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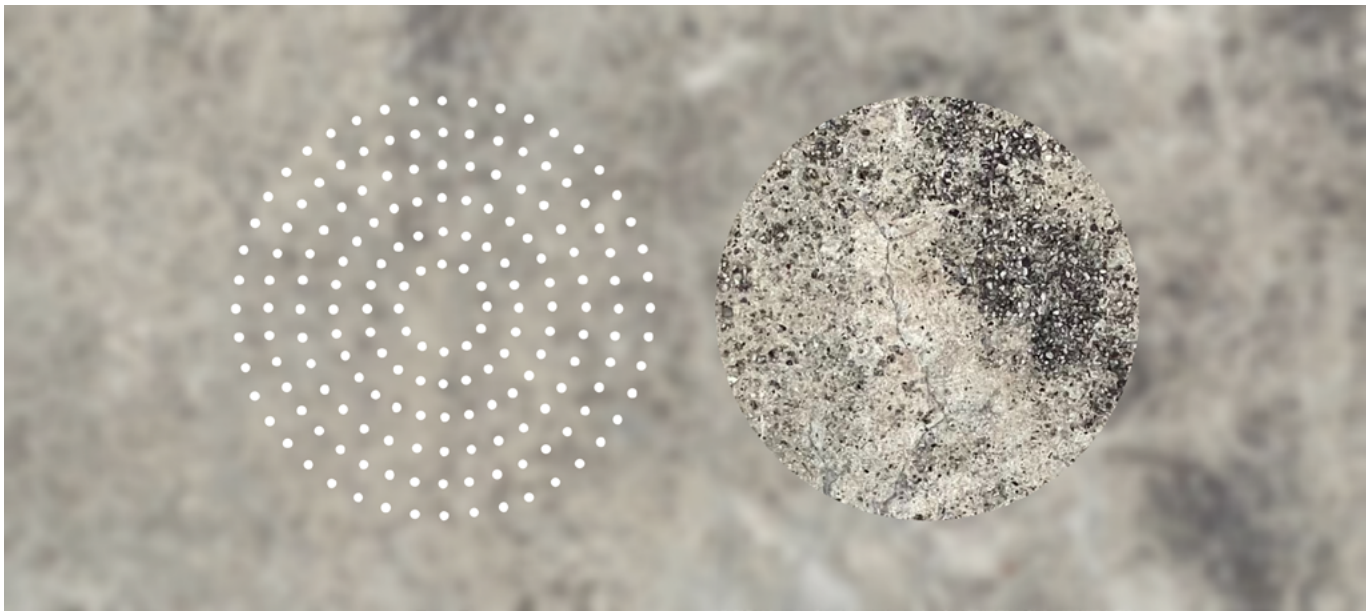
May 2024

FOAK *Guide*

A playbook for first-of-a-kind climate tech projects



Guide *Contributors*

Guy Cohen
Co-Author,
Sightline Climate

David Yeh
Co-Author,
Independent
Contributor

Holly Secon
Editor, Sightline
Climate

Kim Zou
CEO, Co-Founder,
Sightline Climate

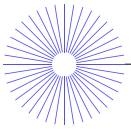
Mark Taylor
CPO, Co-Founder,
Sightline Climate

GUIDE EXPERTS

Caroline McGeough
Chadd Garcia
Deanna Zhang
Natalie Volpe
Jim Totty
Jonah Goldman
Missa Sangimino-Ludwig
Peggy Flannery
Scott Jacobs

The purpose of this FOAK Guide series is to provide a playbook for scaling to a First-of-a-Kind (FOAK) project and beyond, created for founders and developers aiming to launch their first projects to project financiers and strategics involved in scaling them up. This guide is a collaborative effort curating insights from industry experts and real-world data and case studies, and was originally published in the **CTVC newsletter**.

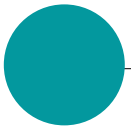
As climate tech sectors approach the FOAK inflection point, Sightline Climate develops research and data tools to assess commercial readiness and identify opportunities in areas such as advanced geothermal, sustainable aviations fuels, carbon capture and storage, long-duration energy storage, and more. Gain insights into when sectors reach FOAK and are ready to scale by exploring Sightline Climate's platform and data. Reach out to **sales@sightlineclimate.com** or **request a demo** to learn more.



ABOUT SIGHTLINE CLIMATE

Sightline Climate is a market intelligence platform bringing clarity to the new climate economy. Sightline Climate's subscription intelligence product provides data, tools, and frameworks, to help investors, corporates, and governments build and finance the new climate economy.

Explore Sightline Climate: **www.sightlineclimate.com**



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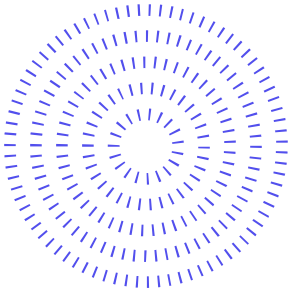

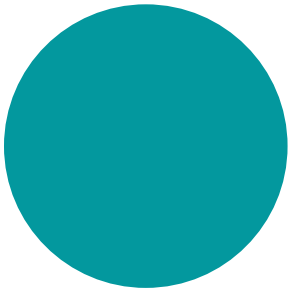

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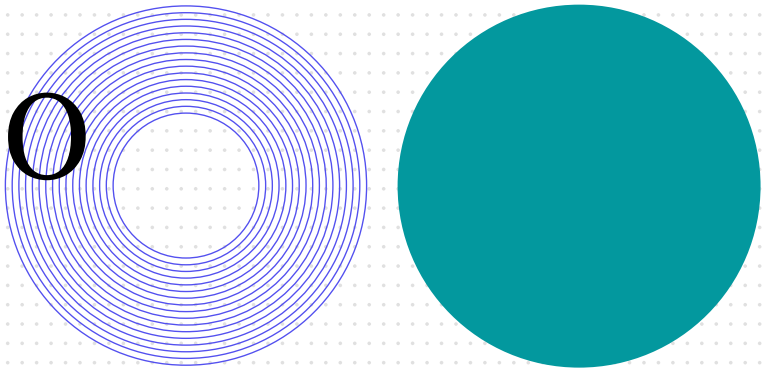
Venture to Project Finance Duolingo



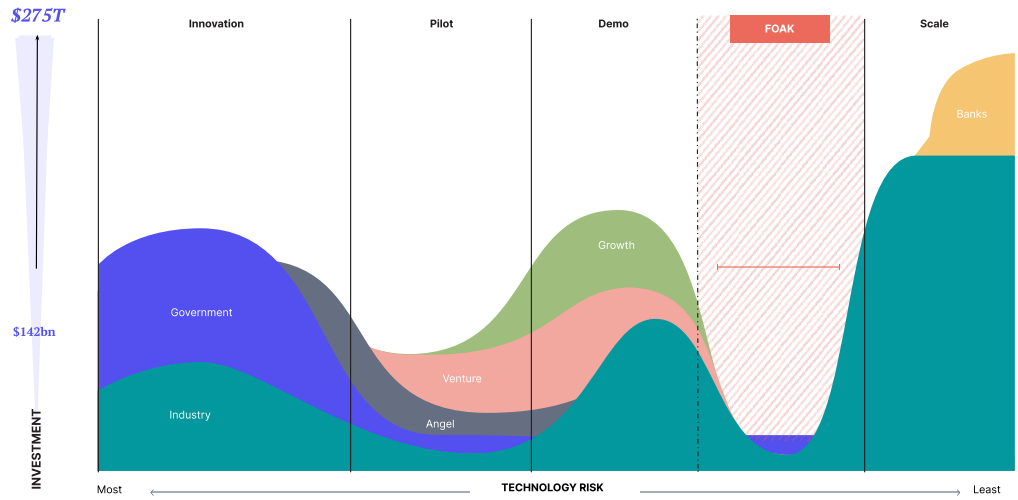
Part I: A translator from venture to project finance

