Data Sheet
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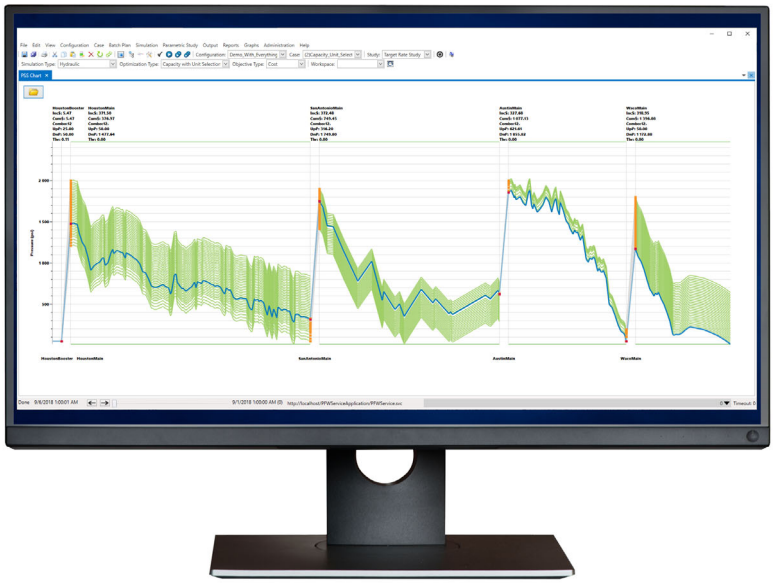
DeltaV™ PipelineManager™ Software for Optimization

Simulation Software for Liquid Pipeline Hydraulics and Batch Operations



Improve profitability by simulating pumping station operations, providing users with valuable insights that lead to reductions in energy and drag-reducing agent (DRA) usage as well as emissions.

Reduce Emissions

- Manage and minimize Scope 2 emissions across multiple pumping stations
- Improve carbon neutrality to enhance ESG reporting
- Avoid financial penalties by meeting legal reporting requirements

Predict Power Consumption

- Plan efficiently by knowing your power consumption costs ahead of time
- Improve efficiency by shutting down and redistributing loads from underperforming pumping stations

Achieve Power and DRA Savings

- Reduce power consumption 5-10% annually across your entire pipeline system
- Reduce DRA usage by 10-15% annually
- Achieve significant savings per year on a single pipeline

Efficiently Manage Cost Analysis

- Accurately assess and study costs under different scenarios
- Evaluate the operational and financial impact of new or modified assets
- Make business decisions based on accurate cost information

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Ensure Efficient and Cost-effective Pipeline Operations

The increasing complexity of pipeline operations combined with the need to meet carbon neutrality goals is putting additional pressure on companies to improve optimization efforts. DeltaV™ PipelineManager™ Software for Optimization can help your engineers run advanced simulations to accurately identify bottlenecks and efficiently manage daily operations with access to mission-critical data via schematics, tables, and menus, resulting in improved profit margins and maximum throughput. Our powerful engineering and operations application simulates the hydraulic and thermodynamic behavior of liquids in a pipeline system to provide operators with valuable insights. It leverages fundamental fluid flow theory to model the behavior of liquid pipelines and applies standard engineering equations to address the complex flow phenomena that occur in cross-country, high-pressure pipelines. Operators can accurately predict and optimize flow rates and pressures by simulating liquid pipeline hydraulics and batch operations. Our software's complex optimization algorithms take into account multiple factors, including pipe size, temperature, length of the pipeline, frequency of pumping stations, and the cost of electricity and DRA.

Physical properties of the product flowing through the pipeline, such as density and viscosity, are also factored into the calculations. The software takes these data points and calculates an optimal operation plan to perform the required movements. Scope 2 emissions of individual pumping stations on a pipeline over a specified period are also calculated. This allows for an objective study to examine the differences and provide insights on actual changes to overall energy costs. Operators can monitor each station separately, focusing on how electricity sourced from different locations impacts emissions. Our software handles batch operations and simulates the movement of liquid batches through the pipeline, enabling operators to accurately predict batch arrival times and optimize batch flow rates while maintaining an overall delivery time. Our powerful DeltaV PipelineManager Software for Optimization is a comprehensive tool that allows users to perform capacity studies, analyze downtime, calculate DRA usage, and manage emissions, fuel usage, and operating cost.

