Agenda

- Step-by-step hands-on discussion of integrated economics with Hysys
- Questions and Answers
- Enter your questions in the Q&A dialog box on the lower right side of your WEBEX screen.
What will you learn in this webinar?

- Evaluate operating costs and capital cost using integrated economic analysis in Hysys
  - Mapping unit operations to equipment
  - Sizing equipment
  - Entering equipment data
  - Evaluating capital and operating costs
  - Viewing economic analysis reports

- We will follow the design of a Gas-Oil Separation Plant from start to end

- We will demonstrate the step-by-step workflow to evaluate operating and capital costs
Good Cost Estimates are Critical

Committed operating cost – 95%
Committed investment cost 80%
Actual cost

% OF TOTAL COST
0 20 40 60 80 100

% OF TIME
0 20 40 60 80 100

Conceptual Design
Basic Engineering
Construction
Startup
Business Challenge: Minimize Capital and Operating Costs

Challenge: to minimize capital and operating costs for a new gas-oil separation (GOSP) facility

Two alternative designs are under consideration:

Two stage separation

1st stage separation

2nd stage separation

Export gas compressor
Business Challenge: Minimize Capital and Operating Costs

Challenge: to **minimize capital and operating costs** for a new gas-oil separation (GOSP) facility

Two alternative designs are under consideration:

- or three stage separation with a stabilizer column

**Diagram:**

- Export gas compressor
- **1st stage separation**
- **2nd stage separation**
- **3rd stage separation**
- Crude oil stabilizer
Typical Workflow is Manual, Iterative, Inefficient and Promotes Silo Mentality

- Process Engineer
  - Conceptual Design
  - 3 days
- Equipment Designer
  - Sized Equipment List
  - 2 days
- Cost Estimator
  - Relative Cost Estimate
  - 5 days

10 days for base case design
20 days to evaluate 2 cases

The cost drivers are not visible to the engineer
aspenONE Workflow is integrated, efficient and promotes collaboration

In Hysys

- Preliminary Equipment Design
- Equipment Designer
- Effective data transfer
- One software vendor
- Efficient
- Supports collaboration

Work is done inside the familiar process simulation environment
Integrated economic evaluation is driven through the new ‘Costing’ toolbar

<table>
<thead>
<tr>
<th>Button</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Grid" /></td>
<td>Opens the model summary grid</td>
</tr>
<tr>
<td><img src="image" alt="Toggle" /></td>
<td>Activates and deactivates economic evaluation</td>
</tr>
<tr>
<td><img src="image" alt="Load" /></td>
<td>Loads simulation data into economics engine</td>
</tr>
<tr>
<td><img src="image" alt="Map" /></td>
<td>Maps unit operation models to equipment</td>
</tr>
<tr>
<td><img src="image" alt="Size" /></td>
<td>Sizes equipment</td>
</tr>
<tr>
<td><img src="image" alt="Evaluate" /></td>
<td>Evaluates capital and operating costs</td>
</tr>
<tr>
<td><img src="image" alt="Open" /></td>
<td>Opens the equipment summary grid</td>
</tr>
<tr>
<td><img src="image" alt="Deactivate" /></td>
<td>Deactivates economics engine; removes files</td>
</tr>
<tr>
<td><img src="image" alt="Report" /></td>
<td>Creates economic analysis summary report</td>
</tr>
</tbody>
</table>

You can skip steps in the workflow – for example click the ‘evaluate’ button to get a quick estimate.
Equipment Design and Cost Procedure

**PROJECT SPECS:**
- Mechanical design specs
- Project components specs

**MECHANICAL DESIGN:**
Develop physical dimensions using:
- design code procedures
- industry standard methods

**FABRICATION LABOR:**
- Shop [+ Field]
- Labor
- Man-hours

**VESSEL COST:**
1. Mat'l cost of parts
2. Shop [+ field] fab labor
3. Labor overheads
4. G and A
5. Profit

Equipment design generated

Equipment cost estimated
Volumetric Models: Calculation of Installation Bulks

- Total installed cost estimated
- Quantities and costs for bulk materials based upon equipment specifications
- Volumetric models for process equipment:
  - Conceptual P&IDs
  - Civil
  - Steel
  - Electrical
  - Insulation
  - Paint
Demonstration

Integrated economic evaluation with Hysys and Aspen Process Economic Analyzer V7.2
Integrated economics is based on Aspen Process Economic Analyzer (formerly IPE)

The APEA license key is *checked out* when you activate the integrated economics feature.

The APEA license key is *released* when you deactivate integrated economics or exit Hysys.
The first time you activate the economics engine you need to select a basis

Select units, enter description

Enter the basis for cost evaluation

A new economic evaluation case file is created
The status indicator helps guide workflow

The indicator is located in the lower left hand corner of Hysys.

Costing: Sim Changed

The status indicator reflects the current state in the workflow and notes changes to the simulation.

Costing: Loading...

Sometimes you need to wait for the economic engine to finish a task before you move on.

Costing: Loaded

The indicator shows when tasks are completed.
Equipment models are created from unit operations during the ‘mapping’ process.

You only need to do the mapping steps when you add or remove unit operations from your model.

You can change, remove, and add equipment during the mapping process.

Conceptual Unit Operation Model

Equipment Models for Cost Estimation
You can change the equipment mapping or add and remove equipment.

