Transformation of Process Engineering – Innovations and Best Practices

An Industry White Paper

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Executive Summary

AspenTech process simulators Aspen Plus® and Aspen HYSYS® were first introduced to the market in the early 1980s. Beginning with that original modeling breakthrough, process engineering has undergone significant transformation over the years, catalyzed by advances and innovation in software both within individual disciplines and also in the integration across the workflow. This continuous evolution has created tremendous value for many companies, resulting in capital and energy savings, increased safety and reliability, and optimized designs with dramatic improvements in engineering quality and productivity.

This paper outlines specific innovations and best practices, highlights examples of recent successes in the industry, and examines new innovations, presenting additional opportunities for change in process engineering practice. The examples presented here span the asset creation lifecycle including R&D, early feasibility studies, conceptual engineering, basic engineering, equipment design, economic evaluation, energy management, debottlenecking and continuous improvement, and engineering support to manufacturing and planning.

A common aspect of all these examples is the huge impact cross-discipline integration of modeling tools has on the selection of the best design options, the overall quality of the designs, and the safe and profitable operation of process plants. The ability to achieve superior energy and environmental performance while at the same time saving both capital and operating expense would not be possible without the capability of the models to analyze many alternative solutions rapidly and present design and cost tradeoffs to decision makers. This is critical as companies across the globe are facing an increasingly interconnected and highly competitive environment.

This paper highlights how owner-operators, E&C companies and technology licensors can take advantage of the latest software tools and innovations from AspenTech to gain a competitive advantage in the rapidly evolving global marketplace.¹

The Process Optimization Opportunity

Process engineering plays a critical role across the entire asset lifecycle—during development, design, construction, debottlenecking and operations. At the front end, process engineering decisions determine and constrain the ultimate economics of a facility (see Figure 1). In operations, process engineering decisions solve throughput, yield, regulatory and performance issues. Given their highly varied role, process engineers benefit from interactions with other engineering and operational functions and disciplines on a daily basis. The exchange of ideas, recommendations, designs, analyses, plant data and process models of various kinds support optimizing increasingly complex designs and operations. By considering a broader range of ideas, companies are able to achieve improved asset performance, reduced costs, and increased safety and reliability.

Unfortunately, within many organizations, communication between engineering disciplines and with other functions is manual, sequential and inefficient. Organizational “silos” hold the expertise and data of each individual group and discipline largely within the group, shared with other groups only after a design is “released,” or on a case-by-case basis when it is important. Understanding of the current state of the asset and opportunities for improvement are not consistently shared and executed across the groups. This leads to significant loss of opportunities since ideas developed in one group are not fully exploited by other groups. Furthermore, the sequential nature of the interactions between engineering groups limits the screening of multiple alternatives during design and manufacturing and leads to suboptimal choices.

This sequential workflow results in a significant loss of opportunity in capital, energy and operating costs, and in improving safety and reliability, which AspenTech estimates amounts to approximately $100 billion per year in lost value (see Figure 2). Improving on this information sharing and workflow presents a compelling opportunity in helping asset owners and engineering companies to actualize the lost opportunity through a clear understanding of current asset performance and identification of optimum improvement opportunities which can be consistently executed across the lifecycle. Let’s examine the journey of process engineering over the last three decades and the exciting innovations driving its evolution.

Figure 2. Process Optimization represents a $100 billion opportunity for process manufacturers around the world.

Impact of the Desktop Revolution in 1980s and 1990s

Following the introduction of chemical process simulators such as Aspen Plus and Aspen HYSYS, personal computer (PC) price/performance was the next major breakthrough. This had a dramatic impact on process engineering practice — it lowered the barrier-to-entry to automate engineering calculations and democratized the ability to model and analyze an asset through process simulation and modeling. The steady increase of PC power to solve bigger and bigger simulation models quickly moved the simulators from mainframes to each engineer’s PC. In parallel, the evolving Microsoft Windows® user environment spurred an evolution in ease of use of the models with graphical user interfaces, making them more accessible to a broader range of chemical engineers.

