EXAM -03

K.SURYA PRAKASH
EE18BTECH11026

Q. Cost-benefit analysis for setting up a rooftop solar system for my home.

Electricity Consumption (Monthly):

1.	**Sept'20**	**333 units**	**Rs. 1887/-**
2.	**Aug'20**	**320 units**	**Rs. 1790/-**
3.	**Jul'20**	**340 units**	**Rs. 1904/-**

Avg. results : 330 units Rs.1840/- (per month)

Per Day consumption (E_{day}) = 330/30 ~ **11 units(KWH) per day**

Main components of rooftop solar :

1. **PV solar panel**
2. **Battery(considering 2day back up)**
3. **DC- AC inverter**
4. **Charge Controller**

5. Miscellaneous (installation , Cables e.t.c)

---

1. PV solar panel :

$P_{PV} = E_{day} / S_d\ d = 11 / (7 * 0.8) \sim 2$ kW

But as per sources if we consider the worst case scenario (during cloudy days / winter) , a 3kW Solar Panel System generates around 12-15 units per day.

Hence for safe side we can go with a 3kW System. So that we can completely rely on Solar

P_{PV} (total PV generation capacity required)= 3kW

P_o (Power output capacity of one panel) = 330W

N_P (No. of panels required) = 3k / 330 ~ 9 panels

For 330 W panels , Cost = 22 Rs per Watt

Total Cost for panels = 330 W * 9 * 22 Rs per W ~ **₹66,000**

---

2. Batteries (for a 2 Day backup) :

Considering a 12V, 220 Ah battery, and assuming the DOD(depth of discharge) = 0.5

The no. of batteries required for a producing 11 units per day for 2 day backup is :

No.of batteries reqd.= (2 * 11 * 1000) / (12 * 220 * 0.5) ~17
Considering Luminous 220Ah inverlast battery , which costs :

Cost of each battery(with same specifications) = 16,000
Cost for all batteries = 17 * 16,000 = ₹**2,72,000**

---

3. Inverter :

Inverter Size = Capacity installed / DF(diversity factor)
= 2000W / 1.7 = 1117.6
Capacity for 8 LED lights, 2 fans, 1 ton AC ,1 fridge ~ 2kW
Cost of inverter = 18 Rs / Watt

Total Cost of inverter = 18 * 1117.6 ~ **₹22,000**

Note : This is just for ordinary inverters, yet we have some good quality Luminous UPS inverters which for the same size cost about 40,000 (this involves additional features (safety measures, good display) unlike the above inverters)

---

4. Charge Controller :

It has a fixed cost of **₹3300** (It does not depend on capacity because it is a microcontroller)

---

5. Miscellaneous Costs :

The miscellaneous costs include (per Watt) :
Cables : 2 Rs
Structuring cost : 5 Rs
Peripherals (JBs, earthing) : 2 Rs
Installation costs : 4 Rs

COST = 13 Rs per Watt
Total Cost = 13 * (3kW) ~ **₹40,000**

TOTAL = 66,000 + 2,72,000 + 22,000 + 3300 + 40,000 ~ 4,00,000

The total cost to setup the system is **₹4,00,000**

Subsidy :
A net of 40% subsidy can be availed upto 3kW Systems through central and state govt. schemes

Subsidized price = 60% (4,00,000) = **₹2,40,000**

Cost-Benefit analysis :

Investment :

1. With subsidy = ₹2,40,000
2. Without subside = ₹4,00,000

The lifespan of the above system = 25 yrs

Total electricity bill for 25 yrs without using solar = 25 * 365 * 11 * 6(Rs per unit) = ₹6,02,000

Savings for a span of 25 yrs :

1. With subsidy : 6,02,000 - 2,40,000 ~ ₹3,60,000
2. Without Subsidy : 6,02,000 - 4,00,000 ~ ₹2,00,000

Payback Period :

1. With subsidy : (2.4/6) * 25 = 10 years (15 yrs of free electricity)
2. Without Subsidy : (4/6)*25 = 16.6 years(9 yrs of free electricity)

Solar net metering :

Apart from this we can notice that we are consuming 11 units daily while the system is producing 12 units , we need not waste this excess energy rather we can send it

back to the actual grid (now we act as a supplier of energy) and we are rewarded for that per unit basis.
As of now the price is 5.50 Rs per unit
In this way we make money by using the whole energy produced by the system.
