INTRODUCTION TO TECHNO-ECONOMIC ANALYSIS

produced by the DOE Advanced Manufacturing Office (AMO)

Introduction to Techno-Economic Analysis

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Welcome to AMO's video tutorial series on cost and environmental impact analysis!

Heather

In this module, we will:

- Provide an overview of techno-economic analysis (TEA) concepts and estimation methods
- Describe a simplified TEA approach used by AMO to estimate potential costs for pre-commercial industrial technologies

Welcome to the AMO video tutorial series on cost and environmental impact analysis.

I'm Heather.

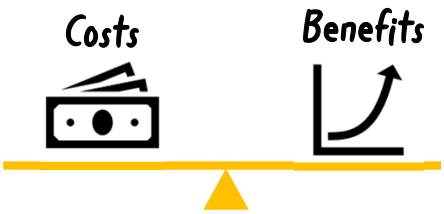
In this module, we will:

- Provide an overview of techno-economic analysis concepts and estimation methods
- Describe a simplified TEA approach used by AMO to estimate potential costs for pre-commercial industrial technologies.

WHAT IS TEA?

Techno-economic analysis (TEA) is a method for evaluating the economic performance of a technology

A TEA assesses the overall value of a technology



Techno-economic analysis, or TEA, is a method for evaluating the economic performance of a technology.

A TEA assesses the overall value of a technology, allowing analysts to objectively weigh benefits against costs.

AMO's approach to TEA focuses on cost benchmarking.

In a cost benchmarking approach, the costs of a new technology are compared head-to-head against those of an existing commercial technology that it would compete with in the marketplace.

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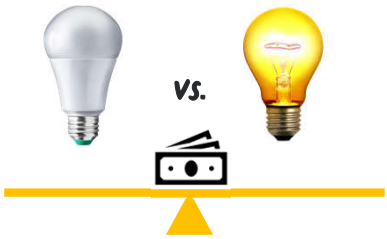
COST ASSESSMENT

For successful commercialization, a new technology must be cost-competitive.



