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Whitepaper

The Value of Repowering Legacy Solar Inverters

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Executive Summary

A single 1 MWac block operating under legacy PPA rates may represent hundreds of thousands of dollars in annual revenue. Extended inverter outages can place up to $400,000 per year (per1MW-ac block) of project revenue at risk.

While refurbishment can restore operation at a lower upfront cost, it does not eliminate the growing risks associated with obsolete equipment, limited spare parts, and recurring failures.

Repowering requires a larger capital investment, but it converts an unpredictable reactive maintenance strategy into a planned asset-management approach, improving availability, extending service support, and protecting long-term project revenue. For most aging fleets, repowering becomes the superior economic choice once outage risk and lost production costs are included in the analysis. Repowering could have a payback range of typically 3–7 years from availability gains alone, but often less than 1 year when avoided catastrophic outages are considered.

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Abstract

Projects with 25-year PPAs that were built in the 2009 – 2016 period have a lot of value in them, and maintaining a high uptime is very important to achieve the forecasted earnings. For system owners of legacy projects, it is difficult to assess in real time how to deal with obsolete inverter platforms. Expired warranties, dwindling access to spare components, escalating component costs, as well as a loss of qualified experience technicians all lend to operating costs or performance shortfalls that exceed what was planned.

In an ideal world, continual repair would work well. But for reasons mentioned, the major repairs tend to occur as reactive maintenance, with uptime availability suffering.
In some cases, portions of the site can go unpowered for months or even a year while a solution is investigated. A better alternative would be to investigate a proactive fleet-wide repower solution, which can be scheduled with a lower risk to fleet availability.

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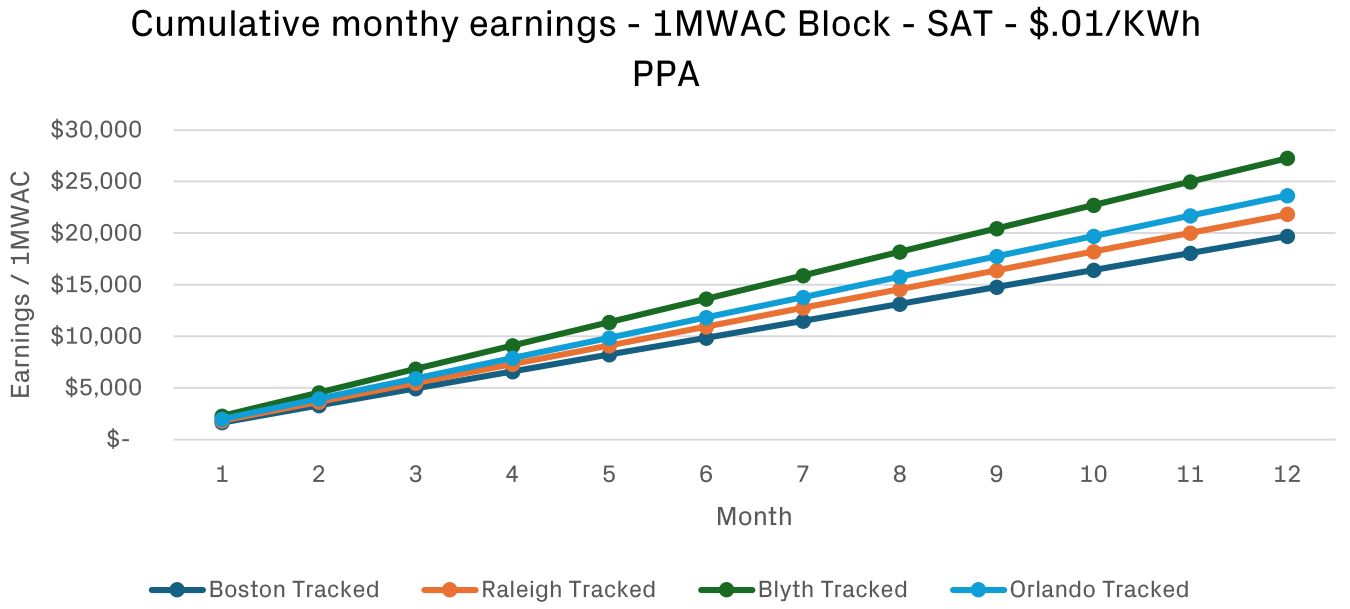
Background

Looking at a typical 1MWAC block, on single access trackers, assuming a 1.3 DC ratio as a baseline, we can assess the monthly production values for a $0.01/KWhr rate, and scale this to current PPA rates easily for 4 typical regions, by multiplying the values in Graph 1 with the PPA Rate.



