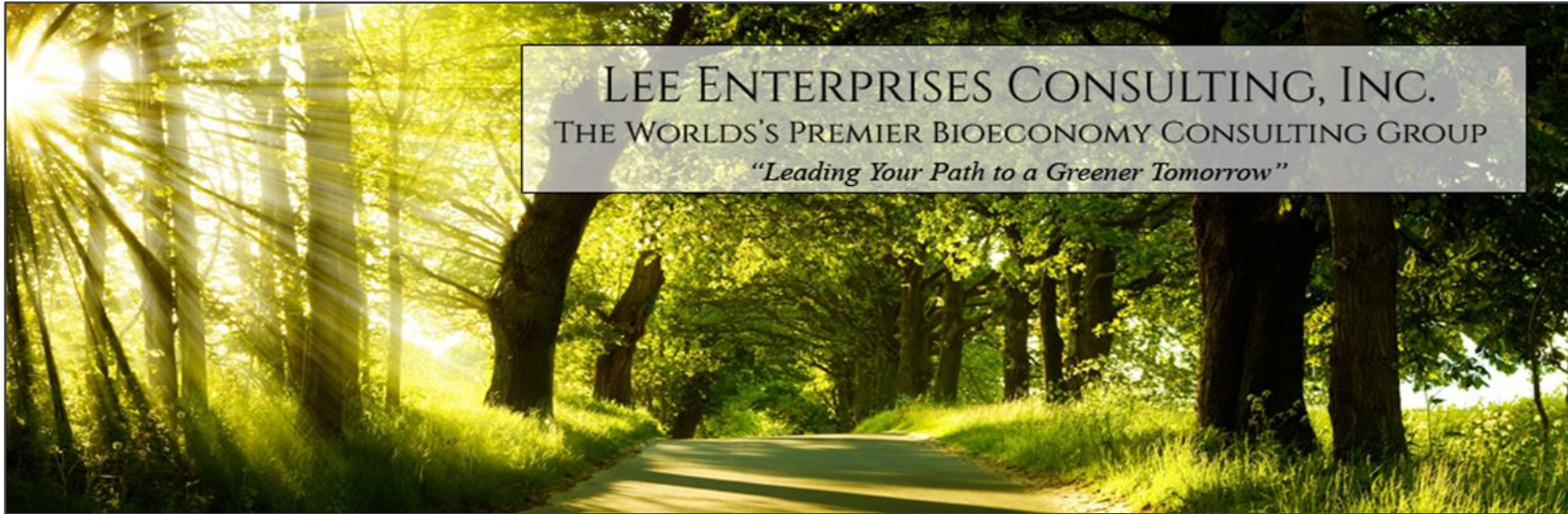


# Techno-economic modeling & analysis in the bioeconomy



Techno-economics for technology developers.

[ Part 3 of 4 ]



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# Developing new technologies is not easy.



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*What you need is a useful way to combine your knowledge with good engineering assumptions and cost estimation techniques...*

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Developing new industrial technologies for the bioeconomy is not easy, and the complexities of research and development are only the beginning.

When you're looking down the long road to commercialization, the prospects of making any kind of *meaningful economic predictions* can seem unrealistic. There is so much still unknown.

If you think about it though, there are many things you do know, otherwise why would you be pursuing the technology in the first place?

What you need is a useful way to combine that knowledge with good engineering assumptions and cost estimation techniques. This is the role of techno-economic modeling.

# Demonstrating economic value.



Technologies can produce economic value in different ways. Sometimes it's as simple as selling a product for more than the manufacturing costs, like a biofuel or electricity. Other times it's not as straight forward.

A new method of pollution control might create value by reducing costs to an existing process or by reducing environmental impact. A new sensor might create value by reducing off-spec product.

Whatever value your technology creates, techno-economic modeling helps you to clarify and quantify it.

