The 5 Factors of Innovation Success

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Analyst

“ ”

Everyone loves the pitch, until the invoice appears.

Anonymous

Image source: Pixabay

Defending the ROI of a product or project

Is it going to be worth the cost?

There are established methodologies for making financial investments

Established Methods

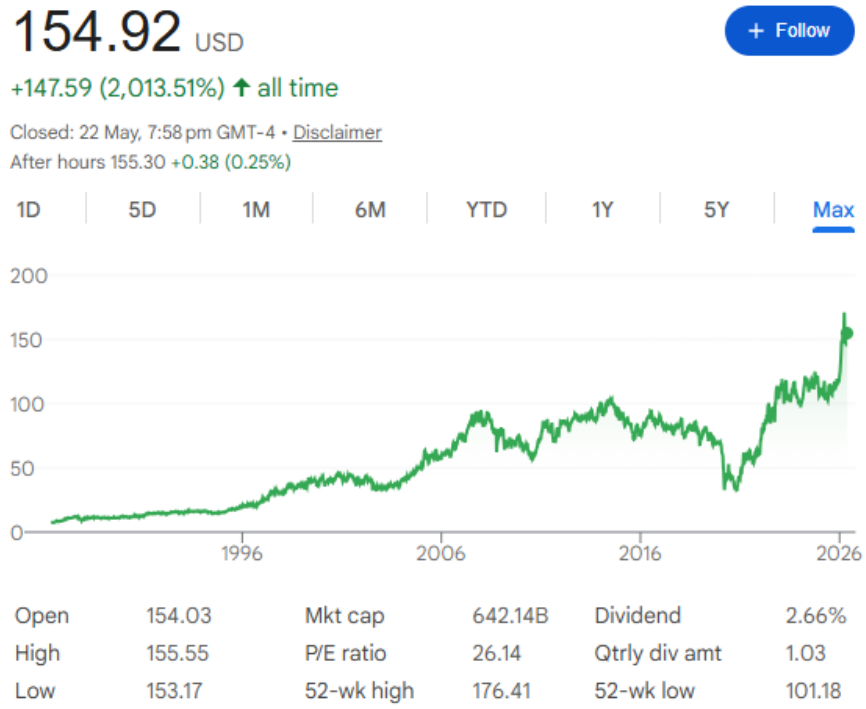
$$\mathrm{DCF} = \sum_{i=1}^{n} \frac{\mathrm{CF}_i}{(1+r)^i}$$

USD in millions	2026E	2027E	2028E	Terminal Value
Revenue	1,250	1,375	1,525	–
EBITDA	250	290	337	–
Free Cash Flow	88	109	136	2,855
Present Value of FCF	**81**	**93**	**107**	**1,902**

Key Assumptions	
WACC	8.5%
Terminal Growth Rate	3.0%
Tax Rate	25.0%
Capex % of Revenue	7.0%

Valuation Summary	
PV of Forecast (2026E–2028E)	281
PV of Terminal Value	1,902
Enterprise Value	**2,183**
Implied Equity Value / Share	**$19.50**

Historical Data



Building the investment case for an emerging technology is trickier

Technoeconomics don’t tell the full story

Pryme’s Flagship Pyrolysis Plant

Metric	Unit	Value
Annual Capacity	MT of pyrolysis oil	6,854
Selling Price Pyrolysis Oil	€/MT of pyrolysis oil	1,200
Cost of plastic waste feedstock	€/MT of pyrolysis oil	346
Energy cost	€/MT of pyrolysis oil	175
Additives & Other	€/MT of pyrolysis oil	163
Other Plant OPEX	€ million	8.5
Plant EBITDA	€/MT of pyrolysis oil	(721)
Annualized Plant EBITDA @ annual capacity	€ million	(4.9)
Approximate Capex	€ million	40.0

Technoeconomics don’t tell the full story

Pryme’s Flagship Plant

Metric	Unit	Value
Annual Capacity	MT of pyrolysis oil	6,854
Pyrolysis oil prices have fluctuated with demand and supply		
Cost of plastic waste feedstock	€/MT of pyrolysis oil	346
Energy prices in Europe has increased by 10% yoy		
Additives & Other	€/MT of pyrolysis oil	163
Other Plant OPEX	€ million	8.5
Plant EBITDA	€/MT of pyrolysis oil	(721)
Annualized Plant EBITDA @ annual capacity	€ million	(4.9)
Actual OSBL capex was closer to EUR 81 million		

Technoeconomics don’t tell the full story

Pryme’s Flagship Plant

Metric	Unit	Value
Annual Capacity	MT of pyrolysis oil	6,854
RISK		
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RISK		

We must better account for uncertainty when building the investment case for emerging technologies