BASF, which ran the Aspen Plus simulator on dedicated Cray supercomputers in the early 1990s, was able to completely transition to a PC-based environment by the late 90s and early 2000. BASF believes that their net benefits from the broad use of process simulation, in a comprehensive way, have been between 10 and 30% of installed capital cost of projects.5

This accessibility has enabled process engineers working on plant problems to quickly establish the understanding of the current asset performance and rapidly consider improvement opportunities through modeling of ‘what-if’ scenarios. Expanded access to plant data and to manufacturing and planning tools helps process engineers translate improvement ideas into real benefits for the asset owners. In parallel, Desktop environments also made engineering design, cost estimation and analysis tools widely available and easier to adopt, enabling greater opportunities for idea creation and collaboration across disciplines and ultimately improved performance and increased productivity.

However, AspenTech has observed that despite all of these democratizing trends, a relatively small population of expert users still constitute the group taking the most advantage of these powerful modeling capabilities. To break through this barrier, AspenTech conducted extensive usability studies and has introduced radically new user interface concepts into several of its modeling tools (such as Aspen Plus) and is continuing to do so across its full suite of engineering optimization products. Of this breakthrough user environment, BP Chemicals’ Dr. Godwin Tongo reports: “The new version (V7.3.2) of Aspen Plus has provided us with a big leap in flexibility and ease of use. Overall, this new version of Aspen Plus offers many new features to enhance and optimize our engineering productivity.”5

Evolution of user interface and workflow paradigms has continued to accelerate, catalyzed by Apple’s iPad®, Web 2.0 and the Microsoft Office 2007/2010 approach. AspenTech is embracing these as a further opportunity to innovate the user experience, making process

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models much easier for a new generation of chemical engineers to learn and use and promoting the collaboration between engineering disciplines during process engineering as mentioned above. For instance, AspenTech introduced a “mobile properties” application in 2011 that provides a subset of the Aspen Properties® capabilities on the iPod®, iPhone® and iPad platforms (see Figure 3).

Convergence of Modeling Approaches

Another related area of improvement (pioneered by AspenTech) involved the convergence of steady state modeling with dynamic modeling tools and the integration of sequential modeling with equation-oriented solution approaches. This has great significance, with the time-consuming efforts to build dynamic models and equation-oriented models for a complex process being overcome through building models first in the steady state mode and then re-using and building on them. The ability to model processes dynamically is required to address the increasing complexity of safety, start-up and quality challenges in highly optimized, large and integrated process plants, as well as for effective modeling of sequential batch units within process plants. A recent example which demonstrates the power of this approach is the use of dynamic modeling together with relief system analysis involving Aspen HYSYS® steady-state, Aspen HYSYS Dynamics and Aspen Flare System Analyzer for more accurate relief load and flare system analysis with potential savings in capital costs.6

Physical Properties as an Example of Innovation in Process Optimization

Web and software evolution has enabled several areas of core chemical engineering innovation that provide the foundation for process modeling and optimization. Such innovations have been an integral ingredient for achieving optimization benefits. An important example of innovation is the new tools introduced by AspenTech that make the largest set of thermo-physical properties accessible with more accuracy to modelers. The example of a close boiling distillation column (see Figure 4) provides a clear picture of the value of better thermo-physical property characterization.

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A 5% error in vapor liquid equilibrium predictions can result in 100% error in capital cost estimation for the distillation column, a major capital item. Accurate physical properties, therefore, are a key input parameter for achieving results with process modeling and optimization and for reducing project capital and technical risk.

Availability of physical properties data has always been a challenge in developing a new process or a new equipment design. Traditionally (and still today in many organizations), obtaining the physical property parameters requires researching the literature or purchasing services from a lab to carry out the necessary experiments. There are established laboratories and agencies that provide contract services today to develop such data. Such an exercise, however, results in weeks of delay and potentially additional expense in obtaining the property data.

Recent breakthroughs in physical properties software enables owner operators and engineering companies to obtain such data from within the process modeling environment. Aspen Properties, serving both Aspen Plus and Aspen HYSYS simulation software, has dramatically expanded its capabilities to cover over 4 million experimental data points, 30,000 binary pairs of compounds and 24,000 pure components. More are added every day. This enables users of AspenTech simulators to readily obtain the experimental data inside the process simulation environment in a matter of minutes at no extra cost (see Figure 5).

Figure 5. Expanded properties database dramatically reduces the time to develop physical properties from weeks to minutes.