First appeared as post in CTVC on February 9, 2024

"Deploy, deploy, deploy" starts with building the first project or factory, or the first-of-a-kind (FOAK). Only after the launch of its first factory plant in Fremont (thanks to the DOE Loan Programs Office) did Tesla grow into the success story of Cleantech 1.0 and drive the shift towards full-electric transportation. But the first of anything is always the hardest, and a true net zero future will depend on a "Tesla" arising in every industry – from new clean ways of flying, generating power, or producing steel.

DEFINING FOAK

FOAK is the first step to *Scale*



Source: Sightline Climate, RMI, McKinsey

A FOAK project is the first step on the bridge to bankability, and getting to FOAK is as Darwinian as it is ambitious. Companies ready to cross the bridge will have already traversed several valleys of death, first proving their tech works in a lab, then progressing to pilots to demonstrate their technology can work in the real world. They'll have raised tens, if not hundreds, of millions of venture, won customers and deals, and hired top talent. But it's only at FOAK where the rubber really meets the road – where they'll demonstrate the solution scales effectively and de-risk all of the commercial, operating, technical and even manufacturing risks that make them attractive to project financiers - before moving to second-of-a-kind projects then third, and eventually "Nth" where projects become repeatable and derisked (boring for VCs and entrepreneurs) which means bankable for project finance (PF).

We've written about the FOAK challenges companies face when scaling beyond the world of venture:

- From the **bridge to bankability** that helps companies reach the promised land of scale
- To the practical **project execution and human capital** to get steel in the ground
- The **sophisticating climate capital stack** that invests before and after FOAK
- And facilitating a discussion with experts on **how the FOAK** to finance FOAK itself
- Then highlighting the growth funding gap for FOAK in our **2023 investment trends report**

Today, more climate technologies are maturing, and we're starting to see FOAKs in a variety of sectors, from **sustainable aviation fuel to green steel** (e.g. H2Green Steel's $5B deal, Lanzajet's Freedom Pines sustainable jet fuel plant, DOE's DAC and green hydrogen hubs).

The problem is that while venture capital funds the lab and pilot stages, and project finance is available for commercial projects, FOAK falls in between, requiring infrastructure-scale sums of money with risk comparable to venture capital. This leaves these potentially pioneering projects in a finance "no man's land", straddling two adjacent asset classes with contrasting risk and return profiles.

A TALE OF TWO INVESTORS

Venture investors swing to hit home runs, where a few investments can return multiples of a fund. Project finance investors look for a high batting average –– no strikeouts in investments characterized by long-term stable cash flows from projects with de-risked technology and creditworthy commercial agreements, secured by assets. Financing FOAK is a brave new world, requiring a blend of VC and infra expertise, as well as philanthropic capital, grant funders, customers, and strategics.

Learning project finance lingo as companies plan the first commercial-scale, $100m+ facility is already too late. Talking the talk and walking the walk to get to FOAK takes years of putting steel in the ground, operating performing projects, and raising capital in a markedly

different world than VC. Project financiers have their own distinct pattern recognition for what "good" looks like. Due diligence requires detailed review of long-term commercial agreements, credit quality of off takers, market studies, and EPC contracts to start. **Debt-service coverage ratios** (DSCRs) are more important than return multiples. VCs' ears may perk up at "innovative" and "disruptive", but "off-the-shelf" and "vanilla" are the preferred adjectives for PF.

Fluency in project finance takes years. But we've built a VC-to-PF Duolingo to get you started.

(Note: Both venture and project finance are incredibly nuanced in their own right, and the information below is for illustrative purposes only. For simplicity here we're only addressing project finance debt, and ignoring project equity. Typically debt-equity ratio for project finance will be around 80% debt and 20% equity. FOAK terms will not be that generous in debt.)

VENTURE TO PROJECT FINANCE DUOLINGO

You say unicorn, I say repayment

	VC	PF
What they do	Buy preferred equity in a company, typically a minority ownership stake and (ideally) mentor the next generation of "Teslas" for ~10x returns	Loan money plus interest to credit worthy projects and manage risk. PF is non-dilutive to founders and VCs
Mindset	Swing for a home run	Play it safe, don't strikeout
Background	Serial entrepreneurs and tech executives often with a technical background. These polymaths cover a wide range of areas and may invest when relatively new to a space	Career finance executives who tend to specialize in an area and spend years working on deals in that space
Their math	In a portfolio of 15-20 investments, a couple to return the whole fund. Failure is an accepted part of venture.	Lenders expect the vast majority to repay in full. For the remainder they can recover ~80% if not more of the losses through the sale of project assets and collateral
Returns	20%+ pa over 10 years.	~7-9% over ~10-20 years (SOFR+several hundred basis points)
Check size	$1ms to $10ms	~$100ms to $bns
What is in their term sheet?	Relatively simple compared to PF. Valuation and capitalization, board representation, downside protection, voting rights, negative control covenants, and exit provisions	Highly structured including interest rate and term, fees, minimum DSCR, events of default, guarantees, ROFRs, debt reserve accounts, equity contribution obligations, and collateral to start
TRL	1-7	Does this come in a 10?
Due diligence	• Relatively light compared to PF with costs in the tens of thousands of dollars • Team, team, team. Is this a cohesive and well-balanced team of all stars? • Tech - Ambitious but plausible roadmap for a superior product • Growth Show me a hockey stick • Market! Is there a big addressable market for even more growth? • Product market fit. Is their product being bought, renewed and expanded? • IP. Is it there and is it protected? • Competitive landscape • Exit - who will buy them? Can they IPO?	• Expensive and extensive if not exhaustive diligence of the project with an army of 3rd party consultants. Transaction costs may reach hundreds of thousands if not millions of dollars. • A short list of DD items below to start • Forensic analysis of the project finance model. PF xls dwarf the size and complexity of their venture cousins • Offtake agreements. PF lenders check your customers' credit on top of the contract • Construction and tech due diligence including independent engineering report, EPC contract review, and modeling construction contingencies (overruns) • Permits and more permits. Is your NEPA ready? • Supply agreements. Does your "4 cents a kwh" renewable electricity contract pass muster? • Reference checks on you, your developer, your investors, and all of your mutual agreements • And when you thought you were done: • O&M agreements • Third party market due diligence report • Third party legal and regulatory report • Insurance agreements • Interconnection study if you are in power generation

Looking for a dynamic project finance model to get you started? Check out Extantia's FOAK Financing Toolbox here.

