

Linear Model for Cost Benefit and Break-Even Analysis of Households Roof Top Solar Panels Installation

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Abstract:

Due to increase in the electricity energy consumption in day to day and it is difficult to meet the demand through non-conventional energy sources. The government has been encouraging the energy power supply demand through renewable energy power generation techniques and also providing subsidies to the installation solar roof top for house holds. A study on the installation of a solar panel system at home was carried out and the researcher has compared the solar panel installations of different from the range 1kw to 5 kw and also suggested which is the best capacity of solar panels to install on the roof top of the average household energy consumer.

Key words: solar panel system, Return on investment, energy consumption, excel goal seek analysis.

I.INTRODUCTION:

Solar power is a renewable energy and it is generated by the conversion of energy from the sunlight to electricity by utilising photovoltaic panels. The design of rooftop photovoltaic (PV) systems for residential applications has become increasingly essential due to growing energy demand driven by both economic development and population growth. These systems offer a viable alternative energy source for households, contributing to energy security and sustainability. Photovoltaic rooftop systems can boost energy supply, provide reliable, cost-effective electricity, reduce environmental impact, and lower long-term energy costs for households.

However, some households are unsure whether they will be able to afford the panel cost and are Unaware of the product's longevity, how much they will invest, and how long the investment will pay off.so, the study aimed to describe the solar panel installation in terms of average electricity consumption, number of kilowatts to be installed. Accelerated growth in the ability of consumers to generate own-use electricity offers new opportunities and risks for electricity providers and policymakers around the world (IEA 2019).

II. LITERATURE REVIEW:

The Cost and Benefit Analysis of Solar Panels at Home⁽¹⁾, ISSN: 2454-1311 | Vol-9, Issue-5; May, 2023 focus on Cabanatuan in order to address the on-going rise in oil prices and pollution and help consumers reduce their utility costs, save money, and produce greener energy, a study on the installation of a solar panel system at home was carried out.

Optimal Investment Strategy for Solar PV Integration in Residential Buildings⁽²⁾, IJRED-ISSN: 2252-4940, Int. Journal of Renewable Energy Development 10 (1) 2021: 79-89 on analyses the economic viability of its integration in different types of residential buildings. Applying real options approach under uncertainty in electricity prices, this study compares the attractiveness of adopting solar PV over continuing electricity from the grid focusing on various investment payment schemes including (i) full payment, (ii) distributed payment for 5 or 10 years.

Most economic valuation techniques used in previous studies are based on discounted cash flow such as the net present value (NPV), internal rate of return (IRR), payback period (PBP), profitability index (PI), and return on investments (ROI). The recent economic valuation study shows the break even analysis of solar plant installation with respect to the different range of solar plant capacities i.e. 1kw to 5kw variation and also the study of payback period with respect to number of months and units generation required.

III. METHODOLOGY:

The researcher used the descriptive research design in order to describe and also used the excel goal seek software analysis for the number of kilowatts to be installed and the breakeven point of the capital investment at different capacity of solar plants. The research has also helped in the capital investment, recovery and life span power generated through profit analysis.

In this analysis the researcher considered the energy consumptions of units on an averaging of 2000 units per month, the per unit rate of energy consumption Rs. 8/unit. Based on case taken into consideration i.e. the whole capital investment done by the own fund.

IV. RESULTS AND DISCUSSION:

The solar panel system is used to supply electricity to power appliances as alternative energy to reduce or eliminate the utility expenses of homeowners. In the following case study there is no excess energy generated as compared to the electricity required to consumer because the capacity of plant installed less than the energy consumption of house hold.

Case study:

Here considered the one individual consumer invested the capital through own fund, no loan and subsidiaries has been taken into consideration. The solar panels of different capacity from 1kW to 5kW may installed at roof top the linear programing calculation and cost benefit analysis as shown below.

Formula:

No. of units required to breakeven = $f(x)$

Fixed cost of solar panels =Rs. z per kW

Solar panels installed= y kW, $1 < y < 5$

Units generated by solar panels = b , $b > 0$

Breakeven point $f(x) = z*y + a*\text{energy cost per unit} + \text{interest rate}*z*y - b*\text{energy cost per unit}$

