TRUE NORTH INSTITUTE

Evaluating FOAK Investment Performance of 25 Leading Climate Investors

This document was prepared for the All Aboard Fund by the All Aboard Team - 14th November 2025

1. Executive Summary

This report analyzes First-of-a-Kind (FOAK) climate-infrastructure financings through the lens of a carefully selected group of 25 leading climate-tech investors.

From a dataset of roughly 70 FOAK or FOAK-adjacent financings (2014–2025), we identified 16 financings in which three or more of the 25 investors co-participated in the same FOAK round. These 16 cases form a strikingly successful cluster within the broader climate-technology landscape.

While FOAK projects are known for extremely high technical and commercial risk, these 16 companies demonstrate multiple up-rounds following FOAK deployment, construction and operation of commercial plants or gigafactories, large government grants or loan guarantees, strong industrial offtake or customer demand, and unicorn-level valuations.

By contrast, the wider FOAK universe shows significant attrition — including cancellations, insolvencies, and stalled deployments.

The findings suggest that the co-investment patterns of these 25 investors form a high-signal early indicator of FOAK success.

2. Research Methodology

2.1 Data collection

We assembled a dataset of approximately 70 FOAK or FOAK-adjacent financings from 2014–2025 using company press releases, DOE and OCED announcements, industry databases such as CTVC and other climate-investment trackers, and mainstream business wires.

Each deal was evaluated for evidence that it financed a first commercial plant, a first manufacturing facility, or a first utility-scale deployment, and that the round size was broadly consistent with FOAK capital needs (typically $50-$600M).

2.2 Investor-cohort matching

We then filtered for participation by any of the 25 investors and isolated rounds in which three or more of the 25 investors co-invested in the same round. This produced 16 qualifying FOAK rounds.

2.3 Why qualified FOAK rounds are all 2022 onward

Although our search extended back to 2014, structural factors explain why no pre-2020 FOAK rounds met the strict 3-of-25 test. Many of the 25 investors only became active in climate-tech between 2017 and 2022, and the hard-climate-tech FOAK wave began in earnest around 2018 and accelerated after the Inflation Reduction Act. Earlier cleantech FOAKs tended to be financed by utilities, strategics, and industrial majors rather than today's climate-focused venture and growth funds.

2.4 Early predictive signals (2019–2021)

Although no pre-2020 deals meet the strict FOAK-plus-3-of-25 definition, we identified a set of 2019–2021 rounds in which three or more of the 25 investors co-invested before FOAK. Those rounds now appear, in hindsight, to be powerful early predictors of the companies that would go on to become top FOAK and post-FOAK performers.

3. The 25 Firm Co-investor Network

25 firms have been approved by the All Aboard team as the universe from which we will draw opportunities for co-investment. Firms were selected through varying degrees of due diligence undertaken over the last five years, in search of the highest-performing and most experienced managers in the climate space. Managers were also chosen for their experience investing in first-of-a-kind (FOAK) stages of finance, their demonstrable value-add capabilities in scaling climate-tech companies and de-risking FOAK, and we looked for those firms who would be most willing to collaborate with others.

This manager due diligence has taken place over the last five years by a combination of Chris Anderson's Exa Ventures team and Stan Miranda and his Partners Capital private equity team and, since July 2024, by Stan's TNI team. Stan Miranda and his Partners Capital energy transition private equity investment team spent four years up until August 2024 building a multimanager platform focused on energy transition private equity – a fund of funds and co-investment strategy entitled "15 degrees." This involved due diligence meetings with over 100 energy transition focused VC, growth equity, LBO and infrastructure funds around the world. Stan and his London-based TNI team picked up where Partners Capital left off, and over the last 15 months since TNI was established, Stan and TNI have met with over 50 energy transition focused funds.

