

BLACKTECHSTARTUP EDUCATION

Deep-Tech Scale-Up & FOAK Readiness: Lab → Pilot → First Commercial Deployment

Plan the engineering, site, supply-chain, permitting, offtake, counterparty and financing work that carries a deep-tech company from controlled pilot to first commercial deployment.

FOAK scale-up changes the risk surface. Physics that worked in the lab can interact with site conditions, supply chains, construction, permitting, uptime, operator training and project finance. DOE commercialization frameworks emphasize adoption risks beyond technology readiness. The first commercial deployment must therefore be designed as an integrated technical-commercial project with explicit interfaces and contingencies.

Know what weak and strong look like

READINESS AREA	WEAK / DILIGENCE RISK	STRONG / INVESTOR-READY
Scale basis	Linear extrapolation from lab/pilot.	Scale-dependent phenomena, design margins and validation plan documented.
Site	"Customer will provide a site."	Site criteria, utilities, permits, interconnection, logistics and owner obligations defined.
Supply chain	Prototype vendors assumed scalable.	Critical suppliers, lead times, capacity, QA and alternates validated for FOAK volume.
Offtake/customer	Letter of support treated as revenue certainty.	Commercial agreement status, conditions precedent, performance acceptance and credit quality mapped.
Capital stack	Corporate equity funds entire asset.	Development, grants, strategic equity, project debt/guarantees and customer contributions matched to stage/risk.

Define the scale jump explicitly

List every parameter changing from pilot to FOAK: throughput, pressure/temperature, material volume, duty cycle, automation, staffing, environment, feedstock/input variation and uptime. Mark which relationships are proven and which are extrapolated.

Build interface control

FOAK failures often happen between systems: technology ↔ civil works, process ↔ utilities, software ↔ controls, supplier ↔ integrator, company ↔ customer. Assign technical owner, specification, acceptance test and change-control process to each interface.

Lock site and permitting critical path

Create a site-readiness checklist with land/control, zoning, environmental/permitting, utility capacity, interconnection, logistics, safety, construction access and commissioning. A technology can be ready while the site delays revenue 12 months.

Treat offtake and counterparties as bankability evidence

A serious commercial agreement states volume/use, price/economics, duration, acceptance/performance conditions, remedies, termination and credit support. “Interested customer” is discovery evidence, not project-finance evidence.

Build the capital stack by risk layer

Early engineering uncertainty may require grants/equity; equipment/customer-specific deployment may attract strategic capital; proven contracted cash flows can support asset/project debt in some sectors. Never assume debt will fund technology risk without credible repayment and collateral/contract support.

Run the diligence stress test before investors do

Do not rehearse an answer. Rehearse the evidence. Give yourself a short diligence window and try to produce the underlying records without rebuilding the story from memory. A clean result is reproducible, tied to a source system or signed document, and consistent with the numbers elsewhere in the company.

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- **Scale basis:** Put the underlying records on screen and prove this standard: Scale-dependent phenomena, design margins and validation plan documented. If the evidence still looks like this weak state—Linear extrapolation from lab/pilot.—record the gap, name an owner and give it a due date instead of explaining it away.
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- **Site:** Put the underlying records on screen and prove this standard: Site criteria, utilities, permits, interconnection, logistics and owner obligations defined. If the evidence still looks like this weak state—"Customer will provide a site."—record the gap, name an owner and give it a due date instead of explaining it away.
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- **Supply chain:** Put the underlying records on screen and prove this standard: Critical suppliers, lead times, capacity, QA and alternates validated for FOAK volume. If the evidence still looks like this weak state—Prototype vendors assumed scalable.—record the gap, name an owner and give it a due date instead of explaining it away.
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- **Offtake/customer:** Put the underlying records on screen and prove this standard: Commercial agreement status, conditions precedent, performance acceptance and credit quality mapped. If the evidence still looks like this weak state—Letter of support treated as revenue certainty.—record the gap, name an owner and give it a due date instead of explaining it away.
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- **Capital stack:** Put the underlying records on screen and prove this standard: Development, grants, strategic equity, project debt/guarantees and customer contributions matched to stage/risk. If the evidence still looks like this weak state—Corporate equity funds entire asset.—record the gap, name an owner and give it a due date instead of explaining it away.
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Do the math investors will do

FOAK cost model should show engineering/procurement/construction, contingency, owner's costs, commissioning, working capital and operating ramp—not just equipment BOM. Track estimate class/uncertainty. If a \$12M base project has 25% design uncertainty, presenting \$12.0M as a precise funding need is false precision; show range, contingency logic and what design work retires the uncertainty.

Build the evidence investors can verify

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- ✓ Scale-up basis/design-assumption register
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- ✓ Site-readiness and permitting matrix
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✓ Critical-interface register

✓ Supplier/capacity/QA plan

✓ FOAK cost/schedule with contingency

✓ Offtake/customer agreement and acceptance criteria

✓ Counterparty credit/dependency review

✓ Milestone-based capital-stack plan

Questions an investor may ask

? What is unproven at this scale?

? Which permit or utility dependency drives the critical path?

? What happens if the primary customer/site slips six months?

? Which performance metric triggers commercial acceptance?

? Which portion of the project can be financed without corporate venture equity?

30-day repair sprint

1 Days 1–5: document every scale change and technical unknown.

2 Days 6–10: build site/interface/supplier critical path.

3 Days 11–15: update FOAK cost/schedule with uncertainty/contingency.

4 Days 16–20: convert customer interest into acceptance/offtake structure.

5 Days 21–25: map counterparties and failure contingencies.

6 Days 26–30: match financing instruments to risk layers and produce the FOAK readiness memo.

SOURCE DESK

Research behind this guide

Use the primary and authoritative sources below to verify current rules, market conditions and technical guidance. Terms and regulations can change.

U.S. Department of Energy — Adoption Readiness Levels



NSF — 2025 I-Corps Biennial Report



NSF — I-Corps Commercialization Program



SEC — Ready to Raise CAPITAL



Important: This guide is educational information, not individualized legal, tax, investment, employment, security or compliance advice. For decisions with material legal or financial consequences, use a qualified professional who can review your facts.

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