

ECONOMICS OF ROOFTOP PV

AGBRES II - A Solar Roof Concept

PRINCIPLE

- Converts light to electricity (DC)
 - Examples: watches, calculators
- DC is converted to AC using inverters
 - Example: UPS, inverters with batteries
- Uses GHI & Diffuse components of solar radiation (KWh/m²)
- Temperature & dust impacts performance
 - Temperature coefficient
 - Dust reduces output

LOSSES

- Panel
 - Temperature coefficient
 - Dust (frequent cleaning): dust on car windscreen
- DC to AC loss
 - Inverter efficiency
- DC loss
 - $< 1\%$
- AC loss
 - $< 1.5\%$

MODULE PERFORMANCE

- Efficiency (output at 1,000 W_{peak})
- Year-to-year degradation (0.2% - 5%)
- Cost \$ / Wp (lower efficiency, larger area of modules)
 - Means whether efficiency is 9% or 18%, the cost of modules required for the same output is the same
 - However BOS costs (mounting structures, junction boxes, connectors, cables, area etc.) are more
- Efficiency in lab vs. performance in the field
- Temperature coefficient

INVERTER PERFORMANCE

- Efficiency of inverter
- Impact of temperature (cooling)
- BOS losses
 - Junction
 - Connectors
 - Cable, particularly size of cable

HOW TO REDUCE LOSSES

- Module degradation
 - cycle test, supplier guarantee of performance
- Temperature
 - Panel frame, mounting structure, heat
- Dust
 - Cleaning, coating
- Inverter efficiency and degradation of performance, impact of temperature

HOW TO BUY

- Module degradation, efficiency for 25 years; temperature coefficient
- Inverter efficiency and temperature degradation
- Mounting structures, foundation
- Direction (N-S)
- Tilt = latitude
- Tracking vs. fixed tilted (summer-winter sun)

OTHER CONSIDERATIONS

- Main source or back-up
- Load calculations or existing inverter capacity & battery back-up
- Average hours of failure

ECONOMICS

- CAPEX vs. OPEX
- LCOE concept
- Payback period
- Govt. incentive vs. no incentive

COST

- DC side kit (only)
 - Rs. 90 / Wp (without battery)
 - Yield: 1,400 units / year (esti.)
 - Payback: 10 years (at current costs)

ADVANTAGES

- Mounting structures
 - Aluminium, no foundation/civil; fit & forget
 - Structural stability, loss heat conduction
 - Lightning protection
- Panels
 - Anti reflective coating & Duraflex sheet (> transmission >> efficiency)
 - Tedlar back sheet: low convection
 - AR glass: self cleaning properties (hydrophobic)