# An analysis between Installation cost & payback through on grid Solar Energy System

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**ABSTRACT**

In India, as per report of Ministry of New and Renewable Energy, Government of India (Press Information Bureau - 19-July-2018), The Government has set a target of installing 100 GW of solar capacity by 2022 in the country. A target of installing 175 GW of renewable energy capacity by the year 2022 has been set, which includes 100 GW from solar, 60 GW from wind, 10 GW from bio-power and 5 GW from small hydro-power.Solar energy systems reduce up to 100% your electricity costs, depending on system size. Utility prices are only going up every year. Solar energy provides us security from rising electricity rates.

Now a days, a solar string (combination of solar panel based on requirement in series or parallel is used to meet demand load) converts solar energy in to electrical power. to light energy from the sun into electrical energy (charge emission) is called a solar power plant process. In this paper author(s) will analysis between installation cost and payback through on grid solar energy system.

**Keywords:**Solar Energy, Solar Photovoltaic systems, ON Grid, SPV

## 1. INTRODUCTION

Conversion of sunlight into usable electrical energy is known as Solar energy. Solar photovoltaics (PV), solar thermal electricity and solar heating and cooling are well well-known technologies based on solar energy.

An approximately 9% growth in India's electricity demand rising as per record received CEICDATA from March 2007-March 2018. To meet this demand Solar Energy system are best supporters to other generation plants in India. As the demand for solar electric systems grows, progressive builders are adding solarphotovoltaics (PV) as an option for their customers. India's Electricity: Consumption: Utilities from 1, March 2007 to 1, March 2018 are as follows.**[1]**

| Year | Consumption in GWh. | Yearly rise in Consumption | Comparison year |
|---|---|---|---|
| 2007 | 455749 | | |
| 2008 | 501977 | 10.1433 | 2007 |
| 2009 | 553995 | 10.36263 | 2008 |
| 2010 | 612645 | 10.58674 | 2009 |
| 2011 | 694392 | 13.34329 | 2010 |
| 2012 | 785194 | 13.07648 | 2011 |
| 2013 | 824301 | 4.980553 | 2012 |
| 2014 | 874209 | 6.054584 | 2013 |
| 2015 | 948522 | 8.500599 | 2014 |
| 2016 | 1001191 | 5.552744 | 2015 |
| 2017 | 1061183 | 5.992063 | 2016 |
| 2018 | 1130244 | 6.507926 | 2017 |
| **Chart -1** | | **Chart 2** | |

