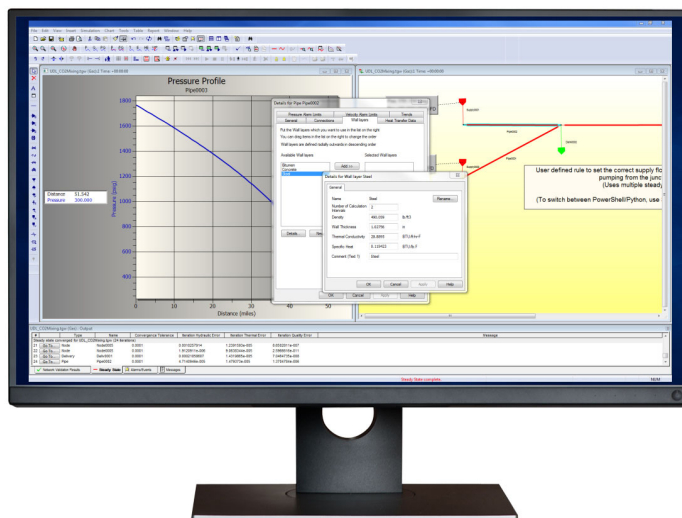


PipelineStudio™ Software

Steady-state and Transient Pipeline Network Simulator for Gas and Liquids



Emerson's PipelineStudio™ Software is a comprehensive yet intuitive tool for accurate offline pipeline management design, planning, and hydraulic analysis for gas and liquids operations.

Simplify the User Experience

- Quickly install software out-of-the box
- Develop configurations without consultation or extensive training
- Rapidly establish general purpose hydraulic simulation
- Easily configure pipelines with minimal mouse clicks
- Upskill with a familiar and intuitive graphical user interface (GUI)

Proactively Plan Networks

- Strategically design, route, and properly size pipeline networks
- Rapidly assess unscheduled changes in operation
- Accurately predict future capacity based on simulations generated from available data
- Effectively manage the line pack

Analyze Data Using Detailed Models

- Perform fuel consumption, flow assurance, surge, and survival time analyses
- Simulate upset conditions caused by equipment failure or a leak
- Run studies to determine the feasibility of installing a leak detection system
- Accurately model slack line flow conditions

Run Simulations Offline

- Run steady-state and transient simulations in a single software solution
- Run fully interactive or unattended simulations
- Eliminate costly delays to online production by running offline hydraulic simulations
- Create emergency and contingency plans without hindering the online system

Streamline Design & Day-To-Day Planning

Pipeline design can be a complex and time-consuming process for engineers that generally have limited time to learn, navigate, and transition between multiple software packages. Emerson’s powerful yet intuitive PipelineStudio Software is a complete engineering tool that allows users to efficiently design, plan and perform hydraulic analysis on natural gas and liquid pipeline networks. It provides quick and accurate steady-state and transient analysis of single-phase fluid flow in pipeline networks in a single software offering. Our intuitive and easy-to-use simulation software is a complete and powerful advanced engineering tool that provides accurate offline pipeline management design, planning, and hydraulic analysis for natural gas and liquids pipelines. The software simulates any dense phase, liquid phase, gas phase, and supercritical phase. This supercritical capability is growing in importance as anthropogenic CO₂ and hydrogen enriched natural gas are being used more frequently due to the expanding energy transition. PipelineStudio Software also offers an out-of-the-box solution that can be quickly implemented with no consultation project required, allowing users to design, route, and size pipeline networks quickly.

Engineers and planners have reliable and accurate information at their fingertips to make informed decisions, leading to improvements in pipeline design, performance, and throughput.