Experimental data on demand
- Over 4 million data points
- Over 24,000 pure components
- Over 30,000 component pairs

Minutes to Find & Fit Data
Furthermore, a user can access newly introduced easy-to-use tools that use the experimental data to fit parameters of the physical property models in Aspen Plus. This ensures close agreement between the model and the data, thus yielding reliable simulations of the new process or equipment. This has dramatically reduced the time to acquire reliable property data—from weeks to minutes. The new Aspen Plus (V7.3.2 and higher) has additionally simplified access to these physical properties capabilities by streamlining the workflow and separating the properties tasks from the modeling environment. Innovations in this area continue to accelerate engineering efficiency while improving the accuracy and reliability of model predictions and equipment sizing.

New optimization algorithms have continued to expand the scope and impact of process optimization. Improved analysis and visualization tools help engineers understand complex phenomenon, enabling the development of more efficient processes. Continued focus on these innovations will be critical for value creation through process optimization.

**Optimizing Conceptual Engineering in More Dimensions through Collaboration**

In addition to innovations in process engineering, another aspect that is critical for value creation is collaboration among groups and disciplines to consider cost and energy parameters in the designs. Figure 6 shows traditional workflow for Conceptual Engineering today. During Conceptual Engineering, the main objective is to screen multiple design alternatives to ensure that an optimum design has been selected. A process engineer typically develops these alternatives using a process simulation tool. The most promising alternatives are then passed on to equipment (e.g., heat exchanger) specialists to size and design the equipment. The equipment specialist develops preliminary equipment designs and passes these to cost estimators to estimate the total cost of the alternative. This sequence of tasks may take several days or even weeks to complete. The sequential nature of the workflow slows down the overall process and limits the number of design alternatives that can be evaluated in the short window of opportunity available for conceptual engineering. One consequence is that economics and adequate heat exchanger options are not rigorously considered early enough. The result is sub-optimal designs and lost opportunities.

![Figure 6. Traditional approach to conceptual engineering is sequential and time consuming.](image-url)
Figure 7 shows an integrated Conceptual Engineering workflow using aspenONE® Engineering. The integrated approach provides access to equipment modeling, sizing and economic analysis capabilities inside the simulation environment simultaneously in a manner that a process engineer can use without being a specialist in design and costing. This enables the process engineer to quickly screen multiple alternatives using economic analysis. The approach also enables the process engineer to easily identify any critical equipment bottlenecks (such as a pressure drop constraint) inside the simulation environment. Figure 8 provides a more detailed view of the workflow that is available for both Aspen Plus and Aspen HYSYS users today. This integrated approach allows the process engineer to rapidly screen multiple alternatives in a matter of hours instead of days or weeks. The selected alternatives can always be reviewed and confirmed with equipment experts and cost estimators. They receive the preliminary estimates and designs electronically, thereby speeding up their workflows with a better starting point. This approach saves 10-30% capital and energy compared to the traditional approach due to the ability to screen multiple alternatives rapidly and optimize designs early.

Figure 8. The tight integration of design and costing software with process simulation eliminates costly manual iterations and promotes more optimal designs.
Dow Chemical has reported savings of $65 million using an integrated simulation and equipment modeling approach using Aspen Plus together with Aspen Shell & Tube Exchanger software tools in an integrated fashion. The approach enabled identification of a debottlenecking opportunity in a chemical process while diagnosing and fixing a specific operational problem. Kuwait Oil reported saving 60% of the total costs on an 8-figure capital project through an integrated approach using Aspen HYSYS together with Aspen Process Economic Analyzer. This approach helped Kuwait Oil screen alternatives reliably and quickly in their revamp project and examine project costs in their totality early in the feasibility study.

aspenONE Engineering also enables energy analysis directly from within the simulation model so that promising conceptual options for energy saving can be identified during process design (see Figure 9). Energy analysis combined with equipment and cost analysis enables process engineers to quickly identify the most promising options within their familiar process simulation user environment using Aspen Plus or Aspen HYSYS. Huntsman Chemicals reported reduction of 25% in energy intensity by using the integrated conceptual engineering approach using Aspen Plus simulation together with energy and equipment analysis. Honam Petrochemicals reported energy savings of 17.5% using the integrated conceptual engineering approach. S-Oil reported savings of $39 million with payback of less than one year using the integrated approach.

