

 Brochure

Aspen HYSYS®: Process Simulation for Oil & Gas



Adapting to Change: Overcoming Today's Challenges in the Oil & Gas Industry

The oil and gas industry is addressing rising energy consumption due to population growth, a rise in manufacturing, and higher living standards. It aims to ensure energy security and reduce its carbon footprint by adopting sustainable energy transition initiatives. To manage these transitions safely and profitably, process engineers need advanced technological solutions to accurately predict and optimize operations.

Gain Precise Insights with the Industry's Leading Process Simulator

For decades, Aspen HYSYS has been the leading process simulation solution for both the oil and gas industry and the EPC sector. Due to continuous innovations over the years, process engineers can derive unparalleled insights from highly accurate process simulations. Key features include estimating capital and operating expenses, conducting energy analysis with pinch technology, estimating plant-wide emissions, and rigorously simulating equipment like refinery reactors, distillation columns, heat exchangers and more. The built-in Industrial AI technology enhances the development of precise digital twin models.

Aspen HYSYS supports rigorous simulation of end-to-end processes in the oil and gas industry, from upstream to gas processing and crude oil refining. It helps engineers ensure process safety by modeling complete overpressure protection systems. Additionally, it enables both steady-state and dynamic simulations within the same software environment.

The rigorous process simulation in Aspen HYSYS empowers engineers to optimize process design, continually monitor operations, uncover opportunities for improvement, debottleneck processes, troubleshoot issues, and analyze “what-if” scenarios. For decades, Aspen HYSYS has helped engineers worldwide address critical engineering and operational challenges throughout the asset lifecycle.



Aspen HYSYS can help achieve a wide range of business goals, including:

- Reduce CAPEX with rapid optioneering
- Ensure process safety while minimizing costs
- Improve operational decisions with model-backed intelligence
- Simulate accurate high-fidelity models faster with Industrial AI
- Optimize design and operation of H₂ and carbon capture facilities
- Reduce risk in transitioning to bio-feed/co-feed processes
- Enhance operations by gaining real-time insights into KPIs that were previously unmeasurable



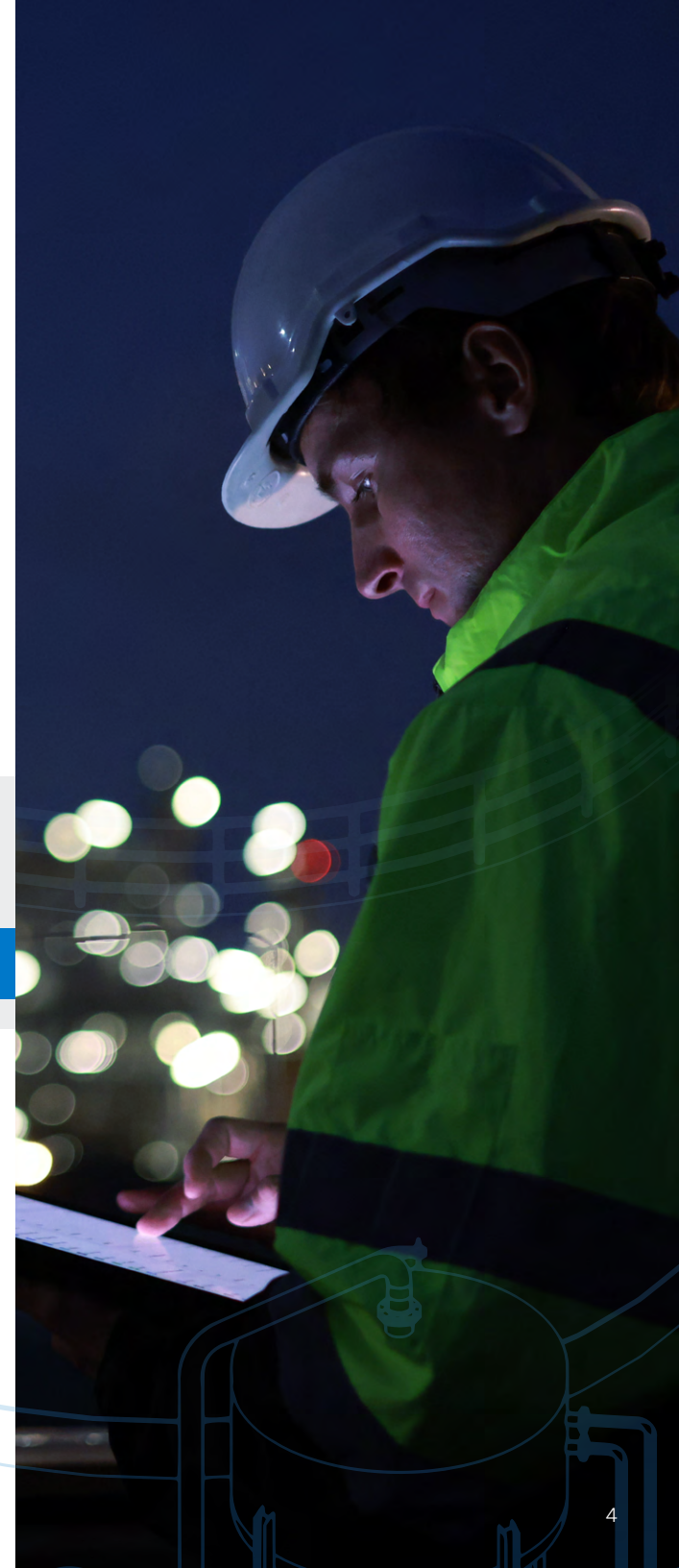
Leading Physical Properties Database

Model processes with confidence using a solid foundation of first principles.