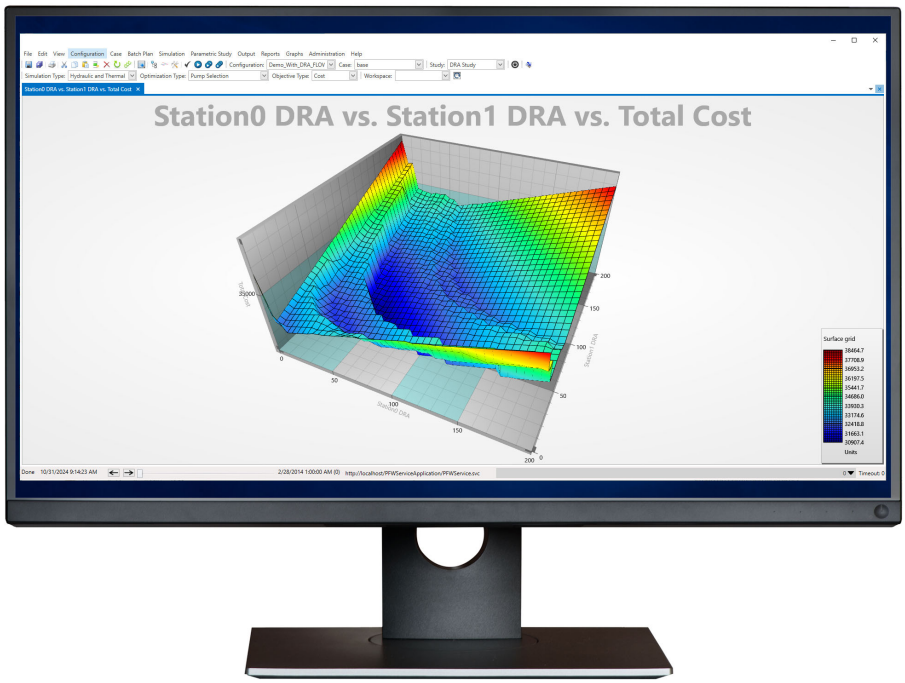


Figure 1: Generate and study full solution spaces for power, cost, or other parameters using the parametric study tool.

Limit Emissions for Carbon Neutrality

Lowering energy usage and subsequently limiting emissions are steps that pipeline operators can begin taking today to proactively achieve carbon neutrality. Our DeltaV PipelineManager Software for Optimization allows you to efficiently manage and optimize your pipelines to reduce energy use while monitoring emissions. The flexible application allows users to efficiently toggle between optimizing pipeline operations based on emissions or based on costs. Analytics generated by the software allow you to better minimize energy consumption, improve efficiencies, and promote peak operating performance.

Transparent and Reliable GHG Emissions Reporting

Greenhouse gas emissions (GHG) reporting may not be required but has been identified as a 'greening' opportunity for pipeline operators. Reliable and transparent reporting demonstrates your commitment to sustainability and can identify risks associated with energy consumption and emissions. It will also help you build trust with your investors, customers, and other stakeholders by sharing verifiable emissions data. This accurate emissions data can also help you meet legal requirements and avoid penalties with regulatory bodies.

Manage and Optimize DRA Use

Minimize operational costs by better managing DRA usage. Striking the correct balance between how much DRA to use versus relying on expensive pumping stations to move product is a complex balance made simple by our software. Our DeltaV PipelineManager Software for Optimization considers pump schedules, flow rates, power contracts, and DRA injection rates to calculate the correct amount of DRA needed and how often pumps should run to efficiently move product. Our advanced application has a proven track record for helping users achieve a 10-15% reduction in DRA usage, resulting in annual savings of hundreds of thousands of dollars per year on a single pipeline.

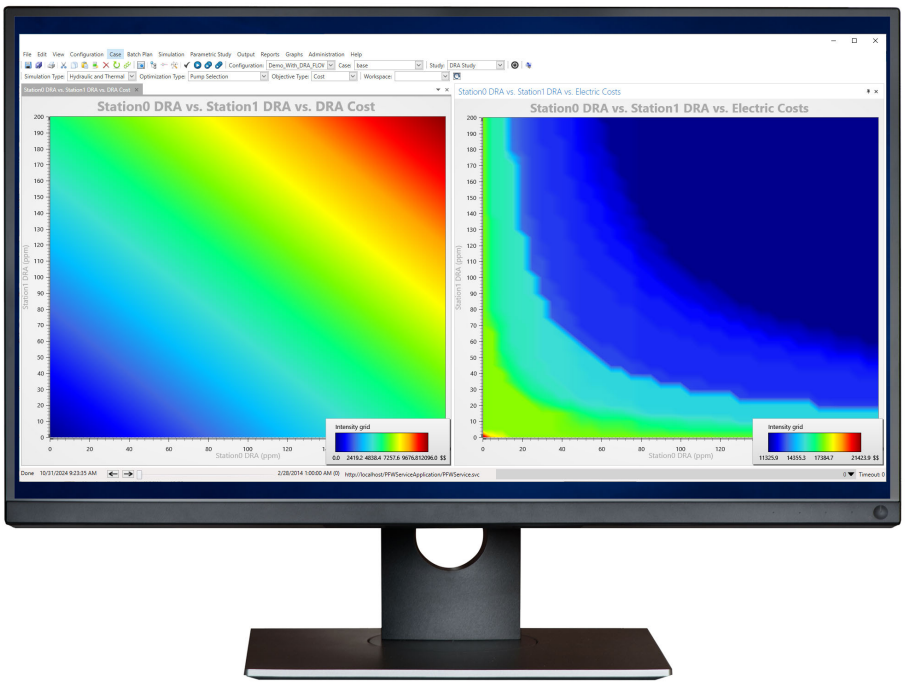


Figure 2: View 2D, 3D, or heat map graphs of the solution space to find the design that minimizes operating cost.

