The value of repowering legacy solar inverters

Owners of aging solar plants should evaluate inverter replacement before repeated failures force the decision. A low repair invoice can obscure a much larger cost: the electricity a plant cannot sell while equipment is out of service. For projects with valuable legacy power purchase agreements, planned repowering deserves a place in the asset management budget alongside routine maintenance.

Solar projects built between 2009 and 2016, including those operating under 25-year power purchase agreements (PPAs), may still have substantial earning potential. Preserving that value depends on keeping the equipment available. Expired warranties, scarce replacement components, rising parts costs and fewer technicians familiar with older platforms make that task increasingly difficult.

Repair remains a reasonable response to an isolated failure when parts and qualified labor are available. The problem emerges when each repair returns an obsolete inverter to service without addressing the conditions that caused repeated outages. Portions of a site can remain offline for months, or longer, while owners search for a workable solution.

The economics begin with the revenue at risk. The accompanying baseline chart models a 1 MWac block with single-axis trackers and a DC-to-AC ratio of 1.3, using a PPA rate of $0.01 per kWh. It compares four locations to show how regional production affects earnings. Values can be adjusted by the ratio of the actual PPA rate to this baseline rate.

The cost of lost availability

A legacy contract can make an extended outage especially expensive. FIMER's analysis cites illustrative PPA rates of $0.09 to $0.27 per kWh for 2010 projects, $0.12 to $0.14 for 2015 projects and $0.035 to $0.085 for 2025 projects. These ranges describe the analysis assumptions; individual contracts determine the revenue actually at risk.

At the modeled $0.10 and $0.20 rates, annual earnings for a 1 MWac block range from roughly $200,000 in Boston at the lower rate to nearly $475,000 in Blyth at the higher rate. An outage therefore has a financial consequence well beyond the cost of replacement parts.

Repair and refurbishment have a role

The uptime comparison shows the direct relationship between availability and earnings under the model assumptions. At 75 percent uptime, a block earns approximately three-quarters of its full-uptime revenue; at 50 percent, approximately half. The analysis estimates that availability losses in Boston could put roughly $44,000 to $400,000 in annual revenue at risk under legacy PPA rates, depending on the contract and severity of the outage.

Reactive repair is the least expensive way to restore basic operation. The analysis estimates $5,000 to $10,000 per event, with a one-week lead time and one to two days of repair work. If the required parts and labor are available, this can deliver a quick return to

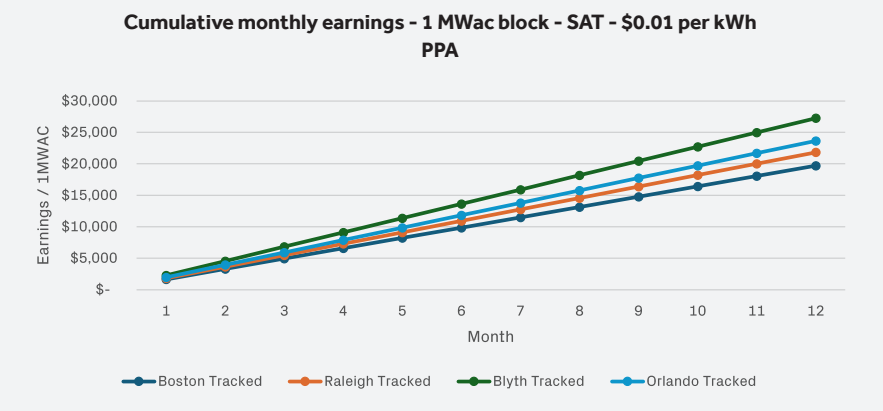


Chart 1. Baseline cumulative earnings by region at $0.01 per kWh

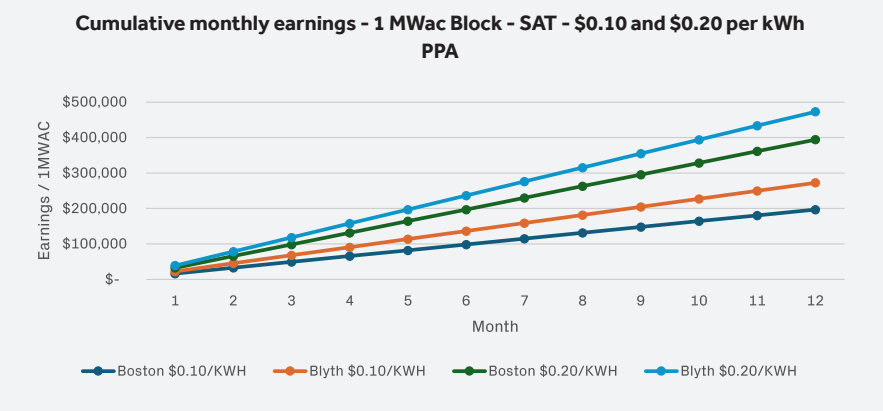


Chart 2. Cumulative earnings in low and high irradiance regions at $0.10 and $0.20 per kWh

FIMER's modeling suggests a repowering payback of three to seven years from availability improvements alone, and potentially less than one year when a major prolonged outage is avoided.