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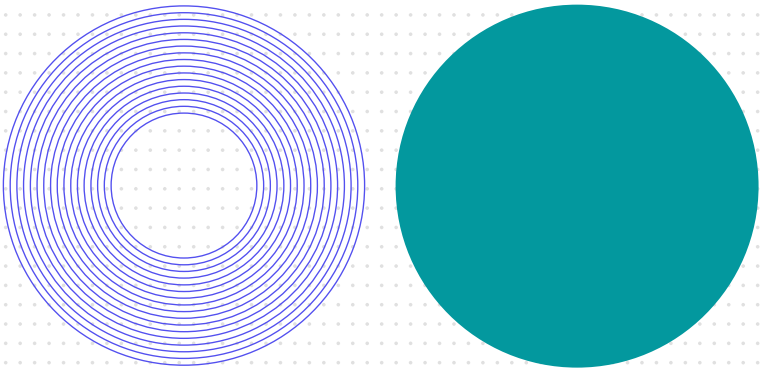
The FOAK checklist



Part II: The five P's of FOAK preparation

First appeared as a post in **CTVC** on February 23, 2024

In this second feature in our *First-of-a-kind (FOAK)* series we've gone completely and unabashedly full framework to bring some structure to this adventure wonderland of finicky first projects. Porters Five Forces stand down, the FOAK Five Ps have arrived! As everyone will tell you, FOAK is hard. But rather than wax cynical about the chasm ahead, we'll review what actions help aspiring Teslas put one foot in front of the next on the path to the promised land of bankability; people, pilots, plan, and partners, all tied together with a lot of persistence.

PEOPLE – MEET THE FOAKERS

Planning and delivering a FOAK requires recruiting a purpose-built FOAK team. This team will have years of track record in developing, engineering, financing, and constructing projects that are often outside of venture's and tech's wheelhouse. While ideally new recruits would have already worked on a FOAK, that may be too much to ask. Instead ideal candidates will have completed several projects at name brand infrastructure firms like Avangrid, SunPower, Bechtel, or Macquarie. Ideally their prior experience will be in an area with similar dynamics, e.g. a Tellurian LNG alum if you're in hydrogen, or a Baker Hughes O&G engineer if you're in geothermal where skills translate well. And don't be shy about recruiting from energy majors or SpaceX, Tesla, and other FOAK success stories. Leading FOAK growth companies like Fervo are stocked with ex-oil and gas veterans lending their skills to the energy transition. Recruiting your FOAK dream team not only brings in the necessary skills but also demonstrates that expertise to potential investors to build confidence. Key roles are:

1. **Project manager / developer.** They'll be your internal founder and project CEO; they'll find the site, and manage everything from permitting to key stakeholder relationships to locking down the offtake agreement. Their background is business not technical. They're responsible for the project's strategy, fundraising and finances, development milestones, managing engineers, etc. They may have an MBA and spent some time in finance or at an investment bank.
2. **Project engineer.** They'll be responsible for the engineering from design to construction. They'll manage the FEED process, liaise with your OE (**Owner's Engineer**), EPC (Engineering, Procurement, and Construction), and someone else's IE (**Independent Engineer**), and make sure your roadmap from the pilot to FOAK to full

commercial is investment-grade. Background includes being an engineer building projects at blue chips like Fluor, Power Engineering, and Kiewit as well as operating companies too.

3. **Commercial director/CCO.** While initially it may be the project manager building commercial relationships, later on when it comes to negotiating the supply and offtake contracts it's important to have someone who's been through relevant large long term contracting cycles before. They'll be the one making sure the terms will meet PF investors expectations and checking the assumptions in your models pass the sniff test.

PILOTS – PRE-FLIGHT TRAINING

Before taking on your FOAK you'll likely have run a pilot if not pilots. Climeworks started with a lab project in 2012 capturing kgs of CO2, moving to tons in their 2017 pilot, then onto hundreds of tons in 2017, then up to thousands of tons with their Orca project in 2021, and are due to step up to the tens of thousands of tons with Mammoth this year. Ideally from your pilot/s you'll be able to show:

1. **The tech works.** The three scariest words in project finance are "binary technology risk." Does tech work or does it not? If there is a whiff that your tech is not ready, infra finance will flee. So your pilot/s' job #1, 2, 3, and 4 is to demonstrate the de-risking of your tech in the field, not just in the lab. You may have specific KPIs that show you're ready, these could be operational KPIs like running for x many hundred hours without issues, commercial KPIs like producing units at a certain rate and cost, or impact metrics like being able to show that your product leads to tangible emissions reductions, something that may be a prerequisite for some investors.

2. **Kickable tires.** The explicit role of your pilot is to demonstrate an operating project - your climate solution works in the real world under real world conditions. The expression, "you have to see it to believe it" applies doubly in infrastructure. Having a concrete project outside the lab at "clearly beyond lab scale" where your investors, strategics, and other partners can "kick the tires" and diligence is paramount. Climework's $600M+ round was not won with powerpoint, white paper, or techno-economic model (though we are sure that they were great). Their series of working pilots won them their FOAK street cred. By the way, all investors like to play Bob the Builder and wear hard hats around construction sites :)

3. **Modular.** Startups often base their FOAK projects on the principle of modularity, but claiming scalability akin to "solar" isn't enough. True modularity, as deemed by project finance, implies that the engineering and design used in pilots will be replicated exactly in the FOAK. For example, a billion-dollar energy storage plant may use their pilot to test a single manufacturing line, then scale 50+ identical lines for the gigafactory FOAK. The startup mindset of "move fast and break things" doesn't apply here. If you have to iterate, you'll need a bulletproof story for your investor's engineers to explain your rationale for the change, how risks will be mitigated and managed, and what aspects of pilot performance are comparable to the FOAK, vs. where you're asking FOAK financiers to take a leap.

PLAN – LOOKING FOR GOLDILOCKS

Not only is FOAK planning a bigger exercise than earlier projects, but it'll need to be written in a different language for a different audience. Check out our **Venture to Project Finance Duolingo** to learn more about code switching.

1. **How big?** The scale of your project should be ambitious yet realistic, striking a balance in the "Goldilocks zone". Your project shouldn't be too big where there's a "billion dollar capex" sticker shock or scale too fast to be probable (100x might be excessive). It should be substantial enough to validate your technology at a commercial level and provide a credible reference for larger commercial scale projects to follow.

2. **Commercial model.** What is the source of your cash flow? You need an offtake contract that uses realistic assumptions about supply chain and the offtake market and prices that shows a path to price parity or an acceptable green premium. It should give a PF a credible basis for believing your unit economics. What is the IRR (internal rate of return), MOIC (Multiple on Invested Capital), and DSCR (debt service coverage ratio)? They may expect a higher risk premium for being early in the asset class, so to make the numbers work you may need to get creative. Infinium, a SAF producer, managed to attract investment for their Project Roadrunner by partnering with American Airlines and Citi to fund the largest eSAF site in North America. As well as an offtake agreement with American Airlines, they arranged to transfer the associated emissions reductions to Citi to reduce their scope 3 emissions, enabling them to secure additional future revenue.

3. **Critical path to bankability.** From FOAK to nth. As well as outlining how you get to FOAK, you'll also need to map out how you expect tech and engineering learning curves to affect your future commercials and unlock the path to bankability.
4. **Permits not powerpoints.** Do you know where you're going to build it? Have you engaged with the local community, started work on your FEED study, got the team in place and operational? You may not have been through permitting yet but you'll know everything that needs to happen to break ground on your project - every permitting milestone and the associated level of spend and risk with each. When it comes to pitching for FOAK financing just ambitious ideas in a deck = a short meeting.