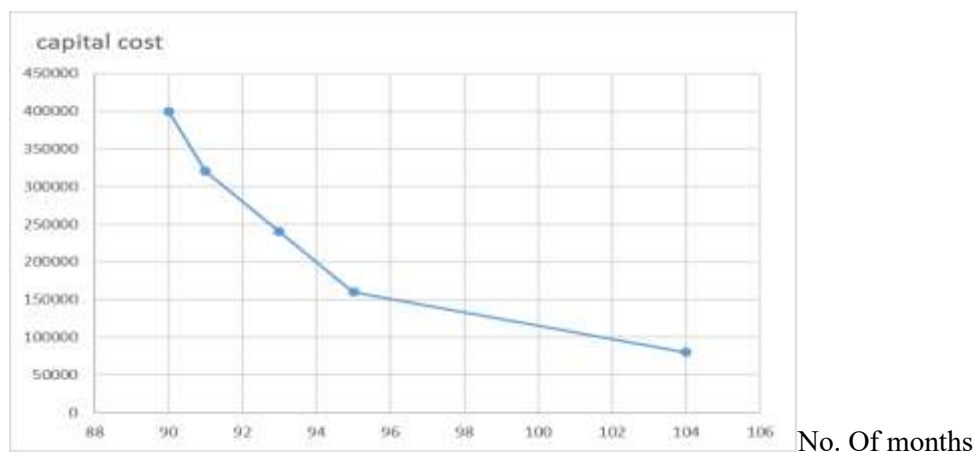
Result:

The different capacity solar panel installed from the range of 1kw to 5kw with capital the expenditure mentioned in the table no: 1

Table: 1

s.no.	KW solar plant installation	No. of months required to breakeven	capital cost
1	1	104	80000
2	2	95	160000
3	3	93	240000
4	4	91	320000
5	5	90	400000

The cost benefit analysis as shown in the graph as below figure



Figure(1)

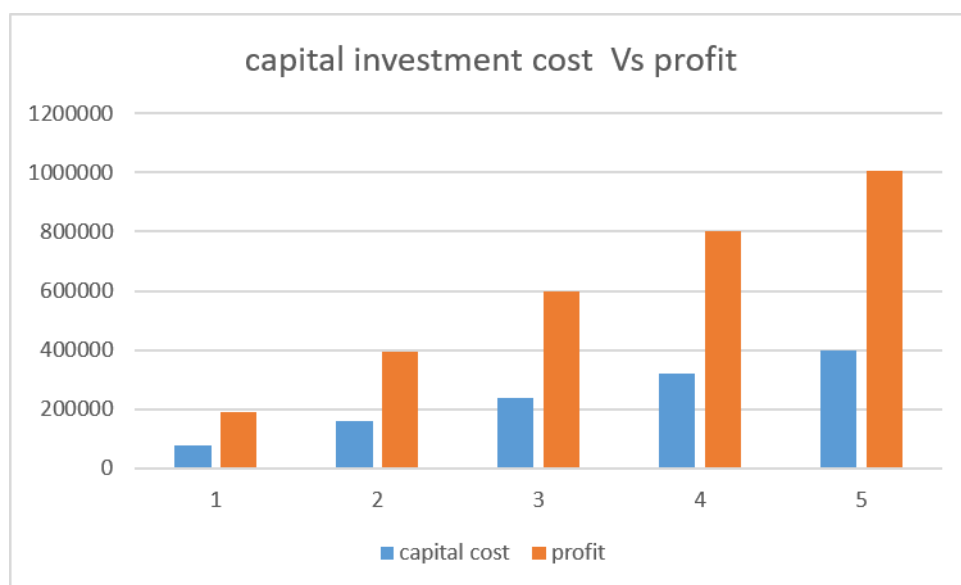


Figure (2)

Capital investment increment	profit increment accordingly
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1	1
0. 5	0. 5203
0. 3333333	0. 3422
0. 25	0. 255

Table (2)

From the above analysis, the cost benefits analysis is the decision model to estimate the cost, payback period and savings from the adoption of an on-grid solar panel system as an alternative source of electricity at home. The price of the solar system is a little bit costly and before we invest, we usually want to know when the investment's back.

It is very important for us to know the amount of time it will take to recover the investment. By considering the investment average savings for 25yrs. Payback Period varies from 7 to 9 Years proportionally of 5kw to 1kw solar panel installations respectively. However there is no effective change of breakeven point i.e. the year/month of breakeven has no much difference by increasing the capacity of solar plant but the profit after the breakeven point is more as per the change in capital investment and also, it is observing that the capital investments changes accordingly the profit also changed proportionally. So, for the long term investment the high capacity solar panel installation is beneficial as compare to low capacity solar plant. However the percentage of increase in capital investment increases accordingly the same percentage of profit only increases.

IV CONCLUSIONS:

Based on the analysis of data the following conclusion was made: The installation of the solar panel at home is beneficial and would be easier. It is a bit expensive and not all people can afford to invest in a one-time payment. In addition, there are factors to consider that may affect the installation such as roof type, a location where the sunlight can fully reach the panel and also appliances and devices that will use solar energy. The adoption of a solar panel system is a win/win investment with respect to capital investment to payback period and returns received through life span of solar panels.

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