- Accurately predict process stream yields and properties by leveraging the most comprehensive property packages in the industry, including specialized packages for acid gas and carbon capture, dehydration, sour water treatment, sulfur recovery, H₂ liquefaction, etc.
- Aspen Tech's process simulator software is known throughout the process industry to have the most complete set of physical properties data, built in collaboration with the National Institute of Standards and Technology (NIST).
- Supports a wide range of state-of-the-art methods and physical properties, including the predictive Peng-Robinson integration that calculates VLE and VLLE data from the structure.
- With specialized property packages and rigorous equipment models, engineers can simulate actual plant behavior while saving months of time and improving engineering accuracy.

- The industry gold standard
- A comprehensive set of property methods
- Built-in libraries with in-house data

[Learn More](#)



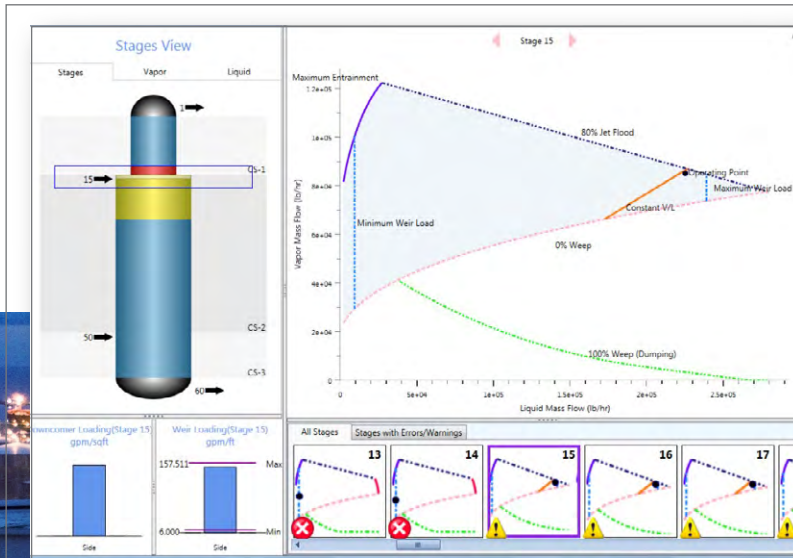
Improve Distillation

Visualize hydraulics and conduct rigorous analysis of distillation columns.

- Quickly gain the insights needed to evaluate how changes to design and operating conditions affect distillation column performance using intuitive visualization of column hydraulics.
- Accurately predict column separation efficiencies using highly rigorous rate-based calculations.
- Reduce engineering time and effort by modeling columns using a built-in library of trays, packings and trusted correlations.

- Informative hydraulic plots that update automatically
- Complete thermodynamic and hydraulic analysis in one tool
- Eliminate risk using correlations tested against vendor data

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**40% increase in
column capacity**

Tüpraş

**Improved gas & oil
yield and quality**

**Pan American
ENERGY**

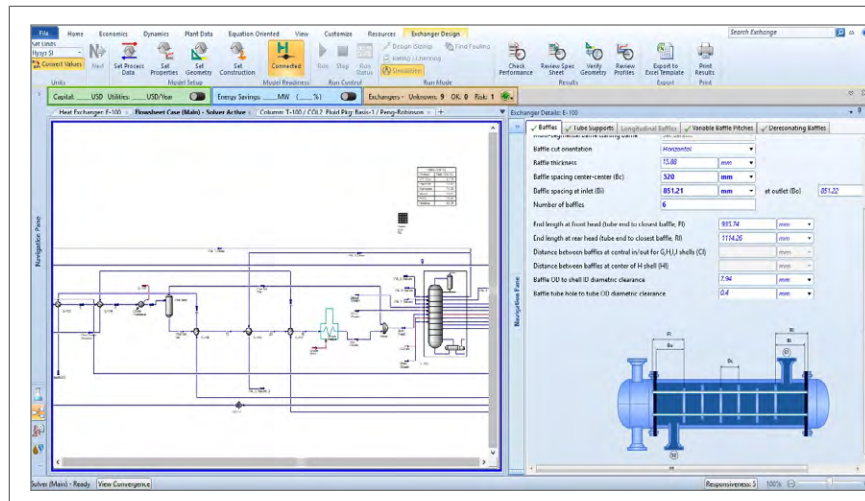
Optimize Exchanger Design, Monitor Operational Risks

Troubleshoot performance without ever leaving Aspen HYSYS.