PARTNERS – ANYONE I'D KNOW?

Investors are more comfortable coming to a party when they recognize and know the other guests (i.e. partners). Supply and offtake are the name of the game, but so is the creditworthiness of those partners so investors can have confidence that the project can meet its commitments ten years from now. Don't underestimate the importance of your offtake partner's financial strength, as well as the reputation of your EPC partner, even in early project stages like engineering design and feasibility studies.

1. **Board.** You're going to need a bigger board. While your venture investors may be the biggest names in Silicon Valley, you're not just playing in the valley anymore. Having names on your project sponsor list, cap table or advisory board that other infra investors recognize will not only give you a useful advisor but also breed confidence. Some names like Singapore's GIC and Temasek, and strategics in general, can be well-regarded on both sides of the aisle.
2. **Offtake.** Securing a 20-year PPA (Power Purchase Agreement) with a Microsoft or SK Group might be ideal but not always feasible. Energy contracts are often long-term, unlike other decarbonization sectors like concrete or jet fuel. The key to success in offtake is securing long-term contracts with creditworthy buyers. But in sectors like concrete or jet fuel, there's a need for innovation in moving buyers from short-term merchant markets to longer-term contracts, and potentially leveraging newer financial mechanisms like Low Carbon Fuel Standards (LCFS), tax credits (e.g. 45X or Q), or carbon credits.

3. **Supply.** The yin to the offtake yang. Like you need a reliable buyer you need a reliable source too. Even if a feedstock is commoditized and easily purchasable on the market, the absence of a formal supply contract can still cause investors to be skittish. And, like with offtake, it needs to be with someone who can be trusted to still be around to fulfill the contract.
4. **EPC.** Working with an experienced EPC can also mitigate FOAK risk. The ideal scenario would be to secure a fixed-price **full-wrap** agreement with an EPC like Bechtel, who would guarantee the total cost of the project. But these are harder to come by, especially for FOAK projects. What's more likely is a partial wrap, where the EPC assumes ownership for specific elements of the project. The more that's covered, the lower the risk for investors and the more attractive the project opportunity.

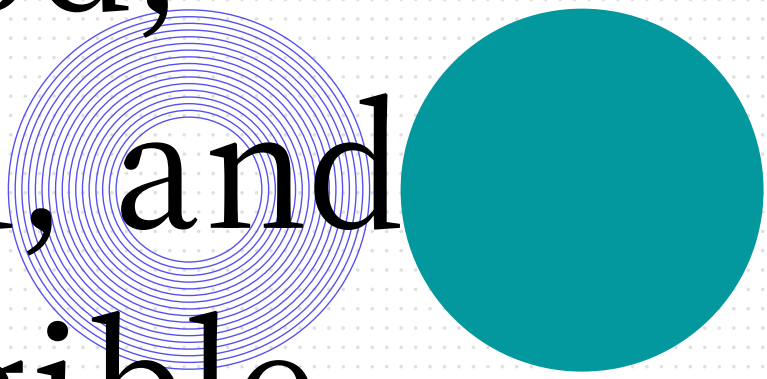
PERSISTENCE - ONE DOES NOT SIMPLY WALK INTO FOAK

Nothing to tick off here, other than the inevitable passage of time as weeks turn to months and on into years. Critical FOAK steps of project development, offtake negotiations, and government funding don't happen overnight. The course from path to pilot is a marathon, not a sprint, and will require patience, resilience, and persistence. But you're not alone! There are many experts willing to advise and lament with you, and their first call might even be free.

GROUP		TO DO	DONE
People	**1**	Project developer	☐
	2	Project engineer	☐
	3	CCO/commercial director	☐
Pilot	**4**	The tech works & meets core KPIs	☐
	5	Kickable tires	☐
	6	Modular; repicable and scalable	☐
Plan	**7**	How big?	☐
	8	Commercial model	☐
	9	Critical path to bankability	☐
	10	Permits not powerpoints	☐
Partners	**11**	Board	☐
	12	Offtake	☐
	13	Supply	☐
	14	EPC	☐

The Five P's of FOAK preparation (source: Sightline Climate)

FOAK Financing: The Good, The Bad, and The Eligible



Part III: Five funders & formulas for FOAK financing

First appeared as a post in **CTVC** on March 8, 2024

Pilot, check. Project team, check. You've been diligently making your way down the FOAK checklist. You're ready to build. Up next: raising the eight to nine figures, yikes!

FOAK finance is finicky, to say the least. While not quite a plug-and-play formula yet, five primary financing buckets repeatedly back up FOAK with bucks: "Super Round" with Equity, Philanthropic or Catalytic Capital, Strategics, Government, and Project Investment. *(For an intro to the different kinds of funding check out our **Climate Capital Stack**.)*

In this piece we'll look at what each investor group is looking for (The Eligible), the benefits of raising money from them (The Good), the drawbacks (The Bad), and companies that have done this before (The Exemplars).

THE ELIGIBLE

What are FOAK investors looking for? Generally, it's some combination of:

- **Technology readiness level (TRL).** The state of your tech will determine what you can do. Start with the technology – how de-risked is the tech, how long has the pilot been running? The level of risk you're at will dictate which investors will be open to you.
- **Alignment.** VC and project finance (PF) may not mind what your product does so long as it makes money, but Philanthropic/Catalytic, Strategics, and Government will be led by non-financial criteria. For Strategics this might be supporting the growth of existing or even new billion dollar businesses, while for Government it might be about supporting technologies with national strategic importance, but for all three, $ alone isn't sufficient.
- **Capex requirements.** How much do you need? If it's nine figures, it'll be hard, expensive, and extraordinarily dilutive to finance from the balance sheet, and it'll be too much for most philanthropic/catalytic funders. But on the other hand it won't be worth going to the DOE for a $20m LPO loan.
- **Internal Rate of Return (IRR).** If your first few project equity returns are in the mid teens then you might be able to raise project capital, but anything less than that and it's going to be tough.

THE GOOD AND THE BAD

Some of the areas that may or may not go your way are:

- **Scalability.** Ultimately you'll want this to be the first-of-a-kind, but not the last. That means you'll need to get onto a pathway that can support scaling up and developing lots of commercial projects. Long term for many that will mean moving to a licensing model, being acquired by an incumbent, or tapping mainstream project finance (PF) sources. Acceptance into the mature infrastructure market takes time - think project 10. But when it happens, it enables the rapid and massive scale that wind, solar, and batteries, who were FOAKs 15 years ago, experienced. Infra leaders like Brookfield or Sumitomo think in billions, not millions, will likely want to finance as many de-risked projects as you can develop, and the cost of their capital is a fraction of VC.
- **Cost of capital.** How much is it going to cost you? Cost of capital for a FOAK is not cheap, both for debt or equity, and boards need to understand that. The appeal of PF isn't necessarily that it's cheaper, but rather that it's off balance sheet which means non-dilutive and most importantly, it's the only path to gigaton scale.
- **Transaction costs.** Your biggest cost is not often money but time. Levels and types of due diligence for FOAK will be much higher than conventional deals. So budget a year for engaging the DOE or an energy major and expect the process to be orders of magnitude more rigorous than VC diligence.
- **Other factors.** While less significant than the points above, each financing option comes with its own quirks, for better or worse. A few key ones include:
    - **Size of ticket.** What's their funding appetite? How much of the total they can take? Some funds are limited in their maximum ticket size, while those issuing debt may have loan to value (LTV) constraints. The LTV can have both a minimum and maximum threshold.
    - **Credibility.** Getting a well known and trusted infrastructure brand as an investor can help you raise capital from other sources, and boost your brand. In particular the DOE and global institutional investors have the halo effect. Sorry VCs.