**Table 1 :India's Electricity: Consumption: Utilities from 1, March 2007 to 1, March 2018**

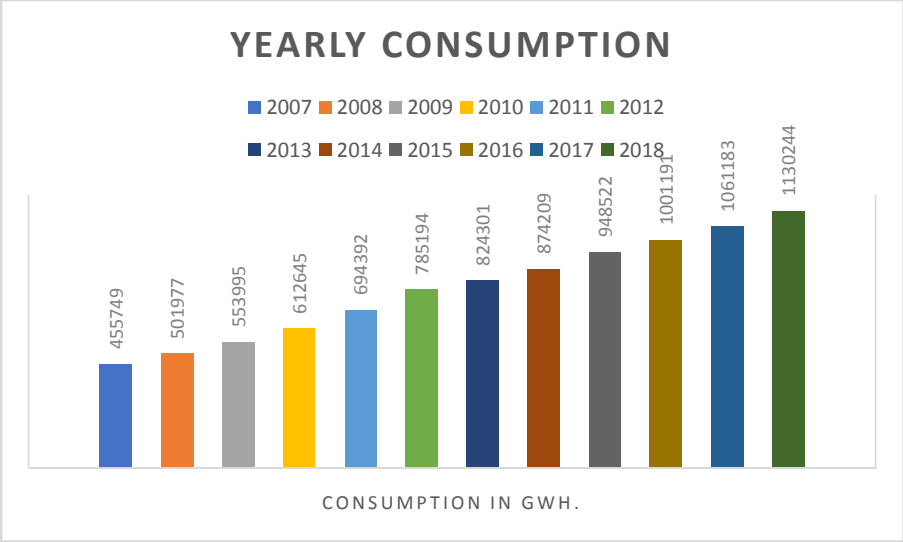


**Chart 1 : Energy Consumption for Last one Decade**

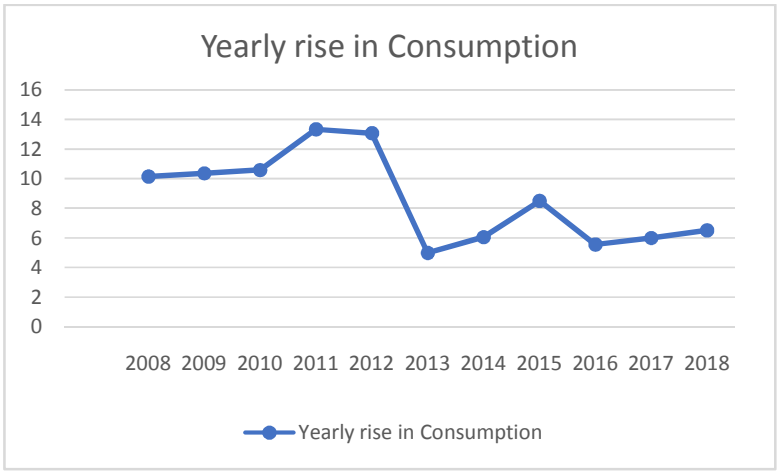


**Chart 2 : Energy Consumption yearly rise for Last one Decade**

## 2. Types of Solar Plants:

Available in three different types as below:

**a)** On Grid Solar Power Plant

**b)** Off Grid Solar Power Plant

**c)** Hybrid Solar Power Plant

On the basis of provision, these solar photos voltaic power system are different from each other while works on same principle. These energy generation units can be divided into two sub-categories as residential (On grid/Off grid/Hybrid) and Commercial (On grid & hybrid)

### a) Off Grid Solar Power System

*"If consumer have no electricity connection, remotely located (Hilly area etc),not reliable grid connection(villages)than in such condition off grid* solar photo-voltaic (SPV) power *system is recommend for to consumer."*

It consists of a SPV power plant with battery unit(s), store powerin batteries(DC) can used as per user requirement. SPV panels gives power in DC which fed to solar inverter (SI) to charge battery and allows SI to convert DC to AC for user consumption.


**Figure 1: Off Grid Solar Power System**

### b) On Grid Solar Power System

*"If consumer is staying in urban area and have reliable grid connection but have financial issue due to high electricity bill than in such condition on grid solar photo-voltaic (SPV) power system is recommend for to consumer."*

The utility power grid should be available for this type of solar photo voltaic power plant to generate electrical power. In this type of SPV system excess power send to the utility grid automatically.Net metering system keep all data of utility Grid import and export unit, will get credited for next bill cycle by Vidyut Vitran Nigam limited.

***Figure 2: On-Grid Solar Panel System***

### c) Hybrid Solar Power System

*" On grid solar system and off grid solar system feature provides by Hybrid solar system provides. User can store power followed by export facility."*

*"hybrid solar system =on grid solar system + off grid solar system"*

***Figure 3: Hybrid Grid Solar Panel System***

In this paper author wants to show analysis of installation cost and revenue from on grid Solar photo voltaic systemfor residential load of 4 KW. Key benefits of this system are financial benefits, Green Efficient Building, Saving Environment, zero emissions, increases property value and user can enjoy no cost electricity up to 20 years.

## 3. Calculation Home's Electricity Usage

### a) Calculation of daily kWh usage: -[2]

**Chart3: Consumption Graph**

Based on bill graph yearly consumption = 3644 KWh
Average monthly electricity usage = (3644/12)=303.67KWh
Daily usage = (303.67/30)=10.12 Kwh

**b) Size the PV modules: -**

Power generation directly proportional to the size of PV. For calculation of size of PV module, the total peak watt produced needed which is depends on site location. In calculation, consider panel generation factor, depends upon site location. For Thailand, the panel generation factor is 3.43, for India, it is 4.32.

**Total Watt-peak rating needed for PV modules**

= total Watt-hours per day/ panel generation factor

=10.12KWh/4.32 =2.34 KWh

**Calculate the number of PV panels for the system**

= Total Watt-peak rating needed for PV modules/325= 2.34 KWh/325 =7.2 Panel (Approx 8 pannel required)

**c) Inverter sizing**

The inverter size should be 25-30% bigger than total Watts of appliances for safe and efficient operation as requirement may vary some times. Assuming 30% bigger inverter become 3 KW approximately.

