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# SITE, SEIZING AND ANALYSIS OF STAND-ALONE MICROGID DESIGN WITH ECONOMY IN HOMER SOFTWARE

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***Abstract- Decentralized sustainable power source advancements dependent on, for example, Photo Voltaic (PV) or/and Wind Turbine Generators (WT) address the above boundaries to a huge degree and are subsequently considered as developing exchange power solutions to residual loads. There is stand-alone micro grid PV/WT with utility grid connected systems using power storage component i.e. PV/wind case, PV/WT/grid case along WT-Battery-grid connected cases were designed, analysis along comparisons done in this paper. The design along ratings is developed about to micro grid deliver the residential AC load presented in the HOMER. PV/WT systems are considered the maximum power point tracker (MPPT) is combined. In HOMER simulations, this concluded WT-Grid micro grid case is the most economical explication. Cost of economy along sensitivity results within sun radiation and wind data are also examined in particular location.***

## 1. Introduction

Micro grid PV/wind power producing frameworks are concentrated broadly. Vitality stockpiling is required in these frameworks because of the stochastic idea of wind and sun-based vitality. Generally, profound cycle lead corrosive batteries are utilized as the methods for vitality stockpiling. Be that as it may, there are numerous ecological concerns related with batteries; therefore, different options are looked about to purpose.

Software is created to measure the segments about to micro grid to coordinate the heap of a run of the mill home in the India that isn't situated close to the electric utility. Power sources like solar wind energy systems in micro grid. This design has been both examined [1-6] and executed [7-9].

Anyway, a definite monetary examination has not been done for these frameworks. In this paper an itemized monetary correlation between with grid and a without grid is introduced. The converter has taken also its small load in micro grid system.

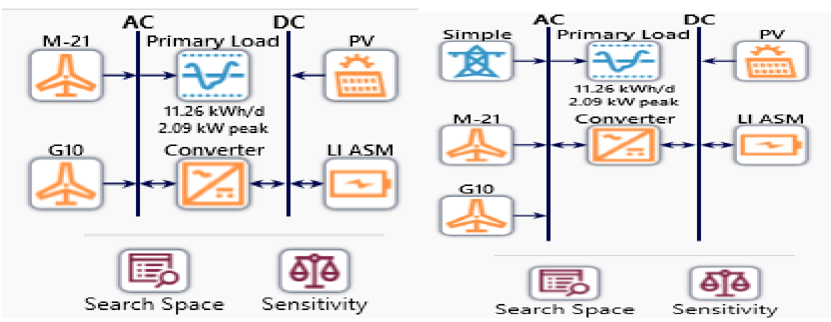

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Fig.1. Microgrid construction in homer with and without grid

Homer optimiser has shown in figure 1 for micro grid construction. If any excess PV or wind production, the utility grid turns on start to take the power from renewable generation, also the battery charge if battery exceeds grid is start take the excess electricity. If any deficit energy the grid and battery will supply to the load. Unit estimating is performed on arrangements, then the framework within PV/wind capacity and that with battery stockpiling. wind turbine is utilized in the framework and the quantity of photovoltaic (PV) boards is determined, utilizing the Loss of Power Supply Probability (LPSP) method [9-12], to coordinate age with load. In this paper, the LPSP strategy is adjusted from estimating the traditional battery stockpiling frameworks for structuring a PV/Wind turbine capacity framework. The Cost of Electricity (COE), and the absolute yearly expense are then determined for the two setups.

## 2. System design

### a. Photovoltaic in HOMER optimiser

Here photovoltaic cell (PV) modelled in homer optimiser typical model shown in figure.1, it can observe that PV cost table and graphs are presented. In the cost table capacity to capital cost, replacement cost and operation & maintenance cost observed in the table, and also per unit cost graph presented. These values are considered as typical values in HOMER software and it can size own values according to selected place in the homer. Here the place is selected podili town in prakasham district belongs Andhra Pradesh in India; in this place it has taken the solar irradiation by using NASA reports per year. The total cost against to kW graphs is taken in HOMER optimiser it can show in figure 2.