Agenda

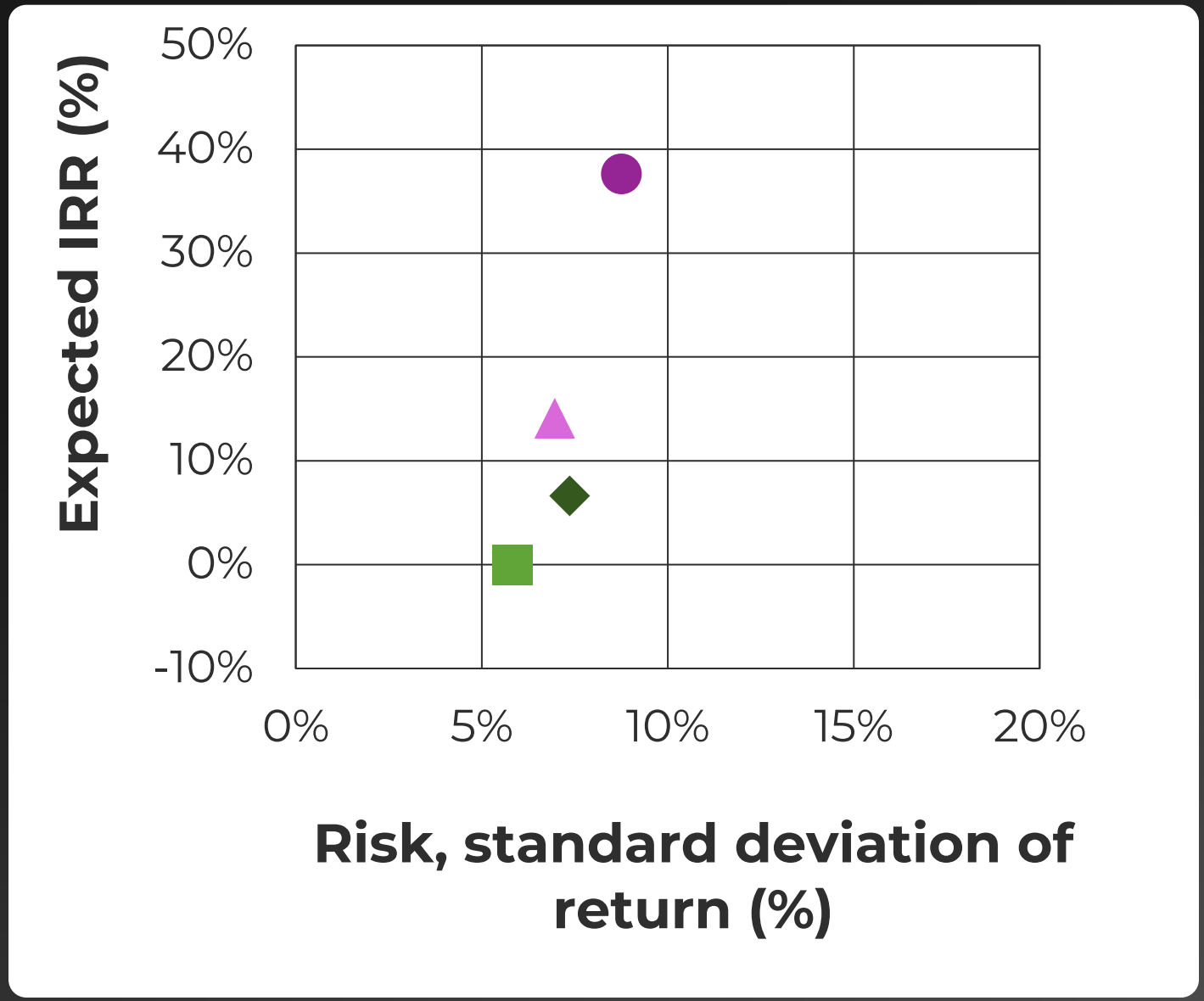
01 | **Lux’s five factors of innovation success for FOAK investments**

02 | Scenario-building for future developments

03 | Taking action

Image source: Plastic Energy

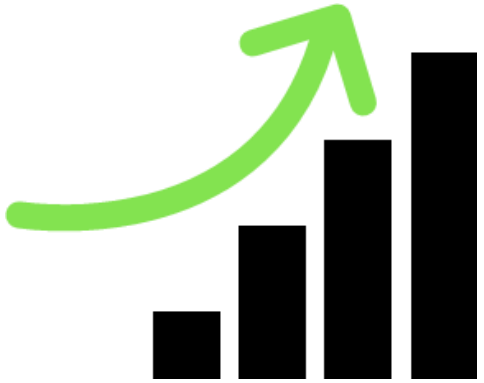
We need to determine the IRR and the risk

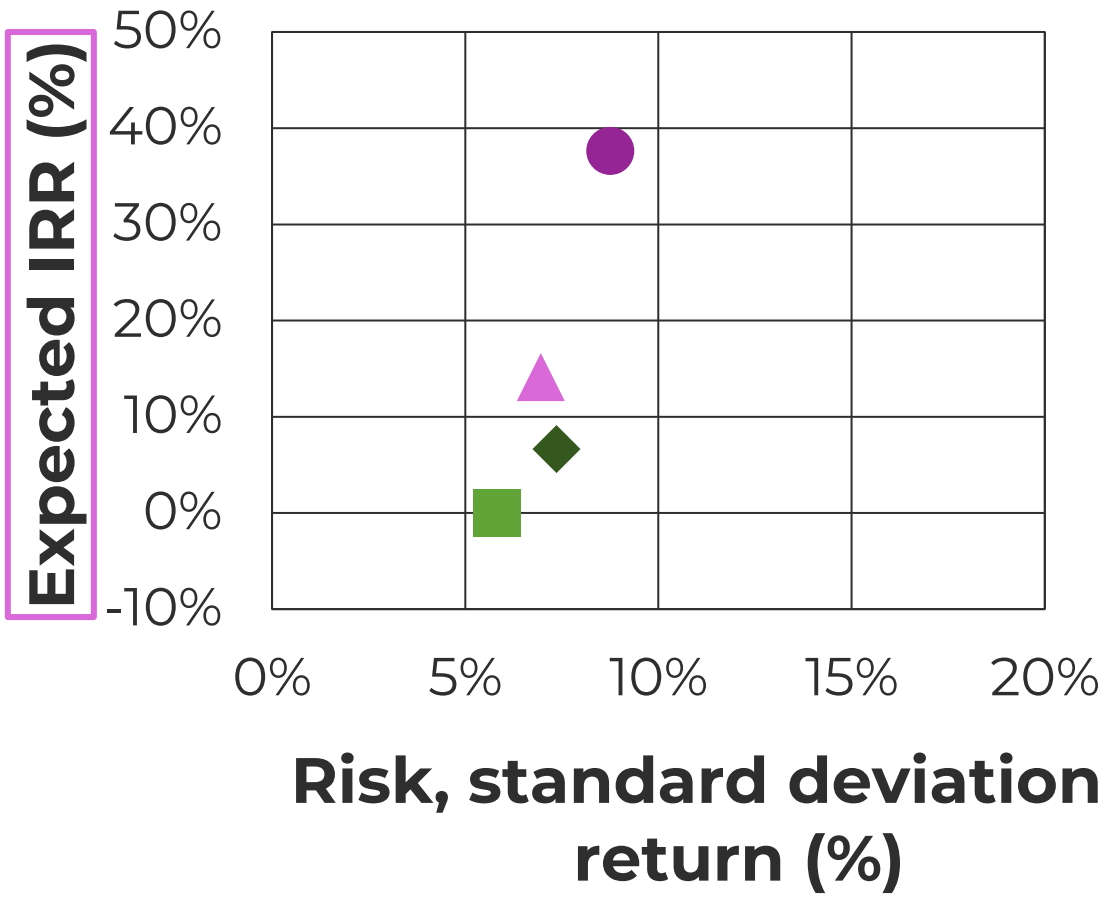


IRR measures the size of the reward

Internal Rate of Return (IRR)

The **rate of return** a project or investment is expected to generate.