- **Partnerships.** Strategics can offer much more than just money. Acting as investor, offtaker, advisor, and more allows them to offer a range of benefits, albeit at the cost of a loss of control.
- **Term.** Different asset classes measure time differently. Strategics can be patient with time horizons that can go beyond a decade, whereas institutional investors want to get their money out within a life of a 10-12 year fund. For project investment, debt terms are usually <10 years while project equity sponsors typically own assets for the life of the asset (e.g. 20 years).

THE PATHS TAKEN

1. "Super Round" (with Equity)

Who & how

- Venture Capital, Growth, and Strategics – a similar group to those who may have invested in your last round – with the addition of Sovereign Wealth Funds and Pension Funds to super size the round.
- Nine figure equity investment into your startup / growth company

The eligible

- **Actually kind of a big deal.** Do you look in the mirror and see a climate unicorn? Are investors and strategics banging on your door with eight/nine figure term sheets? Most start-ups, even the ones with momentum, won't qualify.

The good

- **Fast.** Raises take months, not years, and once the money's in you can get going straight away. This will likely be the fastest path.
- **Simple and familiar.** No need to mess around with becoming a PF expert. Just raise more venture and PE money on top of the heaps you raised in the past.

The bad

- **Dilution.** This is the most expensive and dilutive form of capital.
- **Low scalability.** This may be how you pay for your first, but it's unlikely you'll be paying for your third this way. At some point you'll need to get on the PF bus.
- **Pressure.** You are now a unicorn and have to defend that lofty valuation going forward. Any hiccup (and if you are doing FOAK, there will be hiccups) could lead to the dreaded down round.

Examples

- Climeworks (DAC), raised a whopping $650m round back in 2022 to break ground on Mammoth, their first large-scale site. Off the broad back of Mammoth, Climeworks has since begun scale-up for its megaton-scale projects, leveraging DOE's funding in the US.
- Boston Metal (green steel), raised $262m Series C last year to finance their FOAK from a who's who of funds, strategics, and family offices.

2. Philanthropic or Catalytic Capital

Who & how

- Catalytic investors (e.g. Breakthrough Energy Catalyst, Trellis Climate), NGOs (e.g. Elemental Excelerator), High net-worth individuals, Family Offices, and some Strategics (e.g. Microsoft) can also behave this way.
- Debt, grant, equity or something in between/whatever you need.

The eligible

- **Alignment: Impact.** Do you impact areas they care about? Are you catalyzing gigatons of CO2 reduction or decarbonizing the hardest industrial sectors? Don't forget about environmental justice and issues of access and equality. Will your success support communities that have been left behind?
- **Catalytic.** Climate-first funders have lofty goals of seeding new markets and spurring revolutionary climate solutions. Many share the goal of being the FOAK bridge that takes you from VC to PF or other kinds of scalable finance.

The good

- **Cheap(er) and Flexible.** Catalytic funders boast of flexible capital - debt, equity, and even grants. Whatever is needed in the capital stack to get the project financed.
- **Credibility.** Some catalytic funders, e.g. Breakthrough Catalyst, are well respected by financial investors and strategics. Their involvement has a halo effect - opening doors, adding negotiation leverage, and, most importantly, improving the chances of gaining other funding.

The bad

- **Not-scalable.** They're only here to FOAK, not NOAK (Nth of a kind). Your second and third projects are likely to need other funders.
- **Small check size.** With a few exceptions, the checks are smaller. Fine if your project is millions to tens of millions, but if it's more then you'll need to blend with other sources too.

- **Restrictive.** Investment may come with specific impact metrics based on the funder's priorities.

Examples

- Infinium (SAF), raised $75m from Breakthrough Energy Catalyst last year. SAF's is one of Breakthrough's five stated priority areas. Breakthrough went on to support Infinium for their Project Roadrunner by partnering with American Airlines and Citi to fund the largest eSAF site in North America. As well as an offtake agreement with American Airlines, they arranged to transfer the associated emissions reductions to Citi to reduce their scope 3 emissions, enabling them to secure additional future revenue. In doing so they not only helped Infinum scale, but created a blueprint that other SAF producers could follow.

3. Strategics

Who & how

- Strategics (e.g. corporates like ArcelorMittal, Occidental, bp, BHP, Microsoft) are typically global leaders in a category who are looking not only for financial returns but also to bring additional value through industry expertise, specialized knowledge, access to distribution channels, technology, or markets.
- Equity or debt (either in the project or the company), or some combination of the two as well as in-kind services. They may likely ask for a ROFR (Right of First Refusal).

The eligible

- **Alignment: Business strategy.** How does your startup meaningful impact a giant? Are you a disruptive tech that they need to monitor? Are you a potential new billion dollar business for them? Can your addition meaningfully grow existing operations? Sometimes it's clear like British Airways + Shell + LanzaJet or more complex like a European energy major buying a biofuels business to grow its trading business.

The good

- **Silver bullet.** Strategic investors can be your FOAK silver bullet. If a giant incumbent like an Oxy believes your success is his/her success (NET Power, Carbon Engineering), strategics can be not only your investor and lender but your project development partner and offtake customer.
- **Long term.** Incumbents can take a long term view and make billion dollar commitments. Strategics like Total took LNG from FOAK to NOAK in ~10 years.

- **Credibility.** Big strategics are well known and often trusted, having one as a partner can help unlock offtake and investment from risk-averse blue chippers.

The bad

- **Slow.** Energy majors and other strategics may take a long time to commit. You may have to meet with their business units, their engineering teams, and then meet them again.
- **ROFRs (Right of First Refusal).** Since most FOAK and early projects don't have high IRRs, they may ask for ROFRs on your pipeline as the technology becomes proven and hopefully profitable. This means that the strategic would have first dibs on future projects.
- **Optimal for who?** The gravitational pull of a strategic's size will naturally optimize the FOAK for their business. The incumbent's competitors (who likely may be your future customers) may start to see you as part of their competitor's defacto subsidiary and avoid doing business with you.

Examples

- Carbon Engineering (DAC), was bought by Occidental for $1.1bn last year. Occidental have stated their plan to build 100 DAC plants and see the potential to license 1,000. This commitment may have helped drive BlackRock's decision to invest $550m in Stratos, Carbon Engineering's FOAK. Alternatively...
- NET Power (clean natural gas power), raised money from a purpose-built syndicate of strategics. This included leaders for each part of its supply chain – Baker Hughes (energy services giant), Shaw / McDermott / Lummus (EPC and process tech), Exelon (utility), and Occidental (EOR). These investors provided more than just capital and were critical for NET Power's FOAK in 2022. NET power ultimately went public through a SPAC last year at a valuation of around $1.5bn.