Market cost of 2.4 KW solar system is approx. 96,000 INR @4o rupees/ watt.[3]

As per standard 5 units/ KW can be generated daily when 6 hours daily sun light available. So daily 12 units can be generated thorough 2.4 KW Solar system.

**4. Total Electricity Generation from Solar Plant**

Yearly = 365*12 =4380Units Life Time (25 Years) =25* 4380 = 109500 Units

**5. Financial Savings**

**a) Tariff @ Rs.5/ kWh (for top slab of traffic) –**

No increase assumed over 25 years: Annually: =4380*5 = Rs. 21900
Life-Time (25 years) : = Rs. 547500

**b) Calculation Results:**

| **Sr. NO.** | **Installation Cost:** | **96,000 INR** |
|---|---|---|
| 1 | Annually Financial saving | 21900 INR |
| 2 | No. of years for pay back | 96,000/21900= 4.38 year or 53 months. |
| This calculation shows that if user install on grid system payback time will be 4.38 year or 53 months and user can enjoy no cost electricity up to 20 years. **[4]** | | |

**Table 2: Annual Energy Generation and Payback Duration**

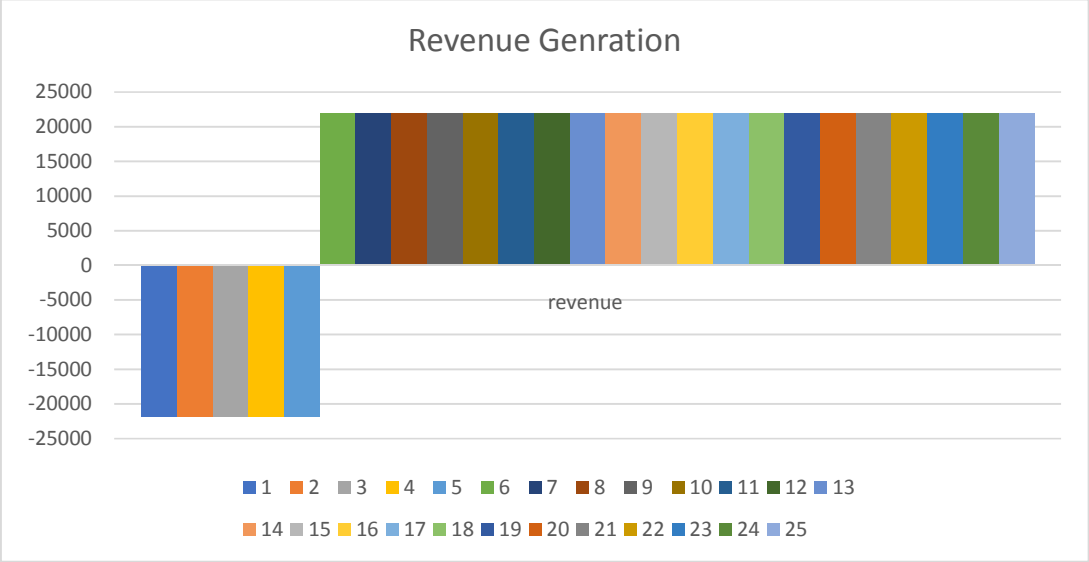


**Chart 4: Revenue Generation**

First five years shown negative data, which means user received against installation cost. From 6 to 25 year shows positive data which means revenue generation (no cost electricity).

## 5. CONCLUSION

The results promise to user that electricity will be received at no cost electricity up to 20 yearsfromthis solar system. development in the future. Solar energy should be strongly considered for generation of power more affordable relative to fossil fuels. This analysis encourages residential user to get install on-grid solar system. With the help of this type system transmission and distribution line reduced losses and new utility requirement if maximum user utilize it. The goal of this paper was to analysis the installation cost and payback time. Analysis has shown positive results on integration solar system and national grid. Maintenance (cleaning of panels, inverter, tighten of cables) should be ensure for better result. The use of on grid or hybrid system will help to utility grid in system stability.

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