

Financials of Solar Water Pumping and Off-grid Power Plant

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Sample case: Farm, 2HP

- 2 HP DC SPV water pump
- Can cater for 3 Hectare irrigation
- Requiring 1800 Wp module rating
- Cost Rs. 250000/-
- MNRE subsidy: Rs. 75000/-
- Soft loan @ 5% for Rs. 125000/- (50% of capital cost, 5 years)
- Upfront capital cost of Rs. 50000/-
- Recommended: State government subsidy 10% of capital cost i.e. Rs. 25000
- Farmer's share: Rs. 25000

Sample case: Farm, 1HP

- 1 HP DC SPV water pump
- Can cater for 1.5 Hectare irrigation
- Requiring 900 Wp module rating
- Cost Rs. 140000/-
- MNRE subsidy: Rs. 42000/-
- Soft loan @ 5% for Rs. 70000/- (50% of capital cost, 5 years)
- Upfront capital cost of Rs. 28000/-
- Recommended: State government subsidy 10% of capital cost i.e. Rs. 14000/-
- Farmer's share: Rs. 14000/-

Assumption for Cost-Benefit Analysis

Particular	Unit	1 HP	2 HP
Capital cost	INR	140000	250000
Central Capital subsidy 30% of capital cost	INR	42000	75000
Soft loan interest	%	5	5
Soft loan available on 50% Capital cost	INR	70000	125000
State govt subsidy 10% of total cost	INR	14000	25000
User upfront cost 10% of capital cost	INR	14000	25000
Crop yield without irrigation/Hectare	ton	1.5	1.5
Crop yield with irrigation/ Hectare	ton	3	3
Net Benefit from the crop/ kg	INR	14	14
Suitability of pump	Ha	1.5	3
Farmer's capability for loan repayment per year	INR	18000	30000

Cost-Benefit Analysis

2 HP DC SPV water pump

Year	1	2	3	4	5
Net capital	125000	101250	76313	50128	22635
Interest @ 5%	6250	5063	3816	2506	1132
Principal repayment	23750	24938	26184	27494	22635
Annual Payment	30000	30000	30000	30000	23766
Benefit from crop yield by irrigation in 3 hectare	63000	63000	63000	63000	63000
Net benefit to farmer	33000	33000	33000	33000	39234

1 HP DC SPV water pump

Net capital	70000	55500	40275	24289	7503
Interest @ 5%	3500	2775	2014	1214	375
Principal repayment	14500	15225	15986	16786	7503
Annual Payment	18000	18000	18000	18000	7878
Benefit from crop yield by irrigation in 1.5 hectare	31500	31500	31500	31500	31500
Net benefit to farmer	13500	13500	13500	13500	23622

- **Simple payback period: 4 to 5 years**
- **SPV pump pays for itself**
- **Net benefit to the farmers even during repayment period**

Off-Grid SPV Power

Garment factory

- 1. Automatic cutting, stitching, folding and pressing machines**
- 2. Only daytime requirement: 8 hours**
- 3. Erratic grid power available**
- 4. SPV as replacement for diesel gen-set**
- 5. Shadow free flat roof available**
- 6. Monthly electricity units: 50000 kWh**
- 7. Daily electricity units: 1667 kWh**
- 8. Thumb rule: 1 kW of SPV module produces 4 kWh/day**

Off-Grid SPV Power Financials

Garment factory

- 9. Modules capacity: 417 kW required**
- 10. With safety margin: 500 kW plant needed (no battery)**
- 11. Cost Rs. 10 Cr./MW, Subsidy: Rs. 3 Cr/MW**
- 12. Cost of 500kW plant: Rs. 350 lakhs**
- 13. Shadow free area required: 5000 sq.m.**
- 14. Diesel gen-set: 1 litre diesel produces 4 kWh**
- 15. Electricity through diesel: Rs. 15 per kWh**
- 16. Avoided electricity bill: Rs. 7 per kWh**
- 17. Profit and loss account prepared for 25 years**

Financial Parameters

- **Rs. 10 cr per MW**
- **Rs. 5 cr for 500 kW**
- **MNRE subsidy 30%**
- **Subsidy: Rs. 1.5 cr**
- **Net cost: Rs. 3.5 cr**
- **Loan 70%: Rs. 2.45 cr**
- **Equity 30%: Rs. 1.05 cr**
- **Bank interest rate: 13%**
- **AD benefit: 80% + 20%**

