

A detailed view of an industrial heat exchanger system. The main component is a large, horizontal, cylindrical vessel with a circular access door on the right side, secured with numerous bolts. It is surrounded by a complex network of white pipes, some with red handwheels for valves. The background shows a clear blue sky and parts of an industrial structure with blue and red metal railings.

Interview with an Expert

Optimizing Heat Exchanger Design and Performance from a Single Platform



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Wafa Said-Ibrahim is a Principal Solution Consultant at AspenTech, specializing in process engineering and process simulation. With over 40 years of experience in the process industry, she has worked mainly in the Oil and Gas sector in a variety of roles.

She has been with AspenTech for over 20 years, providing customer support and solution consulting for process simulation and heat exchanger sizing software, helping major oil and gas and EPC companies across North America.

Wafa holds a degree in Chemical Engineering from the University of Baghdad. Currently residing in Canada, she is a licensed engineer in Canada and a member of the Association of Professional Engineers and Geoscientists of Alberta (APEGA).

In this interview, Wafa Said-Ibrahim explains the advantages of Aspen Exchanger Design & Rating (EDR)[™] software designed to help customers model optimal heat exchangers. Leveraging a fully integrated platform, engineers and operators are able to run the full gamut of design, rating and simulation of all major types of heat exchangers used in the process industry. Wafa currently works with many industry leaders in designing their assets to run to the full limits of performance.

As an expert in Aspen EDR software, can you explain what this heat exchanger design software does?

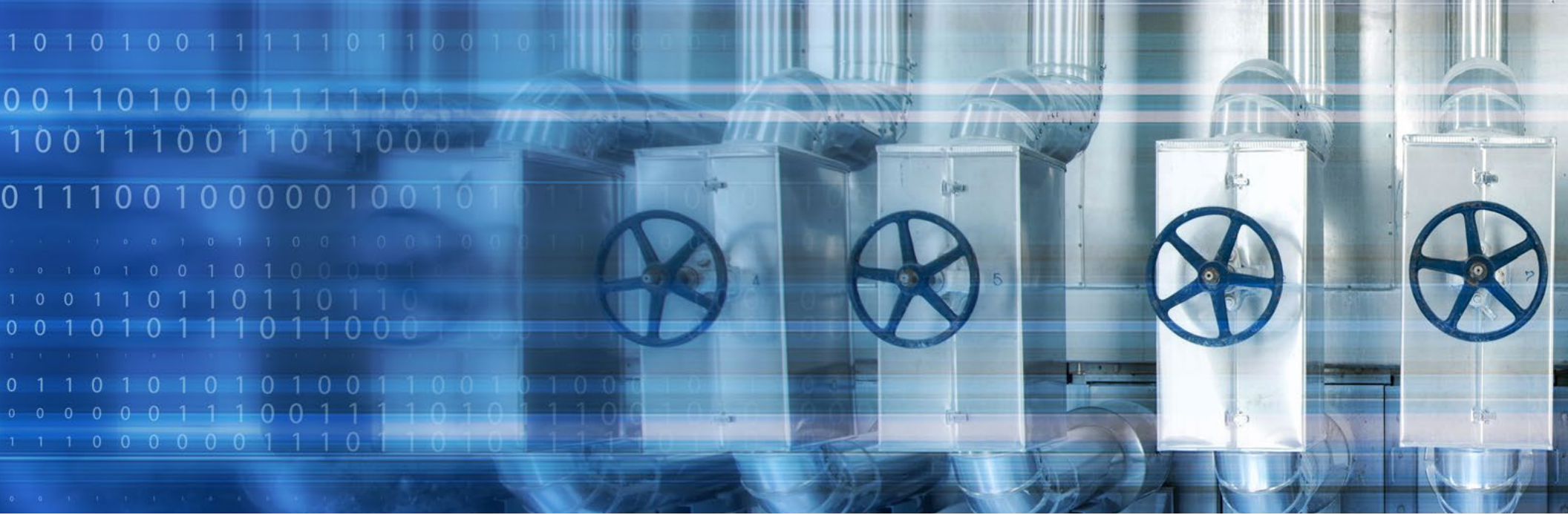
Optimal heat exchanger design software is vital for designing and improving the energy efficiency of any process plant. To that end, AspenTech offers Aspen Exchanger Design & Rating[™], or Aspen EDR. The Aspen EDR software is used to rigorously design, rate and simulate the performance of heat exchangers deployed in the process industry using “first principles” and detailed thermodynamic properties of the process fluids. These models can be integrated with industry-leading process simulation tools such as Aspen HYSYS[®] and Aspen Plus[®], and thermodynamics using Aspen Properties[®], to understand the impact of the heat exchanger’s performance on the broader process.