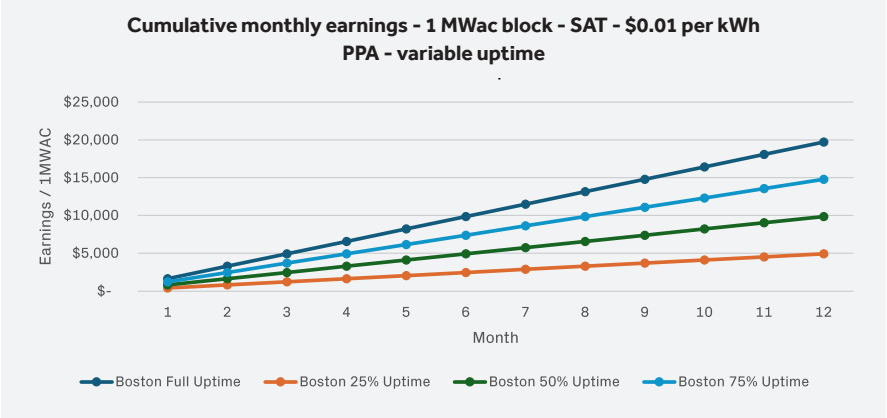


Chart 3. Boston cumulative earnings at different levels of uptime

service without changes to the supervisory control and data acquisition (SCADA) system.

Those advantages come with limits. Troubleshooting begins after production stops, the event is unplanned, and replacing a failed component does not necessarily restore the entire inverter. Recurring failures can undermine availability, while shrinking inventories make future repair schedules harder to predict. A repair strategy that appears economical today can become expensive as outages accumulate.

Planned refurbishment offers an intermediate approach. The analysis estimates $50,000 to $80,000 per event, one to two weeks of lead time and three to five days of repair work. Scheduling the work allows owners to forecast the expense and interruption. It can improve uptime at a lower initial cost than replacement and generally avoids changes to SCADA.

Refurbishment nevertheless leaves the project dependent on an aging platform. It may restore performance, but it does not eliminate the ongoing challenge of finding obsolete parts or maintaining access to experienced service personnel. Its value depends on how much reliable service it buys and whether that period aligns with the owner's plans for the asset.

The case for planned repowering

Repowering requires a larger capital commitment. The analysis estimates $125,000 to $300,000, with a lead time of 12 to 24 weeks and approximately one week for installation. New equipment may require SCADA updates, and transformer compatibility can add cost and extend the schedule. These factors should be resolved early, before an urgent failure compresses the planning window.

In return, replacement can renew warranty coverage, improve performance and safety, and restore access to parts and service. The analysis describes a five-year warranty extension, a 98 percent fleet uptime target and potential service and parts support extending beyond 25 years. Actual warranty terms, support commitments and achievable availability depend on the selected equipment and project conditions.

Plan the transition before the next outage

A scheduled replacement gives owners the opportunity to work during periods of lower production and coordinate installation with the rest of the site. Where transformer compatibility is straightforward, the analysis describes an inverter replacement schedule of approximately three to four months. Its broader procurement estimate of 12 to 24 weeks shows why the project-specific scope and equipment availability must guide planning.

A transformer replacement does not automatically rule out repowering. Owners should consider whether the existing transformer can serve as a fleet spare and whether salvaged inverter components can support the remaining legacy equipment during a staged transition. Parts recovered from failed units may also help bridge the period before replacement equipment arrives.

The financial comparison should include repair spending, refurbishment costs, replacement capital and the revenue lost during outages. FIMER's modeling suggests a repowering payback of three to seven years from availability improvements alone, and potentially less than one year when a major prolonged outage is avoided. Those outcomes are scenario dependent, rather than a universal promise. Contract rates, regional production, outage duration and installation costs determine the result for each project.

For a 1 MWac block earning hundreds of thousands of dollars annually, the replacement investment may represent only a few months to a year of revenue. That comparison explains why the cheapest immediate repair can be the more expensive long-term choice. Owners need to evaluate the cost of continued uncertainty as carefully as the price of new equipment.

Continual break-and-fix maintenance becomes harder to defend when parts are depleted, failures recur and production losses keep rising. Planned repowering offers a way to replace that uncertainty with a defined investment and an installation schedule. The strongest case for acting is a project that still has valuable years of contracted revenue ahead, but increasingly unreliable equipment standing between the plant and those earnings.

FIMER has developed a calculator to help owners assess the economics of repowering and refurbishing older solar projects under different operating scenarios.

- FIMER Repower Economics Calculator
- fimer.com