Taxation: A.Y. 2015-16 & A.Y. 2014-15

Indian companies:

- **Income tax: 30%**
 - + **Surcharge (5% of IT) for income Rs. 1 - 10 Cr**
 - Or (10% of IT) for income more than 10 Cr**
 - + **Education cess (3% of: IT + surcharge)**
- **MAT (Minimum Alternative Tax): 18.5%**
 - + **Surcharge (5% of MAT)**
 - + **Education cess (3% of: MAT + surcharge)**

Foreign companies:

- **Income tax: 40%**
 - + **Surcharge (2% of IT) for income Rs. 1 - 10 Cr**
 - Or (5% of 30%) for income more than 10 Cr**
 - + **Education cess (3% of IT + surcharge)**
- **MAT (Minimum Alternative Tax): 18.5%**
 - + **Surcharge (5% of 30%)**
 - + **Education cess (3% of MAT + surcharge)**

Definitions

Debt-to-Equity Ratio

- **Debt-to-Equity ratio is the ratio of total liabilities of a business to its shareholders' equity. It is a leverage ratio and it measures the degree to which the assets of the business are financed by the debts and the shareholders' equity of a business.**
- **Debt-to-Equity Ratio = Total Liabilities/ Shareholders' Equity**
- **Lower values of debt-to-equity ratio are favorable indicating less risk**
- **Higher debt-to-equity ratio is unfavorable because it means that the business relies more on external lenders thus it is at higher risk, especially at higher interest rates**
- **In solar sector Govt. allows only 70:30 ratio**

Net Present Value and Discount Rate

Net Present Value (NPV):

- NPV is the discounted net cash flow. NPV takes into account cost of capital (which is discount rate). If the NPV is positive then all the investors recover their investment over the project life, on the other hand if it's negative then all investors are not likely to recover their investments.
 - $NPV = - \text{Initial Investment} + \text{DCF year 1} + \text{DCF year 2} + \dots + \text{DCF Last year}$
 - Where DCF: discounted cash flow

Discount Rate:

- The interest rate used in discounted cash flow (DCF) analysis to determine the present value of future cash flows.
 - The discount rate in DCF analysis takes into account not just the time value of money, but also the risk or uncertainty of future cash flows;
 - The greater the uncertainty of future cash flows, the higher the discount rate
- Example:
 - Expected revenue: Rs.1,000/- per year
 - Present value Rs.1,000/- in a year's time with discount rate of 10% would be Rs. 909.09/- ($1,000 / [1.00 + 0.10]$)
 - Present value of Rs.1,000/- in two years time would be Rs. 826.45

Debt-Service Coverage Ratio - DSCR

- For a commercial project, it is the amount of cash flow available to meet annual interest and principal payments on debt
- This ratio should ideally be over 1. That would mean the project is generating enough income to pay its debt obligations
- In general, it is calculated by:

$$= \frac{\text{Net Operating Income}}{\text{Total Debt Service}}$$

- A DSCR of less than 1 would mean a negative cash flow
- A DSCR of less than 1, say .95, would mean that there is only enough net operating income to cover 95% of annual debt payments

Internal Rate Of Return – Project IRR

- **The discount rate often used in capital budgeting that makes the net present value of all cash flows from a particular project equal to zero**
- **The higher a project's internal rate of return, the more desirable it is to undertake the project**
- **As such, IRR can be used to rank several prospective projects a firm is considering**
- **Assuming all other factors are equal among the various projects, the project with the highest IRR would probably be considered the best and undertaken first**
- **IRR is sometimes referred to as "economic rate of return (ERR)"**
- **An investment is considered acceptable if its internal rate of return is greater than an established minimum acceptable rate of return or cost of capital**

Equity IRR

- **Calculation of the internal rate of return considering the cash flows net of financing gives us the equity IRR**
- **If the project is fully funded by equity, the project IRR and Equity IRR will be the same**
- **If the project is fully funded by the debt, equity IRR simply doesn't exist**
- **The outflows are cash flows from the project minus any interest and debt repayments**
- **Equity IRR measures the returns for the shareholders of company, after the debt has been paid off. Therefore it is based on the free cash flows of equity holders**

Scenario 1: Avoided Electricity

Financial Analysis

Particulars	Total Cost
Plant, machinery and Transmission line Cost	297.50
Civil and General Works	42.00
Interest during construction period	7.96
Preliminary and Preoperative Expenses	10.50
Total Cost	350.00
Total Cost including IDC	357.96

