

Online training of SAARC Professionals on Small, Mini and Micro Hydro Power Generation (Sept 13 - 17, 2021)

Tariff Structure and Power Purchase Agreement of SMMHP plants

Sept 16, 2021

Prof Anand Kumar

HRED, IIT Roorkee, India

devinaanand@gmail.com

Outline of Presentation

- Importance of Renewable Energy
- Need of Small Hydro
- Tariff Structure
- All Component of Tariff Determination Exercise
- Cash Flow Exercise
- Tariff Fixation for Small Hydro
- Key Component of PPA
- Discussion on Model Small Hydro PPA

Objective of Learning

To understand how tariff of small hydro is fixed in a regulated regime following country specific regulations. the importance of Power Purchase agreement, its need and key component shall be also understood

Why do we need Renewable Energy

- Danger of Fossil Fuels
- Greenhouse Effect & Global Warming
- Climate Change
- Carbon Dioxide emission must fall
- Renewable as Alternative to Fossil fuels
- Economics of Renewable Power Plants
- Land or Sea required for Renewable
- Variability of Renewable Energy

Small Hydro Power

- Environmental and Social Impact of Hydropower
- Potential for Hydro Power
- Small Hydro Power with Distributed Generation

Tariff Fixation

Regulated or Competitive Auction

➤ Objectives of Tariff Regulations

- Regulatory certainty
- Address the risk
- Ensure financial viability
- Operational norms
- Promote operational efficiency
- Single-Part Tariff Vs Two-Part Tariff
- Project Specific Tariff Vs Generic Tariff

➤ Law Governing for tariff fixation

Tariff Design

- Cost Plus- Single Part Tariff
- Control Period of the Regulations
- Useful Life of the Plant & Tariff Period
- Operational and Financial Parameters
 - Capital cost
 - Operations & Maintenance Charges
 - Capacity Utilization Factor (CUF)
 - Auxiliary Consumption
 - Debt-Equity Ratio

- Loan Tenure and Rate of Interest on Term Loan
- Depreciation
- Working Capital and Interest on Working Capital
- Return on Equity j. Discount Rate
- Income Tax

Capital Cost

- Benchmark capital cost in Rs /MW
- Comparable with others States
- Comparable with similarly located
- Study of few projects
- Cost includes evacuation from project to nearest sub station

Operation and Maintenance Charges

- Study of O&M costs data of similar SHP project
- Comparable
- Fixing Normative as percentage of Capital Cost
- Allowing Escalation factor

Capacity Utilization Factor

- Normative CUF in percentage term
- Study and Examination of all relevant type and design of the SHP schemes likely to come up
- Examination of the availability of flow of water in the irrigation canals on which majority of SHP schemes would be developed
- Study of normative CUF fixed by SERCs of other States
- Examination of actual CUF of the operating SHP plants in other States

Auxiliary Consumption

- Normative as 1% of gross generation
- Examination of Actual Data
- Comparable with Other States

Debt-Equity Ratio

- Tariff Regulations generally prescribes 70:30 for Generating Company/Licensees.
- The Tariff Policy formulated by the Ministry of Power, Govt. of India, stipulates debt-equity ratio of 70:30 for power projects
- Depending upon market Rates (ROE/Interest) should be decided.

Loan Tenure and Rate of Interest on Term Loan

- loan tenure as 10 years or as per the market practice
- Interest rate of loan to be linked to Main Bank's Rates with some basis points
- Basis Point to judged
- Normative rate can also be fixed

Depreciation

- Capital cost as value base for the purpose of determination of depreciation
- salvage value of the asset is considered as 10% of capital cost of the asset
- Balance value is depreciated over the project life as per Straight Line Method.
- To facilitate the principal loan repayment, the depreciation rate can be fixed for loan repayment period as per 'Straight Line Method'
- Remaining useful life of the plant i.e. depreciation at the rate per annum from 11th to 35th year

