

BRIEFING · BRIEFING · HEL-0001 · 2026-06-12

Beyond Solar Briefing — June 2026

Enhanced geothermal posts two years of production data; perovskite leaves the lab; airborne wind reaches the grid

Beyond Solar — Research Desk

Coverage: Beyond Solar

ABSTRACT

This Briefing covers six developments in novel renewable technology: (1) Fervo's two-year Project Red dataset turns enhanced geothermal from promise into a measured, baseload-grade resource ahead of Cape Station's first 100 MW; (2) First Solar's perovskite patent licence from Oxford PV moves tandem PV from pilot to a credible US manufacturing path; (3) a 25.14% perovskite-CIGS tandem cracks the 25% barrier for a flexible, silicon-free architecture; (4) China grid-connects a megawatt-class airborne wind aerostat at 2,000 m; (5) a tidal array logs 6½ years of unplanned-maintenance-free running, the metric that actually governs ocean-energy bankability; and (6) Quaise's millimeter-wave drilling clears the milestone that superhot-rock geothermal has to clear to exist at all.

Keywords: perovskite tandem, CIGS tandem, First Solar, Oxford PV, enhanced geothermal, Fervo, Cape Station, superhot rock, Quaise, airborne wind, tidal energy, MeyGen, clean firm power, data center load

In this Briefing

1. Enhanced geothermal stops being a promise: Fervo's two-year production data
2. First Solar licences Oxford PV's perovskite IP — the commercialization signal that matters
3. A 25% perovskite-CIGS tandem reopens the silicon-free, flexible PV lane
4. China grid-connects a megawatt-class airborne wind aerostat at 2,000 m
5. Tidal's real record isn't power — it's 6½ years without a service call
6. Quaise drills rock with millimeter waves — superhot geothermal clears its gating risk

Enhanced geothermal stops being a promise: Fervo's two-year production data

What's new. Enhanced geothermal systems (EGS) have spent a decade as a "physics works, economics unproven" story. In April 2026 Fervo Energy published 614+ days of continuous production data from its Project Red pilot in Nevada — the first multi-year, public, well-instrumented EGS dataset — and it shows the resource behaving like firm baseload rather than a depleting science experiment [1]. This is the evidence base that underwrites Cape Station in Utah, whose first 100 MW is targeted to reach the grid in 2026 [2][3].

The evidence. Across 614+ days, Project Red held 98.4% system uptime (excluding surface/grid events), ~2.1 MW average gross output, and a production temperature that fell only ~2.5 °F over 500+ days — essentially flat and matching the reservoir model [1]. Fervo reports a ~20% thermal recovery factor in two years, above DOE benchmarks [1]. At Cape Station, a 30-day flow test hit 107 kg/s at >220 °C, enough for >10 MW per well — roughly triple Project Red's per-well output — alongside a ~70% year-over-year cut in drilling time as the team applied oilfield horizontal-drilling and fracturing methods [2]. Cape Station is contracted to reach 400–500 MW by 2028 [2][3].

THE TAKE:

The decision-relevant number here is not megawatts — it is the ~2.5 °F drawdown over 500 days. Thermal decline is the variable that has historically killed geothermal project finance, because it converts a "firm" asset into a declining one and forces conservative debt sizing. A near-flat, model-matching temperature profile is what lets lenders underwrite a 30-year resource at a high capacity factor. Beyond Solar estimate: at 98% uptime and the demonstrated thermal stability, an EGS plant supports a ~90%+ annual capacity factor versus ~25% for solar and ~40% for onshore wind — meaning one EGS MW displaces roughly 3–3.6 MW of intermittent nameplate on an energy basis (derived from the cited uptime/temperature data and standard US resource capacity factors). That energy-density-of-firmness is precisely what data-center offtakers are now paying a premium for, and it is why geothermal PPAs are repricing upward rather than down.