# A tool for exploring the relationships driving your economics.

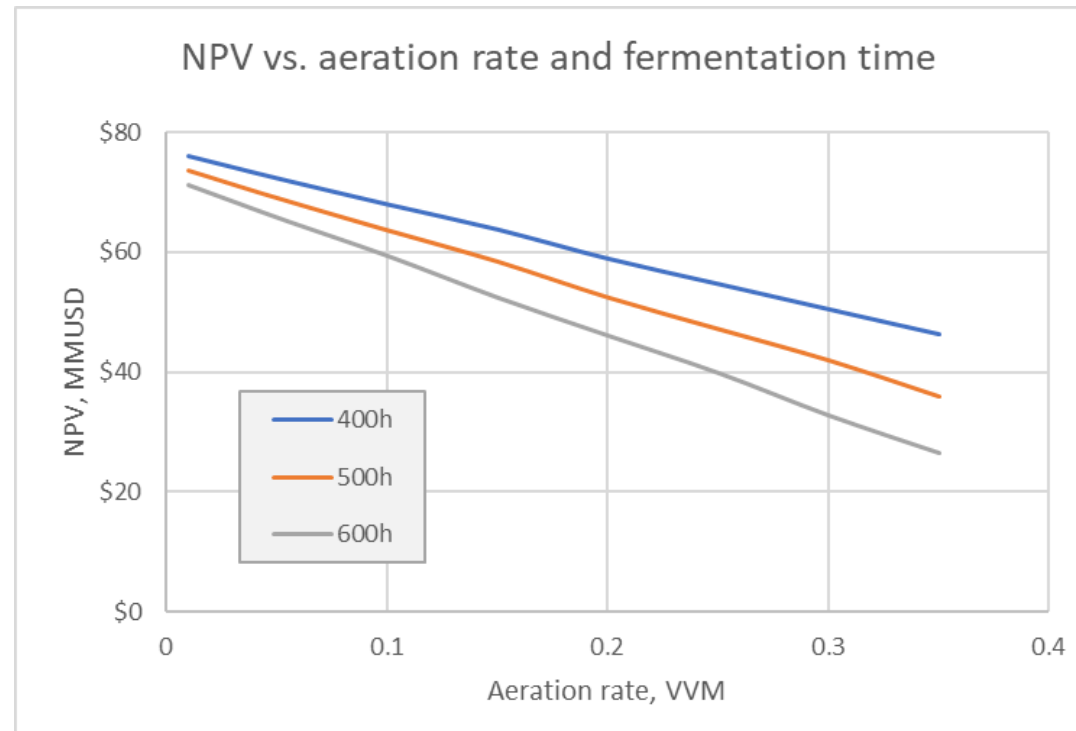
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*With a techno-economic model you can quickly answer questions and test new ideas.*

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A good techno-economic model captures your best current understanding of the technology, including lab findings, engineering design, and prices. Often it reveals relationships that you didn't expect. Building a model also forces you to make any assumptions more explicit and to quantify them.

Once built, it's *a powerful tool for understanding the factors that drive your economics*. It lets you quickly answer questions and test new ideas, saving time and misdirected effort.



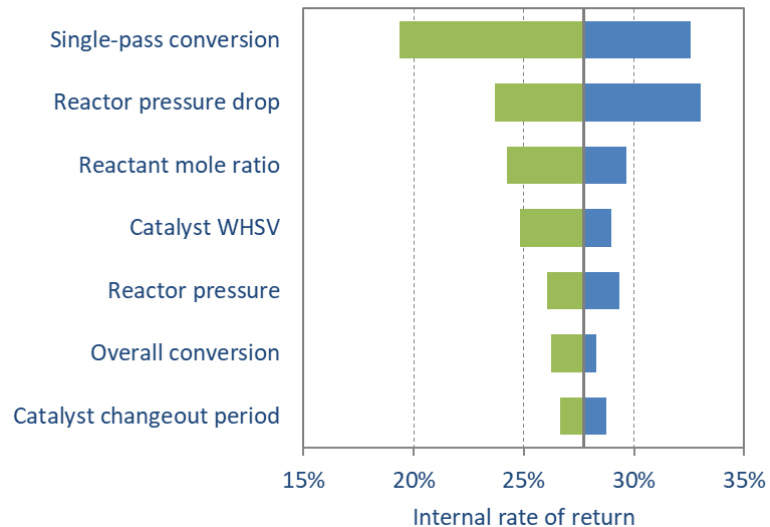
# Prioritizing research & development.

Tornado diagrams are a graphical form of sensitivity analysis for comparing the potential impact of a number of input variables on a single result parameter. Longer bars indicate greater impact.

When used in techno-economic analysis, tornado diagrams help guide research and development toward the most useful objectives. With regular reassessment, they can also help track and respond to changing priorities.