Quickly Upskill Users

PipelineStudio Software is designed to provide powerful capabilities with easy-to-use default settings, wizards, templates, and libraries. Operator training occurs offline in the faster-than-real-time environment, enabling participants to observe and learn from emergencies with no risk to life, equipment, or the environment. Our software incorporates an intuitive and comprehensive GUI that is familiar to all users of Microsoft® Office®. The GUI includes toolbars, a simple point-and-click interface, and Multiple Document Interface windows. Users can rapidly create pipeline models by dragging and dropping pipeline elements onto the Network View drawing pad. A validation process informs users if the model has missing data and guides them on how to correct any errors. Users can also create emergency and contingency plans offline without interrupting online production. PipelineStudio Software eliminates costly delays to online production by enabling engineers to design and simulate models offline.

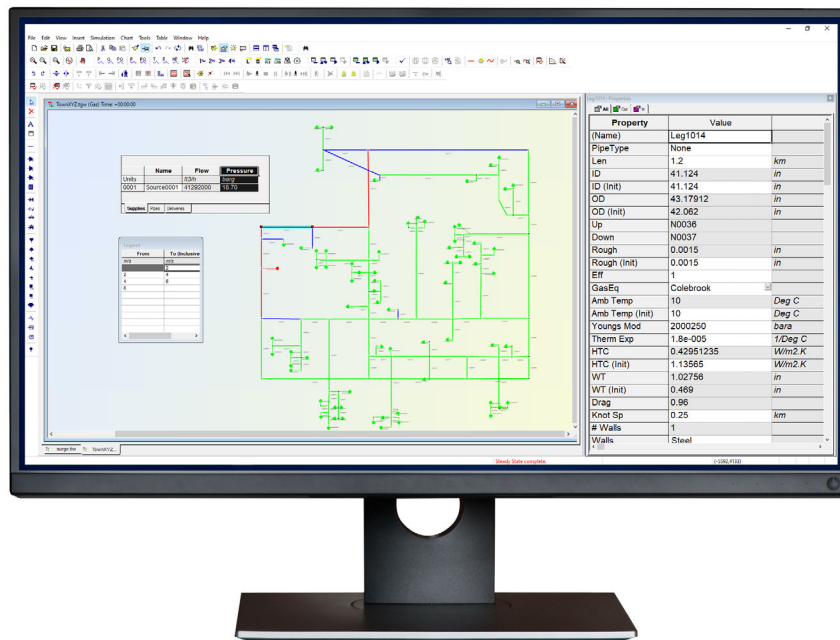


Figure 1: View all the properties of the entire pipeline network.

Reliably Predict Future Performance

With PipelineStudio Software, users can accurately and efficiently determine whether a network can meet increasing future demand with or without adding more equipment by performing deliverability analysis. Users can achieve optimal system performance by running offline simulations and creating emergency plans while production remains online. Our software incorporates the TNET simulation engine to simulate both the steady-state and transient behavior of single-phase fluid flow. Engineers can analyze pipeline deliverability, run simulations on tanks and pipeline surge, determine maximum throughput, and predict the impact of a leak on the environment without interrupting production. This analysis provides companies with the necessary insights to proactively manage nominations, schedule maintenance, model transmission and distribution networks, and accurately predict future capacity based on simulations run by PipelineStudio Software.

Integrate for a More Agile Modeling Environment

Simplify and streamline the modeling process by seamlessly integrating PipelineStudio Software with our PipelineManager™ Software that offers real-time transient modeling (RTTM). The result is an ultra-flexible working environment that gives engineers the agility to consume a real-time hydraulic state to initialize a simulation in PipelineManager Software with the option of generating a steady state for initializing pipeline modeling directly in PipelineStudio Software. To further drive synergies, engineers can leverage the option of sharing the same simulation technology between the two systems, allowing a live pipeline state to be used as the initial condition to run predictive simulations. This feature significantly enhances the user experience during any type of simulation that requires transient analysis, such as predictive modeling, surge studies, or transient capacity analysis.