- Avoid costly operational problems by early identification of potential risks to heat exchangers (HX) from vibrations, erosion, excessive temperatures or pressures, using rigorous HX models.
- Reduce engineering time and ensure optimal HX design by leveraging the Activated Exchanger Design & Rating™ capability in Aspen HYSYS, which automatically evaluates hundreds of design geometries to find the best fit for the specified process constraints.
- Optimize CAPEX and OPEX of heat exchangers by leveraging Aspen HYSYS to conduct pinch analysis, model HXs, and perform risk cost estimate analysis—all within the same software.
- Maximize plant capacity by identifying potential bottlenecks with heat exchangers and evaluating multiple strategies to optimize process performance using rigorous HX simulations within the Aspen HYSYS flowsheet.

- Fast project execution and cost-effective HX design
- Spot potential bottlenecks to increase plant capacity
- Identify issues early

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Saved **>\$1M/Yr**
and reduced
CO₂ emissions



Fuel savings of
650 SRFT/Yr.



Concurrent Conceptual Engineering

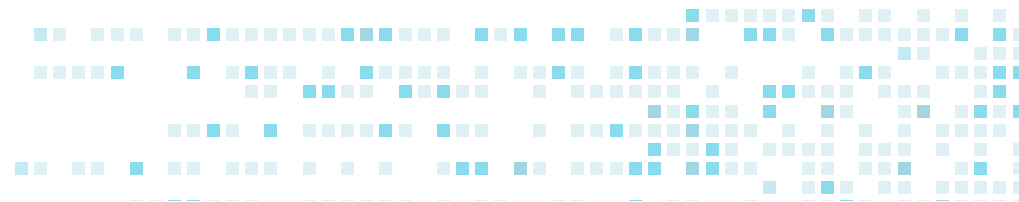
The only concurrent engineering workflow.

- Optimize your design by quickly evaluating numerous process alternatives, analyzing their cost, energy usage, emissions and equipment design in the same flowsheet.
- From within the Aspen HYSYS interface:
 - Analyze the economic impact of any design changes in the simulation, screen various design options and process configurations.
 - Maximize energy savings and optimize utility usage with design recommendations developed using built-in pinch analysis.
 - Fully incorporate heat exchanger designs within the simulation to produce the most optimal designs at the right economics.

- Reduce the carbon footprint of the design by analyzing the impact of any process change on emissions (scope 1&2) and carbon tax numbers.

- Perform multiple activities simultaneously
- Deliver optimal designs at the right economics
- Reduce carbon footprint

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Economics		Energy		EDR Exchanger Feasibility			Greenhouse Gas Emissions	
Capital Cost	Utility Cost	Available Energy Savings		Unknown	OK	At Risk	Scope 1 CO2 equivalent	-0.64801 kg/h
18,637,500	16,163,700	176.40	62.19	0	12	0	Scope 2 CO2 equivalent	29493 kg/h
USD	USD/Year	MW	% of Actual				Total Carbon Tax	3.1023e+08 Cost/year
								

Energy Savings of
\$1.6 M/yr.



Saved **20%** on
CAPEX & OPEX



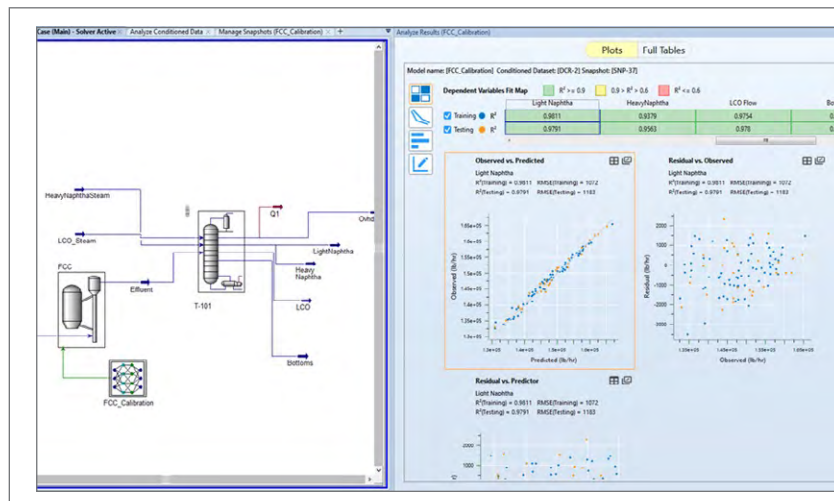
Integration with Industrial AI

Simulate accurate high-fidelity models faster with Industrial AI capabilities built into Aspen HYSYS.