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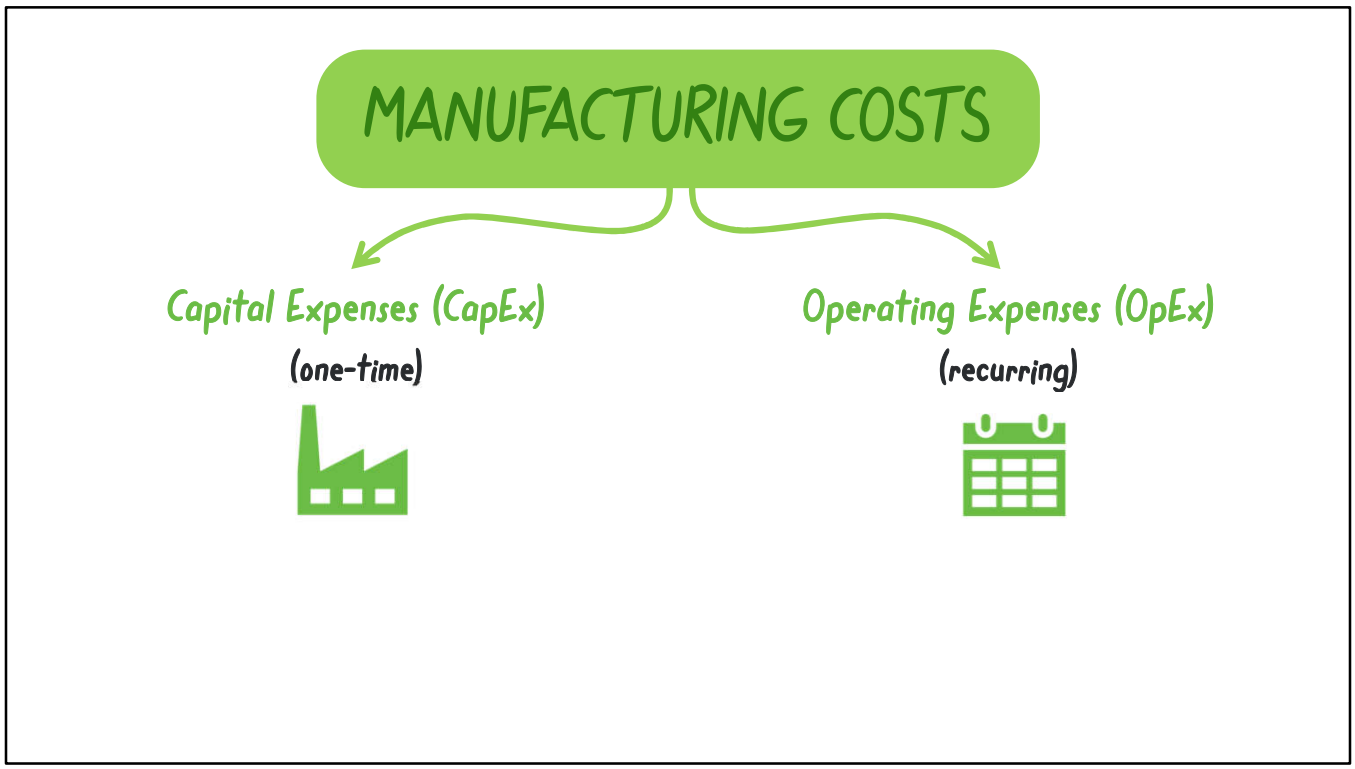