What types of heat exchangers can Aspen EDR model?

Aspen EDR can model all major types of heat exchangers used across the process industry, including Shell & Tube Exchangers (S&T); air coolers and heat recovery systems; fired heaters; plate exchangers; cold-box heat exchangers like brazed aluminum and plate-fin heat exchangers; and coil-wound heat exchangers. Among S&T exchangers, it can model all types of TEMA (Tubular Exchangers Manufacturers Association) heat exchangers such as thermosiphon reboilers, kettle reboilers and others; as well as non-TEMA types like double pipe HX and multi-hairpin HX.

What value does Aspen EDR bring to customers?

- The Aspen EDR suite enables rigorous design, rating and simulation of all major types of heat exchangers used in the process industry.



- Design calculations can be done for S&T Exchangers using TEMA, ASME BPVC Section VIII and other major international standards. The software is regularly updated to ensure that it reflects the latest updates made to these design standards.
- The unique bi-directional integration between the thermal and mechanical designs of S&T heat exchangers is exceptional, as it enables engineers to develop the most optimal heat exchanger design in record time. Users can transfer their thermal design to the mechanical design platform at the click of a button, without leaving the software environment. In addition to saving design time, it helps avoid design errors by eliminating the need for manual data transfer.
- Our S&T mechanical design software helps optimize the design of all mechanical components, producing detailed code calculations, customized cost estimates, a detailed drawing package, and a complete bill of materials. It's well-trusted by the industry and is based on international standards.
- Seamless integration with industry-leading simulators such as Aspen Plus and Aspen HYSYS saves engineering teams considerable time and effort, while significantly improving heat exchanger design and fidelity of the broader process simulation, by enabling them to rigorously design and simulate heat exchangers within the context of the broader process.
- The thermodynamics and property packages in Aspen EDR use the reliable, industry-standard Aspen Properties and Aspen HYSYS databases. The proprietary theoretical models and correlations employed by Aspen EDR for its calculations are based on more than 40 years of in-house research.



- The Aspen EDR solution provides value to companies across a wide range of industries, such as upstream oil & gas production, LNG plants, refineries, chemical industries, EPCs, technology licensors, equipment manufacturers, and others. They are used in design as well as in supporting operations.
- With the increasing interest in the LNG industry, especially its role in energy transition, the design and simulation of the highly energy-intrinsic LNG liquefaction process is critical. The ability of Aspen EDR to rigorously simulate cryogenic heat exchangers used in the liquefaction process, such as plate fin and coil-wound heat exchangers, is of enormous value to our customers and differentiates our solution from the competition. This capability includes rigorously simulating brazed aluminum and other types of plate fin heat exchangers. Many companies across the world have derived substantial value from these solutions, including leading manufacturers of plate fin heat exchangers in the USA.
- Another major advantage, especially for the majority of our customers who subscribe to the entire performance engineering solution suite, is that our commercial model provides our users not only with access to the complete heat exchanger design and rating solution suite, but also to all of the engineering programs. These include solutions for process simulation, energy analysis, cost estimation, 3D layout design, datasheet generation and more.
- Many leading heat exchanger manufacturers around the world use Aspen EDR because of its reliability, which is among the best in the market. Our clientele spans the engineering value chain, including major EPC industries, owner operators and major heat exchanger manufacturers. Heat exchanger manufacturers in the US, Canada, Europe and Asia have been deriving significant value from EDR for decades.

What benefits do users gain from the integration of Aspen EDR with Aspen HYSYS & Aspen Plus?

The integration enables users to rigorously design heat exchangers with Aspen Plus or Aspen HYSYS simulations. This allows engineers to arrive at the most optimal design by understanding heat exchanger performance for multiple scenarios and impact on the overall process. It also enables them to develop operational strategies, and to better understand how to safely operate the plant without compromising on production requirements. This results in significant engineering time savings and avoids the design errors that may occur during manual data transfer.