Figure 9. aspenONE Engineering enables energy and CO2 analysis from within the process simulation environment.

Another recent innovation from AspenTech enables rapid evaluation of CO2 and Greenhouse Gas emissions from within Aspen Plus and Aspen HYSYS for any process model scenario. These accounting reports, based on US EPA and EEC certified calculation methods, account for both direct emissions created by the process conditions as well as the indirect emissions attributable to the shared utility sources used by the process, and go a long way towards evaluating the total carbon footprint of a designed process.

Conceptual Modeling’s Next Step: Process Modeling “In a Box”

One of the factors that slows down the conceptual design stage of engineering is the practice of recreating commonly used processes in every project. This is especially pronounced in fields where process configurations are quite well defined and have limited number of combinations. Innovation has been applied in this area in several ways. AspenTech has recently introduced an upstream oil and gas model-in-a-box approach, marketed as Aspen Conceptual Design Builder (CDB). This menu-driven application takes advantage of the well-defined nature of oilfield production systems, incorporating such commonly applied process sections as compression and multi-stage separation, to rapidly model production facilities such as Gas-Oil Separation Plants (GOSPs). After selecting a simple set of design parameters, the CDB application automatically creates a Aspen HYSYS flowsheet model and can calculate the proposed process’ capital costs to a level suitable for screening multiple conceptual designs. This provides speed and accuracy for facilities modeling and cost estimation during the asset appraisal, development, and conceptual design phase.

Another approach is to build up libraries of re-usable “process fragments”, or sections of plants, consisting of process models and associated economic calculations, using reusable model “templates.” DSM has taken this approach, building up libraries comprised of Aspen Plus and Aspen Process Economic Analyzer economic models that were taken from early feasibility studies performed for various business units over time. These libraries have proved to speed up the feasibility study timetables, increase confidence in process scope very early in the design, facilitate powerful what-if analysis, and in sum increased executive confidence in the use of this approach for technical and business analysis.

Optimizing Basic Engineering and Front End Engineering Design (FEED)

Basic engineering is a pivotal stage in a process design from concept to an approved project. By the end of basic engineering (or FEED or FEL) most of the major decisions have been made that pre-determine the overall cost of building a facility and its operating costs. It is therefore critical to maintain as much flexibility as possible during FEED to consider different aspects of the design and make changes quickly and accurately during this process.

Design alternatives selected during conceptual engineering provide the basis for basic engineering in which the process design gets further defined in the form of equipment selection, definition, control schemes and cost estimates, with the objective of making a decision as to project go-ahead (the so-called Authorization for Expenditure or “AFE”). The basic engineering activity culminates in the FEED package, consisting of process deliverables such as Process Flow Diagrams (PFD), equipment lists and data sheets, safety and hazard analysis, and FEED level cost estimates. Multiple engineering disciplines contribute to basic engineering activity in a significantly larger team than the conceptual engineering phase. Several challenges are typically encountered during basic engineering such as:

1. **Inefficient Estimation Process:** FEED estimates are dependent on accurate definition of scope. This relies on the information provided by all the engineering disciplines such as a sized equipment list, civil, structural, piping, electrical and controls. There are several key bottlenecks in preparing the first estimate, including process engineering changes to scope and sizing and rating tasks (see Figure 10). The interactions between estimating and other engineering disciplines means that it takes months to develop a FEED level cost estimate for a significantly sized project. Often considerable estimating effort is wasted on aspects of the design with minimal impact on the overall cost.

2. **Collaboration Barriers:** Engineers from different disciplines and in different locations need to coordinate their activities in developing the FEED package. Any change in the design basis needs to be rapidly visible to all project team members and incorporated in each design activity and deliverable. Multiple spreadsheets and databases result in inefficiencies in the change-control process, increased data quality checking effort and additional inefficiency in the overall design activity due to increased rework.

3. **Repeatability:** There are many elements of process designs that are re-used within a project or from project to project. This is especially true for technology licensors, but also for owner-operators who often repeat designs in oil and gas production and refining or produce a particular menu of chemical products.

4. **Rapid Loading of the Detailed Design Systems:** A key objective of FEED is to ‘front end load’ the design process. As detailed design teams increasingly move to the use of intelligent P&ID systems and to intelligent design databases, electronic loading of those systems offers the promise of significant productivity benefit to the typically large detailed design teams.