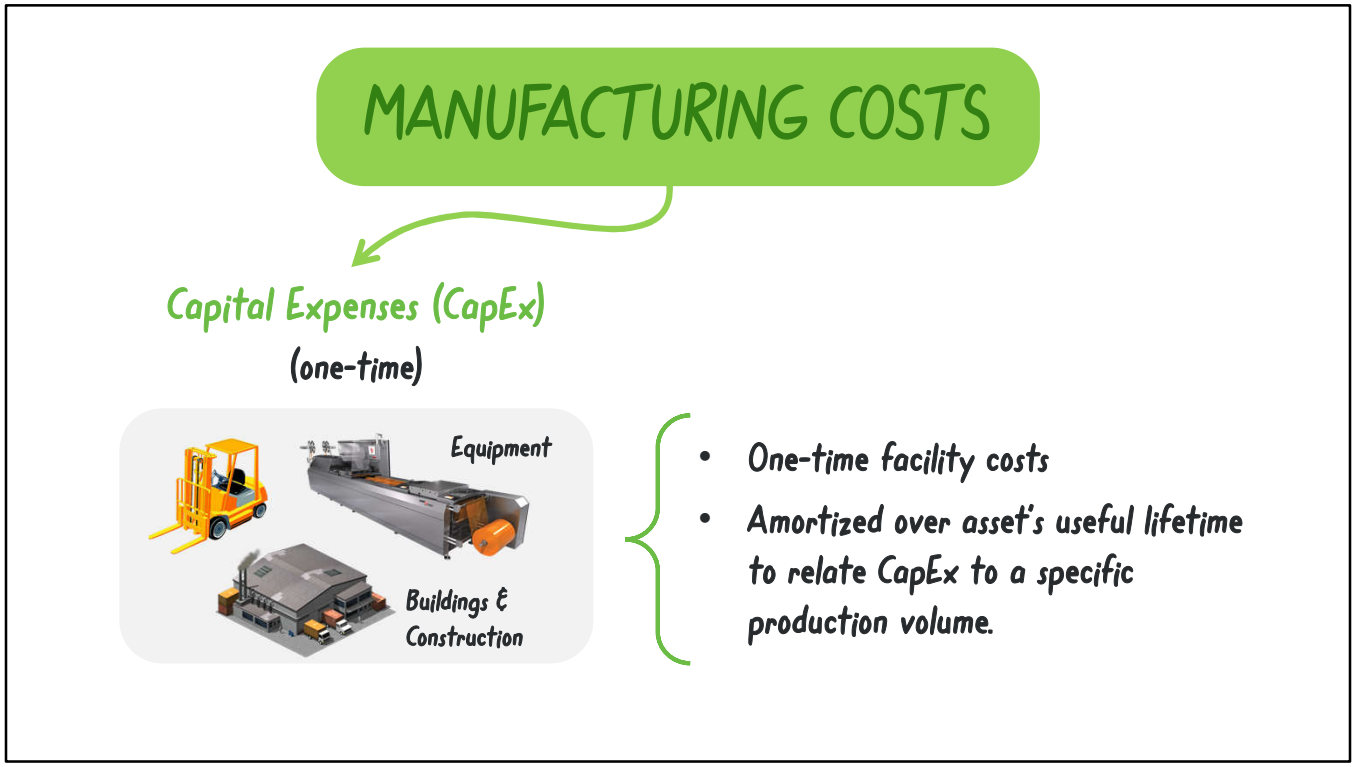
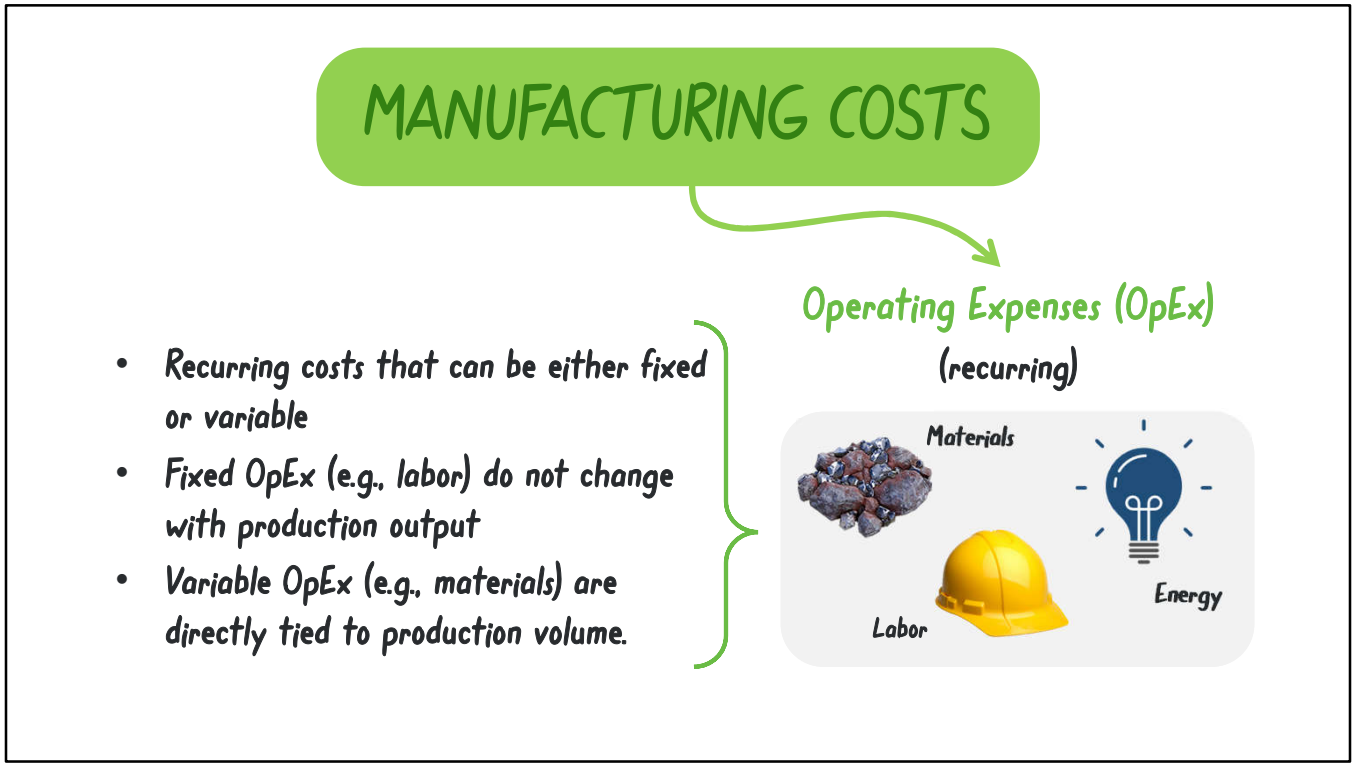