- Empower engineers of all skill levels with Industrial AI to quickly build and deploy accurate models for digital twins using built-in Industrial AI capabilities
 - Industrial AI capabilities combine the capabilities of first principles-based Aspen HYSYS models with the power of AI technology.
- Gain insight into unmeasurable process parameters using AI-enhanced simulation models that provide a better representation of the plant. The predictions vis-à-vis actual plant behavior remain accurate over a longer period of time and broader range of conditions, and require much less effort for maintenance.
- Improve performance of planning and process optimization solutions by developing accurate models for complex process units.

- Solve complex problems
- Empower engineers of all skill levels
- Ease model maintenance efforts

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Gained over
\$100M/Yr.



50% reduction
in design time



Complete Overpressure Protection

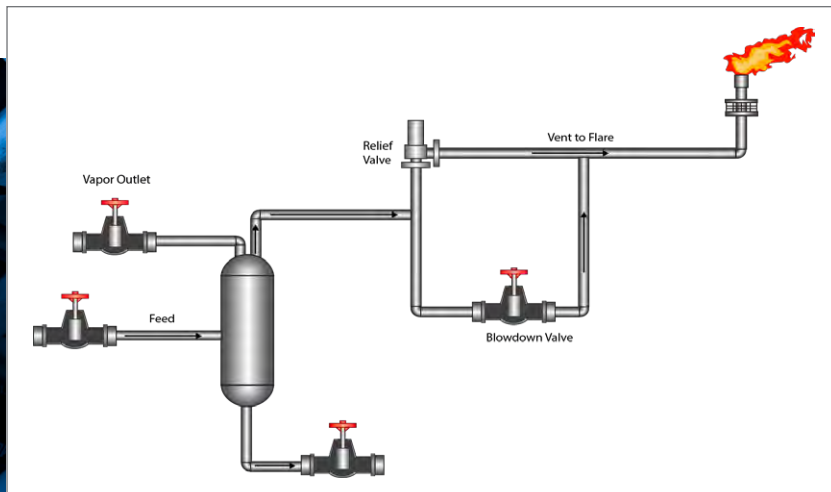
Minimize costs without compromising safety.

- Ensure safety while simultaneously reducing CAPEX and engineering time using a complete overpressure protection simulation solution with expert-trusted calculations and guided workflows. This is enabled by:
 - Accurately predicting process stream flow and conditions using dynamic process simulation.
 - Sizing relief valves by analyzing multiple scenarios, ensuring that sizing calculations conform to industry standards, and automatically generating relief valve datasheets.

- Pinpointing exact piping locations that require expensive materials for blowdown systems, using the industry-validated BLOWDOWN technology developed by professors at Imperial College London.
- Designing and evaluating single/multiple flare and vent systems using seamless integration with Aspen Flare System Analyzer™.

- Comply with safety standards and generate documentation
- Avoid costly overdesign without compromising safety
- Use a single tool for process safety work

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Ensured safety and
saved **\$30M**
in CAPEX



Accurate analysis
resulted in **50%** drop
in flare peak relief load



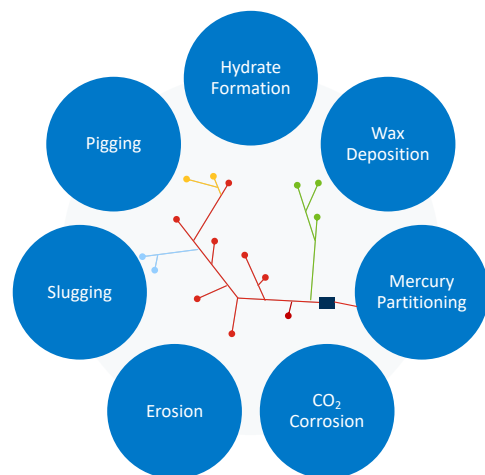
Upstream (Above Surface) Process Simulation

Site-wide simulation of processing facilities.

- Optimize the entire asset (gathering network, production facility and transport pipelines) using integrated fluid characterization, rigorous multiphase pipeline network modeling and integration with AspenTech's Subsurface Science & Engineering solution suite.
- Predict hydrate formation, slugging, corrosion rates, wax deposition, mercury partitioning and the potential for physical erosion in pipelines.
- Predict operational issues by modeling the effect of variations in terrain, asset design and production rates.
 - Connections to third-party tools like Olga, Pipesim, GAP, etc. are available in Aspen HYSYS.
 - Aspen HYSYS can work with fluid characterization results from third-party solutions such as PVTsim, PVTP, etc.

