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FEASIBILITY ANALYSIS OF PV SYSTEM WITH DUAL AXIS MODE FOR ELECTRIFICATION

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Abstract: A standalone PV framework is analyzed utilizing RETScreen programming for dual axis mode of PV system in urban area of India. Techno economic assessment of demonstrated framework is performed in terms of undertaking resultant sunlight based portion, power conveyed to load, NPV, IRR, value and straightforward payback periods. Emissions analysis is likewise done. Investigation demonstrates that establishment of standalone PV framework is achievable for urban communities. In any case, on near premise, ujjain city is most feasible location.Technical and economic feasibility analysis of modeled system is done and found the the dual axis system of PV is more feasible solution and enviorment friendly solution at very lower cost.

Keyword: PV system, inverter, Dual axis mode, renewable system

I. INTRODUCTION

Due to the development demand for renewable energy origin, the manufacturing of solar cells and photovoltaic order has progressive much in fresh years. Starting from a short base, solar panel usage has grown to a complete global capability of 40 GW (40,000 MW) at the close of 2010. More than 100 countries use solar PV. Solar photovoltaic installations take on a variety of forms conclude power stations, buildings, transporting applications, standalone devices, rural electrification, solar roadways, and satellites. One of the most common forms of PV installations is on the rooftops of house and buildings. One of the benefits of grid-connected solar electricity is that it can be used locally thus reducing transmission/distribution losses [1], [8-9]. In 1995, transmission losses in the US were approximately 7.2%. Some of the other benefits of solar generation are the environmental benefits and the purchase incentives for homeowners.

II. SOLAR PHOTOVOLTAIC SYSTEM

A solar photovoltaic system consists of one or more than one solar PV panel or module or array working together for conversion of solar energy into electrical energy. Solar modules are mostly made from silicon because of its properties. Silicon crystalline PV modules are widely used in the world. New PV technologies with cheaper manufacturing cost compared to traditional silicon crystalline based modules are available in the international market these days such as; amorphous silicon (a-Si), Cadmium Telluride (Cd-Te) and Copper Indium Selenium (CIS) [8]. In addition, new standards and testing schemes are developed to be comparable with the new or improved technologies. A solar PV array consists of an array of series-parallel combination of solar PV module to achieve a desired level of solar power with appropriate voltage and current as required. A PV module consists of group of solar cells arranged altogether producing rated output power. A maximum power point tracking block is used in order to track extract maximum power from PV array. It is important that the solar PV module be used at its maximum potential. As the maximum power point varies with insolation and temperature, it is quiet tough to maintain optimum matching at all radiation levels. There are many research papers which have focused on growing the ability of the everywhere solar PV system by insure highest power capture by arrange the operating step of the DC-DC converter. A DC-DC converter acts as an interface between the load and the solar PV module. By exchange the duty cycle, the load impedance as seen by the origin is various and matched such that highest power is harnessed from the PV origin by appropriately maintaining the voltage–current relationship. Once the maximum power is harnessed from the PV source, it could be easily converted into AC power through various kinds of inverters available. In the designing of inverter, switching sequence generation of switches plays vital role.

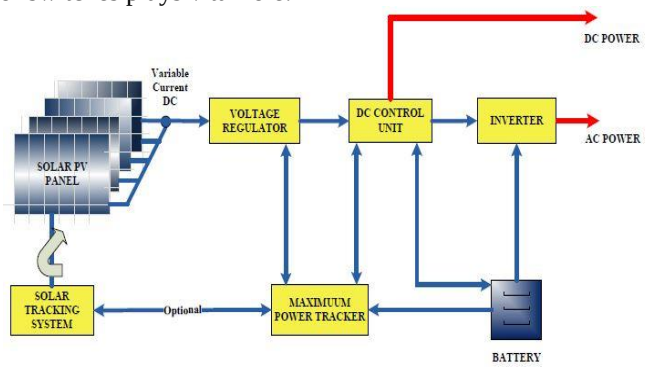

Fig. 1 Solar Photovoltaic System

It is commonly termed as modulation. There are several modulation techniques that have been described in literatures in the past. Some techniques reduce harmonics present in the signal to great extent making the output signal more fine and stable.