4. Government

Who & how

- From Gov or its entities (e.g. DOE Loans Program Office (LPO), European Investment Bank (EIB), British Business Bank, Canada Infrastructure Bank). There are hundreds of billions from hundreds of government programs to support FOAK.
- Typically loan / loan guarantees, and grants (e.g. DOE's Office of Clean Energy Demonstrations (OCED)). *More on navigating government money in our **Founder's Guide to the DOE** and **Government Grants guide**.*

The eligible

- **Alignment: program qualification.** Government dollars are earmarked for specific policy goals with defined eligibility and a set application window. For example, for the DOE's $3.5B DAC hub funding, there is a tight definition of qualifying tech, qualifications around EOR, stipulations on cost shares, and a set application timeline. Don't forget about community benefits that are integrated through IRA's and BIL's requirements.

The good

- **Cheap.** Often the cheapest debt (e.g. 6%) for FOAK. Grants of course are even better.
- **Big checks.** The LPO can write billion dollar checks for FOAKs. No one else will.
- **Credibility.** Getting funding from the DOE is tough but worth it. It's a stamp of approval that can unlock other funding pathways.

The bad

- **High transaction costs.** Applying to the $400bn LPO is likely a year plus and will cost millions. So aim high ($250m+), or otherwise it's not worth the fees and time. Other funding programs like the $25bn OCED and ARPA-E's SCALEUP have lower transaction costs but write smaller checks.
- **Conditions.** Loans and loan guarantees can come with constraints (e.g. domestic content requirements, NEPA permits, and community benefits).
- **Partial.** Won't be able to cover all of the ticket, think LTVs in the range of 50:50 or 60:40 depending on likelihood of repayment. This is also true of other funding sources, but not always known about government loans.

Examples

- Monolith (clean hydrogen, carbon black) in 2021 received a $1bn LPO loan guarantee to expand their plant into a FOAK commercial site. The DOE stated that the project was both in line with the purpose of the fund, and would create high paying jobs, along with a strong community benefits plan.
- Energy Dome (LDES), raised $25m out of a $65m funding round from the European Investment Bank for its first-of-a-kind utility-scale long duration energy storage facility in Sardinia, Italy.

5. Project Investment (equity & debt)

Who & how

- While typical project investors would include large banks, sovereign wealth funds, pension funds, and other infrastructure investors, realistically they're not going to engage at the FOAK stage. Instead it will be smaller specialist "**emerging infra**" firms like Spring Lane, Wollemi, Grok, Wavelength or larger funds like Antin who can do THOAK (third-of-a-kind).
- Can be either debt and/or equity at the project level often coupled with investment at the TopCo.

The eligible

- **Lower risk.** These investors in sustainable small(er) scale projects are looking for technologies to be as de-risked as possible, think EV charging for buses where similar tech and business models have already been proven with passenger EVs.
- **Racing for the Bronze.** In the world of emerging infrastructure, most investors would rather win the Bronze medal. A THOAK should have two operating plants that can demonstrate the tech and commercial model has been derisked.
- **Worth the (lower) risk.** The risk reward calculus will need to be compelling, one way of doing this might be having an IRR commensurate to the risk (e.g. above 15%).

The good

- **Highly scalable.** If all goes well, your NOAK projects can graduate to mainstream investors and lenders who can write big checks and keep writing them. It'll take a while to get there, it won't be the second, nor probably the third.
- **Show me the money.** Infra investors' job is to generate returns for their LPs. While they might also care about climate impact, it's secondary.

The bad

- **Expensive.** You can get cheaper capital but it won't be for ambitious stuff.
- **Small checks.** While their mainstream siblings can write the biggest checks, at the FOAK stage typically they'll only occur in small deals, think $10ms not $100ms, although their portfolio of deals might cross the $100ms threshold.

- **Not easy.** Even if you do meet the eligibility criteria it can still be a lengthy process to raise PF, especially if it's a novel technology. Your funding universe is smaller and due diligence will be more rigorous. If you're wondering how to talk project finance, check out our duolingo.

Examples

- Aries Clean Energy - Spring Lane wrote a $25 million equity check to Aries for the next iteration of their operating tech to gasify biosolids and create a self powered virtual landfill. One facility soon to be up and running!
- SOLARCYCLE raised asset-level equity finance from Fifth Wall for their FOAK in Texas and NOAKs for solar panel recycling. Their goal is to recycle millions of panels per year.

BLEND – EVERYTHING EVERYWHERE ALL AT ONCE

Ultimately, how you finance your FOAK will be a blend. But each layer can help unlock the next; the credibility from a philanthropic/catalytic funder or government funding can help de-risk a project enough to unlock project finance.

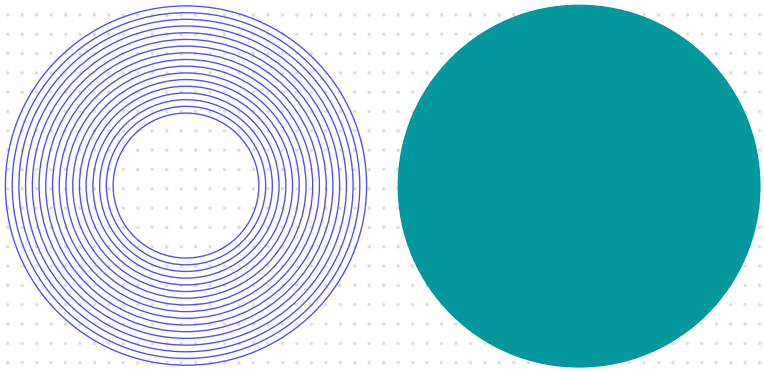
As you move from FOAK to the second and third, that financing mix will change, that philanthropic/catalytic funding and Government backing will likely drop away potentially to be replaced with project finance. If that leaves you with more questions, don't worry, moving from FOAK to NOAK will be the topic for the fourth (and final) piece in this series.

Funding pathway	Transaction costs	Cost of capital	Scalability	Likelihood / eligibility	Other key benefits
Super round	Low	High	Low	Venture-backed	Easy & familiar
Philanthropic / catalytic	Medium	Low	Low	Mission aligned and able to seed a market	Flexible
Strategic	High	Medium	High	Aligned with the strategic's strategy	Future exit, scaling partner
Government	High	Low	Medium	Impact aligned and wider public benefit	Halo effect
FOAK Project equality and debt	Medium	High	High	Smaller scale and lower risk	Halo effect

The good, the bad, the eligible (Source: Sightline Climate)

sightline climate

From FOAK to NOAK



Part IV: Scaling from the first to the Nth-of-a-kind

First appeared as a post in CTVC on April 19, 2024

Thought we were done with this FOAK series? NOAK! Think again. Before we set you off on your merry deployment way, we've got one more project scaling step left from *Pilot to FOAK*, now to *NOAK and beyond*.

At FOAK, definitionally something must be novel — otherwise, it wouldn't be a First-of-a-kind. That novelty can come in the form of the technology, the business model, the application, the geography, or a plethora of other knowns and unknowns. Each dimension of novelty adds risk, and the riskier, the higher the cost of capital. But these obstacles aren't impassable, nor is the journey impossible with the right FOAK financing and the right people, pilots, plan, and partners.