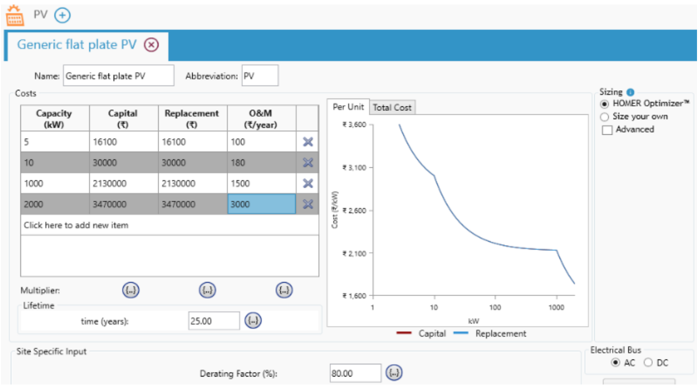


Figure.2. PV cell cost optimiser in HOMER

For the modelling of PV cell only one diode is using in single diode model, the electrical equivalent circuit diagram as shown in Fig. 2.2 this model is commonly used for cell based or module-based analysis. It consists of a diode, a current source, a series resistance and a parallel resistance.

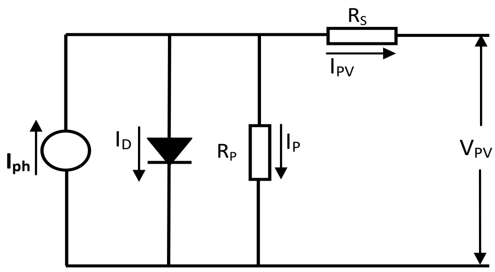


Figure. 3. PV Cell equivalent circuit

The photo voltaic current IPV is directly related to the insolation this relation is showing in equation (1)



(1)

$$I_{PV} = I_{Ph}(G_a, T) - I_D(G_a, T)$$

Where,

$$I_{Ph}(G_a, T) = I_{SCS}\left(1 + \Delta I_{SC}(T - T_S)\right) \times \frac{G_a}{G_{as}} \quad (2)$$

$$I_D(G_a, T) = I_{sat}(G_a, T) \times \left(e^{\left(\frac{V_{oc}}{V_t}\right)} - 1\right) \quad (3)$$

When this PV cell is open circuited the value of saturation current is

$$I_D(G_a, T) = I_{sat}(G_a, T) \quad (4)$$

$$I_{sat}(G_a, T) = \frac{I_{Ph}(G_a, T)}{e^{\left(\frac{V_{oc}}{V_t}\right)} - 1} \quad (5)$$

Therefore $V_{oc}$ as a function of temperature is as equation (6)

$$V_{oc}(T) = V_{ocs} + \Delta V_{oc}(T - T_S) \quad (6)$$

Thermal voltage $V_t$ is directly proportional to the temperature

$$V_t = \frac{n \times K \times T}{q} \quad (7)$$

As a function of voltage, the current of a cell is defined by

$$I_{PV} = I_{ph} - I_D\left[\exp\left(\frac{V_{PV} + R_s \times I_{PV}}{V_t}\right) - 1\right] - \frac{(V_{PV} + R_s \times I_{PV})}{R_p} \quad (8)$$

We can find out the current at maximum power point by putting the value of voltage at maximum power point as equation (9).

$$I_{MPP} = I_{Ph} - I_{sat} \times \left(e^{\left(\frac{V_{MPP} + I \times R_S}{V_t}\right)} - 1\right) \quad (9)$$

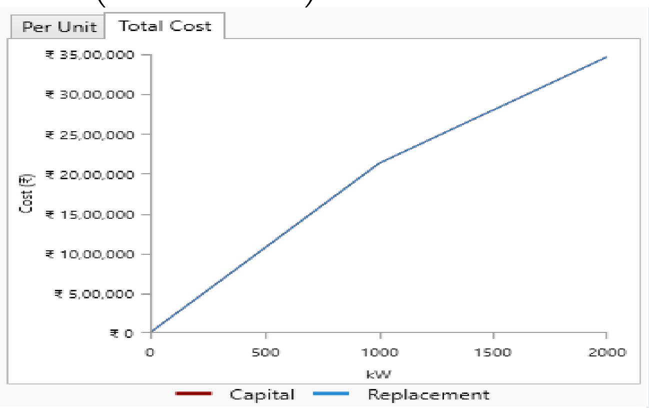


Figure.4. PV total cost per kW

b. Wind turbine in HOMER optimiser

Wind turbine also most promising technology in renewable energy system like PV, added to design to micro grid construction. Here generic 10 kw wind turbine is taken, the cost of wind turbine 1 unit capital cost is 50,000rs. Here it can see wind power curve against to wind speed to power output and at the 15m/s the highest power can extract using this model in HOMER is shown in figure 5, and life time is 20 years, replacement is taken 100% and O&M is rs 500.