Market read. No pure-play public EGS name exists (Fervo is private), so the cleanest read is the conventional-geothermal incumbent positioned to ride the same firm-power demand and to deploy EGS techniques on its own resource base. ORA (NYSE) — Add · conviction Medium · 12–24 mo — Ormat's February 2026 data-center PPAs (up to 150 MW to Google via NV Energy; a direct deal with Switch) and a ~27% price step-up on a contract renewal show firm-geothermal pricing power inflecting as load grows [4]. EGS validation expands Ormat's addressable resource rather than threatening it.

First Solar licences Oxford PV's perovskite IP — the commercialization signal that matters

What's new. Lab efficiency records are routine; manufacturing commitments are not. In February 2026 First Solar took a non-exclusive licence to Oxford PV's perovskite materials and device patents for the US market, explicitly carved to exclude crystalline-silicon semiconductors [5]. The signal is that the largest US module maker — a thin-film house with no silicon legacy to defend — now sees perovskite as core IP rather than a science project.

The evidence. The licence covers issued and pending perovskite patents with US manufacturing and distribution rights; financial terms were undisclosed [5]. First Solar reports having invested over \$2 billion in thin-film R&D and runs a development line in Ohio producing small perovskite modules that have met internal efficiency and manufacturability targets [5]. Separately, Oxford PV — which shipped its first commercial 24.5% tandem modules to a US utility customer in 2024 from its Brandenburg, Germany line — is targeting 26% modules in 2026 and a GW-scale plant in 2026–27 [6]. Hanwha Qcells has a ~\$100 M perovskite pilot line, 28.6% certified cell efficiency, and commercial production guided for 2026 [6].

THE TAKE:

The carve-out is the whole story. By licensing perovskite while excluding silicon, First Solar is positioning a perovskite-on-CdTe or perovskite-tandem path that sidesteps the crystalline-silicon supply chain entirely — the one part of PV the US has structurally failed to reshore. Every other tandem roadmap (Oxford PV, Qcells, LONGi) bolts perovskite onto a silicon bottom cell and therefore inherits Chinese wafer dependence. A silicon-free US tandem is the only version of this technology that is simultaneously a higher-efficiency play and a domestic-content/tariff play. Beyond Solar estimate: that dual exposure is worth more to First Solar's policy-driven order book than the ~2–4 efficiency points a tandem adds, which is why a thin-film incumbent paid for silicon-excluded IP it cannot use in a conventional tandem.

Market read. FSLR (NASDAQ) — Add · conviction Medium · 24–36 mo — optionality on a silicon-free US tandem stacks on an already domestic-content-advantaged book; perovskite is upside, not the base case, so downside is limited if it slips [5]. ENPH (NASDAQ), NXT (NASDAQ) — Hold — balance-of-system and tracker names benefit from any higher-watt module but are technology-agnostic; no clean directional edge from this specific deal.

A 25% perovskite-CIGS tandem reopens the silicon-free, flexible PV lane

What's new. Most tandem headlines are perovskite-on-silicon. In May 2026 a Tokyo City University group reported a two-terminal perovskite-CIGS tandem at 25.14% certified efficiency — the first time the 25% barrier has been broken for this silicon-free architecture, which is inherently thin-film, flexible and lightweight [7].

The evidence. AIST certified 25.14% on a 1 cm² two-terminal device with a perovskite top cell and CIGS bottom cell, edging past the prior 24.6% set by Germany's HZB in February 2025 [7]. For context on the broader field's pace, perovskite-silicon tandems now sit at ~34% (a certified 33.6% flexible device with a 2.015 V open-circuit voltage was published in Nature in 2026), and all-perovskite tandems have reached 28.4% certified [8]. Durability is improving in parallel: cross-linked phosphonic-acid hole transporters cut thermal degradation to <4% loss after ~1,200 h at 65 °C, and graded dielectric layers retain >92% efficiency after 1,000 h of reverse-bias stress [8].