Post-FOAK, what's to show for it? Tens of thousands of hours of consistent operations and product creation. An established track record that can be diligenced, robust partnerships, and proven profitable unit economics. The remaining risks are those common to all new projects; macroeconomic conditions, regulatory changes, suppliers or offtakers going bust, acts of God, etc.

If FOAK crosses the "**Valley of Death**", NOAK bridges projects to repeatable bankability. Nth-of-a-kind projects that are de-risked at scale are rewarded with access to deep pools of comparatively cheap capital. This may be from institutional infrastructure investors like Antin, Macquarie, GIC, Generate, and Brookfield's Energy Transition Fund, as well as, ideally, global asset managers like Carlyle and mega-pensions like CPP Investments. By NOAK, it becomes possible to raise debt (and other credit vehicles) from conservative project finance banks, like MUFG or Santander. By this stage the gates of non-dilutive capital have opened — key to the FOAK-to-NOAK transition. Projects are no longer built with equity, but ideally ~80% debt. Finally, growth doesn't come at the price of dilution.

A NOAK investor speaks a **different language than the world of VC**: Rather than looking at the *growth* potential of the company, they're looking for *proof* that projects are delivered and operate as intended. Consistently. Again and again. Until underwriting becomes beautifully boring.

This post outlines expectations for companies setting out on the journey from FOAK to NOAK, and some anticipated challenges. Primarily, we explore five areas where change should be expected:

1. **Goals.** It may all be about risk, but the risks they're a-changin'
2. **Finance.** Goodbye TopCo expensive equity, hello project finance and cheap(er) debt
3. **Structure.** JVs, SPVs, OEM, licensing — by NOAK, it's not just about TopCo anymore
4. **Terms.** Making the FOAK bottomline add up is tough, but by NOAK, there may be alternative options
5. **Product and processes.** Maybe you nailed it the first time, but chances are what you're making and how you make it will evolve and improve until you hit the ultimate goal: standardized modular units

GOING FOR NOAK!

1. Goals

At FOAK: The goal is to prove that the products/molecules/electrons made at small scale can be made at commercial scale, from reliable supply chains, and sold and delivered to a market that wants them. Technology risk is often talked about first, but equally important is developing creditworthy commercial agreements and demonstrating product market fit. Scale is moot if no one wants it.

At NOAK: The expectation isn't just that it's worked once, it's that it works reliably in different situations. While FOAK just proves it can work, NOAK requires showing it always works, so much so that it's "boring." Easy to build, easy to finance. A fully de-risked project model is when all you have to do is rinse and repeat.

What to watch:

- One is the loneliest number: Doing projects serially can lead to the "Valley of Loneliness". This can be avoided by working on projects in parallel, which likely requires a project development team, rather than an individual. As NOAK veterans say, it gets easier after FOAK but incrementally so.
- FOAK is context-specific. If you expand to a new geography, use your technology in a new application, or make any other meaningful alteration, in the eyes of investors you'll be bringing risk back in and so in some ways be FOAKing again.
- The fine print of de-risking reads: All risks are owned, contracted, and possibly insured against, by the relevant parties. The EPC owns project delivery risks, suppliers own supply chain risks, and offtaker contracts ensure buyers. It doesn't mean no risks exist.

2. Finance

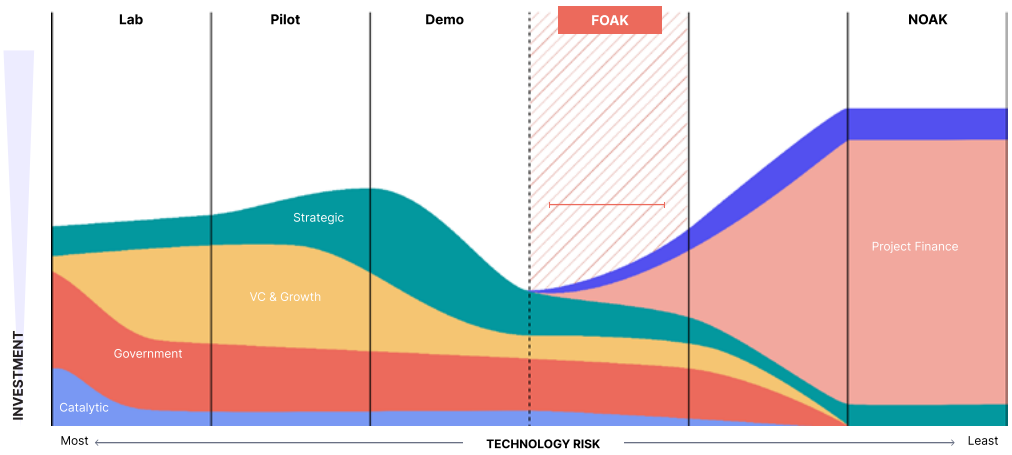
At FOAK: As we covered in our last post, **financing FOAK is hard**. The combination of high risk and high capital requirements means FOAK financing falls between growth equity and project finance. Typically FOAKs, as well as second-of-a-kind (SOAK), and third-of-a-kind (THOAK) projects, blend several sources of capital.

At NOAK: As indicated in the chart below, by NOAK project finance dominates, along with support from tax equity in the US and some investment from strategics.

What to watch:

- FOAK finance is finicky. Our third piece in this series on **FOAK financing** covers more.

The blended capital stack: from FOAK to NOAK



Capital availability against project stage (Source: Sightline Climate)

The chart suggests how the blend and availability of capital changes over time. The split between the colors at each project stage represents which types of capital are most available at which stage, while the total height of the stack at each stage indicates the relative availability of capital; the higher it is, the easier it's likely to be to access.

As a refresher, "**catalytic**" refers to patient, risk-tolerant, concessionary, and flexible investment capital, while "**VC & Growth**" refers to venture capital (investing in early-stage companies) and growth equity (funds investing in growth-stage climate tech companies or acquiring controlling stakes in climate tech companies). **Strategics** are corporates, like O&G or industrials, scaling up direct investment. **Government** includes non-dilutive government grants and loans, typically from the DOE in the US. With **tax equity**, tax credits can be monetized as an offset to the taxpayer's tax liability. **Project finance** consists of a number of different types of capital, including debt (maybe 60-80%) and equity (20-40%).

3. Structure

At FOAK: The project may technically be run by a subsidiary of the company though a special purpose vehicle (SPV) for the project, or in rare cases, developed directly by the topco. Either way, it'll likely be topco staff who are developing and then operating the project.

At NOAK: Before you know it, your tech-led startup has grown up. A much wider range of structures and models become possible, such as:

- Companies will set up an SPV to develop projects. Unlike at the FOAK stage, this company will have its own distinct staff from the topco.
- Joint ventures (JV). As your pipeline grows, the transaction costs of doing a bespoke financing and development for each new project gets expensive in time and fees. Having long-term financing and execution partners minimizes friction between project development, financing, and execution. This can happen at FOAK, but becomes more common as project pipelines grow.
- Whatever the legal vehicle, by NOAK, a buffet of revenue and go-to-market models will be available, including:
  - Projectco or assetco: SPV raises funds to build and operate. See Invenergy.
  - Build and sell (devco): Once the project is at **COD** or even **NTP**, you can sell the project or, realistically, a pipeline of NTP projects to asset owners. Developer platforms like Apex or Longroad have scaled by deploying this assembly line of renewable energy projects.
  - Original equipment manufacturer (OEM or Licensor): A goal for many climate tech companies. Once they successfully get to THOAK, they don't have to develop projects anymore, but can license the tech. They can go back to their first love of making great tech and be the next Nextracker, Bloom, First Solar, or Enphase.