Innovations introduced by AspenTech have addressed these basic engineering challenges:
Efficient Estimation Process: aspenONE Engineering provides a single economic evaluation model to span feasibility study, conceptual, FEED, and post-AFE level estimates, following the estimate classes recommended by the Association for the Advancement of Cost Engineering International (AACEI) (see Figure 11). The underlying economic evaluation model developed during the conceptual engineering phase is fully reused and provides a starting point for the FEED level estimate using Aspen Capital Cost Estimator. The economic evaluation model is based on the “volumetric approach” since it sizes all the equipment, bulks and the associated civil and structural elements as if one was constructing the asset. This provides a reliable basis for the estimator who can then further refine the estimate by validating it with the different engineering discipline leaders. This approach is dramatically more efficient than the traditional sequential approach, enabling the estimator to generate estimates early and only rely on the discipline leads to review and confirm the details in the FEED level estimates (see Figure 12).

The volumetric approach also improves the accuracy of the estimation models from typical 40% to within 15% variability.

### AACEI Recommended Practice 18R-97

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<td>-10/3% to +3/15%</td>
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*Figure 11. A single economic evaluation model spans feasibility study to post-AFE level estimates.*
The estimation efficiency improvement is typically 3 to 5 times. PEMEX reports that use of the Aspen Economic Evaluation tools over the project lifecycle (a ten year period) has resulted in estimating accuracy that exceed industry benchmarks and are able to meet the stringent PEMEX capital project standards of 10% variability.\(^{13}\) ConocoPhillips reports improvement in estimation throughput by 40% and a dramatic reduction in estimate variability due to adoption of the aspenONE approach using Aspen Capital Cost Estimator.\(^{14}\) S&B Engineering reports 5:1 increase in estimation efficiency due to the adoption of the aspenONE approach.\(^{15}\)

*Increased collaboration during FEED:* Innovations introduced in Aspen Basic Engineering collaboration software over the past four years enable full visibility of the actual state of FEED design for all team members. A change in the design basis, for example, different ambient temperature or material of construction, will be consistently incorporated into all engineering views and all related deliverable documents through a central database. Aspen Basic Engineering provides an effective platform for collaboration across the groups so that companies can execute projects across the globe and also affords each engineering discipline to maintain control of the sharing and release of design. DuPont has reported savings of up to 50% in engineering time in developing a design package for their licensed technologies. Part of that has been through the ability to reuse designs. Another part is through the automation of information flow during the process design package (PDP) development, and a third part has been through the ability to use global design teams involving Kansas, the UK and India working on one collaborative database.\(^{16}\)

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Tracking Mega Projects: Capital projects that exceed $1 billion are often referred to as Mega Projects. Traditionally, for cost estimation and FEED deliverables, these projects are carved into smaller sub-projects due to size limitations of both engineering teams and limitations of the software tools (see Figure 13). Following that approach, it takes between six to twelve months to develop the cost estimate and up to three years for FEED due to interactions between the smaller sub-projects. Long duration in developing the packages results in inability to optimize across the sub-projects. Mega project capabilities have recently been introduced in aspenONE, enabling large scale and faster estimation and basic engineering. Customers are able to include the entire mega project as a single model and database while additionally providing enhanced tools to combine estimates produced by the subcontractor into one site-wide estimate. As a result, AspenTech customers like Dow Chemical have been able to reduce the time to develop cost estimates from 6-12 months to 1-3 months. Leading engineering and construction firms, technology licensors and owner operators have adopted mega project capabilities on several of the largest grassroots projects being designed and constructed this decade.

![Figure 13. aspenONE accelerates the development of FEED for billion-dollar mega projects.](image)

Communication between Designers and Suppliers

Another major lost opportunity and bottleneck on large projects is the inefficiencies involved in providing technical data and bid requirements to suppliers and fabricators, and the practice of re-typing information received from these same suppliers and fabricators.

This is an area where the process industry has badly lagged behind other manufacturing domains.

AspenTech has recently introduced a major innovation in this area. The newly introduced Microsoft Excel-based export-import facility creates fillable equipment and bulks lists (covering 450 equipment and bulk categories) that can be provided to the fabricator and supplier to fill in and return to the estimator team for automated loading into the estimating system. This new tool is forecast to save 10-20% time that is currently spent re-typing and checking this information.