The integration enhances the fidelity of the process simulation models developed using Aspen Plus or Aspen HYSYS, for several reasons:

- It makes it possible to automatically design heat exchangers with minimal geometry inputs from within Aspen HYSYS or Aspen Plus.
- Process data and property data are updated automatically between the rest of the process flowsheet and the heat exchanger models.
- The thermal and hydraulic calculations are very accurate, since they are based on detailed heat exchanger geometry. The theoretical models and correlations used by Aspen EDR are based on decades of experimental research.
- Most importantly, this integration allows identification of heat exchanger operational issues, such as vibrational and erosional issues, early in the design stage by flagging them in the simulator software.
- Users can access detailed heat exchanger (EDR) plots and thermal profiles within Aspen HYSYS and Aspen Plus, in addition to tools that enable model analysis, such as sensitivity studies, etc.

I hear from many of my clients who use the integrated EDR models in the Aspen HYSYS or Aspen Plus flowsheet that they have significantly reduced risk when implementing operational changes, due to their ability to simulate potential changes before actually implementing them in the plant—essentially doing a “what if” analysis.





How does the integrated Aspen EDR-Aspen HYSYS offering compare to competitive solutions?

We know that some of our competitors' software is severely challenged when working with process simulators. One of my clients, a major US-based oil & gas company, showed me how with the Aspen EDR-Aspen HYSYS integration, they were able to simulate the rigorous HX model within the process flowsheet with just a few clicks and in a few minutes. He then showed me the same workflow with our competitor's heat exchanger design software that had a very cumbersome connection via CAPE-OPEN standards and took a long time to solve. This integration has definitely been game-changing for the industry.

What kind of scientific research forms the basis for Aspen EDR, and are those research findings available to customers?

The proprietary theoretical models and correlations used in Aspen EDR are based on 40 years of in-house research. An extensive library that documents the findings from decades of this research is available to all users of Aspen EDR from within the software. This includes over 1200 research papers, over 40 design reports and the HTFS handbook, which is a comprehensive reference to heat exchanger theory and practice. AspenTech additionally maintains ties with a number of research universities to continually solve new challenges in heat exchanger operations and design.

Does Aspen EDR help with estimating the cost of heat exchangers?

Yes, Aspen EDR has a built-in cost estimation capability which considers all aspects of the heat exchanger fabrication process and is very valuable to our customers. Cost calculation is performed after the program calculates the geometry of each component of the heat exchanger. Aspen S&T Mechanical performs detailed mechanical design, through which accurate material costs and relevant fabrication factors are applied to provide accurate costing. Cost estimation is also available for other heat exchanger types like air coolers. It is especially useful when comparing the costs of alternative designs. The costing database is updated on a yearly basis.

As I mentioned above, in addition to the geometrical details, the program uses material costs and labor cost rates. Since these data points vary from fabricator to fabricator, Aspen EDR allows users to update material costs and labor rates to suit their specific requirements.

Can you give us some examples of how Aspen EDR has helped clients?

I have witnessed umpteen cases where my clients have benefited from using Aspen EDR.

- A major EPC client based in the US was able to obtain competitive quotes from multiple vendors for an air cooler for one of its projects, because it was better informed through the cost estimation capabilities in Aspen EDR as well as the ability to rigorously check designs from multiple vendors. This resulted in substantial savings.
- Leveraging the design rigor of Aspen EDR, especially the integrated thermal and mechanical design of the heat exchanger, a major chemicals manufacturer in Canada was able to call out a vendor who proposed an oversized S&T heat exchanger, providing the company with significant cost savings.
- A senior process engineer at a major global EPC company told me how the seamless integration between Aspen EDR and Aspen HYSYS made a considerable difference to their engineering workflow, and that with this integration, the standing of EDR has soared with respect to our competitors. This is feedback I hear repeatedly from process engineers across the industry.
- I distinctly remember one of my clients, a well-known heat exchanger design specialist with decades of experience at one of the largest EPC companies, commenting on how the heat transfer calculations for a vacuum vertical thermosyphon reboiler used by Aspen EDR were far more accurate than any other software on the market.
- I have heard from several of my heat exchanger fabricator clients in Canada and the US who manufacture plate-fin, air cooled and S&T heat exchangers, that they have gained substantial value from both the thermal and mechanical designs of heat exchangers using Aspen EDR.

These are just a few examples of the many times I have observed our clients reap significant value from our solution. On a personal level, it is tremendously rewarding to be able to help our customers with powerful tools like Aspen EDR.

—Wafa Said-Ibrahim



About Aspen Technology

Aspen Technology, Inc. (NASDAQ: AZPN) 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 life-cycle. 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.

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