GRAPH 1: Baseline by Region

The average PPA rates by era:

- 2010 was $0.09 – 0.27/KWhr, average inverter size range was .5-1MW.
- 2015 was $0.12 – 0.14/KWhr, average inverter size range was 1.5 – 2MW.
- 2025 was $0.035 – 0.085/KWhr, average inverter size is 3 – 4.5MW.

So, an inverter in a low irradiance region like Boston, MA could yield $14.8 – 44.3K per month. In a high irradiance market, that range would be $20.5 – 61.3K per month.

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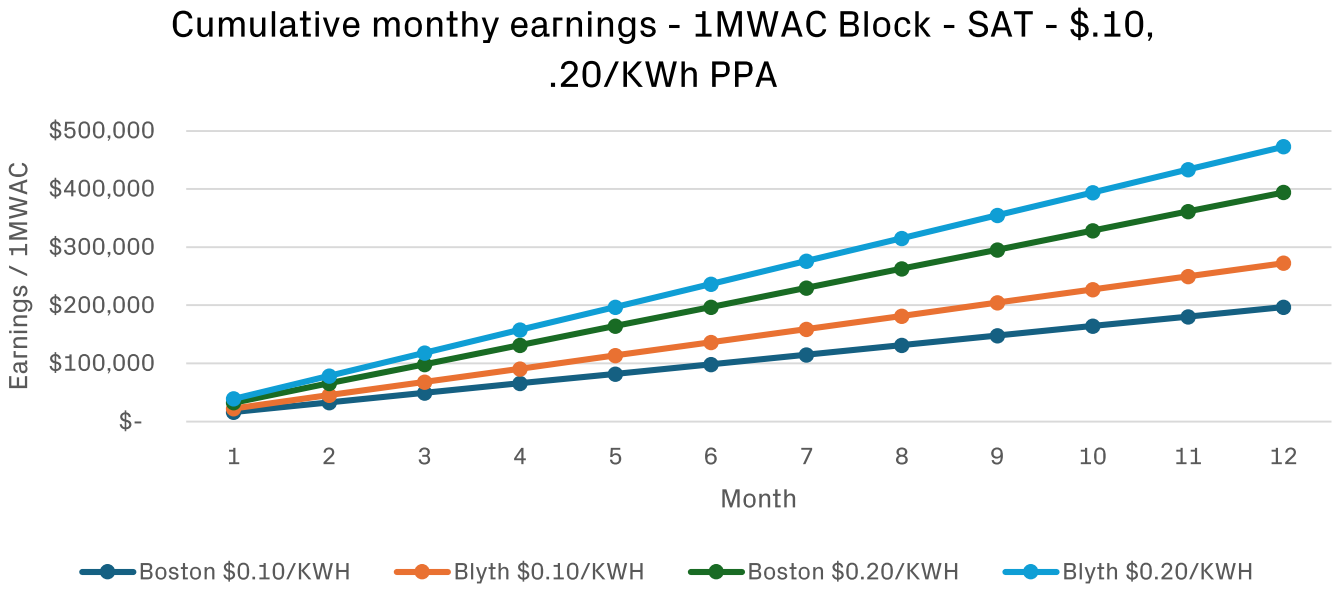
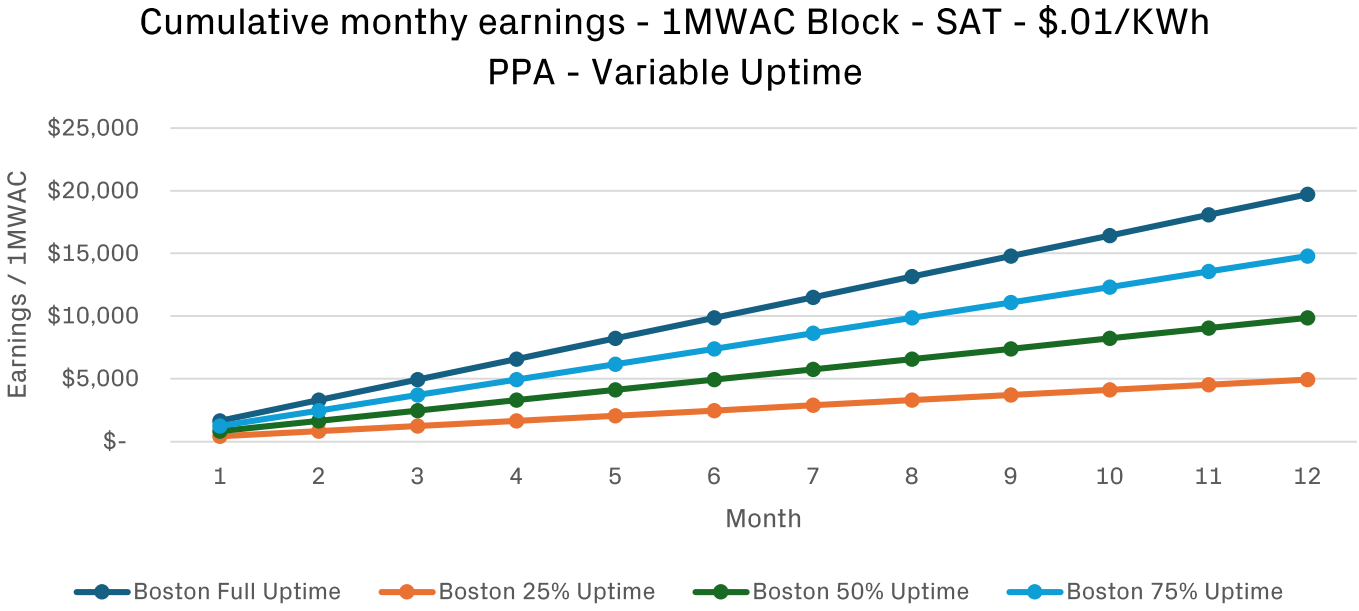
Looking at the impacts of availability in Boston, MA. An inverter could lose $44 – 400K per year based on 2010 PPA rates.