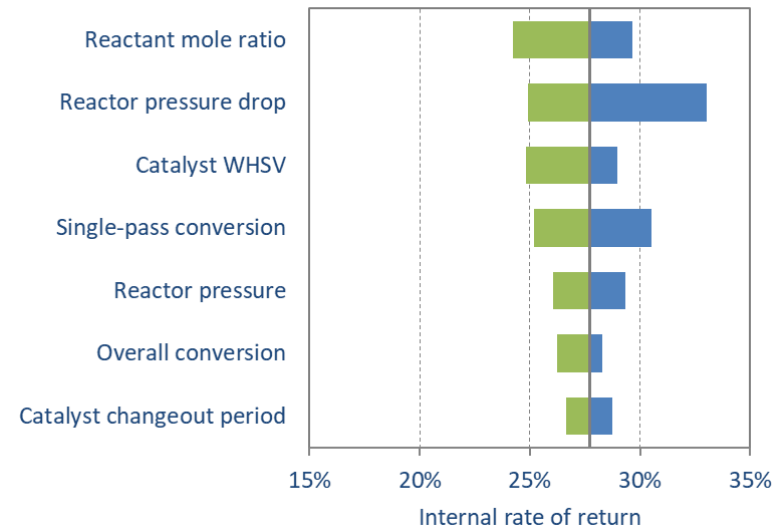
## Initial analysis

Improving single pass conversion is the top priority for improving expected internal rate of return. Catalyst changeout period is not an economic driver.



## Six-month reassessment

Recent improvements in conversion mean that it is no longer a stand-out top priority. Consider broadening efforts to include other variables.



# When is the right time to start modeling?

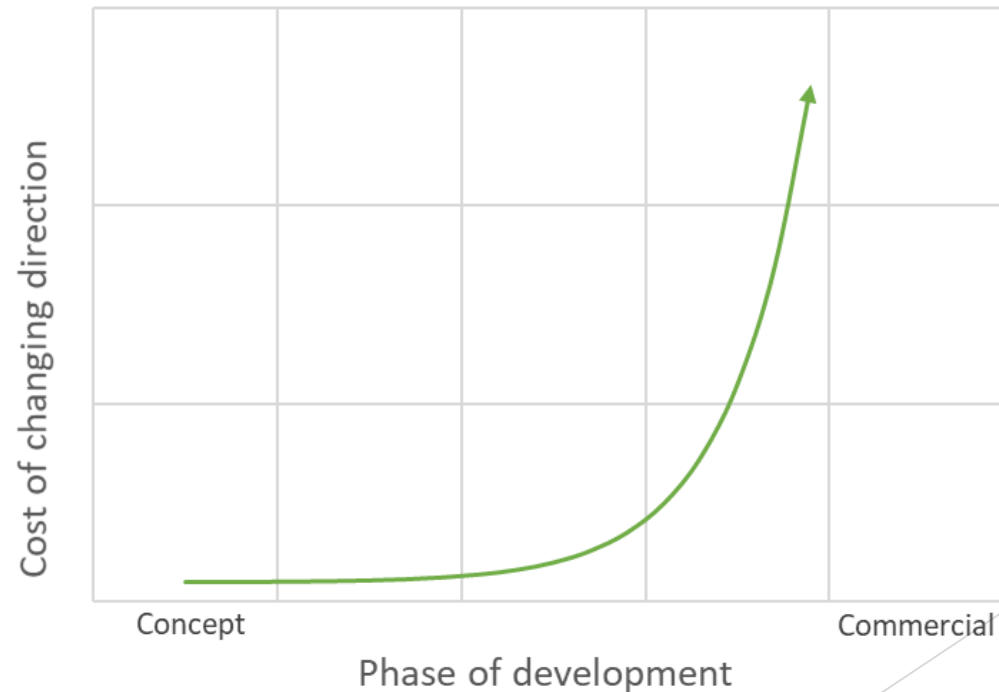
*The earlier the better.* As you progress through R&D, it becomes more difficult and expensive to change course. The investment required to develop a techno-economic model varies, but it is generally small compared to the typical associated R&D budget.

Regardless of how little information is available, systematic economic analysis lays the foundation for objective unbiased decision-making. It gives you confidence in your decisions, helps you avoid surprises, increases your credibility to investors, and guides you along the most efficient path to commercialization.

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*Early techno-economic analysis gives you confidence in our decisions, helps you avoid surprises, increases your credibility to investors, and guides you along the most efficient path to commercialization.*

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Coming up next in  
the series.



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*This is the third in a four-part series on techno-economic analysis for new technologies in the bioeconomy. The next installment outlines key advantages for using a third party for techno-economic analysis.*

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## Techno-economic modeling & analysis in the bioeconomy

1. What is techno-economic modeling and analysis?
2. Techno-economics for technology investors.
3. Techno-economics for technology developers.
4. Advantages of using third party.



# Chris Burk, PE

## Professional bio



Chris specializes in techno-economic analysis. He works with companies that are developing or investing in new chemical and bioprocess technologies, helping them use techno-economic modeling to better understand their economics at a commercial scale. His clients include venture capital firms, universities, national labs, independent startups, and startup incubators.

Prior to consulting, Chris spent twelve years in industry working in R&D, scale-up, and pilot plant EPC. He speaks and writes regularly on the importance and best practices of early-stage cost modeling.

He is a licensed Professional Engineer and he holds BS and MEng degrees in Chemical Engineering from Cornell University.

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