Financial Analysis: Assumptions

Assumption Sheet	
Proposal for 0.5MW Project in Solapur, Maharashtra	
Numbers in Lakhs INR Unless Specified	
Project Details	
Technology	Photo Voltaic
Location	Solapur, Maharashtra
Size (MW)	0.50
Number of MWs	0.50
Generation	
Plant Load Factor	17.00%
Net Expected Generation per MW (Lakhs kWh)	14.89
Transmission Losses	0.01
Auxiliary consumption	0.00%
Net Expected Generation per MW (Lakhs kWh)	14.89
Estimated losses per year	1.0%
Capital Expenditure and Structure	
Total Price (Rs. Lakhs)	350.00
EPC Price/MW (Rs. Lakhs)	700.00
Interest During Construction	7.96
Total Project Cost (Rs. Lakhs)	357.96
<i>Financed by --</i>	
Equity Capital	112.96
Total Debt	245.00

Financial Analysis: Assumptions

Interest Cost (Debt)	13.00%
Post Tax Equity IRR	51.67%
Post Tax Project IRR	17.53%
DSCR	1.31
Loan Particulars	
	<i>INR Debt</i>
Moratorium Period (years)	0.50
Loan Period (Years)	10.50
Period of Loan Excluding Moratorium(Years)	10.00
Operating Expenses	
Interest Cost	<i>As above</i>
O&M Expenses (Rs. Lakhs/MW)	1.00
Annual escalation in O&M Expenses	3.00%
Annual escalation in Land lease Expenses	0.00%
Insurance Expenses (% of Project Cost)	0.15%
Book Depreciation Rates	
Book Depreciation Rate(1-10 year)	10.00%
Revenue Parameters	
MSEDCL, Third Party Tariff	7.00
Increment in MSEDCL	4.00%
Terms of PPA (No. of Years)	25

Financial Analysis: Depreciation

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Civil														
WDV	42.00	21.00	4.20	0.84	0.17	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dep	21.00	16.80	3.36	0.67	0.13	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oustanding	21.00	4.20	0.84	0.17	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Plant and Machinery														
WDV	297.50	148.75	29.75	5.95	1.19	0.24	0.05	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Dep	148.75	119.00	23.80	4.76	0.95	0.19	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Oustanding	148.75	29.75	5.95	1.19	0.24	0.05	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Depreciation	169.75	135.80	27.16	5.43	1.09	0.22	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Income Tax Schedule														
Profit Before Tax and Depreciation	33.28	19.34	22.90	26.77	31.00	35.64	40.74	46.35	52.54	59.39	66.34	69.21	71.27	70.50
Depreciation as per IT Rules	169.75	135.80	27.16	5.43	1.09	0.22	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Pre operative Expense written off	2.10	2.10	2.10	2.10	2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Profit Before Tax	(138.57)	(118.56)	(6.36)	19.24	27.81	35.42	40.69	46.34	52.54	59.39	66.34	69.21	71.27	70.50
Corporate Income Tax Calculations														
Corporate Income Tax	(41.57)	(35.57)	(1.91)	5.77	8.34	10.63	12.21	13.90	15.76	17.82	19.90	20.76	21.38	21.15
Surcharge on Income Tax	(2.08)	(1.78)	(0.10)	0.29	0.42	0.53	0.61	0.70	0.79	0.89	1.00	1.04	1.07	1.06
Education Cess	-1.31	-1.12	-0.06	0.18	0.26	0.33	0.38	0.44	0.50	0.56	0.63	0.65	0.67	0.67
Total Corporate Income Tax	(44.96)	(38.47)	(2.06)	6.24	9.02	11.49	13.20	15.04	17.05	19.27	21.52	22.45	23.12	22.87
Exemption under Sec 80 IA	(44.96)	(38.47)	(2.06)	6.24	9.02	11.49	13.20	15.04	17.05	19.27	21.52	22.45	23.12	0
Corporate Tax Payable	-	-	-	-	-	-	-	-	-	-	-	-	-	22.87
MAT Calculation														
Profit Before Tax and Depreciation	33.28	19.34	22.90	26.77	31.00	35.64	40.74	46.35	52.54	59.39	66.34	69.21	71.27	70.50
Depreciation as per Book rates	33.95	33.95	33.95	33.95	33.95	33.95	33.95	33.95	33.95	33.95	0.00	0.00	0.00	0.00
Pre operative Expense written off	2.10	2.10	2.10	2.10	2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Book Profit For MAT	-2.77	-16.71	-13.15	-9.28	-5.05	1.69	6.79	12.40	18.59	25.44	66.34	69.21	71.27	70.50
MAT	-0.51	-3.09	-2.43	-1.72	-0.93	0.31	1.26	2.29	3.44	4.71	12.27	12.80	13.19	13.04
Surcharge	-0.03	-0.15	-0.12	-0.09	-0.05	0.02	0.06	0.11	0.17	0.24	0.61	0.64	0.66	0.65
Education Cess	-0.02	-0.10	-0.08	-0.05	-0.03	0.01	0.04	0.07	0.11	0.15	0.39	0.40	0.42	0.41
Total MAT	-0.55	-3.34	-2.63	-1.86	-1.01	0.34	1.36	2.48	3.72	5.09	13.27	13.85	14.26	14.11