GRAPH 2: Low and High Irradiance Regions ₾ $.10 - .20/KWH



GRAPH 3: Scaled performance vs Uptime

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Comparison

Comparing the cost of refurbishment to reactive repair and repower:

Reactive Repair

- Cost of $5 - 10K per event.
- 1 week lead time.
- 1-2 days repair time.
- Not forecasted.

PROS

- Quick repair turnaround (assuming parts and labor availability).
- No changes are required to SCADA.
- Lowest cost to achieve basic operation.

CONS

- Requires troubleshooting prior to repair.
- Lowest uptime availability, and potential for frequent outages.
- Reactive, as repairs occur post stoppage.
- Can not guarantee equipment will be fully restored.
- Spare parts availability as lead times will grow exponentially as availability is depleted.

Image of a FIMER inverter repair

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Planned Refurbishment

- Cost of $50 - 80K per event.
- 1-2 weeks lead time.
- 3-5 days repair time.
- Forecasted.

PROS

- Quick repair turnaround (assuming parts and labor availability).
- No changes are required to SCADA.
- Low cost to achieve target uptime.

CONS

- Does not solve ongoing maintenance issues due to parts availability.

Image of an FIMER Ultra, legacy model of inverter

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Repower

- Cost of $125K - 300K.
- 12 - 24 weeks lead time.
- 1 week install time.
- Forecasted.

PROS

- Repair turnaround in 1 week.
- Can be a planned event, done prior to suffering an outage.
- Extends warranty for another 5 years, with access to parts and service for 25+ years.
- Get's uptime to 98% fleet targets.
- Takes advantage of latest technology advancements (higher performance & safety).
- Able to salvage parts to supplement repairs for remainder of fleet.

CONS

- Requires some updates to SCADA for the new platform
- Longer lead-time especially if a new transformer is needed.
- Higher cost investment.

Image of a new FIMER 980 model of inverter

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Takeaways

The cost to replace equipment is order of magnitude worth 2 months to a year of project value for that block but allows the ability to operate predictably. Inoperability is a pure loss of opportunity, with no predictable outcome to recover.

Owners should consider these guidelines when considering a repower for their project:

- Where transformer compatibility is not an issue, replacement of inverter is the best solution. It can be done in 3-4 months and forecasted with little outage by targeting the low production seasons for the rework

- If transformers must be replaced due to compatibility issues, if the transformer can serve as a fleet spare, total replacement is still a viable option. The parts will have a salvage value for further repairs to support a cleaner transition to repower.

- Salvage components from broken inverters as well to utilize as spares for repairs while the repower is forecasted.

- Continual break / fix repair will eventually lead to a dead end as spare parts are depleted, and costs escalate to the point of exceeding the cost of a full repower. This is exponential, so the costs will escalate quickly and without predictability.