III. IMPACT OF RURAL ELECTRIFICATION

Recent meditation of Rural Electrification (RE) show the sequential large consent concern the impact of electrification in the rural areas.

A. Quantifiable benefits: cost saving and increased productiveness

1. Industrial and commercial uses of electricity

- Motive power –restore liquid fuel
- lighting-replacing liquid fuel or gas

- Processing food-replacing liquid fuel, vapour, biomass, beast worthless
- transportation-restore fluid fuel

2. Household uses of electricity
   - lighting-replacing liquid fuel, gas, biomass or animal waste
   - cooking-replacing biomass, beast worthless, wooden, fluid fuel, charcoal, vapour
   - drinking water-restore fluid fuel for pumping
   - Home appliances (fan, TV, Radio)- replacing batteries, biomass, coal

3. Agricultural uses of electricity
   - Water pumping-restore fluid fuel, charcoal, thew power
   - Heating and drying-replacing biomass, coal, liquid
   - Milling, chaff cutting, threshing etc. restore fluid fuel, hydro or thew power

B. Benefits those are painful to quantitate
   - Modernization, dynamism and attitude changes-catalytic effects
   - Quality of life, community services and fellowship
   - Income arrangement and sociable honesty
   - Employment formation

Features of rural loads

Rural goods are characterized by the under mentioned symptom--
   - Dispersed goods need lengthy modirate voltage lines.
   - Unreliable supply of about 6-8 hours per day and phase imbalance.
   - Average weight in the villages order from 5 KW to 25 KW per town.
   - Poor weight element around 0.2(normal demand / maximum demand).
   - Low load factor due to dominant domestic consumption-in particular, lighting, georgic requisition with periodic periodicity and withdrawal of business requisition.
   - Rural grids are often weak and high peak loads and relatively large inductive loads can occur. As the contain of desultory, decentralized, power generators extension, so will their effect on the dynamic behaviour of the power system.
   - Farmers go for higher capacity pumps, use capacitors and state converters. Thus chief to higher energy waste.
   - Poor nature of power increment their cost on account of various factors including frequent motor burnouts, interruptions due to transformer burnouts, unscheduled power cuts.

IV. RETSCREEN

RETScreen is feasibility study tool and is freely downloadable software developed by Ministry of Natural Resources, Canada [2] [5-7] for evaluating both fiscal and environmental charged and advantage of distinct renewable energy technologies for any location in the world. This software uses visual basic and C language as working platform. Here gives diagram description of RETScreen software. RETScreen was liberate in 1998 for on-grid applications. RETScreen PV model also covers off-grid PV applications and include stand-alone, hybrid and water pumping systems also. It has a global clime data databank of more than 6000 ground stations (month wise solar irradiation and temperature data for the year), energy resort diagram (i.e. wind diagram), hydrology data, product data likely solar photovoltaic panel details and wind turbine power curves. It also provides link to NASA climate database. The program is approachable in more than 30 languages and has two part versions, RETScreen 4 and RETScreen Plus. RETScreen 4, is a Microsoft excel based energy project analysis software instrument which can determine the technical and fiscal viability of renewable energy, energy efficiency and cogeneration projects. There are a number of worksheets for performing detailed project analysis including Energy Modeling, Cost Analysis, and Emission Analysis, Financial Analysis and Sensitivity and Risk Analyses sheets. RETScreen is used for the analysis of different types of energy efficient and renewable technologies (RETS) covertures chiefly energy performance, life-cycle costs and greenhouse gas emission reduction.

V. METHOD AND IMPLEMENTATION OF OPTIMAL SIZING WITH RETSCREEN

5.1 Advancement Of Preliminary Arrangement Parameters:

Energy system in structures comprises fundamentally of thermal energy also, electrical energy system.Thermal energy system for structures incorporate water heating, space heating, and space cooling system.Electrical energy systems are typically distributed renewable power generation system and energy supply equipment associated with the power grid. While considering the energy system in a building, it is gainful to consider not just the thermal energy system, additionally the electrical energy system.

In general, improvement issues can be communicated numerically with a target capacity to be minimized with ideal configuration parameters, and subject to physical limitations connected with the system shown in figure.2 [3].