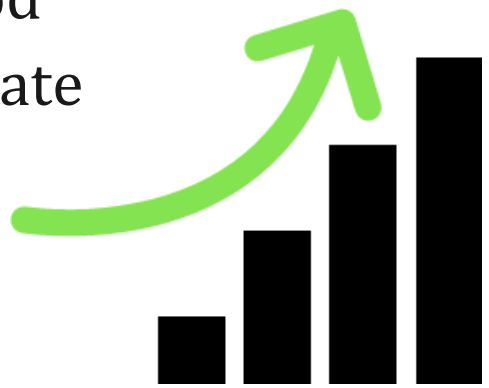
IRR measures the size of the reward

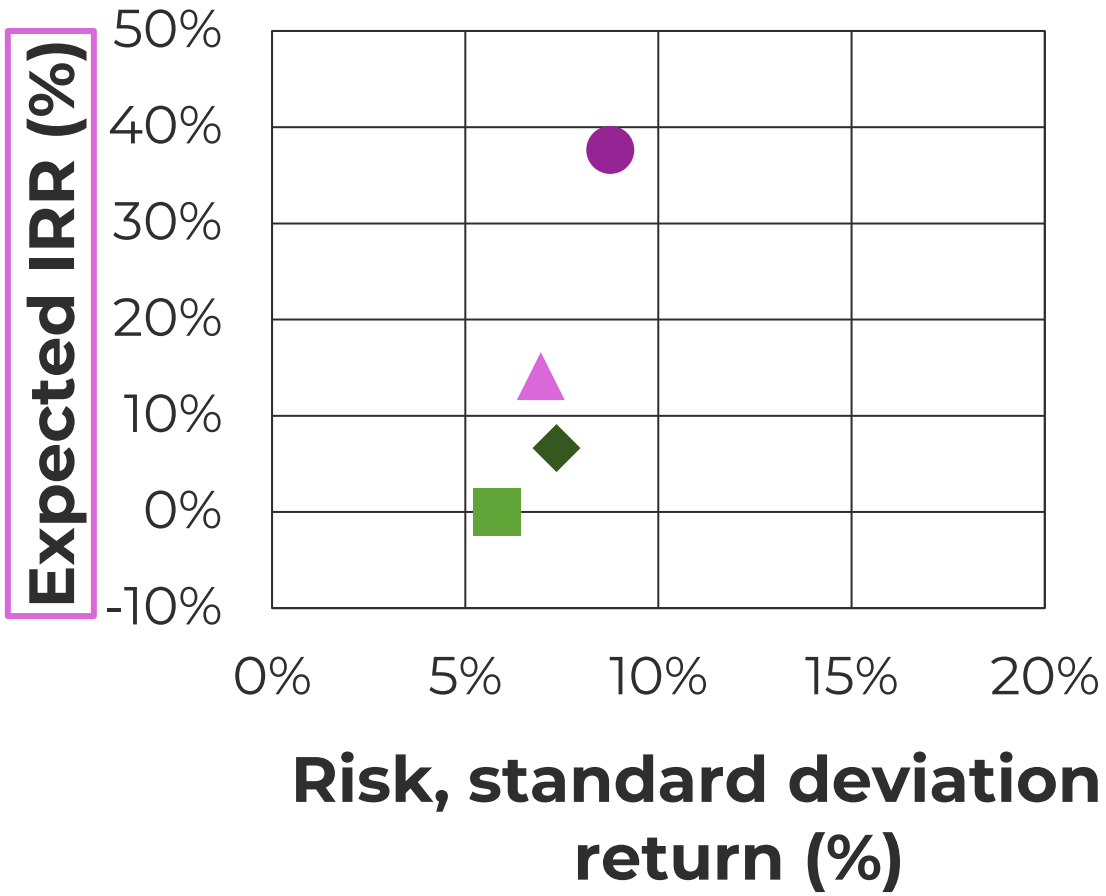
Internal Rate of Return (IRR)