Optimizing Engineering Support to Manufacturing and Planning

A significant part of process engineering in operating companies involves supporting manufacturing and supply chain activities to troubleshoot and optimize assets. One of the key challenges is that engineering, manufacturing and supply chain teams do not share a common understanding of the current state of the asset and opportunities for improvements (see Figure 14). As a result, initiatives to improve performance are often developed in silos and, in some cases, compete with each other. The process engineer’s focus is on understanding the process and predicting the performance of the process. However, this is not shared effectively with the stakeholders in manufacturing and supply chain. Communication tends to be ad-hoc through a variety of mechanisms, including emails, Excel spreadsheets, models, drawings and face-to-face meetings, among others. This prevents complete alignment across the key disciplines and, more importantly, results in lost opportunities for the asset owners.

aspenONE provides the ability to reuse a process model of the asset for what-if analysis, decision support and optimization of the asset (see Figure 15). A process model encapsulates knowledge of the asset and provides the ability to reliably predict asset behavior. aspenONE Engineering includes Aspen Simulation Workbook (ASW), an application that enables the manufacturing staff to work within the comfort zone of Microsoft Excel to analyze what-if scenarios. ASW easily links process models with Excel to enable operational decision support for the manufacturing staff. In addition, aspenONE Engineering provides real-time decision support and real-time optimization capabilities that utilize process models and reliably predict performance of the asset. Dow Chemical has reported cumulative benefits of more than $1 billion over a decade of implementing real-time optimization in their Olefin units. BP has reported 7% increase in production as a result of model-based asset optimization in one of their upstream assets, using Aspen HYSYS models.

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aspenONE Engineering also enables reuse of process modeling information into production planning. This ensures that the production plan is based on accurate information of the current state of the operation and can accurately predict the optimization potential. Saudi Aramco has been using a combination of Aspen HYSYS process models and Aspen PIMS-based production planning models — referred to as their Integrated Oil and Gas Model — to optimize their exploration and production assets. This model is used for daily optimization and for planning purposes. Saudi Aramco has reported benefits of 3-8% increase in production, 3-5% reduction in energy usage, and 50-70% reduction in planning time.23

There are several examples of integrated process modeling, operations, and production planning in petroleum refining. CEPSA has reported benefits of €20,000/day using an integrated solution including Aspen HYSYS Petroleum Refining and rigorous FCC reactor models.24 Leading refiners such as Sinopec, BP, and GS Caltex have reported similar benefits from the same integrated approach with process modeling.25

New Learning Paradigms

A large number of new engineers are joining the process industry. This new generation of engineers is rapidly changing the composition of the process industry workforce. There are huge challenges in transferring an organization’s intellectual property and knowledge that is tied up in sophisticated models to this new wave of engineers. AspenTech is introducing a broad portfolio of innovative approaches to support new styles of learning in the use of its products. Discussions with key users have highlighted that it is not only the use of software, the learning is also integrally tied up with becoming experienced in discipline practices, such as developing conceptual design, flare systems analysis, and capital project estimating, among others, and in effectively training organizations to use the integrated workflows correctly. AspenTech has recently introduced new online training content with each of its process engineering software products. These make use of a number of media, ranging from written documents and pre-recorded tutorials, to animated “viewlets” and more formal computer-based training modules.26


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Another recent innovation is the introduction of Aspen Search, the first intelligent search designed specifically for the process industries. Aspen Search works as an integral part of Aspen Plus and Aspen HYSYS and enables users to quickly identify an appropriate model available within the organization. This eliminates the need to develop a new model for every project, saving significant time. Users can also link models to plant data and visualize the real-time data, side by side the flowsheet inside the simulation environment. This promotes re-use of valuable intellectual property and effort encapsulated in proven models, thereby enhancing collaboration and enabling a faster approach to solving design and operational problems.27

Prize for Process Optimization Available Today – Now Faster and Easier

Figure 16 provides an overview of the integrated process engineering workflow that is supported by aspenONE Engineering today. A recent survey of 15 operating and E&C organizations shows that all of these organizations are currently adopting some aspects of an integrated workflow with the principal goal of improving engineering quality. A key finding has been that each organization’s business model is different, requiring flexibility to effectively support these different needs.28 AspenTech’s integrated process engineering workflow provides that flexibility.