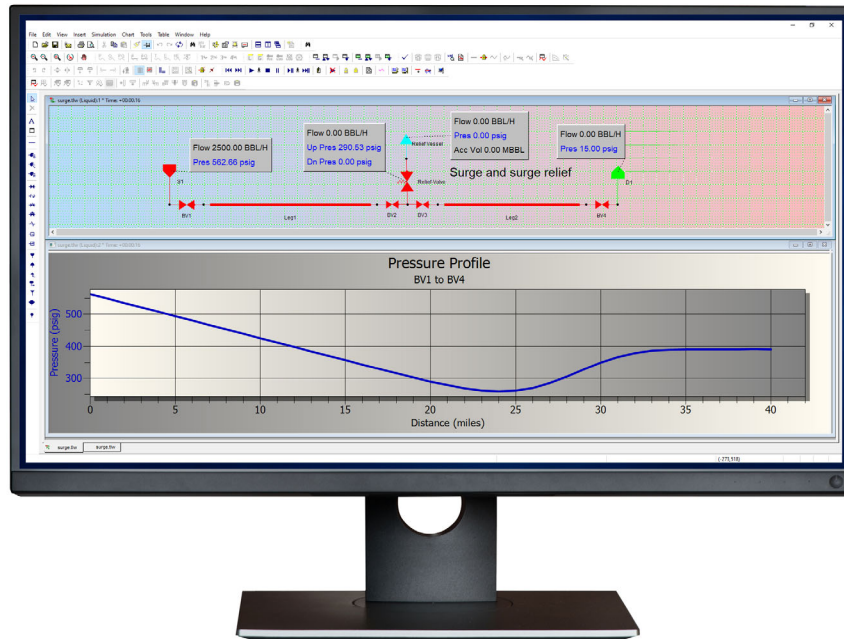


Figure 2: Run surge simulations to accurately determine surge relief.

Engineer Better Pipelines

Enable your engineers to go from zero to design in a single software offering. Our comprehensive yet flexible PipelineStudio Software enables engineers working at major oil companies, pipeline operating companies of all sizes, and consulting or engineering firms to mitigate risk with an all-in-one tool for engineering, planning, and designing pipelines. Engineers can design the entire pipeline network, run steady-state or transient simulations, make facility and pipeline decisions, simulate the impact of a leak, and much more in a cohesive and intuitive environment. PipelineStudio Software features a highly accurate and industry-proven slack line flow model and allows users to define alarm limits and reporting violations with location and value.

Design Your Entire Network

PipelineStudio Software can model both simple and complex pipeline networks. Users can manage increasing complexity, interconnections, crossovers, and loop lines without limits on configuration size. The simulator allows precise modeling of typical sub-division/domestic offtake pressures and flows, and it supports necessary valves and regulators. Engineers can determine pipeline network requirements for 5, 10, and 15 year periods using simulation.

The deliverability of a pipeline system during peak season can be analyzed to determine if it can meet future demands or if additional equipment is needed to improve OPEX and CAPEX projections. Gas and liquids pipelines can be quickly configured offline with minimal mouse clicks using sensible default data. The technology offers detailed models of pipes and common pipeline equipment elements such as valves, compressors, heat exchangers, and other components. Engineers can calculate appropriate equipment costs and determine if looping a pipeline or adding an additional pump or compressor is more cost-effective to improve throughput.

Flexibility to Run Steady-State or Transient Simulations

Run steady-state or transient simulations in high-speed or variable-speed interactive modes. PipelineStudio Software enables users to utilize multiple equations of state, friction factor correlations, and maximum allowable operating pressure (MAOP) and drag reducing agent (DRA) usage correlations to cater to specific requirements. Simulations can run unattended or in an interactive mode. During the simulation, the GUI reports operational changes and alarm violations, providing users with valuable feedback on key events as they occur.