- Integrate production modeling
- Avoid disruption through built-in flow assurance
- Gain accurate insights into multiphase and transient flow conditions

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Gained **\$280M**
in 1 year



40-70% drop
in oscillations for
key process variables



Gas Processing Plant

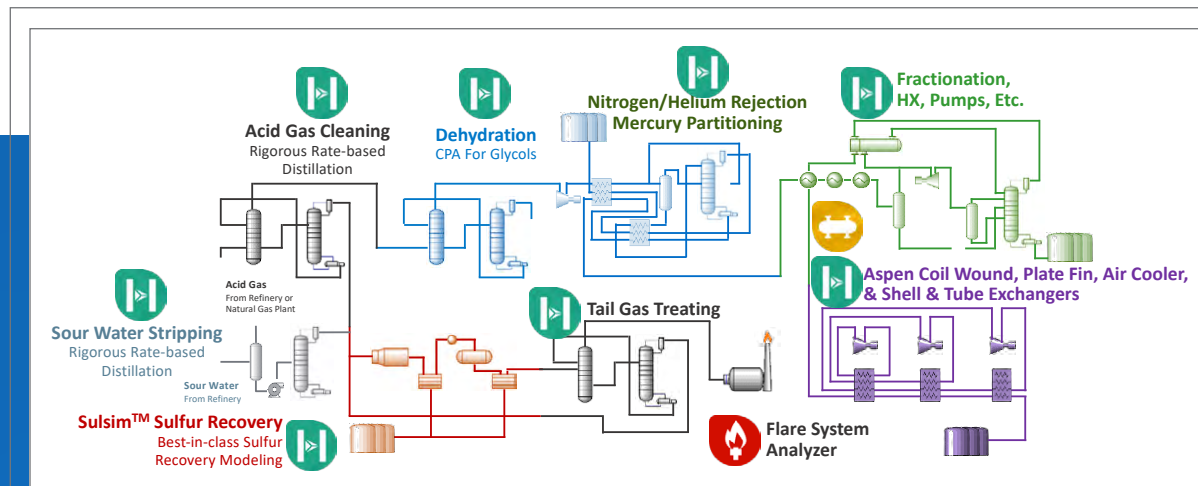
Optimize the entire gas plant with Aspen HYSYS.

- Improve design and operations across the entire gas processing plant by simulating the end-to-end process, including acid gas cleaning, dehydration, sour-water stripping, N₂/He rejection, mercury partitioning, sulfur recovery, tail gas treating and more.
- Optimize design and lower energy costs for acid gas treating systems while meeting specifications with predictive, rate-based distillation models, and specialized physical properties.
- Prevent quality issues that limit dehydration operations and require additional solvent and energy input using the powerful cubic-plus-association (CPA) thermodynamic package.

- Meet environmental regulations by optimizing the design and operation of sulfur recovery units using Sulfur Experts' industry-trusted Sulsim technology in Aspen HYSYS.
- Improve the design and operation of LNG processes with rigorous simulation of equipment such as compressors and heat exchangers, including cryogenic heat exchangers such as plate-fin, coil-wound, etc.

- Predict and resolve bottlenecks
- Minimize solvent and energy use
- Ensure requirements and quality specs are met

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Gained over **\$9M/Yr.**
from improved LNG
production



Saved over **\$5M/Yr.**
from optimizing LNG
delivery



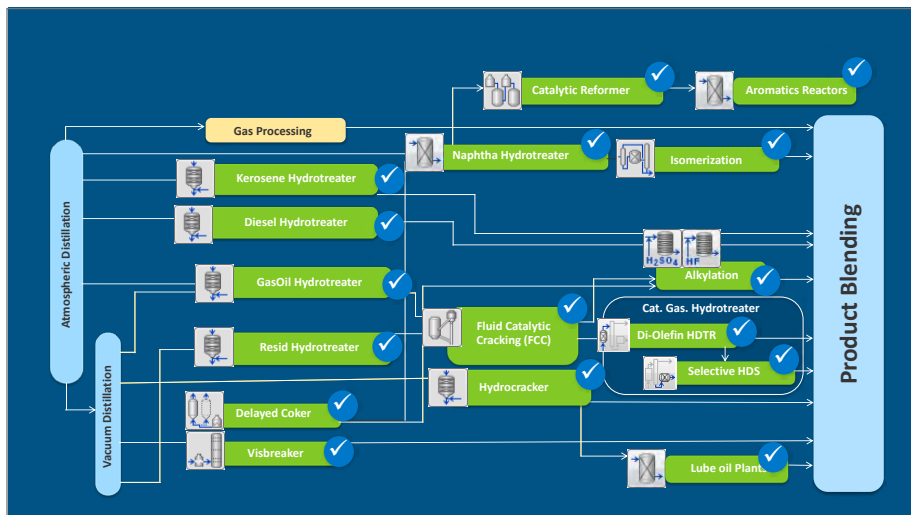
Refinery Process Simulation

Rigorous simulation of refinery-wide processes.

- Quickly and accurately analyze the feasibility of crude blends through precise determination of stream yields and properties at any point in the refinery process.
 - Provides access to 330 petroleum properties and a crude library with over 950 assays, in addition to libraries such as Chevron, etc.
- Meet demand for products while simultaneously reducing energy use with a single solution to optimize the entire crude distillation unit operation, including the distillation column and the pre-heat train.
- Rigorously simulate reactor operations using off-the-shelf kinetic reactor models for all major reactors, including FCC, Hydrocracker, Reformers, Naphtha Hydrotreaters, Cat Gas Hydrotreaters, Delayed Coker, Isomerization, Alkylation and Visbreaker.
 - Additionally, Aspen HYSYS's unique, state-of-the-art, molecule-based reactor simulation technology provides enhanced insights and accuracy, enabling the simulation of bio-feed or co-feed reactors, aromatics reactors, hydro-processors and more.
- Ensure refinery planning models remain accurate with streamlined workflows in Aspen HYSYS, allowing users to easily update planning models and build more accurate non-linear models using Industrial AI.