$$\text{IRR} = \frac{(\text{Cash flows})}{(1+r)^i} - \text{initial investment}$$

i = Time period

r = Discount rate





We have actual data on plant economics

Building a FOAK plastic pyrolysis plant

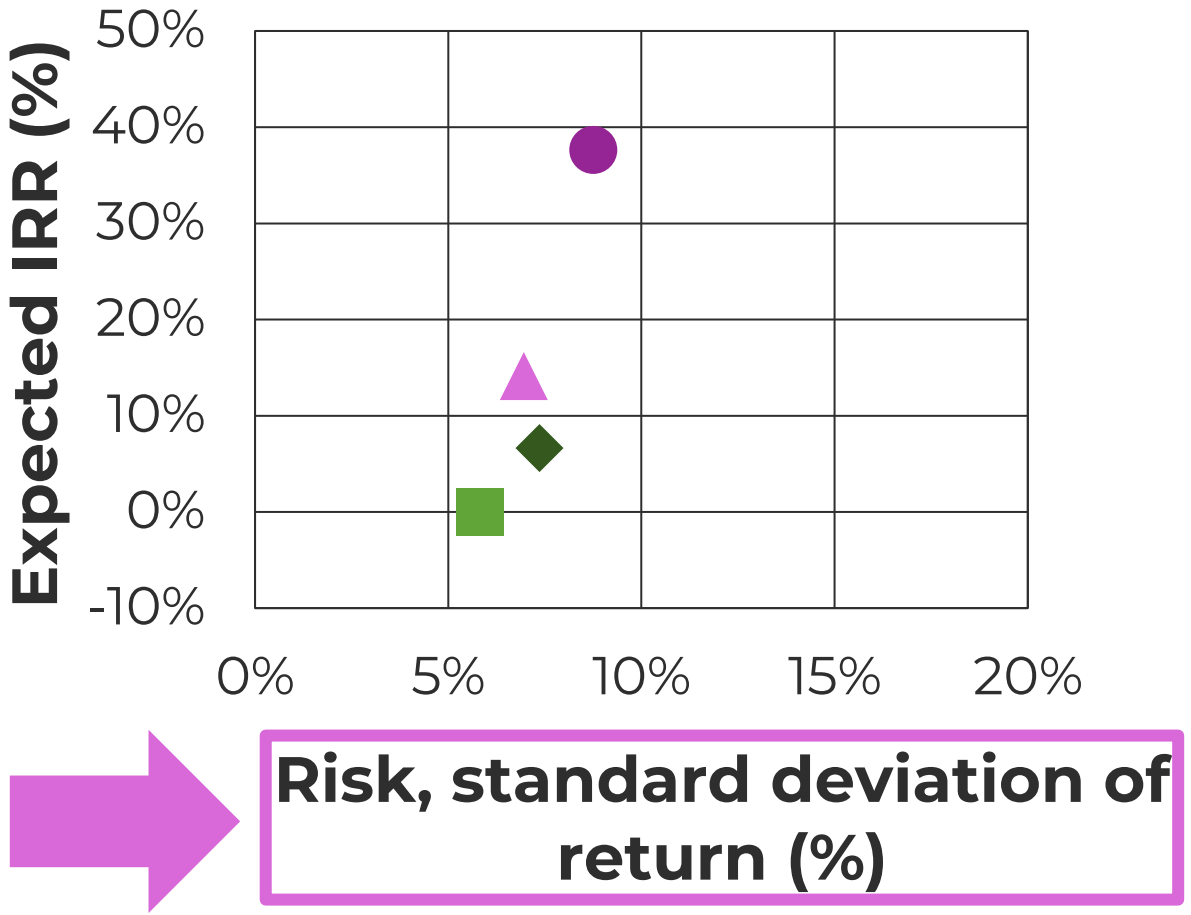
Parameter	Value
Size (input)	25,800 tonne/y
Capex	USD 80.7 million
Opex	USD 850/tonne
Product price	USD 580/tonne

Image source: Plastic Energy

Risk measures how far we may miss the mark

Risk

The **uncertainty** that the expected results will happen.



Two main sources of risk

1

Inherent uncertainty in large capex projects

Parameter	Base Uncertainty
Capex	2%
Opex	20%
Pyrolysis oil price	16%

Two main sources of risk

2

Innovation maturity

Questions we already intuitively ask

Factor	What to Assess?
Product	Is the product well defined with value chain familiarity?
Technology readiness	Is the technology fully developed and proven in operational environments?
Market organization	Are the value chain and legal frameworks established?
Market readiness	Is there a mature, large market for the product?
Production	Is pilot or commercial production demonstrated?

Questions we already intuitively ask

Factor	High Maturity	Medium Maturity	Low Maturity
Product	Add no uncertainty	Add 10% to product price uncertainty	Add 20% to product price uncertainty
Technology readiness	TRL 9, add no uncertainty	TRL 6–8, add 20% to all uncertainty	TRL<6, add 40% to all uncertainty
Market organization	Add no uncertainty	Add 10% to opex uncertainty	Add 20% to opex uncertainty
Market readiness	Add no uncertainty	Add 10% to product price uncertainty	Add 20% to product price uncertainty
Production	Add no uncertainty	Add 10% to capex uncertainty	Add 20% to capex uncertainty

Product

Is the product well defined with value chain familiarity?

Maturity: Medium
+10% to price uncertainty

Technology Readiness

Is the technology fully developed and proven in operational environments?

Maturity: High
No change to uncertainty

Market Organization

Are the value chain and legal frameworks established?

Maturity: Low
+20% to opex uncertainty

Market Readiness

Is there a mature, large market for the product?

Maturity: Medium
+10% to price uncertainty

Production

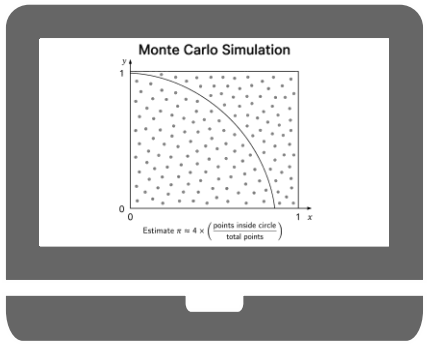
Is pilot or commercial production demonstrated?