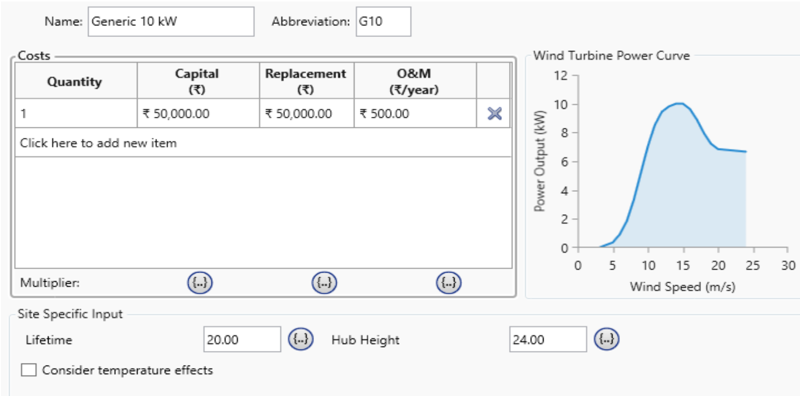


Figure.5. wind turbine cost optimiser and power curve in HOMER

*c.* Storage system

In micro grid construction the storage is main issue for uneven of renewable energy generation especially for night sessions. When the generation is high/low storage system can take charge /discharge. In this case battery is considered as a storage system lithium ion battery is selected in HOMER. Here 5 units of battery unit capital cost is 3,500rs, replacement cost is also same for first year and there is no O&M cost is shown in figure 6. Here it can observe cost to quantity graphs also.

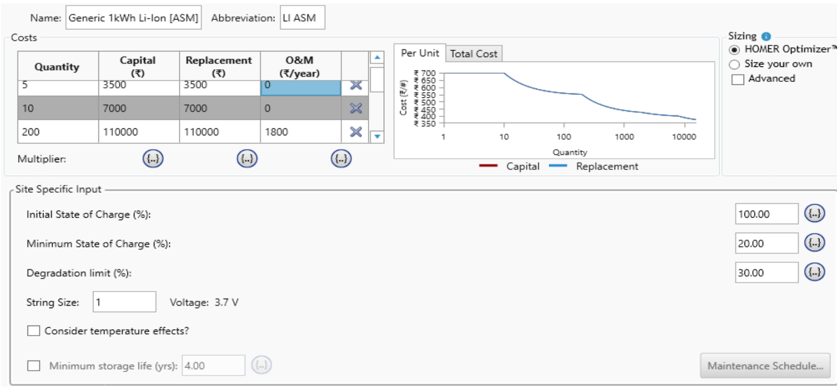


Figure.6. Battery cost optimiser in HOMER

d. Converter system

In the micro grid the converter system plays crucial role to exchanging the powers of AC to AC or DC to AC to the common AC bus for a different level of voltages and it is uses like bidirectional.

e. Electrical load

Electrical load considered as AC daily load profile consider as primary load in a daily load profile can enter 24 hours data entered in the table and graphs are observed. The average daily load kWh/hour is 11.26; peak load is 2.09 kW and load factor 0.22. In this modelling residual load is considered due to because of these type micro grids are more effective for domestic appliances. The HOMER having more types of loads like industrial, commercial and agricultural can see in the figure 7.


Figure.7. Daily electric load profile optimiser

## 3. SIMULATION RESULTS

The micro grid simulations are done by using HOMER software, in this simulations are examined by cost summary, savings and cumulative nominal cash flow graph is shown in figure 8, it gives the analysis of net present cost (NPC) is 28,217 rs and lowest cost of economy (LCOE) 0.007/kwh, the base case is comparing with the lowest cost system line indicates that varies the cost line when usage years is increasing. Here also can see that savings to normal grid to micro grid annualised utility bill savings, net present utility saving, annualised demand charge savings and annualised energy charge savings is discussed. Here it can observe each equipment cost with total NPC, generic 1 kWh means it wind turbine cost, simple tariff can be utility grid including converter system and the capital cost is rs3973.60 per kW of power production is shown in figure 9.

