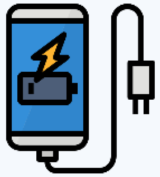
Project Finance Modeling for Renewable Energy

Selling Energy

What is PPA?



PPA is a long-term power purchase agreement between **the power seller** (independent power producer) and **the buyer** (utility)

Important terms:

fixed energy price *($/MWh)*

price escalation formula *(i.e. Consumer Price Index)*

volume *(MWh/year)*

term *(10+ years)*

delivery point *(high side of the transformer)*

Selling Energy – Wind Projects

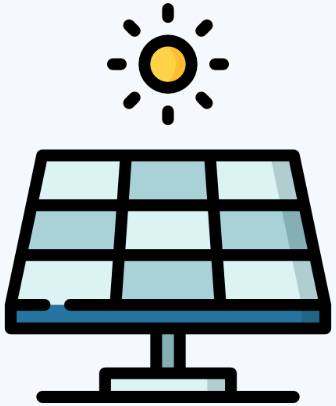
all energy generated by the project is sold to the Offtaker

even if the offtaker does not need the energy, the offtaker is obliged to **purchase all energy production** (**“take or pay”** structure)

the seller must **maintain at least 95% mechanical availability**

failure to maintain at least 95% mechanical availability, results in **availability liquidated damages (cash penalties)** payable by the seller (eventually leads to default, if not cured)

Selling Energy – Solar Projects



committed energy generated by the project is sold to the Offtaker

the offtaker is obliged to **purchase all committed energy production**, even if the offtaker does not need the energy (**"take or pay"** structure)

the seller must **generate at least 85% of the committed energy** adjusted for actual solar conditions

failure to generate 85% of committed energy, results in **performance liquidated damages (cash penalties)** payable by the seller (eventually leads to default, if not cured)

The PPA structured as **“take or pay”** creates **a long-term, secure stream of revenue** for the energy seller

Energy Generation Revenue

Price $/MWh × Actual Energy Output × Curtailment = Revenue

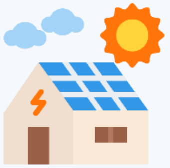
actual energy output has to be within certain limited range of **committed energy output** to be sold to offtaker **for solar projects**

curtailment - **reduction in the energy output** on involuntary basis, can be compensable or non-compensable

Curtailment

non-compensable curtailment: **grid non-availability due to maintenance**

compensable curtailment: offtaker requirement to **reduce power generation for any reason**



the power that could have been produced under compensable curtailment is called **deemed energy generation**

offtaker has to pay for deemed energy generation, as if the energy has been delivered - **deemed energy payment**

Deemed Energy Generation Example

A wind farm could have produced 26,000 MWh in a year, but due to offtaker's request to curtail 1000 MWh, the wind farm delivered only 25,000 MWh in that year.

At ¢10 per kWh what is deemed energy payment to a wind farm?

Actual Generation 25,000 MWh	×	Price $100 / MWh	=	Energy Payment $2.5 mn
Deemed Energy Generation 1,000 MWh	×	Price $100 / MWh	=	Deemed Energy Payment $100,000

Non-compensable Curtailment

What do we do?

Seller **incorporates non-compensable curtailment into electricity price** by increasing the electricity price to compensate for the times when project can generate the energy but the grid cannot take it.