Maturity: High
No change to uncertainty

Predicting average IRR and risk

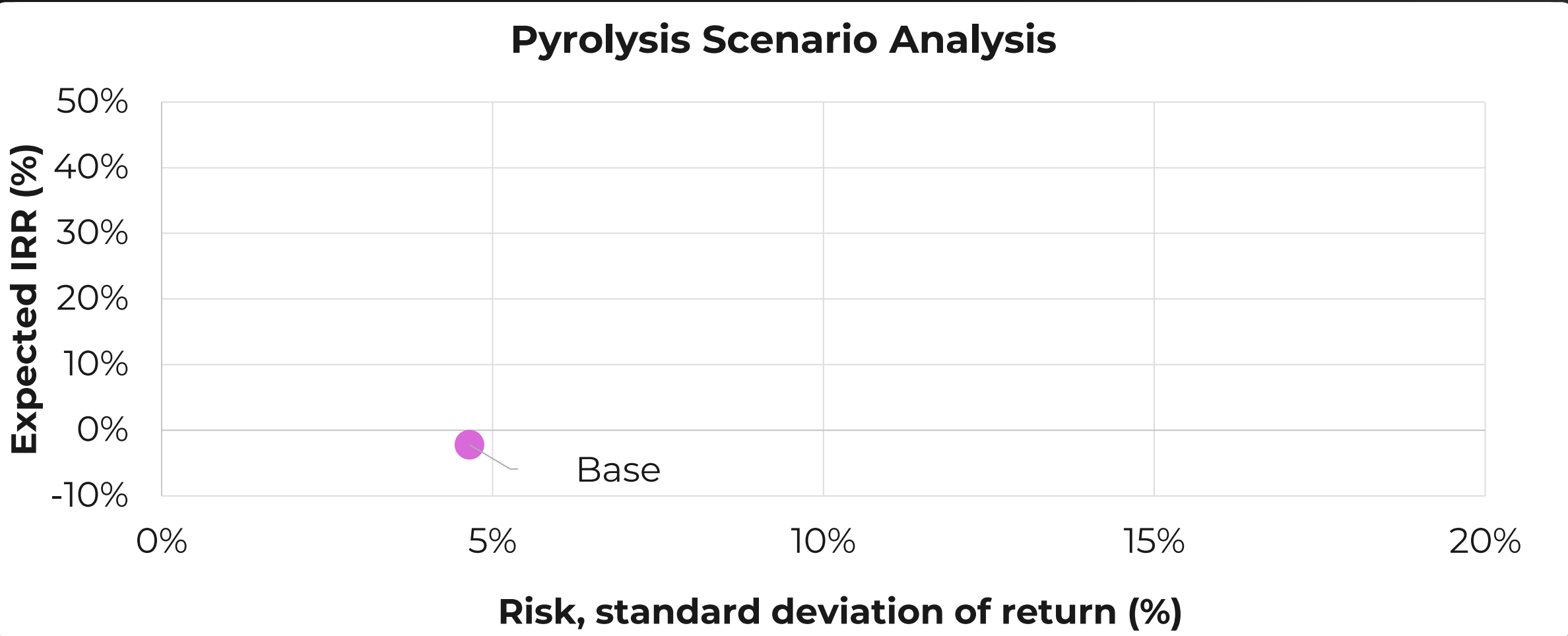
Parameter	Value	Uncertainty Margin
Size (input)	25,800 tonne/y	–
Capex	USD 80.7 million	**2%**
Opex	USD 850/tonne	**21.6%**
Base price	USD 580/tonne	**19.2%**

Monte Carlo Simulations



Average IRR and its variability

The base case has a negative expected IRR



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01 | Lux’s five factors of innovation success for FOAK investments

02 | **Scenario-building for future developments**

03 | Taking action

Scenario 1:

Feedstock supply infrastructure

Scenario 2:

Recycled content mandates

Scenario 3:

Mass balancing goes into effect

Scenario 1:

Feedstock supply infrastructure

Scenario 2:

Recycled content mandates

Scenario 3:

Mass balancing goes into effect

Scenario 1: Feedstock supply infrastructure

Reduce feedstock costs by 25% and opex uncertainty by 10%

Parameter	Value	Uncertainty Margin
Size (input)	25,800 tonne/y	–
Capex	USD 80.7 million	2%
Opex	USD 785/tonne	19.8%
Base product price	USD 580/tonne	19.2%

Feedstock costs have little impact on IRR

Reduce feedstock costs by 25% and opex uncertainty by 10%

Parameter	Value	Uncertainty Margin
Size (input)	25,800 tonne/y	–
Capex	USD 80.7 million	2%
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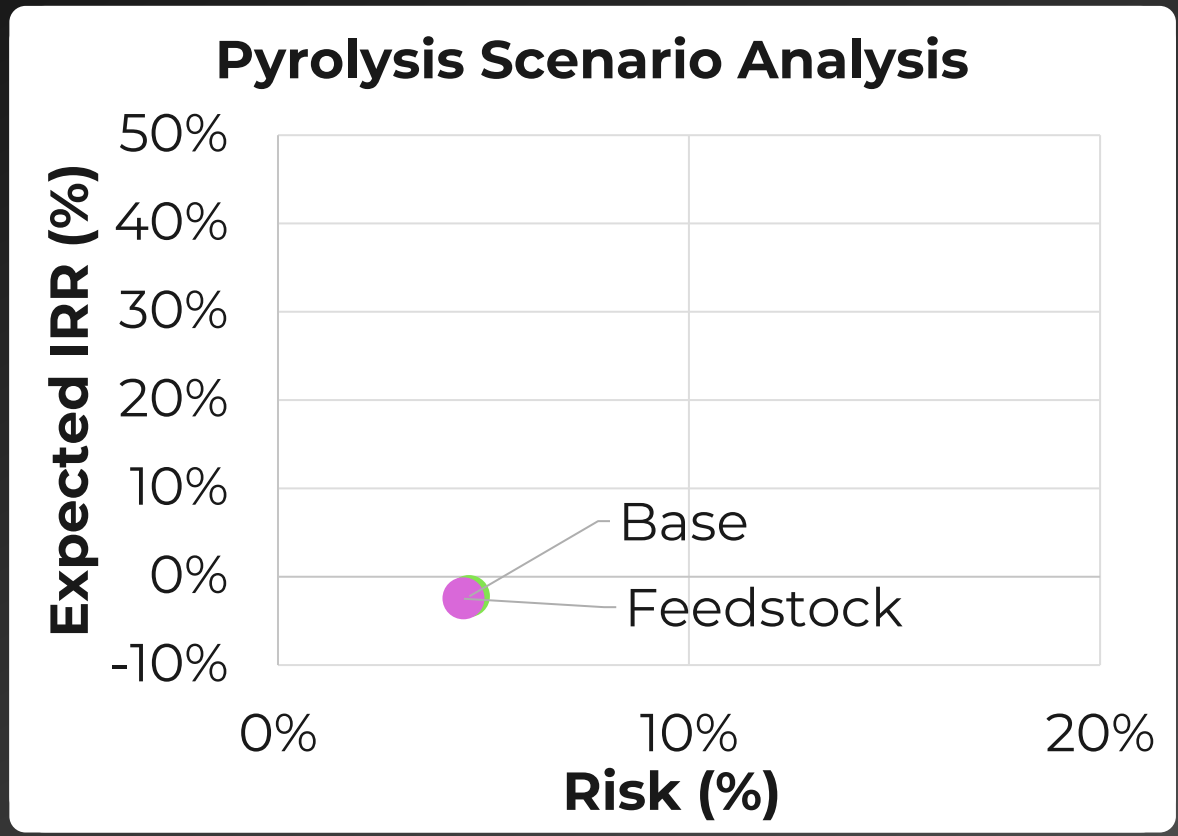