THE TAKE:

Perovskite-CIGS will not win the rooftop/utility efficiency race — it trails silicon tandems by ~9 points and CIGS manufacturing is harder to scale than silicon. Its real market is the one silicon tandems cannot serve: high specific-power (W/kg), flexible, building- and vehicle-integrated, and aerospace/defence surfaces where weight and conformability dominate over \$/W. Crossing 25% on a silicon-free, flexible stack matters because it is the first time this architecture is efficient enough to be commercially interesting in those niches rather than only in the lab. Beyond Solar estimate: the addressable premium markets for flexible high-specific-power PV are a low-single-digit-percent slice of PV demand, but at 3–10× the \$/W of utility modules — a margin pool, not a volume play. Investors should read this as a specialty-materials opportunity, not a threat to mainstream silicon.

Market read. No clean public-market read — the leading perovskite-CIGS groups are academic, and CIGS incumbents are largely private or subsumed. (*Omitted.*)

China grid-connects a megawatt-class airborne wind aerostat at 2,000 m

What's new. Airborne wind energy (AWE) has produced a graveyard of bankrupt startups (Makani, Ampyx). In January 2026 China crossed a threshold the Western AWE sector never reached: a megawatt-class helium aerostat ("S2000 SAWES") lifted a wind unit to ~2,000 m and delivered power to the grid in a test flight in Yibin, Sichuan [9].

The evidence. The platform rose to ~2,000 m (6,560 ft) on a helium aerostat with ~20,000 m³ envelope volume and a maximum rated output of up to 3 MW, feeding grid power during the test [9]. The pitch is access to the stronger, steadier winds of the lower stratosphere, where capacity factors run well above tower-mounted turbines. A domestic envelope-material plant is being scaled toward 200,000 linear meters/year in 2026 [9].

THE TAKE:

The headline is "first megawatt airborne wind," but the binding constraint is helium, not aerodynamics. A 20,000 m³ aerostat is a large, recurring helium liability in a market with chronic supply shocks and price volatility; lift gas, not turbine design, will set this system's levelized cost and its scalability ceiling. The lighter-than-air approach also caps siting to low-turbulence, controlled airspace, which is why this is a Chinese-grid demonstration rather than a globally portable product. Beyond Solar estimate: tethered-kite/rigid-wing AWE remains the more scalable long-run architecture because it carries no lift-gas opex — the aerostat's advantage is that it flies *today*, not that it wins on cost. Read this as a national-champion demonstration of capability, not a template Western developers should copy.

Market read. No clean public read — the developer is a Chinese state-linked consortium with no investable Western pure-play; AWE exposure inside large turbine OEMs is immaterial. (*Omitted.*)

Tidal's real record isn't power — it's 6½ years without a service call

What's new. Marine energy's perennial problem is not generating power but surviving the ocean economically. In 2026 the MeyGen array in Scotland's Pentland Firth — the world's largest tidal-stream array — confirmed that SKF's drivetrain systems on one turbine ran 6½ years with no unplanned or disruptive maintenance, a reliability record for the sector [10].

The evidence. MeyGen Phase 1 comprises four 1.5 MW seabed-mounted turbines and has delivered 80+ GWh to the UK grid; the 6½-year run without unplanned intervention is the headline reliability metric [10]. Tidal's structural advantage is predictability — output is set by lunar cycles, not weather —

and developer pipelines now point to ~30 turbines slated for deployment from 2026 across Scotland, France and Japan, each sized to power ~3,000 homes [10].

THE TAKE:

Tidal's cost problem was never the turbine; it was the boat. Offshore intervention vessels and weather-window risk dominate marine-energy O&M, so unplanned subsea maintenance is the line item that destroys project economics. A 6½-year unplanned-maintenance-free interval is therefore the single most bankable datapoint tidal has produced — it attacks opex and downtime simultaneously, which is what a lender stress-tests. Beyond Solar estimate: demonstrated reliability of this order can move tidal's effective availability and O&M assumptions enough to compress LCOE by a meaningful double-digit percentage versus first-of-a-kind assumptions, which is the gap between "subsidy-dependent demonstrator" and "biddable in a CfD auction." Predictability plus proven uptime is a genuinely differentiated firming product for grids that already have abundant solar.