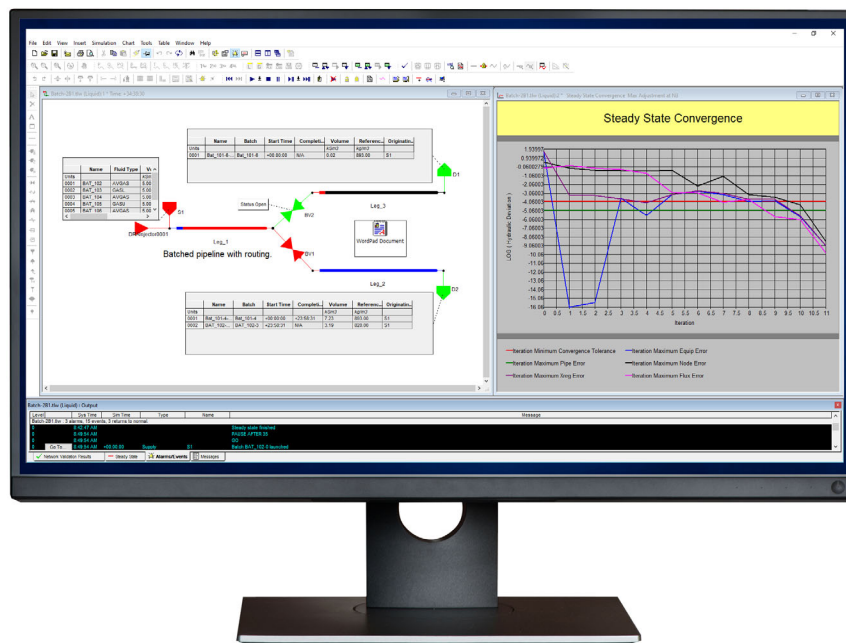


Figure 3: Track simulated batch movements with the Steady State Convergence chart. Current pipeline activities are shown in the events and alarms pane.

Steady-State simulations provide a snapshot of a pipeline's performance under constant operating conditions. Transient simulations model the pipeline's behavior over time, capturing how pressure and other variables respond to real-world changes, such as pumps and compressors starting or stopping. Transient simulations provide detailed insights into how pipelines react to changes and are invaluable for risk assessments. Steady-state simulations can be conducted independently of transient simulations, saving time and resources for users not requiring a transient model.

Proactively Identify Cost-Saving Opportunities

Our software helps reduce overall pipeline operational costs by providing powerful engineering solutions that address complex engineering challenges. Users can rapidly configure pipeline networks by assigning pipeline elements, such as pipe length, wall thickness, roughness, and elevations, to dialog boxes or tables. The software calculates fuel consumption and indicates how it will impact capacity across the pipeline network, enabling users to rapidly take action as needed while increasing efficiencies. Engineers can confirm optimal operating conditions to satisfy demand while identifying all pipeline constraints by using the software to calculate the largest possible flow increase without violating minimum delivery pressure.

It performs survival time analysis in natural gas networks to simulate issues with supply, equipment failures, ruptures, or a shutdown. Our agile software also simulates how liquid levels in tanks change over time, providing operators with accurate data on available inventory.

Accurately Simulate the Impact of a Leak

Leak detection studies are crucial for predicting the environmental impact of accidental pipeline leaks. PipelineStudio Software calculates the total volume of fluid leakage, which serves as the basis for atmospheric dispersion calculations to determine ground-level concentrations near the leak. Simulating leaks helps assess the fluid volume lost between rupture and detection, the transient response to corrective actions, and the total fluid volume lost during the event. In addition, leaks, valve closures, and pump startups or shutdowns can cause potentially damaging pressure surges. Design engineers or operators can simulate upset conditions with PipelineStudio Software and determine if pressure surges will exceed design criteria within the network. Studies run with our software can help determine the instrumentation needed for installing a leak detection system, such as Emerson's PipelineManager Software.