Financial Analysis: PL A/C

	6 Mths	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00
Revenue												
Generation (Lakhs kWh)	0.00	7.45	7.37	7.30	7.22	7.15	7.08	7.01	6.94	6.87	6.80	6.73
Losses due to transmission		0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Net generation		7.37	7.30	7.23	7.15	7.08	7.01	6.94	6.87	6.80	6.73	6.67
Income through Power Sale through REC (Rate /kWh)	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MSEDCL		7.00	7.28	7.57	7.87	8.19	8.52	8.86	9.21	9.58	9.96	10.36
Net price		7.00	7.28	7.57	7.87	8.19	8.52	8.86	9.21	9.58	9.96	10.36
Revenue from sale of Energy (Rs. Lakhs)	0.00	51.60	53.13	54.71	56.33	57.99	59.71	61.48	63.30	65.17	67.10	69.09
Revenue from CDM (Rs. Lakhs)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Revenue	0.00	51.60	53.13	54.71	56.33	57.99	59.71	61.48	63.30	65.17	67.10	69.09
Operating Cost:												
Interest	0.00	16.78	32.22	30.21	27.93	25.33	22.37	19.01	15.18	10.82	5.86	0.86
O & M Expenses	0.00	1.00	1.03	1.06	1.09	1.13	1.16	1.19	1.23	1.27	1.30	1.34
Land Lease Expenses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Insurance Expenses	0.00	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54
Total Operating Cost	0.00	18.32	33.78	31.81	29.56	26.99	24.07	20.74	16.95	12.63	7.70	2.74
Earning before tax and depreciation	0.00	33.28	19.34	22.90	26.77	31.00	35.64	40.74	46.35	52.54	59.39	66.34
Pre-Operative exp		2.10	2.10	2.10	2.10	2.10	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation	0.00	33.95	33.95	33.95	33.95	33.95	33.95	33.95	33.95	33.95	33.95	0.00
Tax payable		0.00	0.00	0.00	0.00	0.00	0.34	1.36	2.48	3.72	5.09	13.27
Earning after Tax		-2.77	-16.71	-13.15	-9.28	-5.05	1.35	5.43	9.92	14.87	20.35	53.07

Financial Analysis: IRR, DSCR

	6 Mths)	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00
Earning after tax		-2.77	-16.71	-13.15	-9.28	-5.05	1.35	5.43	9.92	14.87	20.35	53.07	55.36
Add: Pre op written off		2.10	2.10	2.10	2.10	2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Add: dep as per co. act		33.95	33.95	33.95	33.95	33.95	33.95	33.95	33.95	33.95	33.95	0.00	0.00
Add: Int on term loan		16.78	32.22	30.21	27.93	25.33	22.37	19.01	15.18	10.82	5.86	0.00	0.00
Total cash flow		50.06	51.56	53.11	54.70	56.33	57.68	58.39	59.05	59.65	60.17	53.07	55.36
Int on term loan		16.78	32.22	30.21	27.93	25.33	22.37	19.01	15.18	10.82	5.86	0.00	0.00
Term loan repayment		6.59	14.53	16.54	18.82	21.42	24.38	27.74	31.57	35.93	40.89	22.51	0.00
Total debt to be served		23.38	46.75	46.75	46.75	46.75	46.75	46.75	46.75	46.75	46.75	22.51	0.00
DSCR		2.14	1.10	1.14	1.17	1.20	1.23	1.25	1.26	1.28	1.29	2.36	
Average DSCR		1.31											
Cumm. Cash Flow		71.65	114.92	121.28	129.23	138.81	149.73	161.37	173.67	186.56	199.98	230.53	285.89
Net Cash Flow	-112.96	71.65	43.28	6.36	7.95	9.58	10.92	11.64	12.30	12.90	13.42	30.56	55.36
Equity IRR	51.67%												
Project Cash Flow	-357.96	50.06	51.56	53.11	54.70	56.33	57.68	58.39	59.05	59.65	60.17	53.07	55.36
Project IRR	17.53%												