Manufacturing costs can be broken down into two main categories: Capital Expenses and Operating Expenses.



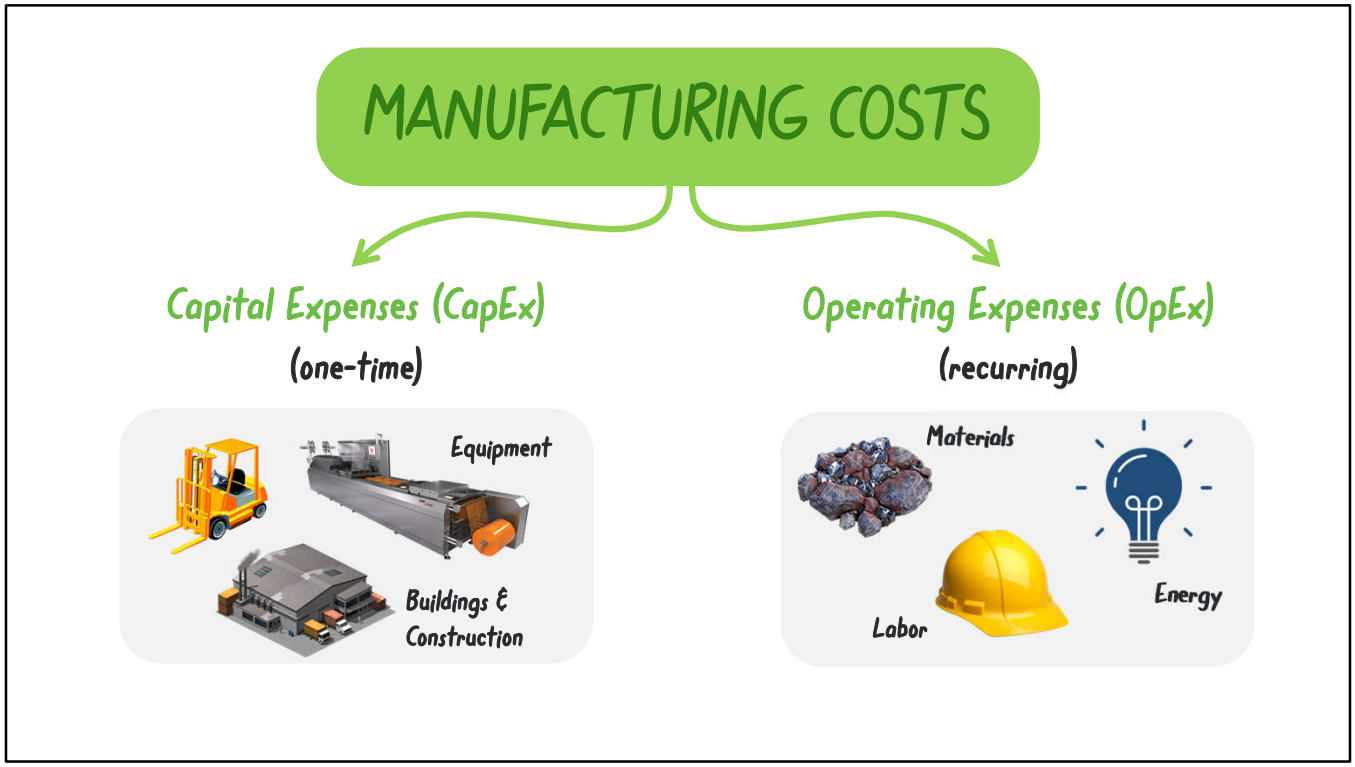
Capital expenses, or CapEx, are non-recurring costs such as equipment, buildings, and construction.