The size of the co-investor network of 25 was chosen based on the combination of a very high-quality threshold and the desire to keep the network small enough to facilitate more collaboration among its members. This led us to create a core group of 16 of the 25 co-investment firms that the All Aboard team would work most closely with to foster more co-investments. These 16 firms have signed an MoU with us confirming their desire to be named publicly as members of the coalition and to undertake reasonable efforts to identify allocations for the All Aboard Fund.

The formally established All Aboard Coalition includes these 16 firms: Ara Partners, Breakthrough Energy Ventures, Clean Energy Ventures, Congruent Ventures, DCVC, Energy Impact Partners, Future Ventures, GenZero (Temasek), Gigascale Capital, Just Climate (Generation), Khosla Ventures, NGP Energy Capital Management, Obvious Ventures, Prelude Ventures, S2G Investments, and Spring Lane Capital.

The additional 9 co-investing firms, who we believe to be of equal caliber as the formal coalition members, have been formally approved by us based on similar analysis to that described above, and on the basis that they have shown a desire to work with the All Aboard team to form powerful investment syndicates in support of some of the most attractive climate-tech companies going through their early commercial scaling stage of development. While we cannot publicly name these 9 firms at this time, they remain active members of the broader co-investment network.

Collectively these 25 investors constitute the **All Aboard Co-investment Network** which brings deep technical diligence, infrastructure-scale check-writing capacity, global capital pools, industrial partnerships, and a willingness to re-up across multiple rounds.

TRUE NORTH INSTITUTE

4. FOAK Investment Landscape and Failure Modes

FOAK deployments sit at the steepest part of the commercialization curve. Projects must assemble large capital stacks, secure long-term offtakes, thread regulatory and permitting risk, and prove technology in the field. Analyses from DOE and CTVC highlight high attrition rates, with many FOAK efforts failing to raise follow-on capital or reach commercial operation.

Common failure patterns include escalating costs, insufficient industrial or utility buy-in, failure to close project finance, regulatory reversals, and technology underperformance at scale.

5. The 16 FOAK Deals with Three or More Cohort Investors

Company	Year	Series	Total Round ($M)	Coalition Investors in the Round (3+ required)
Antora Energy	2024	B	150	Decarbonization Partners, Breakthrough Energy Ventures (BEV), Lowercarbon Capital
Ascend Elements	2023	D	460	Decarbonization Partners, Capricorn Investment Group, GIC
Boston Metal	2023–24	C / C2	262	Breakthrough Energy Ventures, Prelude Ventures, Capricorn Investment Group
Brimstone	2022	A	55	Breakthrough Energy Ventures, DCVC, S2G Investments
Electric Hydrogen	2023	C	380	Energy Impact Partners, Breakthrough Energy Ventures, Capricorn Investment Group, Prelude Ventures, S2G Investments
Electra	2025	B	186	Capricorn Investment Group, Breakthrough Energy Ventures, Lowercarbon Capital, S2G Investments
Fervo Energy	2022	C	138	DCVC, Breakthrough Energy Ventures, Congruent Ventures, Capricorn Investment Group, Prelude Ventures
Form Energy	2024	F	405	The Rise Fund (TPG), Breakthrough Energy Ventures, Capricorn Investment Group, Energy Impact Partners, NGP, GIC, Prelude Ventures, Gigascale Capital
Koloma	2024	B	245	Khosla Ventures, Breakthrough Energy Ventures, Energy Impact Partners, Prelude Ventures
LuxWall	2024	B	51	Breakthrough Energy Ventures, Prelude Ventures, Khosla Ventures
Radiant	2024	C	100+	DCVC, Union Square Ventures, Gigascale Capital
Terra CO_2	2023–24	B	125	Breakthrough Energy Ventures, Just Climate, GenZero
Twelve	2024	C	~200	The Rise Fund (TPG), Capricorn Investment Group, DCVC
Verdox	2022	~A	80	Breakthrough Energy Ventures, Prelude Ventures, Lowercarbon Capital
Zanskar	2024	B	30	Obvious Ventures, Union Square Ventures, Lowercarbon Capital
Zap Energy	2022	C	160	Lowercarbon Capital, Breakthrough Energy Ventures, DCVC, Energy Impact Partners

Each of these rounds financed a first commercial plant, first-of-kind manufacturing facility, or large-scale deployment, and in each case three or more of the 25 investors appeared together on the cap table.