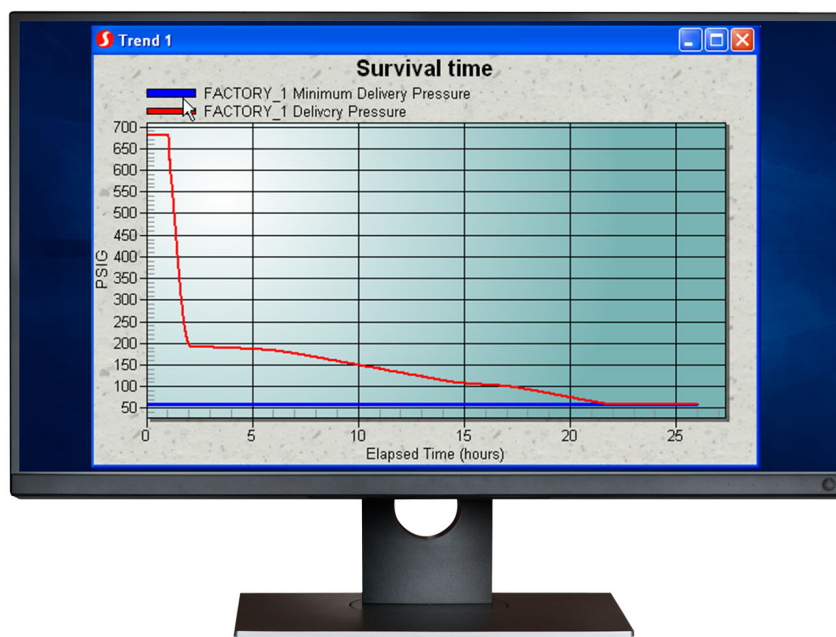


Figure 4: Maintain a safer operating environment by charting survival time.

Improve Operational Activities

PipelineStudio Software is used daily by dispatching and planning departments to track batches, manage nominations, and easily provide reports to stakeholders. Our software enables operators to rapidly assess look-ahead models to improve planning, scheduling, throughput, power costs, storage, and line pack management. Purchase and sale of product or marketing of available pipeline capacity is also analyzed by our software.

Track Batches System-wide

PipelineStudio Software supports mixed streams, also known as batch blending, and simulates batch routing and tracking throughout a pipeline system. This generalized technique results in no restrictions on the number or arrangement of supply and delivery points, or to the complexity of the batch routes. The software calculates changes to batch properties as they move through the system, providing actual start and delivery times.

Users can create custom batch names, and devices such as regulators and pumps can route batches based on these labels, opening or closing to control flow. Our flexible batch labeling system enables users to create custom naming conventions while simulating batch routing.

Field-proven for Reducing Costs

Over 300 pipeline operators and engineering firms worldwide use PipelineStudio Software to address complex planning, engineering, and design challenges. It is proven to reduce costs by delivering effective and innovative engineering solutions to challenging issues.



Figure 5: Monitor flow and pressure constraints with easy to understand charts.

Manage Flow and Pressure Constraints Safely

PipelineStudio Software provides gas dispatching departments with an easy-to-use simulation tool to maintain pipeline safety and ensure that pipeline pressure is maintained within operational limits, all while managing flow and pressure constraints in a single software tool. Users can create and simulate pipeline scenarios with flow and pressure conditions using data generated by the SCADA system. The software runs simulations from nominations manually uploaded or imported from other systems to predict pipeline behavior for the next gas day, enabling operators to efficiently identify issues, ensure safety, and manage scheduling.

Proactively Plan and Manage Power

Minimize power costs by gaining better control of pump and compressor scheduling. Individual units can be accurately modeled within PipelineStudio Software using manufacturer-provided head and efficiency curves, allowing for precise evaluation of fuel or electrical use in different operating scenarios.

