A., Ananthan, T.V. & Rajavarman, V.N. 2015, "Information extraction in unstructured multilingual web documents", Indian Journal of Science and Technology, vol. 8, no. 16.
22. Prakash, K.B., Dorai Rangaswamy, M.A. & Raman, A.R. 2010, "Text studies towards multi-lingual content mining for web communication", Proceedings of the 2nd International Conference on Trends in Information Sciences and Computing, TISC-2010, pp. 28.

23. Prakash, K.B., Kumar, K.S. & Rao, S.U.M. 2017, "Content extraction issues in online web education", Proceedings of the 2016 2nd International Conference on Applied and Theoretical Computing and Communication Technology, iCATccT 2016, pp. 680.
24. Prakash, K.B., Rajaraman, A. & Lakshmi, M. 2017, "Complexities in developing multilingual on-line courses in the Indian context", Proceedings of the 2017 International Conference On Big Data Analytics and Computational Intelligence, ICBDACI 2017, pp. 339.
25. Prakash, K.B., Rajaraman, A., Perumal, T. & Kolla, P. 2016, "Foundations to frontiers of big data analytics", Proceedings of the 2016 2nd International Conference on Contemporary Computing and Informatics, IC3I 2016, pp. 242.
26. Prakash, K.B., Rangaswamy, M.A.D. & Raja Raman, A. 2012, ANN for multi-lingual regional web communication, Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 7667 LNCS(PART 5), pp. 473-478.
27. Prakash, K.B., Rangaswamy, M.A.D. & Raman, A.R. 2013, "Attribute based content mining for regional web documents", IET Seminar Digest, pp. 368.
28. Prakash, K.B., Rangaswamy, M.A.D. & Raman, A.R. 2012, Statistical interpretation for mining hybrid regional web documents, Communications in Computer and Information Science, 292 CCIS, pp. 503-512.
29. Ismail, M., Prakash, K.B. & Rao, M.N. 2018, "Collaborative filtering-based recommendation of online social voting", International Journal of Engineering and Technology(UAE), vol. 7, no. 3, pp. 1504-1507.