6. Early Predictive Signals (2019–2021): Pre-FOAK Rounds

We also identified several earlier rounds that, while not FOAK financings themselves, displayed the 3-of-25 pattern and now clearly foreshadow strong FOAK outcomes.

Form Energy – Series B (2019)

Form's 2019 Series B, roughly $40M, included Breakthrough Energy Ventures, Capricorn Investment Group, and Prelude Ventures. At the time the capital funded long-duration storage R&D rather than a plant, but this early 3-of-25 cluster preceded a sequence of large up-rounds (Series D, E, and F) and the construction of an iron-air battery factory in West Virginia

Form Energy – Series C (2020)

The 2020 Series C $70-$80M round saw an even denser cluster: Breakthrough Energy Ventures, Capricorn, Energy Impact Partners, NGP Energy Technology Partners, Prelude Ventures, and Temasek. Within four years Form had raised more than $1.2B, broken ground on a factory, and signed multi-utility contracts for multi-day storage.

Fervo Energy – Series B (2021)

Fervo's 2021 Series B, at roughly $28M, included Breakthrough Energy Ventures, Capricorn, and Congruent Ventures. That early 3-of-25 round preceded the $138M FOAK Series C, the commissioning of a 24/7 geothermal plant in Nevada, and a subsequent growth round that took total equity and debt above $750M.

Redwood Materials – Series C (2021, 2-of-25)

Redwood's 2021 Series C, around $700M, included Capricorn and Breakthrough Energy Ventures. While this is only two cohort investors, the later trajectory of multi-billion dollar Series D and E financings, DOE loans, and multiple recycling plants under construction shows that even 2-of-25 can be a strong signal.

7. Syndicated FOAK Case Studies (each with >3 of the 25 Investor Cohort)

Antora Energy – thermal batteries for industry

Antora's $150M Series B in 2024, led by Decarbonization Partners with participation from Breakthrough and Lowercarbon, supported the scale-up of thermal battery manufacturing. Antora already operates a commercial pilot system and is engaging with industrial customers seeking to decarbonize high-temperature heat and power.

Ascend Elements – recycled battery materials and cathode active material

Ascend Elements' $460M Series D in 2023, backed by Decarbonization Partners, BlackRock, Temasek, Clean Energy Ventures, and others, followed earlier institutional rounds and pushed the company to a reported ~$2B unicorn valuation. The company is building its Apex 1 "gigafactory" in Kentucky for recycled cathode active material while also commissioning large-scale recycling and black-mass facilities in Georgia and Europe, supported by hundreds of millions of dollars in U.S. DOE grants and state incentives and anchored by long-term supply agreements with EV and battery OEMs.

Boston Metal – molten oxide electrolysis for green metals

Boston Metal has raised more than $350M across a Series C and C2 round since 2023, with Breakthrough Energy Ventures, Capricorn, Prelude Ventures, and others joining the cap table in successive up-rounds. The company is commissioning its first

commercial plant in Brazil to produce high-value metals from mining waste and is using a separate $50M DOE grant to build a chromium and alloys facility in West Virginia, while preparing to deploy full-scale green steel systems later this decade; these FOAK projects underpin growing commercial partnerships with major steelmakers.

Brimstone – carbon-negative cement

Brimstone's $55M Series A in 2022, backed by Breakthrough, DCVC, and S2G, financed a pilot plant capable of producing ASTM-compliant ordinary Portland cement from calcium silicate rock. The company subsequently achieved ASTM C150 certification and was selected for a $189M DOE grant, signalling both technical and commercial validation, even as policy shifts have introduced headwinds.