Market read. Largely private/sponsor-owned (SAE Renewables operates MeyGen; SKF supplies bearings). The cleanest listed read is the diversified industrial supplying the reliability-critical drivetrain content. SKF-B (STO) — Hold · conviction Low · 24–36 mo — marine is a rounding error in SKF's revenue today, but a demonstrated reliability edge positions it as a default supplier if tidal scales; not a thesis to own SKF on, but a credit to its industrial franchise [10].

Quaise drills rock with millimeter waves — superhot geothermal clears its gating risk

What's new. Superhot-rock geothermal (>300 °C "supercritical" resource) promises geothermal almost anywhere, but only if you can drill through kilometers of hard crystalline basement — which conventional bits cannot do economically. Quaise's gating risk is the drilling method itself. In 2026 the company advanced field testing of millimeter-wave drilling — using a gyrotron to vaporize rock with no downhole hardware — and is moving from a 100 kW to a 1 MW gyrotron [11][12].

The evidence. Quaise's hybrid approach drills near-surface rock conventionally, then switches to millimeter-wave ablation in the basement; the company expects to take delivery of a 1 MW gyrotron in early 2026, a ~10× power step from its 100 kW field unit [11]. Analysis presented at the 2026 Stanford Geothermal Workshop supports a first plant producing at least 50 MW [11]. Project Obsidian, the first-of-a-kind plant in Oregon targeting rock >300 °C, is under construction with operation projected as early as 2030 [12].

THE TAKE:

Superhot rock is the highest-prize, lowest-readiness item in this Briefing — and the gyrotron step-up is the right milestone to watch because energy intensity, not concept, is what determines whether millimeter-wave drilling reaches commercial depth at commercial rate-of-penetration. The thermodynamic case is unusually strong: a supercritical well can deliver roughly 5–10× the power per well of a conventional hydrothermal well at the same flow, because energy scales with enthalpy and supercritical fluid carries far more. Beyond Solar estimate: if Quaise hits even the low end of that range, superhot rock needs an order of magnitude fewer wells per delivered MW than EGS — which is the only way the drilling-cost problem ever closes. The risk is binary and the timeline (2030) is long; size exposure accordingly. This is the call option in the geothermal complex, not the core holding.

Market read. Quaise is private; no pure-play exposure. The directional read is that proof of deep-drilling-to-supercritical would be additive — not threatening — to firm-power incumbents. ORA (NYSE) — see Topic 1 — superhot rock expands the long-run geothermal resource Ormat can monetize; it is upside optionality on a 2030+ horizon, not a near-term driver. (*No separate call.*)

Market Calls

Company (Ticker)	Call	Conviction	Horizon	Thesis (one line)
Ormat Technologies (ORA, NYSE)	Add	Medium	12–24 mo	EGS validation + data-center PPAs are repricing firm geothermal upward; incumbent benefits as the resource expands.
First Solar (FSLR, NASDAQ)	Add	Medium	24–36 mo	Silicon-excluded perovskite licence stacks tandem efficiency optionality on a domestic-content-advantaged book.
Enphase (ENPH, NASDAQ)	Hold	Low	12–24 mo	Benefits from higher-watt modules but technology-agnostic; no edge from the First Solar–Oxford PV deal.
Nextracker (NXT, NASDAQ)	Hold	Low	12–24 mo	Tracker demand rises with any module gain; no clean directional read from perovskite specifically.
SKF (SKF-B, STO)	Hold	Low	24–36 mo	Tidal reliability record is a credit to the franchise, not yet material to revenue.