Scenario 1:

Feedstock supply infrastructure

Scenario 2:

Recycled content mandates

Scenario 3:

Mass balancing goes into effect

Scenario 2: Recycled content mandates

Product is 3× base case, and price and opex uncertainty drops by 10%

Parameter	Value	Uncertainty Margin
Size (input)	25,800 tonne/y	–
Capex	USD 80.7 million	2%
Opex	USD 850/tonne	19.8 %
Base product price	USD 1,740/tonne	17.6%

Recycled content mandates can push IRR into the double digits

Product is 3× base case, and price and opex uncertainty drops by 10%

Parameter	Value	Uncertainty Margin
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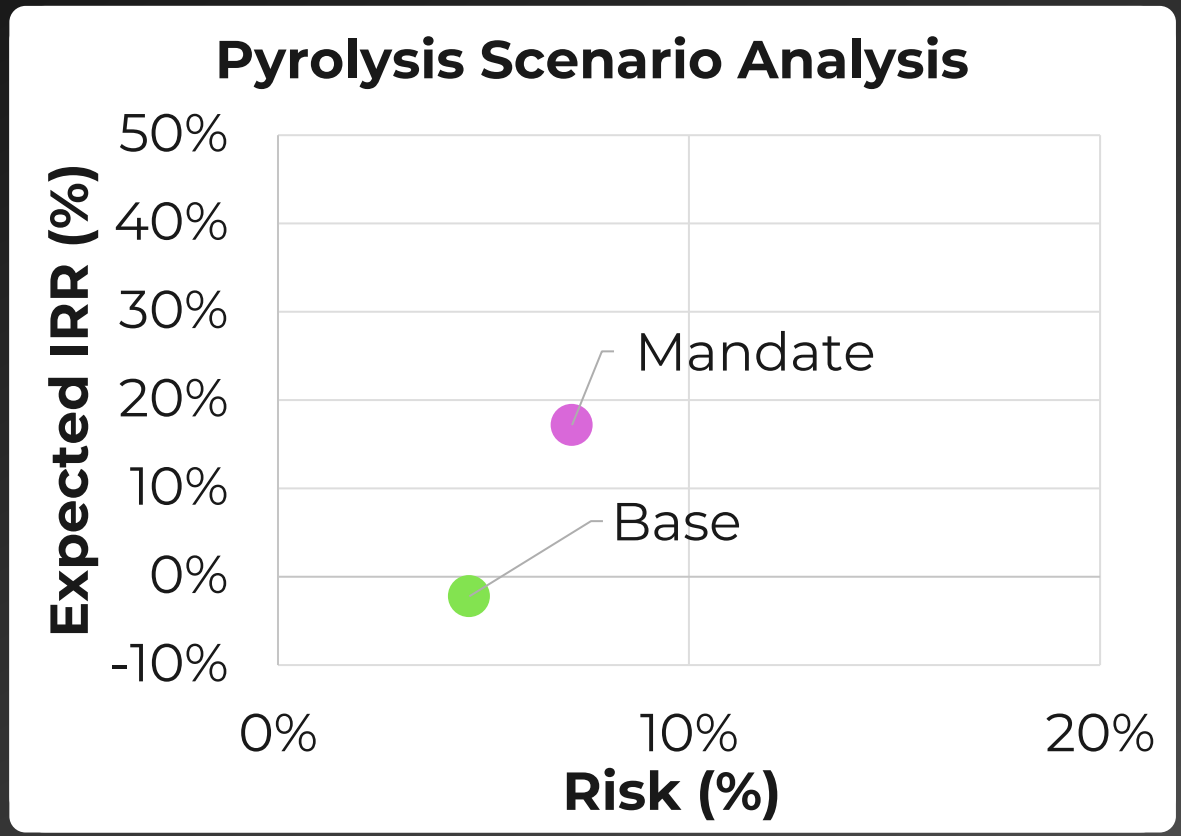

Scenario 1:

Feedstock supply infrastructure

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Mass balancing goes into effect