Scenario2: Diesel

IRR, DSCR: Diesel

	6 Mths	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00
Earning after tax		44.96	35.21	39.49	44.07	48.98	55.94	61.63	67.78	74.45	81.70	116.23	120.39
Add: Pre op written off		2.10	2.10	2.10	2.10	2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Add: dep as per co. act		33.95	33.95	33.95	33.95	33.95	33.95	33.95	33.95	33.95	33.95	0.00	0.00
Add: Int on term loan		16.78	32.22	30.21	27.93	25.33	22.37	19.01	15.18	10.82	5.86	0.00	0.00
Total cash flow		97.79	103.47	105.75	108.05	110.36	112.26	114.59	116.91	119.22	121.51	116.23	120.39
Int on term loan		16.78	32.22	30.21	27.93	25.33	22.37	19.01	15.18	10.82	5.86	0.00	0.00
Term loan repayment		6.59	14.53	16.54	18.82	21.42	24.38	27.74	31.57	35.93	40.89	22.51	0.00
Total debt to be served		23.38	46.75	46.75	46.75	46.75	46.75	46.75	46.75	46.75	46.75	22.51	0.00
DSCR		4.18	2.21	2.26	2.31	2.36	2.40	2.45	2.50	2.55	2.60	5.16	
Average DSCR		2.58											
Cumm. Cash Flow		100.24	175.73	234.73	296.03	359.63	425.14	492.98	563.15	635.62	710.38	804.09	924.48
Net Cash Flow	-112.96	100.24	75.49	59.00	61.30	63.61	65.51	67.84	70.16	72.47	74.76	93.71	120.39
Equity IRR	574.67%												
Project Cash Flow	-357.96	97.79	103.47	105.75	108.05	110.36	112.26	114.59	116.91	119.22	121.51	116.23	120.39
Project IRR	41.65%												

Scenario 3: No Subsidy

IRR, DSCR: No Subsidy

	6 Mths)	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00
Earning after tax		-25.64	-46.19	-41.78	-36.93	-31.59	-22.68	-16.14	-8.89	-0.82	6.52	52.59	55.18
Add: Pre op written off		3.00	3.00	3.00	3.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Add: dep as per co. act		48.50	48.50	48.50	48.50	48.50	48.50	48.50	48.50	48.50	48.50	0.00	0.00
Add: Int on term loan		23.98	46.03	43.16	39.90	36.19	31.96	27.16	21.69	15.46	8.38	0.00	0.00
Total cash flow		49.83	51.33	52.88	54.47	56.10	57.78	59.52	61.30	63.14	63.40	52.59	55.18
Int on term loan		23.98	46.03	43.16	39.90	36.19	31.96	27.16	21.69	15.46	8.38	0.00	0.00
Term loan repayment		9.42	20.76	23.63	26.89	30.60	34.82	39.63	45.10	51.33	58.41	32.16	0.00
Total debt to be served		33.39	66.79	66.79	66.79	66.79	66.79	66.79	66.79	66.79	66.79	32.16	0.00
DSCR		1.49	0.77	0.79	0.82	0.84	0.87	0.89	0.92	0.95	0.95	1.64	
Average DSCR		0.93											
Cumm. Cash Flow		87.70	134.44	120.53	108.21	97.53	88.52	81.25	75.77	72.12	68.72	89.15	144.33
Net Cash Flow	-161.38	87.70	46.74	-13.91	-12.32	-10.69	-9.00	-7.27	-5.49	-3.65	-3.39	20.43	55.18
Equity IRR	16.23%												
Project Cash Flow	-511.38	49.83	51.33	52.88	54.47	56.10	57.78	59.52	61.30	63.14	63.40	52.59	55.18
Project IRR	10.97%												

THANK YOU

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