In a TEA, these one-time facility costs are amortized over the assets' useful lifetime to relate CapEx to a specific production volume.



Operating expenses, or OpEx, are recurring costs such as materials, labor, and energy. These recurring costs can be either fixed or variable.

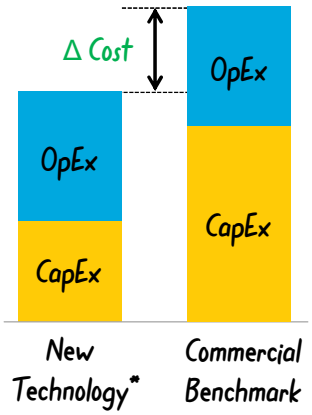
- Fixed operating expenses, like labor, do not change with production output; while
- Variable operating expenses, like materials, are directly tied to production volume.



We'll discuss specific methods for estimating both CapEx and OpEx costs later in this series.

COST BENCHMARKING

Manufacturing Cost Comparison



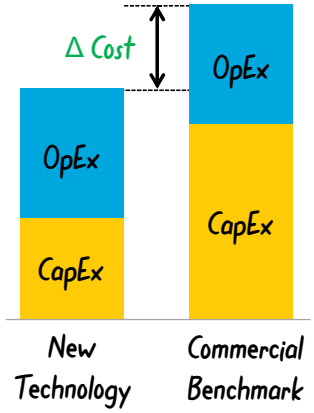
*assuming deployment at industrial scale (even if current TRL is low)

In the cost benchmarking approach, we evaluate the commercial viability of the new technology by comparing its manufacturing costs to those of a corresponding commercial benchmark.

For all cost estimations, we assume that the new technology has been deployed at a full industrial scale– even if its current technology readiness level, or TRL, is low.

COST BENCHMARKING

Manufacturing Cost Comparison



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Benchmarking should be done on a performance-equivalence basis, using an appropriate functional unit to define the reference quantity. The use of a functional unit is particularly important if the two technologies differ significantly in size, function, or final product use, since the new technology might not substitute 1 to 1 for the benchmark technology.

EXAMPLE

Cost Comparison: Catalysts for Ethylene Manufacturing

New Catalyst

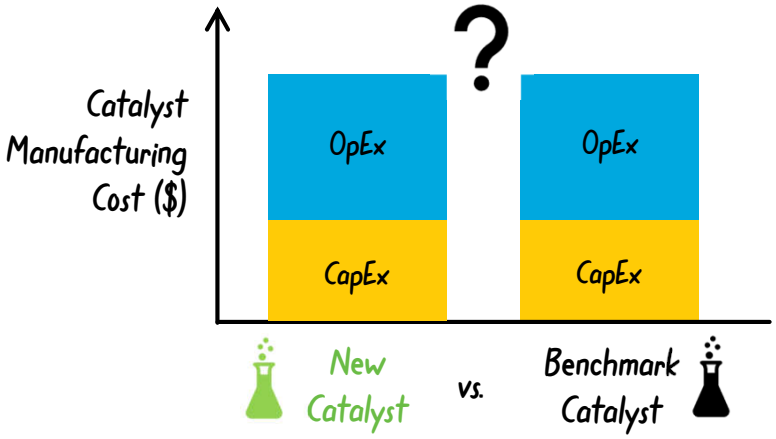
vs.

Benchmark Catalyst

For example, let's say we are performing a cost analysis for a new, advanced catalyst that will be used in ethylene manufacturing. The new catalyst will serve as a drop-in replacement for an existing commercial catalyst - the benchmark technology.