Scenario 3: Mass balancing goes into effect

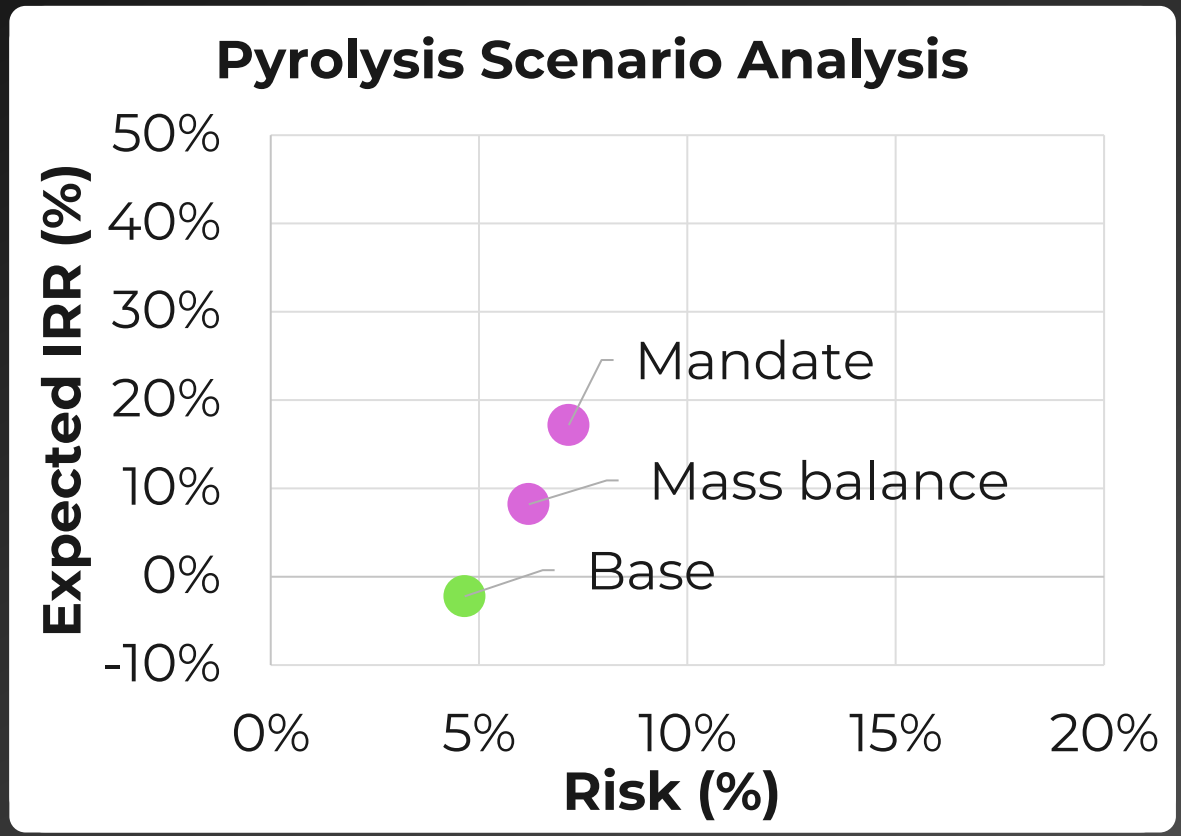
Recycled content premiums halve, and price uncertainty drops by 10%

Parameter	Value	Uncertainty Margin
Size (input)	25,800 tonne/y	–
Capex	USD 80.7 million	2%
Opex	USD 850/tonne	21.6%
Base product price	USD 1,247/tonne	17.6%

Fuel-exempt mass balancing kills the investment case

Recycled content premiums halve and price uncertainty drops by 10%

Parameter	Value	Uncertainty Margin
Size (input)	25,800 tonne/y	–
Capex	USD 80.7 million	2%
Opex	USD 850/tonne	21.6%
Base product price	USD 1,247/tonne	17.6%