What to watch:

- Partners matter. There is a short list of developers looking to catalyze a new technology, because developers, like their project finance banker brethren, typically prefer proven, familiar technologies that they can execute with a ctrl-c and ctrl-v approach. Blue hydrogen feels familiar to LNG developers. But for companies wanting to develop a FOAK in an area that doesn't have a close corollary, they may need to look to Me, Myself, and I LLC.

4. Terms

At FOAK: FOAKs generally don't make eye-popping profits for the topco, but the strategy of going from FOAK to NOAK is to be "long-term greedy." Building early projects may require concessionary deals with investors or strategics. This might mean:

- Accepting Rights of First Refusal (ROFR), so that project partners have the potential to balance out a weaker FOAK with a more profitable SOAK or THOAK.
- Less favorable contractual terms. Companies should manage their revenue expectations. The outside investors may have preferred returns, which means they get first, seconds, and maybe thirds on project cashflows to hit their hurdle IRR, before the developer gets a bite.

At NOAK: As we get to "boring and bankable," everybody eats. With proof of commercial model, greater volume, and plenty of existing successful plants to point to, it should be easier to attract favorable terms with offtakers and suppliers. As well as being possible, it may also be necessary. Infra investors are specifically looking for ironclad contracts to protect against volume and commodity risks.

What to watch:

- Get creative. Sometimes the reason a FOAK is possible is because of innovation in financing and commercials, as shown in the case studies below.
- Just because something's available on a spot market doesn't mean supply contracts aren't needed. If there's the possibility that something could go wrong, like a sudden price surge due to a shipping container getting stuck in the Suez Canal, then that risk will get priced into the cost of capital, an addition many FOAK/SOAK/THOAK projects can't afford.

5. Products & Processes

At FOAK: Stepping up to commercial scale sometimes necessitates doing things differently. That might mean changing processes so it doesn't require the lead engineer to be there at all times, or changing inputs because it turns out using a certain material just isn't cost-effective at scale. From FOAK to SOAK to THOAK, development processes may evolve with learnings from each project applied to the next, hopefully, reducing costs and time frames as you go.

At NOAK: Processes are tried and tested. There are training courses in how to set up and operate your facilities. Crucially, the facilities being built, or products or output produced (depending on your tech) are moving towards modularity and standardization. Modularity enables meeting a range of size requirements by adding units together. It also

allows focus on a smaller number of products, ideally one, which in turn sharpens the learning curve, driving down costs faster. Standardization involves producing units according to established norms, ensuring compatibility with other technologies and products, thereby simplifying usage for clients and boosting demand.

What to watch:

- The metrics that matter; internal rate of return (IRR), Multiple on Investment Capital (MOIC), debt service coverage ratio (DSCR), number of operational hours, unit production rates, unit costs, and any impact metrics, will all matter at both FOAK and NOAK. It's not that the metrics themselves change, but their values and consistency. For example, at FOAK you may be keeping an eye on hitting a thousand operational hours without issue, but by NOAK it may be a hundred thousand.

FOAK → NOAK

	FOAK	NOAK
Goals	Just get it built	Print money
Finance	No PF for you. Expensive growth equity with strategics and government funding	Bankable with established infra investors, ~80/20 debt to equity
Structure	Owner=developer=tech supplier=you	Techco, Devco, Assetco, JVs, SPVs
Terms	Partners have the power, and the terms may show that	Market standard terms and market level returns
Product and processes	Evolving and refining mid-flight	Established, modular and standardized, with hundreds of thousands of operating hours

FOAK HEROS: CASE STUDIES IN NOAKS

Case Study 1 - Archaea Energy

Founded in 2018, Archaea Energy rapidly grew to become one of the largest renewable natural gas (RNG) producers in the US, going public via SPAC in 2021 before being bought out by BP in 2022. While the underlying technology was by no means novel, at the outset their competitors business model was to sell to a transportation credits spot market, Arachea's novelty came by focusing on providing green gas to companies with public net zero targets. The issue was that the

spot market price for these credits fluctuated significantly, reducing the ability to predict future earnings, and therefore borrow against them. Moving to longer-term secure offtake agreements enabled Archaea to secure future revenues and borrow against them, in the form of green bonds to get the most attractive rates.

- **So modular they put their name on it.** Archaea rapidly moved to a modular product, the Archaea Modular Design, a priority for BP post-acquisition.
- **Evolving commercial models.** It wasn't until Archaea's seventh project that they signed their first long-term offtake agreement with a utility.
- **Healthy partnerships.** Before BP acquired Archaea, they had a JV together, along with a host of other JVs with their clients. This enabled them to share risks, costs, and revenue. One client and JV partner stated that the internal rate of return (IRR) from their JV was the best return available to them.
- **Innovative financing.** As Archaea scaled, their financing shifted from raising money through equity at topco, to borrowing at topco, to raising project debt and getting partner contributions through allocating project equity.

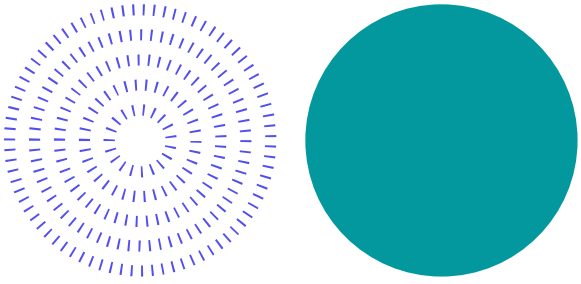
Case Study 2 - Community solar

As well as thinking about companies going from FOAK to NOAK, one can look at whole sectors making the transition too. One example is community solar. Despite the success of utility-scale solar in the mid-2010s, community residential solar presented considerable risks to investors due to its novelty as a business model, characterized by uncertain offtake agreements. Traditionally, onsite utility solar projects are sold to a single, creditworthy offtaker under a long-term contract. However, Generate Capital identified an emerging opportunity enhanced by regulatory incentives and adopted innovative financing structures and partnerships to pioneer community solar in Minnesota.

- **Novel partners for innovative financing.** Generate introduced atypical tax equity investors to the solar sector, notably involving an Engineering, Procurement, and Construction (EPC) partner as a tax equity investor—a first-time participant in such a role. This led to the successful development of two projects, each with a capacity of 5MW (Project Murphy and Project Turning). Generate financed the entire construction phase and engaged a third-party customer acquisition

manager to secure offtake agreements, aiming for full capacity commitment from the start.

- **Changing terms.** These initial projects were completed on schedule and achieved expected returns on debt, with a regional bank contributing as a financial partner. This success established a strong precedent for subsequent ventures. Over time, as residential solar gained recognition and understanding as an asset class, the cost of financing, including interest rates, fees, and spreads, has significantly decreased. Moreover, the perceived risk by lenders has reduced, allowing for more lenient offtake requirements. Projects no longer need 100% offtake coverage upfront, reflecting Generate's evolution into a more flexible capital partner, with an expectation that offtake agreements will materialize in due course.



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sightline climate

sales@sightlineclimate.com