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Risk and resource efficiency of solar Photovoltaic (PV) Systems

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The capacity factor defines the percentage of time a PV system produces power at its rated capacity during a calendar year. It primarily depends on the location, tilt, azimuth, weather pattern, direct to alternate current derate factor and shading obstacles. Typically this value ranges from 13% to 24% for fixed tilt PV arrays in the United States, which is a comparable efficiency to fossil fuels, e.g. liquid fuel to locomotive power efficiency is 15-25%.

Solar energy is the only scalable power source that can meet world's current energy demand. Solar energy potential on earth is 100,000 TW. Assuming the world energy demand will be 30 TW by 2050, we can meet this demand three times over by placing 10% efficient solar panels on only 1% of the land area of the world!

Risks for PV array are limited compared to most other power sources.

As the panels are tilted south, they are generally self-cleaning. In the case of multiple days of snow accumulation, the snow melts off soon after the sun shines.

A typical fixed-tilt solar array has no moving parts except a small fan in the inverter; therefore there is very limited equipment failure opportunities.

There is a slight risk of fire in a PV array mainly caused by an undetected fault in a grounded or ungrounded conductor. This risk can be minimized using proper installation procedures and wire management, as well as installation of additional devices such as, additional ground fault detectors, PV array isolation sensing devices, and arc fault detectors. Detailed continuous monitoring down to module level for PV systems larger than 100 kWDC is recommended for it will determine if unscheduled maintenance is required, thus, will prevent potential fires from conductor faults.

Utility infrastructure upgrades will be required as more and more distributed energy resources such as PV arrays are interconnected with the utility grid. The costs of such upgrades are largely unknown to the customers until the utility conducts an interconnection study, this unknown variable creates uncertainty in a solar developer's initial pro-forma, though can be reasonably bounded.

Currently it is difficult to project the long-term pricing of RECs to be sold in auctions, instilling variability into PV economic returns calculation.

In general, the benefits of PV outweigh the risks in most sunny regions, with high electricity prices (e.g, New England) especially with their strong environmental benefits for greenhouse gas mitigation.

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