Our software simulates anticipated operating scenarios, enabling users to react to system upsets faster or accurately evaluate potential product acquisition and delivery opportunities. Power contracts can be linked to pumps, and the software reports power usage and costs. It can manage multiple pumps under one contract to simulate real conditions. Users can improve flow rates by comparing the cost of adding parallel loops versus more pumps or compressors. PipelineStudio Software helps analyze how each option affects flow and pressure and identifies inefficient pump or compressor stations to help operators improve energy savings and move products more efficiently.

The software quickly configures and simulates different supply and demand scenarios to find the best pump strategy. Users can make better decisions by studying different supply and routing options. PipelineStudio Software integrates with Emerson’s PipelineManager Software to give detailed calculations and reports, including power usage and performance curves.

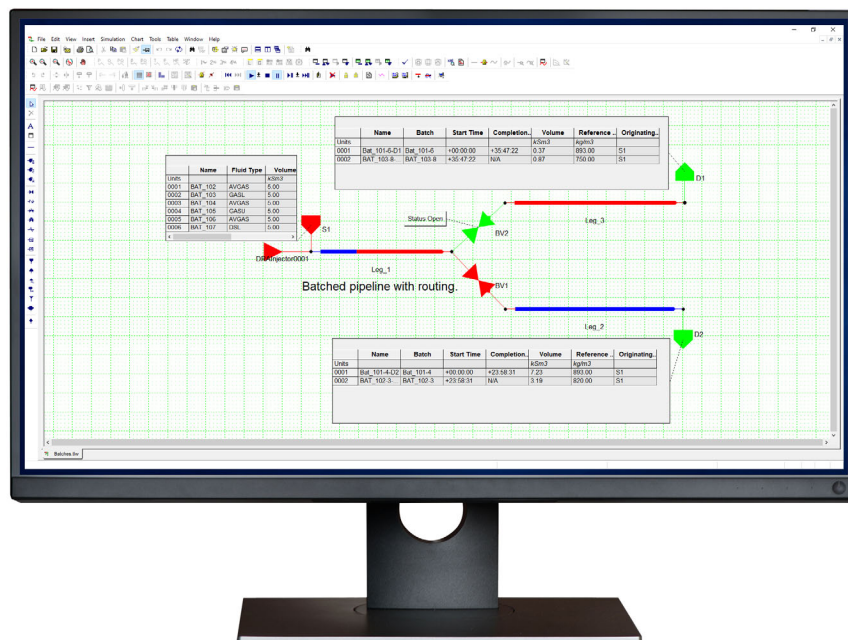


Figure 6: Improve efficiency by enabling users to view movements, deliveries, and routes by batch.

Present, Report, and Act on Data

PipelineStudio Software incorporates multiple ways to present and act on network and simulation data. Simulation results are presented through tables, property views, trend/ profile graphs and report files, improving analysis that leads to faster data-driven decision making. Simulation results may also be exported to third-party applications for additional analysis. Simulation reports are easily accessible in charts, graphs, tables, and formatted ASCII files and are easily shared with Microsoft Excel and other third-party applications.

Simulation reports can also be exported as HTML to web browsers. Data from PipelineStudio Software can be copied or exported to text files and spreadsheets and users can create custom tables to view data for each pipeline element. Configurations can connect with GIS data sources to import and export data. These configurations can also exchange data with third-party applications, including Microsoft Excel and SQL servers. In addition, all PipelineStudio Software models can be rapidly imported into Emerson's PipelineManager Software.