Electric Hydrogen – gigawatt-scale electrolysis

Electric Hydrogen's $380M Series C in 2023, featuring Energy Impact Partners, Breakthrough, Capricorn, Prelude, and S2G, funded a 1.2-gigawatt electrolyzer factory in Massachusetts. The round reportedly valued the company at roughly $1B; Electric Hydrogen has since announced a multi-gigawatt order backlog and received DOE funding under the Clean Electrolysis Program.

Electra – clean iron and green steel

Electra's $186M Series B in 2025, involving Capricorn, Breakthrough, Lowercarbon, and S2G, finances a first clean-iron demonstration plant in Colorado. This positions Electra to move toward commercial-scale decarbonization of iron and steel, a sector responsible for a significant share of global emissions.

Fervo Energy – next-generation geothermal

Fervo's $138M Series C in 2022, with DCVC, Breakthrough, Congruent, Capricorn, and Prelude on the cap table, funded the first generation of commercial 24/7 geothermal projects. Since then, Fervo has raised more than $550M in equity and roughly $200M in debt, reached a valuation slightly above $1B, connected a Nevada plant to the grid, and is reportedly preparing for an initial public offering at a $2–$4B valuation range.

Form Energy – iron-air storage

Form Energy's $405M Series F in 2024, supported by The Rise Fund, Breakthrough, Capricorn, Energy Impact Partners, NGP, GIC, Prelude, and Gigascale, extends a funding trajectory that has now surpassed $1.2B. The capital is being used to build and ramp an iron-air battery factory in West Virginia and deploy multi-day storage projects with several utilities.

Koloma – geologic hydrogen exploration and production

Koloma's $245M Series B in 2024, led by Khosla Ventures with participation from Breakthrough Energy Ventures, Energy Impact Partners, Prelude Ventures, Amazon's Climate Pledge Fund, and United Airlines' VC arm, built on an earlier $91M round, marking a substantial up-round and bringing total funding above $300M. The company is using the capital, plus DOE-backed R&D grants, to design and drill FOAK test wells for naturally occurring "white" hydrogen in U.S. basins and to expand internationally into Australia, Idaho, and the Philippines, positioning geologic hydrogen as a potentially low-cost, low-carbon baseload fuel; the round size implies a high nine-figure valuation.

LuxWall – vacuum-insulating glass

LuxWall's $51M Series B in 2024, with BEV, Prelude, and Khosla as existing investors, financed the expansion of its first vacuum-insulating glass factory and the construction of a second facility in Michigan. LuxWall has also received DOE support for domestic manufacturing and is positioned as a leading building-efficiency hardware company.

Radiant – portable nuclear microreactors

Radiant has progressed from a $40M Series B in 2023 led by Andreessen Horowitz's American Dynamism team to a $100M+ Series C in 2024 led by DCVC with participation from Union Square Ventures, Gigascale Capital, and others, taking total venture funding past $200M and pushing enterprise value toward the $1B range. The company is building its 1-MW Kaleidos microreactor, plans a fuelled test at Idaho National Laboratory's DOME facility in 2026, and has signed agreements with the U.S. Air Force and other early customers that treat the microreactor as a FOAK replacement for diesel generators in remote and critical-infrastructure settings.

Terra CO2 – low-carbon cementitious materials

Terra CO2's Series B has grown to $124.5M of equity commitments co-led by Breakthrough Energy Ventures and Just Climate, following earlier rounds and strategic partnerships with Eagle Materials and other cement producers. The company is breaking ground on a first commercial OPUS SCM plant in Texas and, with the help of a $52.6M DOE grant, a second plant near Salt Lake City, each designed to produce hundreds of thousands of tons per year of low-carbon cement extenders; this FOAK deployment is coupled to exclusive offtake and plant-development agreements that underpin rapid expansion across North America and Europe.