EXAMPLE

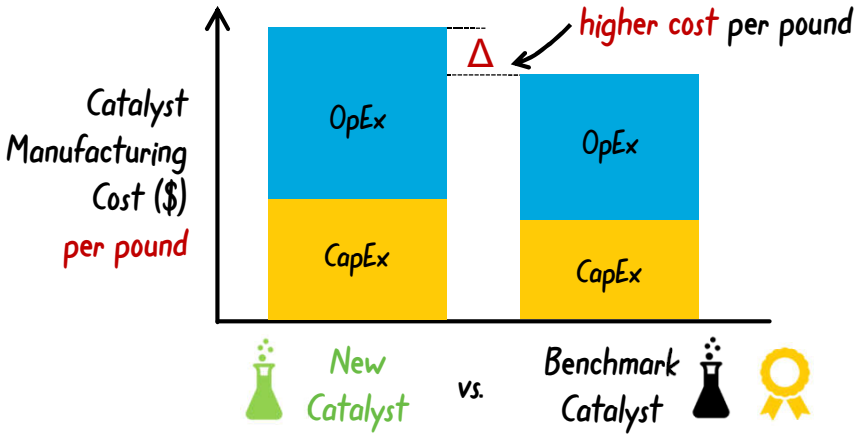
Cost Comparison: Catalysts for Ethylene Manufacturing



We'll compare these technologies by summing the OpEx and CapEx components.

EXAMPLE

Cost Comparison: Catalysts for Ethylene Manufacturing

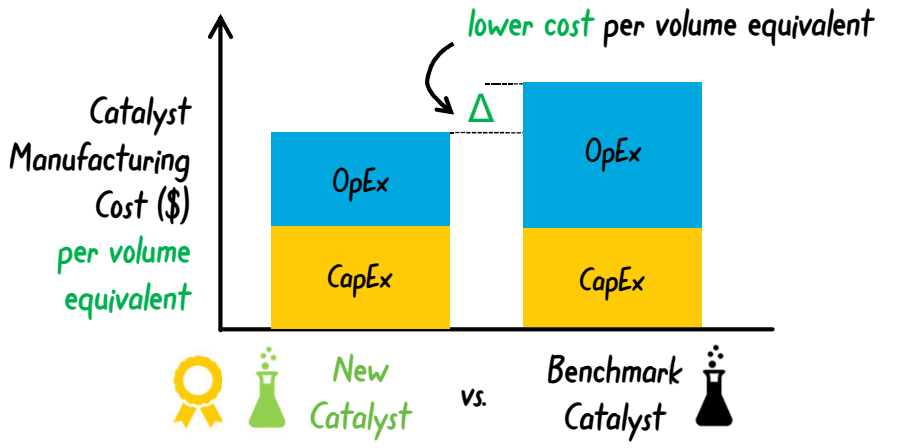


Imagine that the new catalyst will cost 10% more to manufacture, pound-for-pound, than the commercial benchmark technology.

The new technology results in a higher cost per pound.

EXAMPLE

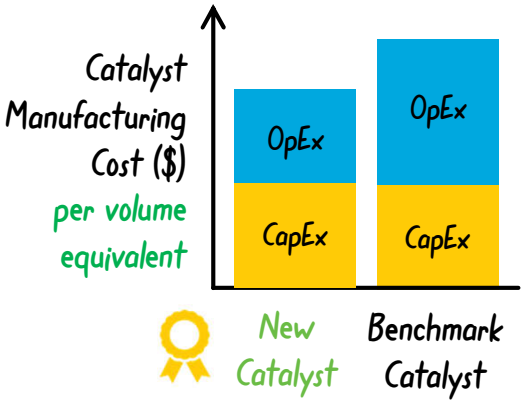
Cost Comparison: Catalysts for Ethylene Manufacturing



However, a key benefit is that it will last 20% longer than the benchmark catalyst. Since the new catalyst won't need to be replaced as frequently, the facility will consume less of the new catalyst to produce an equivalent volume of ethylene.