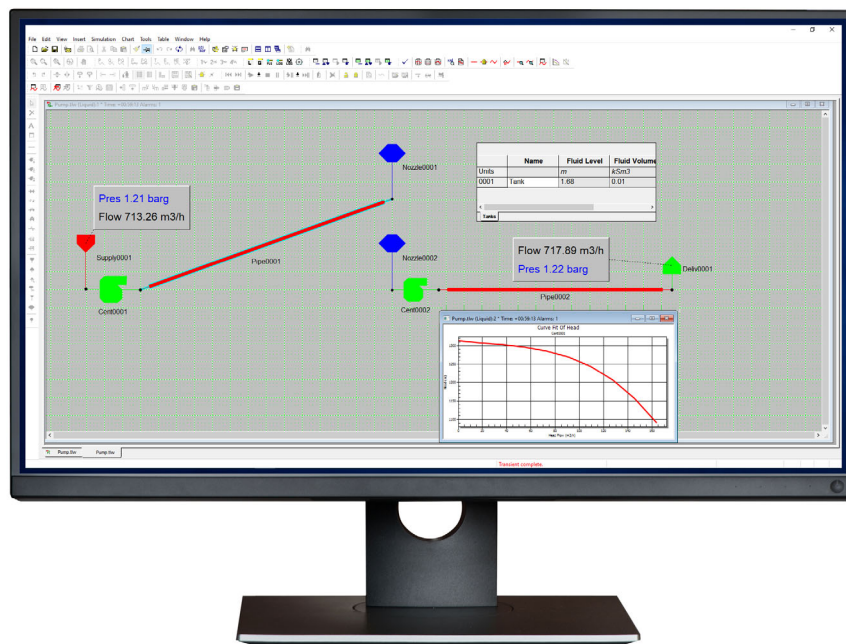
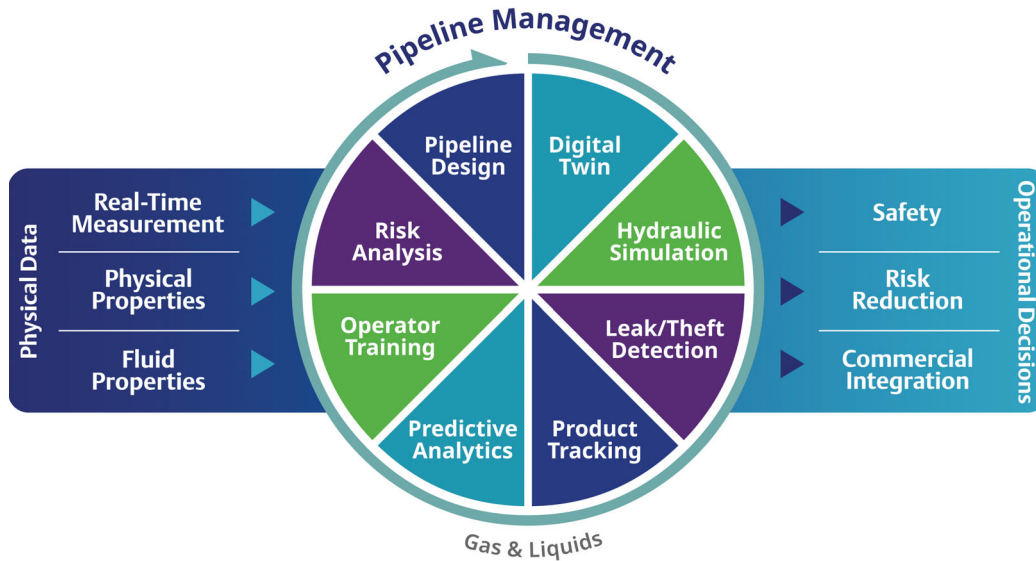


Figure 7: Gain complete visibility into flow rates, pumps, nozzles, and tanks throughout the network to enhance decision making.

Agile Software Solutions for an Evolving Industry

Pipelines will continue to play a critical role in the future of energy transportation. Companies transporting hydrogen and CO₂ will likely use existing natural gas pipeline infrastructures. Carbon capture and sequestration programs will also rely on existing gas pipelines for transport. Emerson's software is built for the energy transition and will continue facilitating the transport of all products, including hydrogen, along the energy value chain as the transition to a low-carbon economy continues.



Streamline opportunities and overcome limitations by meeting commercial and operational objectives and regulatory requirements with our agile, field-proven software portfolio for gas and liquids pipelines.

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