References

1. Fervo Energy, "Enhanced Geothermal Has Been Proven at Scale. Here's What Two Years of Production Data Show." (Apr 13, 2026).
<https://fervoenergy.com/enhanced-geothermal-has-been-proven-at-scale-heres-what-two-years-of-production-data-show/>
2. Fervo Energy, "Fervo Energy's Record-Breaking Production Results Showcase Rapid Scale Up of Enhanced Geothermal."
<https://fervoenergy.com/fervo-energys-record-breaking-production-results-showcase-rapid-scale-up-of-enhanced-geothermal/>
3. Canary Media, "Fervo nabs \$462M to complete massive next-gen geothermal project."
<https://www.canarymedia.com/articles/geothermal/fervo-investment-capital-b-cape-station>
4. The Globe and Mail / StockTitan, "Ormat Technologies Signs Long-Term Geothermal PPA for Google" and related ORA PPA news (Feb 2026).
<https://www.stocktitan.net/news/ORA/ormat-technologies-announces-the-signing-of-geothermal-portfolio-ppa-1ieffqllasex.html>
5. Electrek, "First Solar locks in key perovskite tech with a new Oxford PV deal" (Feb 24, 2026).
<https://electrek.co/2026/02/24/first-solar-perovskite-oxford-pv/>
6. PV-Tech, "Oxford PV ships first commercial perovskite tandem modules"; pv magazine, "Perovskite rollout gathers pace" (2025).
<https://www.pv-tech.org/oxford-pv-ships-first-commercial-perovskite-tandem-modules/>
7. pv magazine, "Japanese scientists achieve world record 25.14% efficiency for perovskite-CIGS tandem solar cell" (May 18, 2026).
<https://www.pv-magazine.com/2026/05/18/japanese-scientists-achieve-world-record-25-14-efficiency-for-perovskite-cigs-tandem-solar-cell/>
8. Wang, Li, Yu et al., "Flexible perovskite/silicon tandem solar cells with 33.6% efficiency," Nature (2025/2026). <https://www.nature.com/articles/s41586-025-09849-4>; "A cross-linked molecular contact for stable operation of perovskite/silicon tandem solar cells," Science (2026). <https://www.science.org/doi/10.1126/science.ady6874>
9. Euronews, "A floating power station? China's flying wind turbine hits milestone with grid-connected test" (Jan 29, 2026).
<https://www.euronews.com/next/2026/01/29/a-floating-power-station-chinas-flying-wind-tur>

- bine-hits-milestone-with-grid-connected-tes
10. Marine Technology News, "MeyGen Tidal Energy Tech Sets New Operational Record"; SKF / Interesting Engineering coverage of the 6½-year reliability record (2025–2026).
<https://www.marinetechologynews.com/news/meygen-tidal-energy-operational-650672>
 11. Quaise Energy, "Quaise Energy Advances Toward Building the World's First Superhot Geothermal Power Plant" and 2026 Stanford Geothermal Workshop analysis.
<https://www.quaise.com/news/quaise-energy-on-track-to-build-worlds-first-power-plant-using-superhot-geothermal-energy>
 12. Canary Media, "Quaise looks to advance 'superhot' geothermal power plant in Oregon."
<https://www.canarymedia.com/articles/geothermal/quaise-superhot-geothermal-power-plant-oregon>

Disclosures & Disclaimer

This report is general commentary published for information purposes only. It is **not** investment advice, a recommendation, or a solicitation to buy or sell any security, and it does not account for the objectives or circumstances of any individual. Beyond Solar is a research publication, not a registered investment adviser or broker-dealer. Views are the publication's own analytical opinions, are subject to change, and may prove wrong. Markets involve risk of loss; past performance does not indicate future results. Readers should do their own research and consult a licensed financial professional before acting. The publication and/or its principals may hold positions in securities mentioned. Company facts and figures are drawn from public sources believed reliable but are not guaranteed. © Beyond Solar.

About Beyond Solar

Beyond Solar publishes independent technical and techno-economic research in its field. Reports are prepared for subscribers and are provided for information only. © Beyond Solar. All rights reserved.