Twelve – CO_2-to-chemicals and SAF

Twelve's approximately $200M Series C, within a $645M package in 2024, included The Rise Fund, Capricorn, and DCVC. This capital is financing the company's first commercial plants for sustainable aviation fuel and CO_2-to-chemicals; the progression from a $130M Series B to this larger C package constitutes a clear up-round, with significant project financing attached.

Verdox – electrochemical carbon capture and removal

Verdox launched in 2022 with an $80M equity commitment from Breakthrough Energy Ventures, Prelude Ventures, and Lowercarbon Capital to scale the core electro-swing DAC module technology, building demonstration units, and proving the low-cost/low-energy thesis in pilot projects its patented electrochemical carbon removal process. Since then, the company has advanced FOAK industrial pilots—including capturing CO_2 from aluminum-smelter flue gas with partner Hydro—and has been recognized as a top climate-tech company in Massachusetts and globally, leveraging non-dilutive awards and commercial partnerships rather than frequent pricing rounds to move toward commercial plants.

Zanskar – geothermal prospecting and subsurface digital twins

Zanskar's $30M Series B in 2024, led by Obvious Ventures with participation from Union Square Ventures, Lowercarbon Capital, and other investors, followed earlier seed and Series A rounds and positioned the company as a well-financed subsurface exploration platform. Its machine-learning-driven geothermal "resource digital twins" are now being used in commercial exploration campaigns across the Western U.S., helping developers and utilities prioritize drilling locations, reduce dry-hole risk, and unlock FOAK next-generation geothermal projects that are increasingly being co-financed by top climate investors.

Zap Energy – compact fusion via sheared-flow-stabilized Z-pinch

Zap Energy has moved through a rapid sequence of up-rounds: a $27.5M Series B in 2021, a $160M Series C in 2022 led by Lowercarbon with participation from Breakthrough, DCVC, Energy Impact Partners, and others, and a $130M Series D in 2024 at a reported ~$650M valuation, with investors including Breakthrough, Chevron, and Soros Fund Management; the company has since been recognized as a Seattle-area unicorn with valuation "over $1B." It has demonstrated 11–37 million-degree plasmas in its FuZE-Q device, joined the DOE Milestone-Based Fusion Development Program, and is now designing a FOAK fusion pilot plant and operating its Century test platform to validate power-plant-relevant technologies like repetitive pulsed power and liquid-metal first walls—steps that collectively de-risk commercial fusion deployment.

We should highlight that Koloma, Radiant, Verdox, Zanskar and Boston Metal are all companies identified in Pitchbook using a broader definition of FOAK to include large post-pilot projects that may not be full commercial scale projects. They do not fit a strict First of a Kind definition.

8. Estimated Performance of Syndicated FOAK Case Studies vs Average

The momentum described above for each of the 16 syndicated FOAK companies has translated into strong follow-on round financing in terms of both capital raised and valuation increases for the FOAK investors. For eight of the 16 companies, we have reasonably reliable data on the capital raised since the FOAK round and the latest valuation which we have translated into an average estimated MOIC of 2.4x after only a couple years in most cases, and to an average IRR% of 41%. Details supporting these estimates are found in the Appendix.

Given the challenges faced by FOAK investments generally, we suspect that these demonstrated returns for the 8 syndicated FOAK case studies will be significantly above the average, which supports the case for more syndication by the leading energy transition private fund investors (our 25 firm alliance. That being said, we acknowledge that these case studies are far from having realized investment gains and we should expect to see a dispersion of ultimate realized returns, but with some extraordinary success stories where powerful new energy companies go on to attain valuations in the 10s of billions or more.

9. Comparative FOAK Failures

Contrasting these cases with failed FOAK efforts underscores the importance of aligned capital and diligence. Britishvolt's UK gigafactory collapsed into administration in 2023 after funding shortfalls. The NuScale–UAMPS small modular reactor project was canceled in 2023 due to cost escalation and insufficient utility subscription. Nikola's hydrogen trucking ambitions ended in bankruptcy following fraud revelations and production failures. The Petra Nova CCS project was idled in 2020 because of uneconomic dependence on oil prices.

