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A New Metric for Measuring the Competitive Cost of Solar

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This guest post was written by Todd Miklos, the senior director of solar inverter marketing at Advanced Energy of Fort Collins, Colo.

Our planet's most abundant form of energy is the sun. Yet conventional utilities have been hesitant to use photovoltaic panels like those found on residential rooftops for large-scale projects, despite falling prices for the technology and free sunshine as fuel. A key reason is utilities have established metrics for generating electricity from coal, gas, oil, and nuclear, but not from solar photovoltaics, or PV, a quickly evolving technology whose cost depends on where the energy is produced.



Fortunately, the solar industry has begun adopting a standardized metric that utilities can understand: levelized cost of energy, commonly called LCOE. Simply put, LCOE factors all costs of a solar plant across its lifetime, compare that to total electrical production and establishes a reliable, long-term financial picture. This metric has wide acceptance by the power industry, research firms and government agencies worldwide.

Dollars per Watt versus LCOE

The solar industry has historically used another metric, "dollars per watt," which measures initial costs of a solar installation versus its theoretical peak power output. This metric, if considered alone, ignores the actual energy produced from the system and many other factors. It is analogous to buying a car based only on sticker price and top speed while ignoring miles per gallon, resale value and cost of maintenance.

LCOE is measured in cents per kilowatt-hour (the same rate on your monthly electric bills) and enables solar to be accurately compared with other energy sources. Some critics argue the LCOE calculation is overly complex, yet proponents say it is crucial for successful business models.

LCOE Factors

The dozens of LCOE variables can be grouped into five main categories.

1. Location – for sun exposure, seasonality and local incentives.
2. Cost of capital – spanning interest, taxes, and leverage.
3. Energy production – how solar panel and other equipment and operations perform.
4. System costs – similar to dollars per watt, but covers total installation and warranties.
5. Operations and maintenance costs – cleaning, monitoring and repairing.

Energy Production

Intuitively, more sunshine, higher efficiency PV modules and reliable uptime mean more electricity. But some aspects are counterintuitive, like cold days being better than hot for solar production since overheating PV can actually lower energy output. High-quality inverters, which convert raw electricity from solar panels to grid-synchronous power, greatly determine effectiveness and power. Trackers direct solar panels to follow the path of the sun, thereby capturing more energy. Even a few percentage points of improvement in production can boost return on investment greatly.

System Costs

Prices of complete solar systems have dropped dramatically in the past decade due to design and technological innovations. For example, solar modules, power inverters and installation costs have been slashed in the past five years. Large utility installations deploy building blocks of multi-megawatt sections for efficiency in design and logistics.

Unfortunately, as with any industry, cutting-corners on quality to lower upfront costs is a risky strategy. Inefficient and inferior inverters can cost more than the original price in lost electricity over time. Risky tradeoffs also apply to modules, trackers, and operation and maintenance contracts. In short, lower LCOE is contingent on superior equipment, planning and execution.

Operations & Maintenance

Long term performance from a solar power plant requires high reliability, remote monitoring, proactive maintenance and service. Thus, selection of equipment must consider service factors like which warranties and ongoing services are best for the financial model and regulations at each site. Look at the fine print and ask questions: Does the warranty cover only materials, or comprehensive ‘bumper to bumper?’ Is the company bankable and capable of service for five to 20 years? How responsive is the supplier? Slow service equals lower energy production and impacts LCOE. Some suppliers are not equipped to respond to service requests but that is changing as the industry scales. A few companies offer expanded service programs to address the entire array including equipment made by other manufacturers.

Looking Ahead

Several research studies report the LCOE of solar PV has begun crossing below peaking gas plants in some regions, and will do so in a dozen States within three to five years. Such examples suggest this time, unlike the 1980s, solar PV is here to stay, albeit with variation by region and time.

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Upfront planning and long-term vision with an eye on LCOE are important for successful adoption of solar for utility-scale power. Additional resources about the bankability and benefits of solar energy are offered below.

[National Renewable Energy Lab](#)

[Colorado State University](#)

[SunPower LCOE](#)