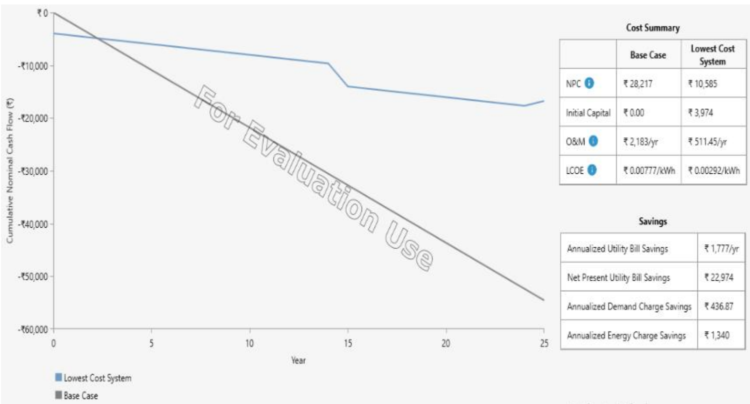


Figure.8. Annual cost summary and annual savings

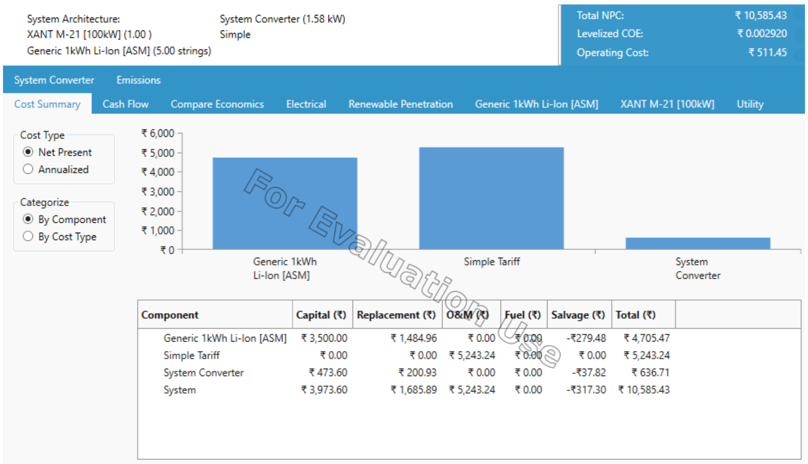


Figure.9. cost summary of different equipment's in mcro grid

Here the figure 10 examines the two systems base system and proposed system comparing the economics of the two microgrid systems, the first system is wind with grid and second one is wind with utility grid including battery and converter. The base system NPC is 28,217 and proposed system cost is 10,585 rs and also comparing economics in table shown in figure 12.

Electrical energy production examines by monthly basis of different energy sources in the microgrid the green colour shows that wind turbine production and orange colour indicate that utility grid production shown in figure 11. the total production of wind turbine is 2,80,438 kWh units is generating in a year, at the same time 51.8 kWh units is producing by the utility grid so in this area the wind turbine system more efficient comparing other sources. It can observe consumption side also ac primary load has taken 4,109 kWh units and remaining generating units of energy 2,76,284 kWh units is sent to the grid per a year and there is no excess electricity because of remaining units to are consuming by the utility grid.

Renewable energy penetration is discussed also throughout the year by day by day in the area is taken is shown in figure.12. in this figure it explains instantaneous renewable output divided by generation in 24 hours and 365 days in that July month is the highest penetration of energy using renewables, then it considers instantaneous renewable energy output divided by load 4000 units taken and reaming energy is sent to grid and non-renewable energy sources are also consider but very less utilisation of these sources.