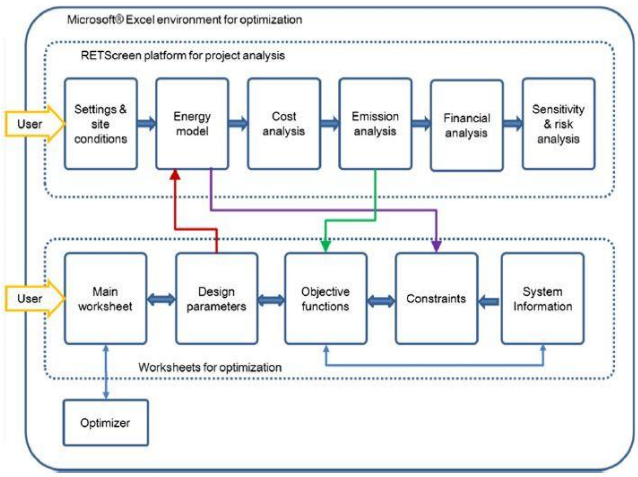

Figure 2 Theoretical schematic diagram of advancement of preliminary arrangement parameters for a a single renewable energy system**.**

The target capacity is enhanced via looking ideal plan parameters, which can be chosen to be either beginning system taken a toll, all out expense including both starting expense and working expense in the life cycle of the framework, or yearly lessening of nursery gas emission of the system. design parameters ought to be the key in the preparatory measuring of the energy system shown in figure.2.

This section deals with the result of our analysis. The optimization results are presented for dual axis mode tracker modes of the PV system such as:

- Fixed mode
- One axis mode
- Dual axis (Two axis) mode

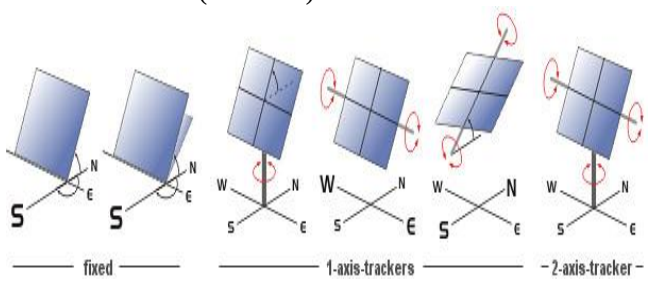

Fig: -3. Solar system tracker modes

The user selects the type of sun tracking device upon which the solar collector is mounted. The options from the drop-down list are: "Fixed," "One-axis," and "Two-axis" A tracker is a device supporting the solar collector which moves the collector in a prescribed way to minimise the angle of incidence of beam radiation on the collector's surface [4]. Hence incident beam radiation (i.e. solar energy collected) is maximized. Solar trackers may be classified as follows:

- If the solar collector is mounted on a fixed structure; this type of arrangement calls as Fixed. The remaining choices may be selected if the solar collector is mounted on a tracker.
- One-axis trackers track the sun by rotating around an axis located in the plane of the collector. The axis can have any orientation but is regularly flat east-west, flat northen-southen,, or parallel to the earth's axis;
- Two-axis trackers always position their surface normal to the beams of the sun by rotating about two axes.

VI. SIZING COMPONENTS

The proposed optimal sizing system through dual axis mode of PV system has more efficient as compared to fixed and one axis mode PV system. in this PV system central grid load is connected of a design location of Ujjain MP, India. The population of the location is less so that the load demand of the village is also less. The approximate peak load demand of the location is 5kW. The solar radiation potential of the design location is high so that no need to use other source of renewable energy. The daily solar horizontal radiation is 5.15 kWh/m²/d for design location which has Latitude 23.2n and Longitude 75.8. The charged of the inverter trust on the request it is usage for, the nature (waveform) of its output, its output capacity, and other integrated functions such as battery charging or gen set automatic starting. For on-grid PV systems, the cost of inverters is in the $800/kW AC to $1,500/kW AC range, where bigger units are on the lower end of this range and smaller units on the higher end. A high volume purchase of small units may bring the cost in the middle range. Note that some PV module manufacturers are offering "AC PV modules" for grid intertie systems. These modules have a short shape-in inverter. In this action, the user will not conclude an inverter cost here.