Working Capital and Interest Rate

➤ Components of Working Capital

- O&M expenses for one month
- Receivables of one month charges for sale of electricity.
- Bank (MCLR) base rate plus 250 basis POINT
- working capital requirement by the project developer would be generally on short term

Return on Equity (RoE)

- 30% of the capital cost of SHP project.
- If the equity employed by the project developer is more than 30%, the amount of equity for the purpose of determining the tariff was proposed to be limited to 30% only and the rest would be treated as loan. In case the equity employed is less than 30%, then the actual equity employed would be considered.
- RoE of 14% per annum.
- Tax payment as per applicable law may differ for different period in case of MAT.

Discount Rate for Levelised Tariff

- weighted average cost of capital (WACC)
- The formula for computation of WACC is given below:
- $WACC = \text{Cost of Debt} + \text{Cost of Equity}$
- Where, Cost of Debt (For first 10 Years) $= 0.70 \times (\text{Market Rate of Interest}) \times (1 - \text{MAT})$
- Cost of Debt (11th Year to 35th Year) $= 0.70 \times (\text{Market Rate of Interest}) \times (1 - \text{Corporate tax})$
- Cost of Equity $= 0.30 \times \text{Return on Equity (i.e. 14\%)}$

- Resulting WACC = $\{(WACC \text{ for first 10 Years} \times 10) + (WACC \text{ from 11th Year to 35th Year} \times 10)\} / (10 + 25)$
 Cost of Debt (For first 10 Years) = $0.70 \times 11.40\%$
 $\times (1 - 21.34\%) = 6.28\%$
 Cost of Debt (11th Year to 35th Year) = $0.70 \times 11.40\% \times (1 - 34.61\%) = 5.22\%$
 Cost of Equity = $0.30 \times 14\% = 4.2\%$
- Resulting WACC = $\{(10.48\% \times 10) + (9.42\% \times 10)\} / (10 + 25) = 9.72\%$

Income Tax

- Rates of IT as Per Law
- MAT for first ten (10) years of operations
- Corporate Tax rate for balance period of 25 years

Other Commercial Items

- Transmission and Wheeling Charges
- Transmission losses
- Distribution Wheeling Charges
- Distribution losses
- Cross Subsidy Charges
- Additional Charges

Parameters	Decided for next control period	
	Below 5 MW	5 – 25 MW
Project Cost		
Total Project Cost (Land + Plant & Machinery + Erection Cost + Evacuation Infrastructure Cost up to GETCO Substation) (Rs. Lakh/MW)	820	748
Normative O&M Cost for first year (% of project cost)	3.3%	2.5%
Escalation in O&M (per annum from 2nd year)	5.72%	5.72%
Performance Parameters		
CUF	42%	42%
Auxiliary Consumption	1%	1%
Project Life in Years	35	35
Financial Parameters		
Debt-Equity ratio	70:30	70:30
Term of Loan in Years	10	10
Interest on Term Loan	11.40%	11.40%

Parameters	Decided for next control period	
	Below 5 MW	5 – 25 MW
Interest on Working Capital	11.40%	11.40%
Depreciation	7% (for first 10 years) 0.8% (from 11 to 35 years)	7% (for first 10 years) 0.8% (from 11 to 35 years)
Minimum Alternate Tax	21.34%	21.34%
Corporate Income Tax	34.61%	34.61%
Return on Equity	14%	14%
Discount Rate	9.72%	9.72%
Tariff	Gross Tariff – Rs 4.32 / kWh AD benefit – Rs 0.38 / kWh Net Tariff – Rs 3.94 / kWh	Gross Tariff – Rs 3.64 / kWh AD benefit – Rs 0.35/ kWh Net Tariff – Rs 3.29 / kWh

Other Commercial Conditions

Transmission and Wheeling Charges

- Third Party Sale
- Wheeling of Power for third party sale from small, mini and micro hydro projects shall be allowed on payment of transmission charges, transmission losses, wheeling charges and wheeling losses of the energy fed into grid, as applicable to normal open access consumer. Set off of wheeled energy at recipient unit(s) shall be carried out in the same 15 –minutes time block.
- Small hydro project owners who desire to wheel electricity for third party sale to more than one location shall pay 5 paisa per unit on energy fed in the grid to the Distribution company concerned in whose area power is consumed in addition to above mentioned transmission charges and losses as applicable.
- 50% of the cross subsidy surcharge and additional surcharge, as applicable to normal open access consumer, shall be applicable.