The simulation data are used to establish default mappings.

The mapping persists between runs.

Costing: Mapped
You can change the equipment mapping or add and remove equipment

To change mapping:

1. Delete the equipment item
2. Click 'New Mapping' to create a new equipment item...
3. Step through the component selection forms to select a new mapping
Equipment is sized based on the simulation results from Hysys.

Simulation sizing results are used if they are available.

Examples include:
- Exchanger sizes
- Pump sizes
- Column geometry
- Column internals
- Etc.

Missing sizes are estimated. You can also specify sizes in the equipment grid.
Enter materials of construction and sizing details in the equipment grid.

Capital cost estimates are very sensitive to the materials of construction you select. Carbon steel is assumed by default.
Aspen Process Economic Analyzer calculates the relative capital and operating costs

Click “Evaluate” to finish the sizing and costing process.

The summary sheet shows the overall capital and operating costs for the plant.

The equipment sheet shows the bare equipment cost and total direct (installed) cost.

Any sizing or cost evaluation errors are reported in this grid.
End of Demonstration

Integrated economic evaluation with Hysys and Aspen Process Economic Analyzer V7.2
## Summary of Operating and Capital Costs

<table>
<thead>
<tr>
<th></th>
<th>Two Stage</th>
<th>Three Stage with Stabilizer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude Oil Production (m³/hr)</td>
<td>300.8</td>
<td>303.4</td>
</tr>
<tr>
<td>Export Gas Production (m³/hr)</td>
<td>7450</td>
<td>7460</td>
</tr>
<tr>
<td>Total Operating Cost [$/Yr]</td>
<td>$13,157,000</td>
<td>$11,831,200</td>
</tr>
<tr>
<td>Total Capital Cost [$]</td>
<td>$29,721,600</td>
<td>$29,242,000</td>
</tr>
</tbody>
</table>

Three Stage Separation with Stabilizer Column is Better Alternative:

- 0.9 % increase in liquids production
- 1.6% reduction in Capital Cost
- 10% reduction in Operating Cost
### Summary of Key Equipment and Utility Costs

<table>
<thead>
<tr>
<th>Equipment Costs</th>
<th>Two Stage</th>
<th>Three Stage with Stabilizer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Stage Heat Exchanger</td>
<td>$5,692,500</td>
<td>$5,970,700</td>
</tr>
<tr>
<td>1st Stage Compressor</td>
<td>$2,498,800</td>
<td>$1,628,100</td>
</tr>
<tr>
<td>2nd Stage Compressor</td>
<td>$1,279,000</td>
<td>$1,243,200</td>
</tr>
<tr>
<td>3rd Stage Compressor</td>
<td>$1,495,800</td>
<td>$1,520,600</td>
</tr>
<tr>
<td>Export Gas Compressor</td>
<td>$2,836,500</td>
<td>$2,837,000</td>
</tr>
<tr>
<td>1st Stage Separator</td>
<td>$358,200</td>
<td>$353,400</td>
</tr>
<tr>
<td>2nd Stage Separator</td>
<td>$267,300</td>
<td>$260,300</td>
</tr>
<tr>
<td>3rd Stage Separator</td>
<td>-</td>
<td>$160,100</td>
</tr>
<tr>
<td>Stabilizer Tower</td>
<td>-</td>
<td>$257,700</td>
</tr>
<tr>
<td>Stabilizer Reboiler</td>
<td>-</td>
<td>$122,300</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Utility Costs</th>
<th>Two Stage</th>
<th>Three Stage with Stabilizer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>$8,380,000</td>
<td>$6,810,000</td>
</tr>
<tr>
<td>Steam</td>
<td>$1,063,000</td>
<td>$1,626,000</td>
</tr>
<tr>
<td>Cooling Water</td>
<td>$735,000</td>
<td>$527,000</td>
</tr>
</tbody>
</table>

Key savings on 1st stage compressor offset cost of stabilizer and 3rd stage separator.

Large savings in electricity costs due to smaller compressors.
## Summary

<table>
<thead>
<tr>
<th>Elapsed Time per Iteration</th>
<th>Typical</th>
<th>Aspen HYSYS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Engineer</td>
<td>2 days</td>
<td>2.5 days</td>
</tr>
<tr>
<td>Equipment Designer</td>
<td>3 days</td>
<td>0 days</td>
</tr>
<tr>
<td>Cost Estimator</td>
<td>5 days</td>
<td>0 days</td>
</tr>
<tr>
<td>Elapsed time to evaluate one option</td>
<td>10 days</td>
<td>2.5 days</td>
</tr>
<tr>
<td>Options evaluated in 40 days</td>
<td>4</td>
<td>16</td>
</tr>
</tbody>
</table>
Benefits
Integrated economic analysis

- Process engineer is more self-sufficient
- Electronic handoff of data between functions
- Rapid relative cost estimation
- Higher efficiency – compare more scenarios
- Decisions based on cost instead of proxies for costs
Next Steps:
Also available – web resources

- **Pre-recorded self-help tutorials**
  - One on Aspen HYSYS; one on Aspen Plus;
- **Integrated economics white paper**
- **Integrated Economics – other overview materials**

Want more in-depth training?

Consider a training class from AspenTech

http://support.aspentech.com/training
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Registration Now Open!

Save the Date
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Washington, D.C.
Thank you.