Table1. Inverter specification

Inverter		
Efficiency	%	98.0%
Capacity	kW	15.0
Miscellaneous losses	%	0.0%

VII. RESULT AND DISCUSSION

Single-axis solar tracker throughout the day rotates solar panels from east to west so that they facing directly towards the sun, which enables yearly, detention around 25% more solar energy than fixed solar compartment. Two-axis PV tracker when trace the sun acts as single axis solar tracker but also considers the annual changing incident angle of solar radiation from the maximum in summer and lowermost in winter and afford around 35% higher annual solar harvest as a fixed installed solar panels. Analysis is followed by outcomes of the sensitivity analysis. Prefeasibility analysis of grid connected PV system for location Ujjain, Madhya Pradesh, INDIA evaluated through the RETSCREEN software. The software gives the result in form of net present value (NPV), internal rate of return (IRR), Simple payback, Equity payback, Annual life cycle savings, Benefit-Cost (B-C) ratio and GHG reduction cost. RETSCREEN software also performs risk and sensitive analysis. The yearly cash flow and cumulative cash flow of fixed, one and dual axis tracker of grid connected PV system is shown in fig 8.2 and 8.3. The analysis is followed by outcomes of the sensitivity analysis. Prefeasibility analysis of grid connected PV system for location Ujjain, Madhya Pradesh, INDIA evaluated through the RETSCREEN software. The software gives the result in form of net present value (NPV). RETSCREEN software also performs risk. The cumulative cash flow of dual axis tracker of grid-connected PV system is shown in fig 3.

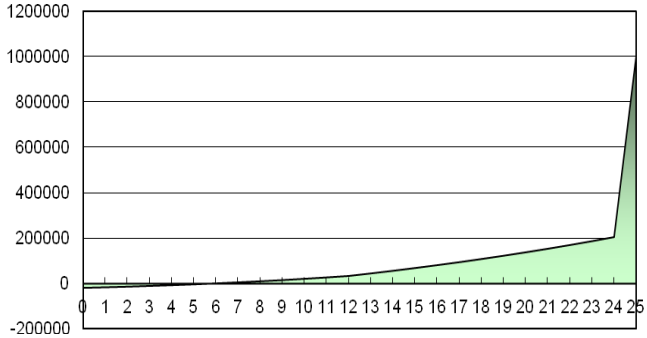

Fig: -3 cumulative cash flow for dual axis

Risk analysis

Risk analysis by taking various range for different parameter are show in table.... with initial cost, O&M cost, fuel cost, Debt ratio Electricity export rate, Debt interest rate, Debt term value.

Table.2 Risk analysis

Risk analysis				
Parameter	Value	Range (+/-)	Minimum	Maximum
Initial costs	63,293	20%	50,634	75,951
O&M	106	15%	90	121
Fuel cost - base case	2,507	5%	2,381	2,632
Electricity export rate	156.60	15%	133.11	180.09
Debt ratio	70%	5%	67%	74%
Debt interest rate	2.25%	30%	1.58%	2.93%
Debt term	12	0%	12	12

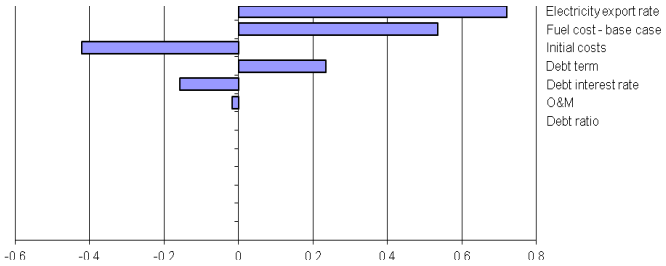

Fig 4.cost feasibility analysis of the system

VIII. CONCLUSIONS

The RETScreen is a financial assessment software tool which is utilized for prefeasibility analysis of any renewable system. The proposed PV system is performed for dual axis mode. The outcome of this study show the best optimal result regarding lower cost analysis for 25 years and also has pollution free system. In this proposed work evaluate prefeasibility analysis of grid connected PV system at various mode of solar tracker system and found that dual axis tracker mode represent more feasible output results as compare to fixes and one axis tracker mode. Dual axis tracker system extract 35% more power from the solar irradiation as compare to fixed axis system.

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