- Obtain refinery-wide insights
- Improve reactor operations
- Ensure accuracy of planning and process optimization solutions

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Improved reactor operations with
molecule-level insights



Increased refining capacity by
100,000 BPD



H₂ Generation & Liquefaction

Accelerate innovation for the hydrogen economy.

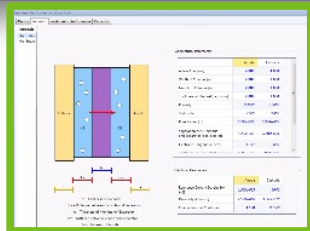
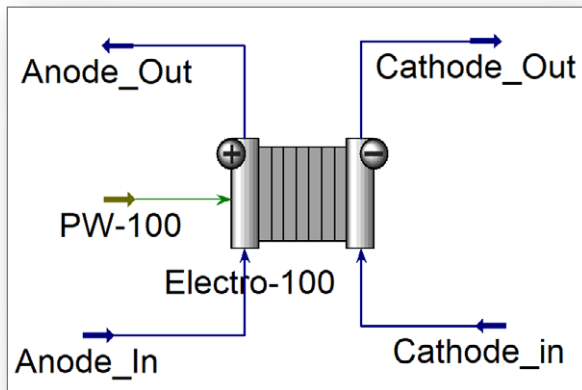
- Rapidly expand the deployment of hydrogen production facilities by addressing the challenges of high CAPEX and energy cost of innovation, scale-up and storage.
- Accelerate feasibility analysis of electrolyzer technology using electrolyzer simulations.
- Simulate major electrolyzers like the Alkaline-water & PEM electrolyzers using off-the-shelf reactor templates (both rigorous and simple) in Aspen HYSYS.
- Simulate electrolyzer operations in both steady state and dynamic conditions.
- Ensure safety of electrolyzer operations by accurately predicting H₂ crossovers across the cell.

- Ensure accurate design for low-temperature H storage systems with specialized H₂ packages that account for ortho/para conversions.

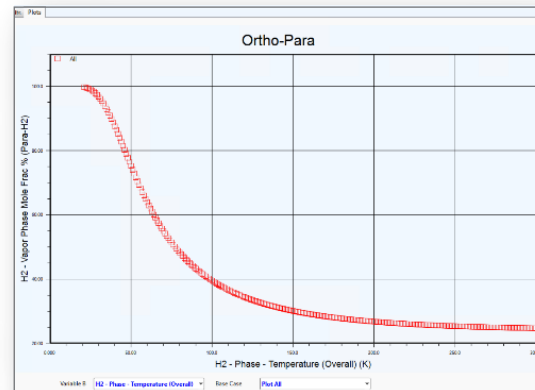
- Faster time to market
- Quick scale-up without expensive test facilities
- Analyze the entire asset

[Learn More](#)

Electrolyzer Unit Op



Hydrogen Package- Ortho Para Conversion



H2 Species		
	Mole %	Mass %
Para-H2	32.69888	32.69888
Ortho-H2	67.30112	67.30112
Total-H2	100.00000	100.00000



Reduced energy use by **17%** **SAMSUNG E&A** for a H2 Plant

50% reduction in time required to train H2 plant operators



Carbon Capture Simulation

Optimize carbon capture process design and operations.

- Design and scale-up highly efficient carbon capture technologies by leveraging:
 - Cost-effective process design and solvent selection for carbon capture
 - Rigorous rate-based distillation modeling and column hydraulic analysis capabilities
 - Optioneering and modularization of new carbon capture technologies
 - Streamlined cost estimation workflows integrated into Aspen HYSYS

- Ensure smooth startup and continued operational improvements for carbon capture plants by reusing the design simulation models as digital twins.