![Common Models & Data](image)

**aspenONE Integration**

> Figure 16. aspenONE Engineering enables integrated Process Engineering.


The core of the workflow is process modeling (Aspen Plus and Aspen HYSYS), which provides the fundamental capability to understand and predict process behavior and optimize asset performance. Aspen Plus serves the needs of the chemical industry and provides additional modules for polymer and custom modeling. Aspen HYSYS is aimed at the energy industry and provides value-added modules for Petroleum Refining and Upstream Oil and Gas. As discussed earlier, Aspen Plus and Aspen HYSYS both have capabilities to integrate economic analysis (using Aspen Process Economic Analyzer) and detailed heat exchanger analysis (using Aspen Exchanger Design and Rating) inside the simulation environment.

In addition, both simulation products provide direct access to energy and flare system analysis. This helps screen the multiple conceptual design alternatives quickly and reliably, resulting in capital and operating cost savings. This level of integration gives process engineers today the capability to optimize process designs for energy use, environmental emissions, yield, profitability and use of capital. The business returns achieved by adopters of these approaches are significant and well documented.29

Furthermore, the results from steady-state models are seamlessly reused in the dynamic modeling environment for safety and controllability analysis. Conceptual designs from Aspen Plus and Aspen HYSYS are brought into the basic engineering environment with Aspen Basic Engineering and into estimating with Integrated Economics. The economic analysis developed during conceptual engineering can be reused to develop detailed cost estimates during the FEED stage with Aspen Capital Cost Estimator. In addition, Aspen Basic Engineering data can be brought into detailed engineering environments.

The models developed during the conceptual phase can be reused in manufacturing operations, providing off-line, real-time decision support and optimization. The same models can also support production planning activities as discussed earlier.

This integrated process engineering environment is available in aspenONE Engineering today. The overall benefits of adopting aspenONE Engineering are 10-30% capital and operating cost savings due to inherently better designs, 10-20% improvement in engineering quality, and 10-20% improvement in engineering efficiency. The integrated workflow enables process optimization and complements innovations in process engineering.

Process engineers play a key part in this workflow because of their understanding of the process. Their ability to model and optimize processes is at the core of the value creation from the entire integrated workflow throughout the asset lifecycle—from conceptual design to operations.

AspenTech continues to be the leader in process simulation and optimization with aspenONE Engineering. Figure 17 highlights the latest market share analysis conducted by ARC, a leading analyst in the process engineering area. The report indicates that AspenTech’s market share has grown from 32% to 39% from 2008 to 2010.

Opportunities Ahead

What are the big opportunities ahead for Process Engineering? New innovations will continue to broaden the scope for process optimization through new, more accurate models for physical properties, process equipment, and through new optimization innovations. Further integration will enable process modelers to have better vision in optimizing process schemas against more parameters including economics and sustainable operations. Current stand-alone design and analysis, such as equipment sizing, detailed column design and the like can be expected to be more closely brought into the simulation modeling world.

Advanced collaboration within the engineering tools combined with advances in engineering databases will open up opportunities to better integrate global teams. This journey is already beginning with the breakthrough process modeling search tool recently introduced by AspenTech.

New IT innovations such as social networking, mobile and cloud computing platforms, and search technologies will transform process engineering once again. Breakthroughs here can be expected to increase the access to process modeling tools, reduce the learning barrier, and make the optimization choices more visual and transparent. The new web and cloud innovations will integrate people in addition to facilitating integration of software applications. Process engineers will play an even more important role in this transformation due to the focus on understanding, modeling and optimization of processes.
About AspenTech

AspenTech is a leading supplier of software that optimizes process manufacturing—for energy, chemicals, pharmaceuticals, engineering and construction, and other industries that manufacture and produce products from a chemical process. With integrated aspenONE® solutions, process manufacturers can implement best practices for optimizing their engineering, manufacturing, and supply chain operations. As a result, AspenTech customers are better able to increase capacity, improve margins, reduce costs, and become more energy efficient. To see how the world’s leading process manufacturers rely on AspenTech to achieve their operational excellence goals, visit www.aspentech.com.