EXAMPLE

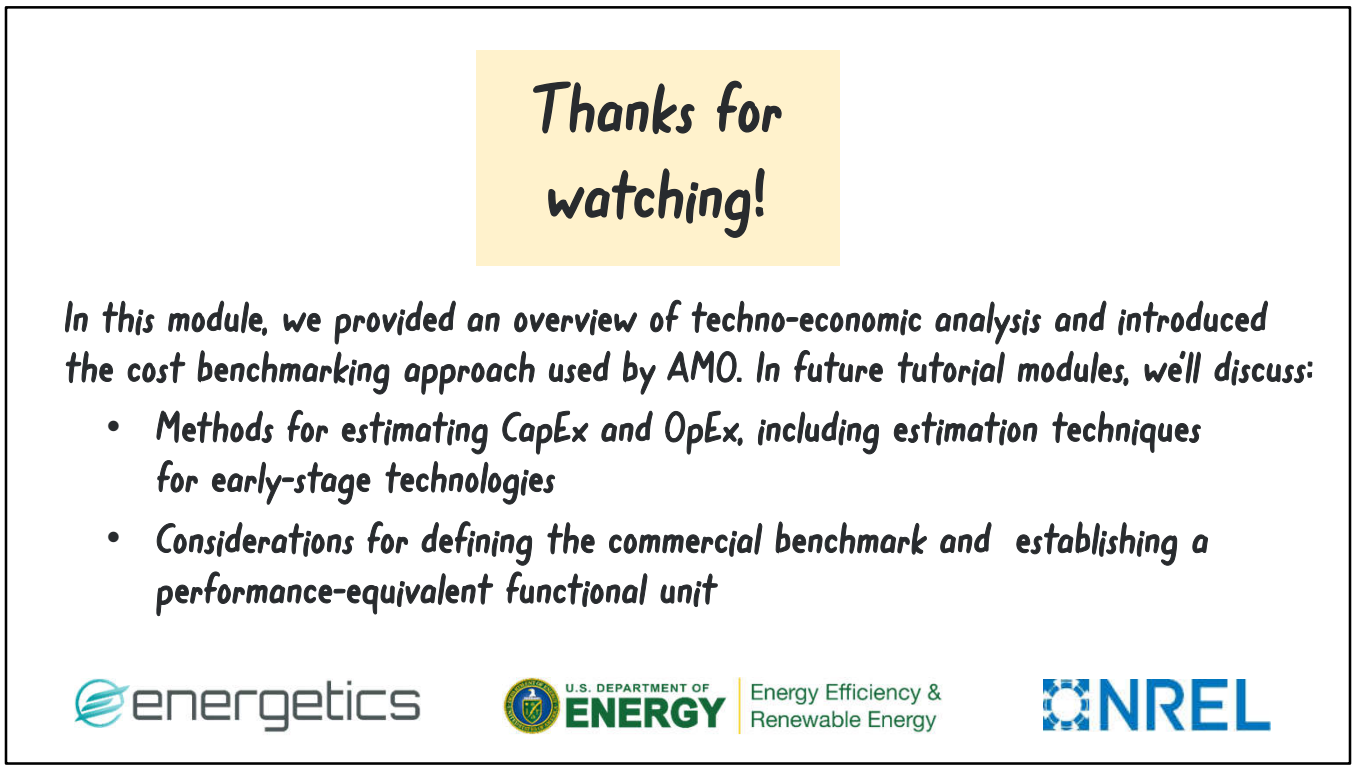
Cost Comparison: Catalysts for Ethylene Manufacturing



The use of a performance-equivalent functional unit enables "apples-to-apples" cost comparisons between technologies.

In this example, after adjusting for performance equivalence, we found that the new technology provided a cost savings over the benchmark technology.

The use of a performance-equivalent functional unit enables “apples-to-apples” cost comparisons between technologies.



In this module, we provided an overview of techno-economic analysis and introduced the cost benchmarking approach used by AMO.

In future tutorial modules, we'll discuss:

- Methods for estimating CapEx and OpEx, including estimation techniques for early-stage technologies
- Considerations for defining the commercial benchmark and establishing a performance-equivalent functional unit

We'll be applying the TEA concepts introduced in this module when carrying out those analysis steps.