10. Why the Investor Cohort Outperforms

Across both pre-FOAK and FOAK financings, the companies backed by clusters of these 25 investors have dramatically outperformed the broader FOAK universe. These investors combine deep technical vetting, the ability to lead large rounds, strong industrial and project-finance networks, and a willingness to support companies through multiple financing cycles.

11.Implications for the All Aboard Fund

For the All Aboard Fund, FOAK deals with three or more of these investors should be considered priority candidates for follow-on capital. Similarly, earlier rounds with strong 3-of-25 clustering, such as Form's B and C rounds or Fervo's Series B, can serve as valuable early-warning signals. By aligning with this cohort's best FOAK and pre-FOAK selections, All Aboard can focus its resources on companies with demonstrably higher probabilities of scaling to multi-plant, multi-billion-dollar outcomes.

TRUE NORTH INSTITUTE

Appendix

Key Terms

CAM/pCAM: battery cathode active materials and their precursors
DAC: Direct air capture
FOAK: First-of-a-kind plant, factory, or large-scale deployment
LDES: Long-duration energy storage
SAF: Sustainable aviation fuel
Up-round: A follow-on equity round priced at a higher valuation than the previous round

Estimated Performance of AA Cohort investments since FOAK round

Of the 16 syndicated FOAK case studies, we found adequate data for eight of them from which to estimate returns over the short period since the FOAK round of financing (usually just a couple years). For the other eight companies, we were unable to find recent valuations.

Below, we estimate performance using the post-money valuation at the AAF entry round and the most recently available post-money valuation. Dilution is approximated by comparing capital raised after the AAF round with the latest valuation, providing a consistent retained-ownership estimate in the absence of full cap-table data. The implied value of the AAF round stake is then calculated by applying this retained share to the most recent valuation. This share of value attributed to the AAF round is then compared to the amount invested in that round to arrive at an estimated multiple of money over invested capital (or MOIC). The IRR is then estimated from the MOIC and the time between the AAF round and the latest valuation date.

This approach offers a transparent, directionally accurate view of performance across companies using publicly available data.

Company	AAF Entry Post-Money Valuation ($M)	AAF Investment Date	Most recent valuation (post-money on most recent round)	Most recent round date	Capital Raised by Company Since AAF Round ($M)	Est Retained Ownership by AAF Round Investors (1- addl. cap. raised/latest valuation)	Implied Value of AAF Round Stake at Most Recent Valuation ($M)	MOIC on AAF Round	Annualized IRR
Input	*Input*	*Input*	*Input*	*Input*	*Input*	*Calc*	*Calc*	*Calc*	*Calc*
Form Energy	376	Sep 20	3,370	Oct 24	1,372	59%	1,998	5.3x	51%
Boston Metal	165	Feb 21	931	Jan 24	332	64%	599	3.6x	54%
Brimstone	185	Mar 22	275	Dec 24	0	100%	275	1.5x	16%
Electric Hydrogen	440	May 22	1,081	Jul 23	579	46%	502	1.1x	12%
Zap Energy	703	Jul 22	1,100	Jul 24	320	71%	780	1.1x	5%
Fervo Energy	308	Aug 22	1,400	Dec 24	981	30%	419	1.4x	14%
LuxWall	101	Dec 22	230	Oct 24	51	78%	179	1.8x	37%
Zanskar	118	May 24	575	Nov 25	130	77%	445	3.8x	137%
Average (n = 8)								2.4x	41%

TRUE NORTH INSTITUTE

Disclaimer

The information provided in this document is for informational purposes only and does not constitute a solicitation, offer, or sale of securities. Neither the investment examples cited nor mention of examples constitute investment advice or a recommendation to purchase or sell any securities.