Energy Metering

- Central Electricity Authority (Installation and Operation of meters) Regulations
- However, for the purpose of energy accounting, such projects shall have to provide ABT compliant meters at generators and if the power is to be wheeled to consumer's premises, then ABT compliant meter is to be installed at the consumer premises also.

Tariff Calculations for Small Hydro (Below 5 MW)																				
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Net Energy sold (lakh kWhs)	36.42	36.42	36.42	36.42	36.42	36.42	36.42	36.42	36.42	36.42	36.42	36.42	36.42	36.42	36.42	36.42	36.42	36.42	36.42	36.42
Costs (Rs./Lakh)																				
O&M	27.06	28.61	30.24	31.97	33.80	35.74	37.78	39.94	42.23	44.64	47.20	49.89	52.75	55.77	58.96	62.33	65.89	69.66	73.65	77.86
Depreciation (SLM)	57.40	57.40	57.40	57.40	57.40	57.40	57.40	57.40	57.40	57.40	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56
Interest on term loan	62.16	55.62	49.08	42.53	35.99	29.45	22.90	16.36	9.82	3.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest on working capital	2.09	2.05	2.02	1.99	1.96	1.93	1.90	1.88	1.86	1.84	1.41	1.47	1.52	1.58	1.64	1.70	1.77	1.84	1.92	2.00
Return on Equity	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44
Tax on equity	7.35	7.35	7.35	7.35	7.35	7.35	7.35	7.35	7.35	7.35	11.92	11.92	11.92	11.92	11.92	11.92	11.92	11.92	11.92	11.92
Total Cost (Rs lakh)	190.50	185.47	180.53	175.68	170.94	166.30	161.78	157.37	153.09	148.94	101.53	104.28	107.19	110.26	113.51	116.95	120.59	124.43	128.49	132.78
Tariff (Rs/kWh)	5.23	5.09	4.96	4.82	4.69	4.57	4.44	4.32	4.20	4.09	2.79	2.86	2.94	3.03	3.12	3.21	3.31	3.42	3.53	3.65

Tariff Calculations for Small Hydro (Below 5 MW)															
Year	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Net Energy sold (lakh kWhs)	36.42	36.42	36.42	36.42	36.42	36.42	36.42	36.42	36.42	36.42	36.42	36.42	36.42	36.42	36.42
Costs (Rs./Lakh)															
O&M	82.31	87.02	92.00	97.26	102.83	108.71	114.92	121.50	128.45	135.80	143.56	151.77	160.46	169.63	179.34
Depreciation (SLM)	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56
Interest on term loan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest on working capital	2.09	2.18	2.27	2.37	2.48	2.59	2.71	2.84	2.97	3.11	3.26	3.42	3.59	3.76	3.95
Return on Equity	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44
Tax on equity	11.92	11.92	11.92	11.92	11.92	11.92	11.92	11.92	11.92	11.92	11.92	11.92	11.92	11.92	11.92
Total Cost (Rs lakh)	137.32	142.12	147.19	152.56	158.23	164.22	170.56	177.26	184.34	191.83	199.75	208.11	216.96	226.32	236.21
Tariff (Rs/kWh)	3.77	3.90	4.04	4.19	4.34	4.51	4.68	4.87	5.06	5.27	5.48	5.71	5.96	6.21	6.48
Discount Rate	9.72 %														
Levelized Fixed Tariff (Rs / kWh)	4.32														