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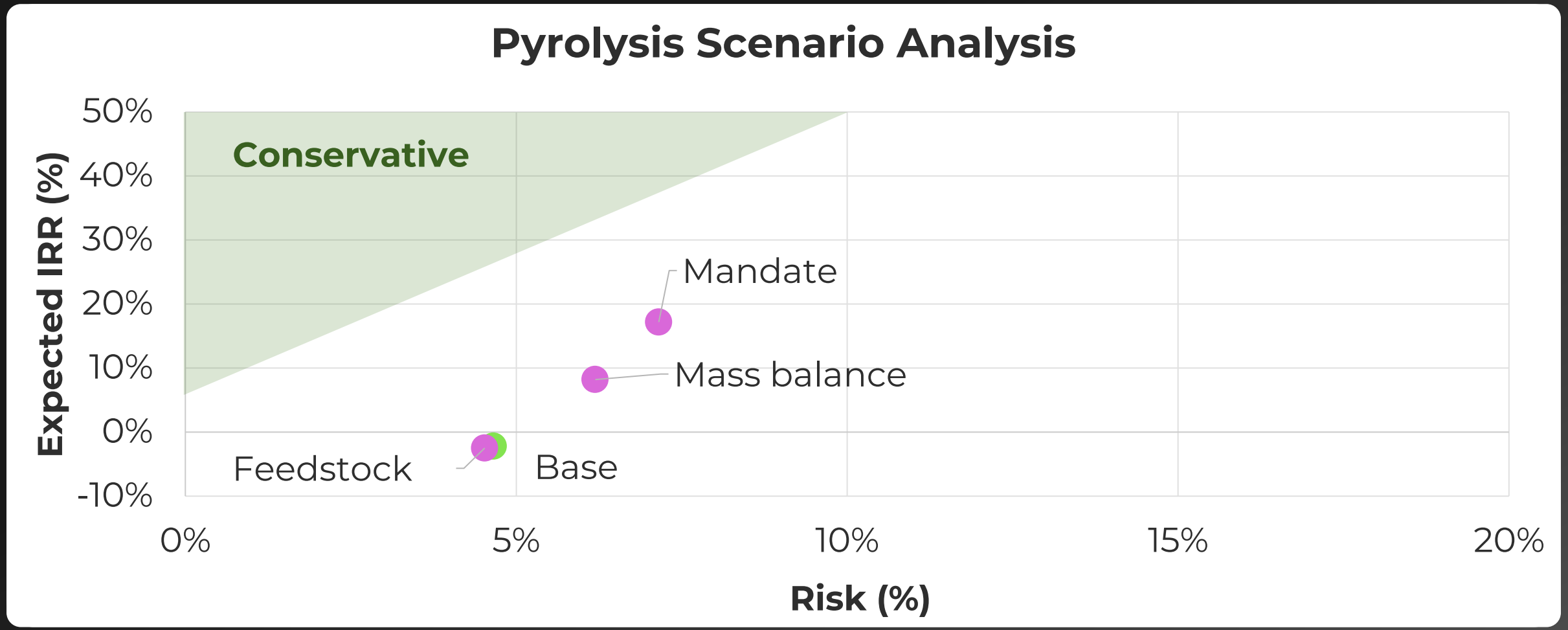
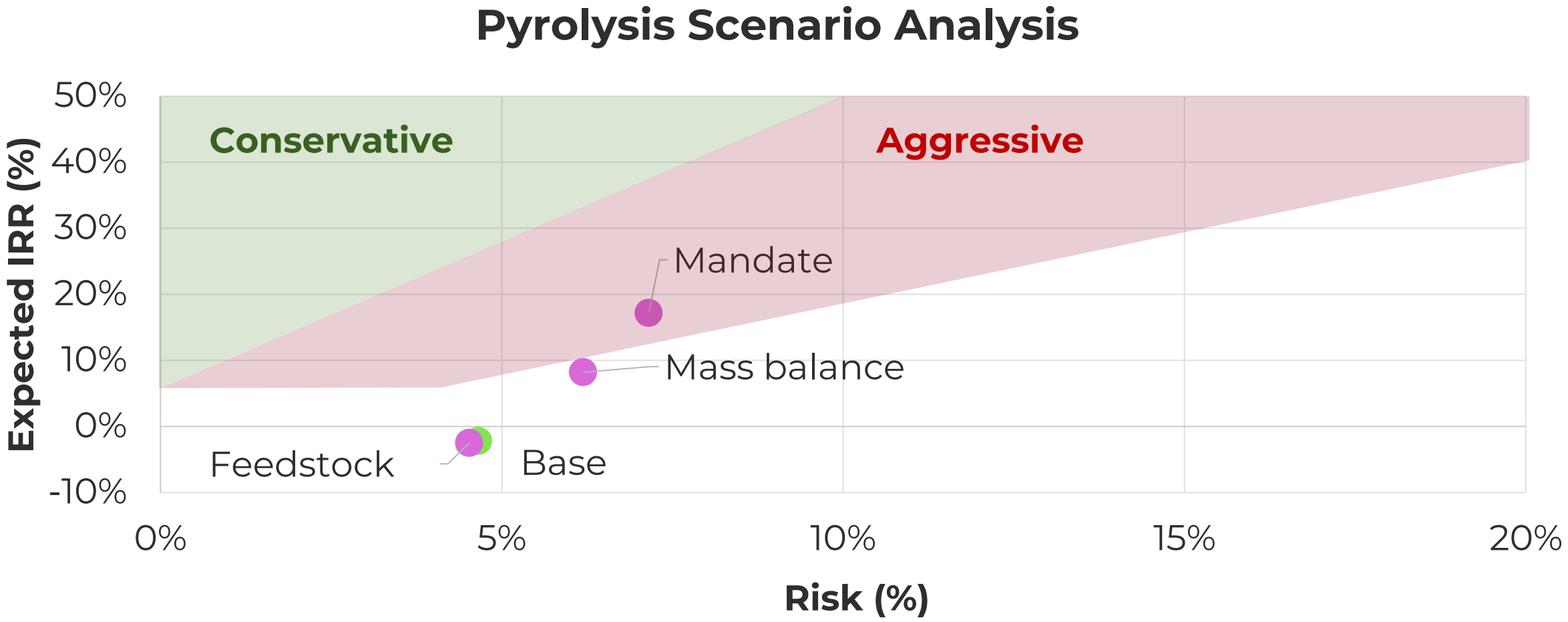
Plastic pyrolysis is not attractive for the conservative investor



It may start making sense for an aggressive risk taker, but with some caveats



Key levers for making the case for pyrolysis

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Feedstock availability is more important than cost.

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Favorable mass-balancing rules is critical for attractive IRRs.

Key levers for making the case for pyrolysis

Feedstock availability is more important than cost.

Favorable mass-balancing rules is critical for attractive IRRs.

Product price is the biggest lever to pull.

The five factors method works for other emerging technologies

Assess any emerging technology with the five factors for innovation success

Factor	CO_2 to PHA	Natural fiber composites
Product	High	Medium
Technology readiness	Low	High
Market organization	Medium	High
Market readiness	Medium	Medium
Production	Low	High

Key Takeaways

1

Look at innovation maturity, not just technical readiness.

TRL is just one aspect of innovation maturity. Even if a technology is technically mature, the rest of the ecosystem must keep up for successful commercialization.

2

Consider the uncertainty when projecting for investment returns to make decisions.

Basic technoeconomic projections give you a snapshot in time. Incorporate uncertainty into the model to project more accurate, longer-term outcomes.

3

Apply scenario planning for longer-term outlooks.

In dynamic markets, considering a range of plausible situations helps identify emerging opportunities early and prepare for potential adverse developments.

Lux Client Action Items

01

Evaluate your next technology investment opportunities.

Use the five factors to evaluate your next opportunities for technology deployment and scale-up. Is the ecosystem mature enough from a strategic standpoint?

02

Check that your investments fit your risk profile.

Assess the expected returns and risk of your technology investments with our methodology to check that it aligns with your risk appetite.

03

Look for weaknesses in innovation maturity to derisk.

Protect your investments by addressing the weaknesses in innovation maturity.

04

Stay responsive to the impacts of broader market developments.

Continuously assess the case for the technology investment as broad market developments start to take shape.

Thank you

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About Lux

Lux Research fuels innovators to not only imagine what's possible in the future but also operationalize innovation success in the near term. We deliver research and advisory services to inspire, illuminate, and ignite innovative thinking that reshapes and grows businesses. Using quality data derived from primary research, fact-based analysis, and opinions that challenge traditional thinking, our experts focus on finding truly disruptive innovations that are also realistic and make good business sense.

The "Lux Take" is trusted by innovation leaders around the world, many of whom seek our advice directly before placing a bet on a startup or partner — our clients rely on Lux insights to make decisions that generate fantastic business outcomes. We pride ourselves on taking a rigorous, scientific approach to avoid the hype and generate unique perspectives and insights that innovation leaders can't live without.

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