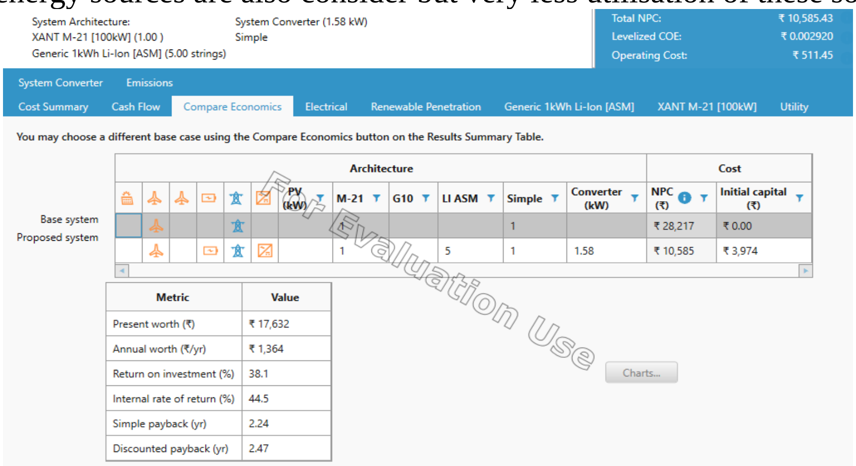


Figure .10. Comparing of economics with base system and proposed system

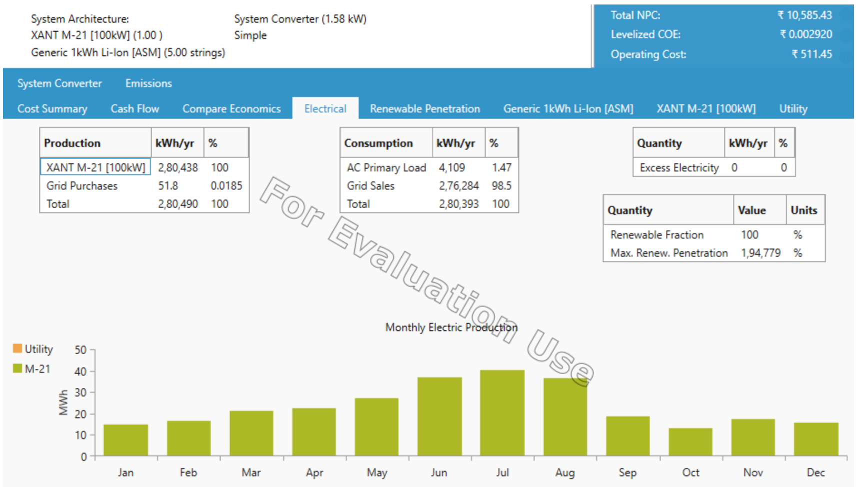

Figure .11. electrical energy production by monthly basis

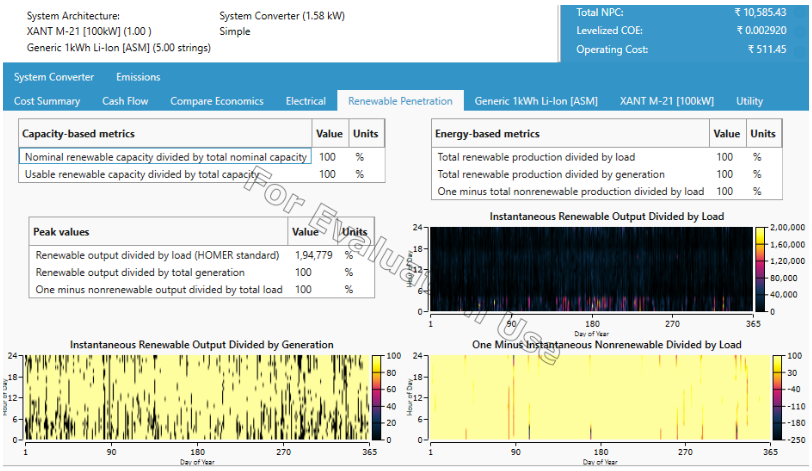

Figure .12. Renewable energy penetration

## 4. Conclusions

The main conclusions of this work can divide to four sections they are

A. HOMER optimisation components in micro grid.
B. Cost of economy design about to different micro grid cases in HOMER

The micro grid design different components studied PV, WT, utility grid, battery and converters are studied. Each and every component having their own importance, using this data it can be design easily micro grids. In this segment every part is clarified with the assistance of wanted conditions, outlines and charts. Construction about to contrasting WT/PV/grid micro grid system is delivers the power to residual load are considered using HOMER software. PV-WT, PV-WT-grid along WT-Battery-Grid. In this study pavilion Andhra Pradesh location is taken along with simulations are done that concludes minimum cost of economy cases about to micro grid case is WT-Battery-grid, but PV-Battery-WT-grid is economy in sense of energy concerns.

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