# Driving Solar Success: LEVELIZED COST OF ELECTRICITY (LCOE)

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## How the Levelized Cost of Electricity Is Affecting Solar Deployment

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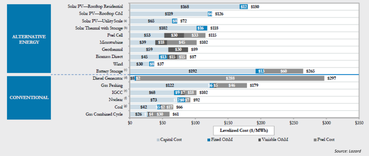
### American Council On Renewable Energy

- The American Council On Renewable Energy (ACORE) is a non-profit membership and advocacy organization dedicated to building a secure and prosperous America with clean, renewable energy.
- ACORE provides a common educational platform for a wide range of interests in the renewable energy community, focusing on technology, finance, policy and market development.
- Our members include many well-known companies such as Amazon, Bank of America, Citigroup, Gehrlicher Solar, Goldman Sachs, Google, First Solar, Flextronics, FLS, NRG, Siemens, SolarCity, SunEdison, as well as other non-profits, trade associations, federal agencies, state governments and many others.
- ACORE accomplishes its mission through a variety of programs and initiatives, and one of the primary industry markers that cross-cut several of our actives is the **Levelized Cost of Electricity or LCOE**.
- ACORE's US Partnership for Renewable Energy Finance (US PREF) comprises the nation's leading financial institutions who rely on developing accurate LCOE calculations to effectively allocate renewable energy investments.
- The Power Generation and Infrastructure Initiative examines power market dynamics and how decreasing LCOE numbers are affecting renewables' integration.
- ACORE's International Initiative examines how the improving economics of renewables can provide solutions and business opportunities globally.

### Levelized Cost of Electricity (LCOE) Overview

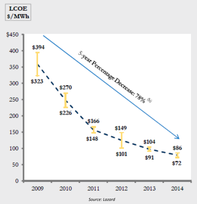
- Levelized Cost of Electricity (LCOE) is often cited as a convenient summary measure of the overall competiveness of different generating technologies.
- The **LCOE** represents the per-kilowatt hour cost (in real dollars) of building and operating a power plant over an assumed financial life and duty cycle.




### Determining LCOE of a PV System

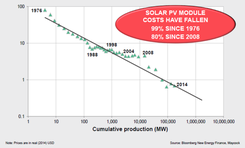
LCOE Calculation:

- In determining the LCOE of a PV system, the following factors should be considered:
  - Costs
    - Initial investment or capital cost
    - O&M and operating expenses
    - Financing costs
    - Insurance costs
    - State and federal income taxes
    - Property taxes
    - Required return on investment
    - Decommissioning or removal
  - Incentives
    - Federal tax credit
    - Accelerated depreciation (MACRS)
    - Incentive revenue
  - Energy
    - Estimated Year 1 production
    - Annual degradation
    - System availability
- ACORE's Power Generation Initiative is actively examining the complex relationship among local electricity prices, system prices, and other localized factors in achieving grid parity for solar PV systems nationally.



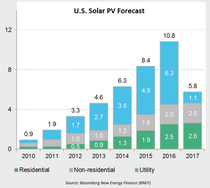

### Quality Assurance

- Rapid declines in the cost of panels have created economies of scale that in turn have provided the necessary competition to develop low-cost, high-quality panels.
- As cost continues to decline, LCOE continues to decrease driving scale and increased production.
- Maximizing energy production per panel area is critical to achieving the best LCOE calculations.
- This feedback loop also decreases investor risk and operation and maintenance (O&M) costs.
- The Power Generation & Infrastructure Initiative has worked diligently to break down all of the associated variables in deployment and integration that will continue to drive industry scale.



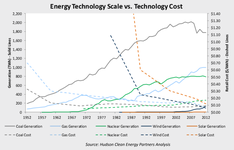

### Risk Mitigation

- Reducing investor risk and the related costs and terms of capital investments hinges on accurate LCOE calculations and future predictions.
- As the industry scales and costs continue to decline, continually decreasing solar LCOE estimates signal a lower risk to investors and provide developers with the needed capital to further reduce risks in each segment of the supply chain.
- With an average operating history of greater than 20 years, PV modules provide predictable energy production which reduces risk and enables longer financeable system lives.
- US PREF takes an active role in not only providing capital to developers, but actively shaping LCOE calculations to decrease risk.



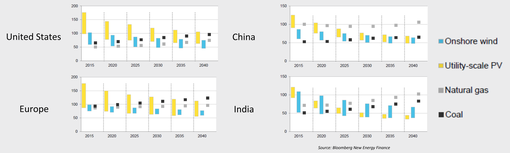

### Operation & Maintenance

- The operation and maintenance (O&M) of a PV system is considerably less than a fuel-based generating system. With few moving parts, fixed and variable O&M costs can be easily quantified in terms of LCOE.
- O&M costs for lifecycle LCOE estimates are generally based on three factors:
  - System peak power based on inverter maintenance,
  - System annual energy production density, and
  - General site-related maintenance
- As capacity factors continue to improve, O&M costs are reduced through higher utilization rates of fixed assets.
- The Power Generation Initiative is actively looking at future O&M cost reductions and has concluded that the following developments will continue to drive down O&M costs:
  - Improved inverter reliability,
  - Economies of scale,
  - Automation, and
  - Remote monitoring




### Global LCOE

- The rapid decline in future LCOE is predicted to continue globally.
- According to many analysts, these are modest predictions and the industry is capable of far greater cost reductions.
- Additionally, the development of advanced ancillary systems – such as smarter infrastructure and battery storage – combined with high probability of a future price or tax on carbon emissions – can further decrease LCOE predictions.
- ACORE's International Initiative is working to contact members with opportunities that will decrease LCOE globally.

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