- Develop efficient new technologies
- Design end-to-end process
- Improve energy efficiency and overall process stability

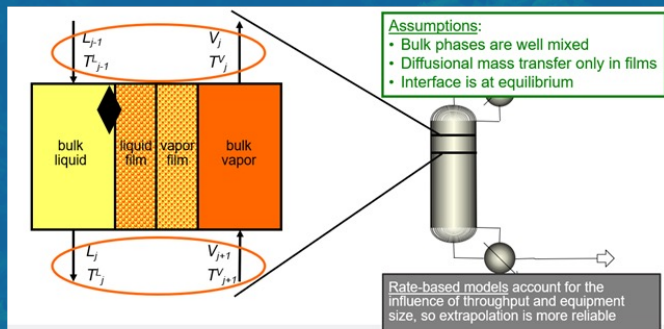
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Captured **>99%**
of CO₂ from
largest NGL plant in North America

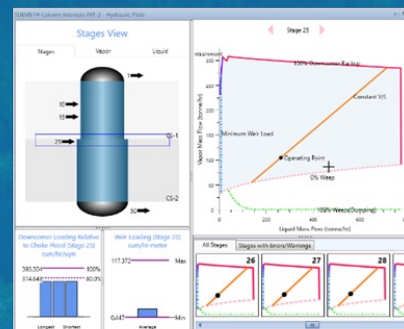
ZACHRY

Simulated
entire CO₂ capture
plant in Aspen HYSYS

Enerflex



Innovate through modeling of the very complex CO₂ removal chemistry



Improve carbon removal efficiency

Overall Cost Summary

Millions of US\$	MEA (Old Plant)	H3-1 (Old Plant)	MEA (New Plant)	H3-1 (New Plant)
Total Capital Cost	237	220	237	220
Operating Cost	117	97	86	76
Utilities Cost	91	73	63	54
Annual Cost (total)	166	143	136	122
CO ₂ Capture Cost, per ton	46	40	38	34
CO ₂ Avoidance Cost, per ton	67	52	48	41
Rate Increase	0.058	0.046	0.042	0.036

Optioneering to accelerate attainment of economic feasibility

SAF & Green Diesel Processing

Reduce risks in transitioning to bio-feed/co-feed processes.

- Eliminate operational risks while replacing or integrating bio-based feedstocks into new and existing processes using advanced molecule-based reactor simulation technology.
- Characterize real-world bio-feed stream with mono-/di-/tri-glycerides, free fatty acids, S, N and more.
- Accurately predict product yields and properties by simulating reactor operations processing pure bio-feed as well as a mixture of conventional hydrocarbon feed and bio-feed.
- Enable accurate reporting by rigorously tracking renewable components in final products.
- Reduce time and effort in building accurate bio-feed and co-feed reactor simulation using off-the-shelf reactor templates for Hydrodeoxygenation (HDO) bed (for pure bio-feed), dewaxing reactors (Hydro-isomerization) and co-feed Hydroprocessing bed.

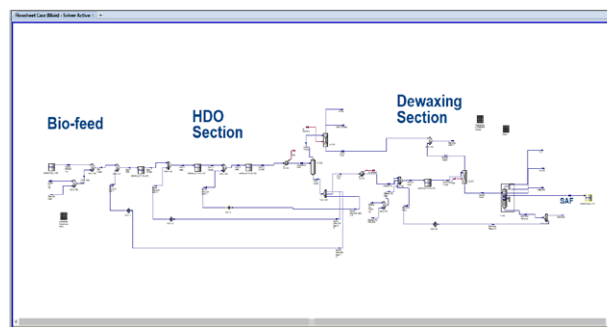
“The molecule-based reactor simulation technology in Aspen HYSYS® is very useful for TotalEnergies’ R&D services. It has helped us get better representation of feed and better calculation of product properties.”

— Head of R&D Service, TotalEnergies.



- Reduce operational risks
- Ensure quality
- Streamline reporting

[Learn More](#)



Helped achieve
5% green diesel
blend



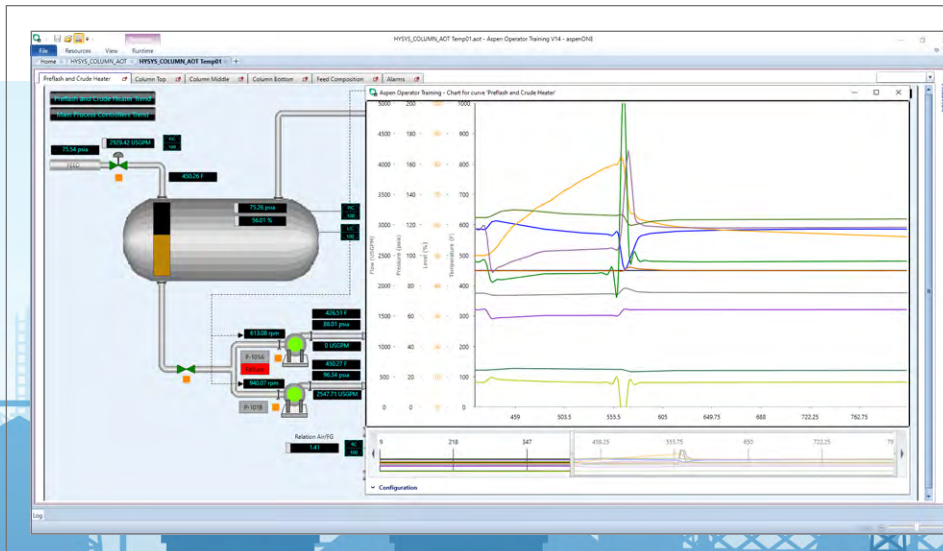
Dynamic Simulation & OTS

Intuitive dynamic modeling across the entire lifecycle.

