ADVANCED ENERGY®

PVPowered™ solaron® siteguard®

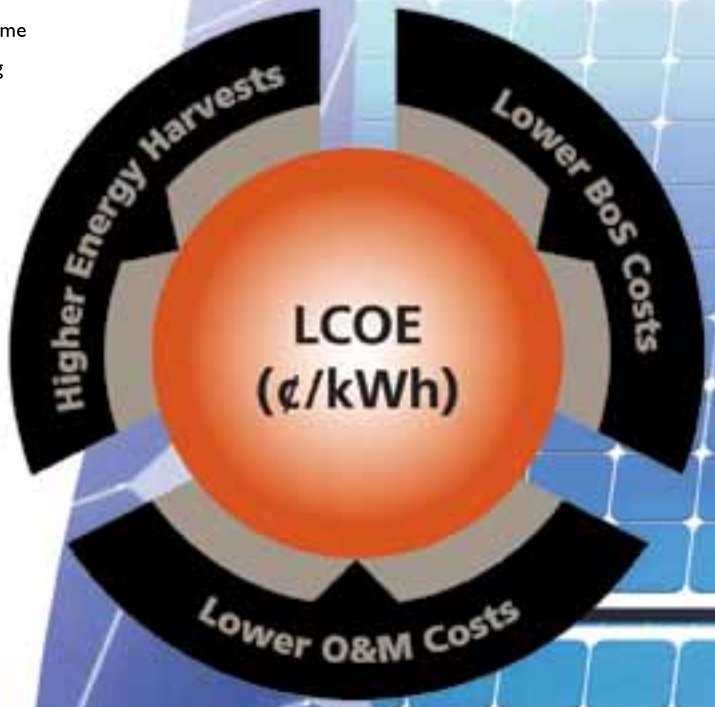
LCOE for Solar PV Installations

Levelized cost of energy depends on performance, system costs, and ongoing operations & maintenance over the lifetime of a system

When it comes to energy production, different sources of energy call for different financial models. Even within the same category—PV solar, for example—ROI varies widely among system architectures, types of equipment, and locations. Analyzing the economics of a project is fundamental, and fortunately there's a calculation that can help: LCOE (levelized cost of energy).

LCOE analysis considers costs distributed over the project lifetime, providing a highly accurate financial picture that system operators prefer over the simple cost-per-watt calculation often used in the industry. LCOE calculates the true cost, measured in ¢/kWh of energy produced. While it may seem difficult to weigh upfront investments against benefits down the road, the payback could be substantial.

Many variables and design decisions determine LCOE. At the equipment level, they can be grouped into three key categories: performance, system costs, and ongoing operations & maintenance (O&M). Inverter efficiency, reliability, and performance directly impact energy output. Some inverters reduce or eliminate costly wiring and BoS equipment—reducing initial equipment costs. Likewise, ensuring the inverters and all PV site equipment remain operational through first-rate O&M affects the amount of energy produced and the long-term return on your capital investment. In short, the inverter equipment and service partner you choose could mean the difference between an economically viable project and one that's not.



PV Powered and Solaron products built in the U.S. are fully compliant with the Buy American Act and qualify for projects funded by the federal stimulus package.

AE Inverters and SiteGuard O&M Services Can Reduce ¢/kWh Over PV Project Lifetimes

Higher Energy Harvests	Lower BoS Costs	Lower O&M Costs
• High peak efficiencies up to 98.7% • High CEC-rated efficiencies (97.5% and 98%) • High European efficiencies (98.1%) • Fast, wide, proprietary maximum power point tracking (MPPT) • Maximum power on hot days (50°C/122°F) • Industry-leading uptime	• Lower site preparation and installation costs • Standalone, outdoor-ready enclosures (high NEMA & IP ratings) • Remote monitoring software included • Reductions in large-diameter cabling • Fewer medium-voltage transformers required • Fewer or smaller pads required	• Standard warranty of 5 to 10 years by model • Extended warranties up to 20 years • High reliability • Remote monitoring & diagnostics • Customizable service plans with 99% uptime guarantee available • Whole-site O&M services available

Example LCOE Analysis

You can see the difference in these examples using a 2 MW AC array with Si panels (208 W) and 1-axis tracking in Sacramento, California. Results are highly dependent on key variables, so be sure to investigate all rebates, tax credits, financing options, and other incentives that may be available in your location. Most importantly, choose equipment that will give you the most your money can buy—not just in the short term but over the lifetime of your PV system.

Example 1, Baseline Design	Example 2, Design Using AE Solaron®
$4/$W_{DC}$ nominal	Slightly lower BoS, transformers, remote PV tie (RPT™)
500 kW inverters with 96% CEC efficiency	500 kW inverters with 97.5% CEC efficiency
96% uptime	99% uptime guarantee
½ pt loss in HVAC	Outdoor ready, lower DC losses
Default O&M $0.025/W/yr	Includes 99% uptime
20 year life, 50% down, 6% loan	Same
35% tax (U.S. Federal, state, local + insurance)	Same
ITC 30% rebate	Same
Nominal RECs, PBI	Same
Annual output: 4.13M kWh	Annual output: 4.35M kWh
LCOE: 13.4 ¢/kWh	LCOE: 12.1 ¢/kWh

Calculations performed using National Renewable Energy Laboratory (NREL) System Advisory Model (SAM 2010). Numbers are illustrative but actual results will vary for any specific site.

This example illustrates that performance, O&M expenses, and BoS costs due to choice of inverter can significantly improve your LCOE. Here, AE Solaron inverters help to achieve 11% better LCOE. When you consider that inverters are usually 10% or less of system costs, choosing AE inverters is an investment that quickly pays for itself and in some cases can double the profitability of a solar PV installation.

LCOE: Cost per kWh

A precise method for determining the net present cost of production for a specific PV installation, or, expressed in terms of key financial aspects:

$$\text{LCOE (¢/kWh)} = \frac{\text{Lifetime expenses for capital + financing + installation + O\&M + miscellaneous}}{\text{Lifetime energy production}}$$

Advantage

Encompasses cumulative system costs and total energy production over the system lifetime, levelized to compare with prevailing electricity rates in ¢/kWh

Limitations

Can entail complex analysis; however, on-line calculators now make LCOE calculations straightforward

Cost per Watt

A simple calculation that estimates the value of your investment at the time of purchase:

$$\$/W = \frac{\text{Total installation expenses}}{\text{Peak power rating}}$$

Advantage

Quick, simple math for budgeting solar PV projects

Limitations

Provides no comparison to grid parity and completely ignores critical factors like efficiency, uptime, system architecture, and lifetime optimization

References

National Renewable Energy Laboratory (NREL) System. Advisory Model (SAM), https://www.nrel.gov/analysis/sam.

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European Photovoltaic Industry Association (EPIA), Alliance for Rural Electrification (ARE), and Asociación d la Industri Fotovoltaica (ASIF), "Potential of On-Grid Photovoltaic Solar Energy in Sunbelt Countries (Executive Summary), Commissioned Report, December 2009.

Solar Buzz LCOE Benchmarks, http://www.solarbuzz.com.

For more information on AE inverters, visit *www.advanced-energy.com/renewables.*
Specifications are subject to change without notice.

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