Key Features of a Power Purchase Agreement

- A Power Purchase Agreement (“PPA”) is generally the primary contract between the public and private sector parties which underpin a power sector PPP.
- It is typically between a public sector purchaser "off-taker" (often a state-owned electricity utility, in jurisdictions where the power sector is largely state operated) and a privately-owned power producer.
- It usually provides the primary revenue stream which underwrites the PPP project.
- the structure and risk allocation regime under the PPA is central to the private sector participant's ability to raise finance for the project, recover its capital costs and earn a return on equity.
- While certain elements may be common across all PPAs, different considerations would apply for mid-range or peaking thermal plants or plants using different generation technology (e.g. wind or solar).

- The PPA often sits alongside or is combined with a BOT or concession agreement: in addition to obligations relating to the sale and purchase of the power generated, the project company is also required to design, construct, operate and maintain the power plant in accordance with agreed specifications.
- Sale of capacity and energy - the PPA may require the project company both to make available to the purchaser an agreed level of capacity at the power plant and deliver the energy generated in accordance with its provisions. However for small hydro only single part tariff is given.

Pricing

- In general, the pricing regime in the PPA typically has two components:
 - an availability or capacity charge, which is payable by the offtaker in consideration of the power plant operator making generation capacity available to the offtaker, whether or not it actually offtakes electricity from the power plant. This component is typically designed to provide a revenue floor for the project and is the primary channel through which each project proponent would recover its fixed costs (including its capital investments, financing costs and a return on equity); and
 - an output charge – this is usually referenced to the volume of electricity actually delivered and is intended to cover the project company's variable costs.

- The pricing mechanism is the primary mechanism for allocating revenue and market risk in respect of the project between the public and private sectors and is central to the private project proponent's and its lenders' assessment of the commercial viability and bankability of the project. Typically, private project proponents and lenders will require the PPA to run for a long term to guarantee investment recovery.
- Third party sales – the ability to make third-party sales can enhance the commercial viability of the project and provide it with a degree of cushioning against demand side risks under the primary long term PPA. This flexibility also has the advantage that, given the long-term nature of the primary PPA, if the market is deregulated at a later date, then the power plant can participate in that market without completely unwinding the primary PPA.

- However, purchasers are often nervous about allowing third-party sales as they want to be sure that all capacity is available to them at all times and so the PPA may include an exclusivity period during which all power produced is to be supplied to the purchaser.
- Flexibility may need to be incorporated into the PPA to ensure that this exclusive period is not an impediment to future development/ deregulation of the electricity market. The practical feasibility of third party sales (both in terms of demand and access to physical infrastructure to deliver electricity to third parties) will also need to be considered carefully.

Termination & Change of Law

- There should be objective and designed to confirm levels of contracted capacity, reliability and fuel efficiency or heat rate. Test results should ideally be certified by an independent engineer.
- PPA will need to provide for what happens on termination (whether at the end of the term of the agreement or early termination for default etc), including obligations of the power producer to hand-over assets to the government offtaker, what happens to employees of the power plant if the power plant is transferred to the offtaker on termination. The availability and calculation of an early termination payment (typically for the purchaser to buyout the power plant) will be central to the commercial viability and bankability of the project.
- Project operation – issues typically include scheduled outages and maintenance outages, operation and maintenance, emergencies and keeping of accounts and records.

Termination & Change of Law

- Change of law – PPA should address impact on tariff in the event of a change in applicable law and the mechanism for tariff adjustment. Private project proponents and their lenders will be anxious to ensure that the cash flows of the project are appropriately protected against changes in law (at least in the country where the project is situated).
- Note that the allocation of change of law and other regulatory risks would be quite different if the off taker were a private entity. In the latter case, the private off taker has significantly less ability and appetite to absorb change in law risks (compare to a government entity).

- Discussions
- Q&A



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Thank you