- Reduce operational risks and costs by confidently designing and analyzing transient process conditions using industry-trusted dynamic simulation.
- Ensure operator competency by deploying operator training simulator (OTS) solutions early using trusted and accurate dynamic simulation, across the full asset lifecycle.
- Optimize compressor operations with the accuracy of advanced models and the convenience provided by built-in dynamic compressor templates.
- Reduce engineering time and effort by easily converting steady-state process simulation models to dynamic simulation models entirely within Aspen HYSYS.

- Mitigate potential failures
- Eliminate delays and expedite operations using OTS solution
- Optimize process by evaluating control schemes

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Reduced start-up time
by **40%**, saving **\$20M**



Gained **\$16M/Yr.**
from improved
oil & gas production



Operational Decision Support with Online Simulation Models

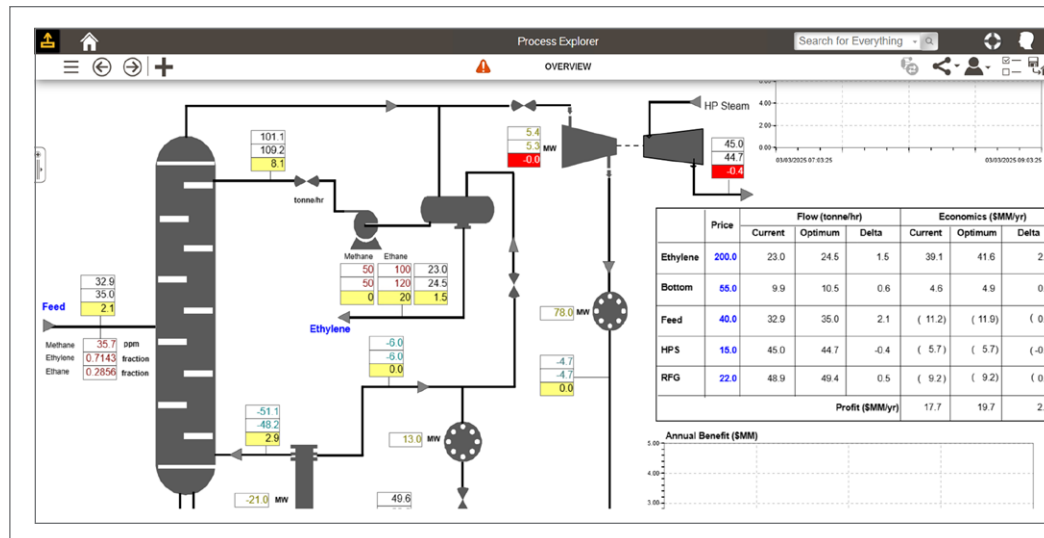
Predictive models for operational insight.

- Increase throughput and operating efficiency with data-driven decisions enabled by calibrated predictive models in an operator-friendly interface.
- Gain real-time operational insights into key equipment operations, plant-wide emissions, fouling of heat exchanger trains and more, by linking simulation models to conditioned real-time plant data.
- Make better operating decisions by monitoring real-time performance for key equipment, such as reactors, distillation columns, rotating equipment, heat exchangers and more with real-time operational insights from online simulation models communicated through intuitive web-based dashboards. Alternatively, enable users of any skill level to access insights from Aspen HYSYS through Microsoft Excel-based interfaces, with the integration between Aspen HYSYS and Aspen Simulation Workbook.

- Streamline deployment of online simulation models by connecting and validating models with a plant historian and/or lab data without leaving the Aspen HYSYS simulation environment.

- Better equipment operating decisions
- Optimize production through operational insights
- Monitor performance in real-time

[Learn More](#)



Increased condensate
yield by
>630 BPD



Gained **\$0.5/bbl**
from improved
CDU operations





Conclusion

Aspen HYSYS is the market-leading process simulator, built on decades of experience and feedback from top oil & gas and EPC companies. It is an integrated process modeling tool that combines economics, energy, safety and emissions analysis to deliver value across an asset's entire lifecycle.

Leveraging recent innovations in AspenTech simulators—combining data and machine learning with first principles fundamentals—users can create models that closely represent real plant behavior.

These accurate, high-fidelity models help organizations accelerate time-to-market for new processes and improve equipment and process efficiency for existing processes, all while enhancing sustainability .

Visit aspentech.com/Aspen HYSYS to learn more.





About Aspen Technology

Aspen Technology, now part of Emerson, is a global software leader helping industries at the forefront of the world's dual challenge meet the increasing demand for resources from a rapidly growing population in a profitable and sustainable manner. AspenTech solutions address complex environments where it is critical to optimize the asset design, operation and maintenance lifecycle. Through our unique combination of deep domain expertise and innovation, customers in asset-intensive industries can run their assets safer, greener, longer and faster to improve their operational excellence.

[aspentech.com](https://www.aspentech.com)

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