Efficiently Manage Pumping Schedules

Transporting denser liquid hydrocarbon products in pipelines requires high pressure. Pumps powered by electric motors, solar power, diesel fuel, gas turbines, or other energy sources are necessary to generate the proper amount of pressure. DeltaV PipelineManager Software for Optimization runs a full hydraulic and thermodynamic physics simulation using the pipe diameter, elevation profiles, physical properties of each product, and other factors to accurately simulate the pipeline system across multiple pumping stations. Our software takes any combination of turbine and centrifugal pumps across multiple pumping stations into account during simulation to ensure maximum and minimum operating pressure thresholds are in place.

A detailed pump driver simulation can be run to optimize operations to meet desired flow rate and minimize power consumption. In addition, pumping schedules across multiple pumping stations can be optimized to minimize emissions by calculating the combination of energy and DRA needed to transport product across different elevation profiles. Operators can also create pumping schedules that maximize cost savings. Another advantage of pump optimization is the reduction of wear and tear on equipment, resulting in less maintenance over time to further improve cost control.

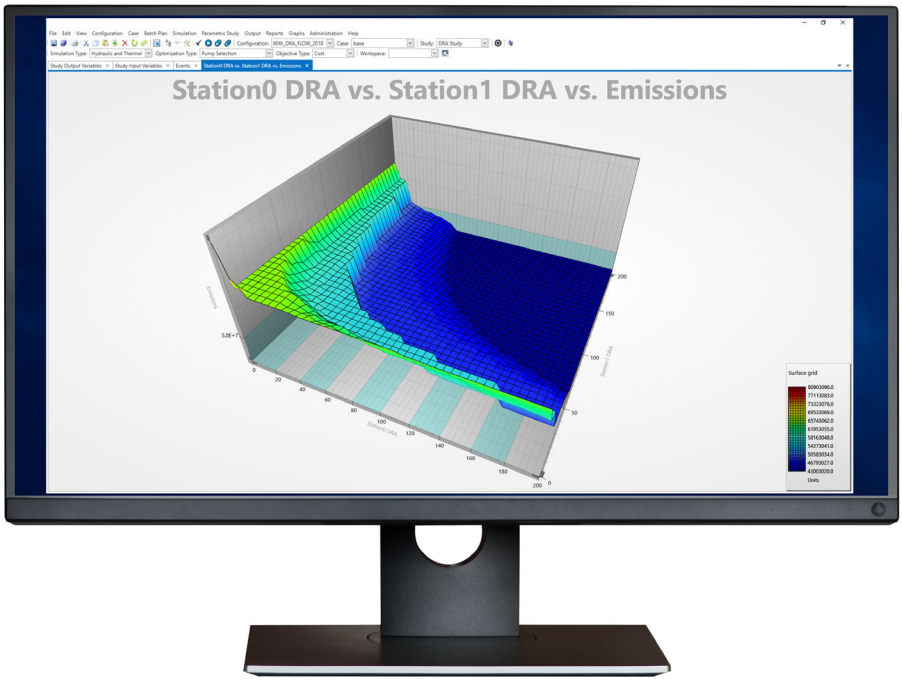


Figure 3: Reduce Scope 2 emissions of pipelines by optimizing DRA injection rates across the network.

Optimize Power Consumption

Running liquids pipelines requires a significant amount of electricity and it is common for costs to be in the millions of dollars annually. Pipeline operators are achieving significant cost savings by reducing power consumption by 5-10% using our DeltaV PipelineManager Software for Optimization. Your planning engineers can achieve similar results by running simulations within the application to review and determine capacity requirements of your pipeline network, enabling demand to more efficiently be met over the long term. Our application enables your engineers to efficiently run parametric studies and design your pipeline network to minimize operating cost while quickly identifying design and operational bottlenecks. Cyclical flow conditions that may cause pumping stations to operate below peak efficiency can also be accounted for, allowing users to take lower volume stations offline and shift the load to stations where the combined volume is higher. Users can further minimize downtime by balancing the use of line assets over time to work through line or unit outages. Our application also manages peak and off-season pricing and provides analyses of various scenarios to reduce costs, including the use of a higher flow rate overnight. In addition, weather or other unforeseen events that cause spikes in demand can be included in the simulation to ensure accurate and reliable results that help reduce power consumption, leading to greater cost control.

Save Money on Power Contracts

Our software helps determine which pumping station(s) offers the most cost-effective utilization for product. Our DeltaV PipelineManager Software for Optimization provides valuable insights by configuring and managing complex power contracts within the simulation. The application analyzes and balances the sum of all the different station costs to provide the best total cost to the pipeline operator. Electric power contract details, including time-to-day rates, are included in the calculation. Since power contracts are highly nonlinear, new nominations can trigger a step-change in power costs. Your pipeline operators can better manage fluctuations in demand and re-evaluate power consumption rates that can change on a daily, hourly, or even minute-to-minute basis using our DeltaV PipelineManager Software for Optimization. With our software, you can accurately calculate the incremental costs of additional throughput and provides your operators with the confidence to manage nominations effectively by analyzing and understanding complex power billing contracts.

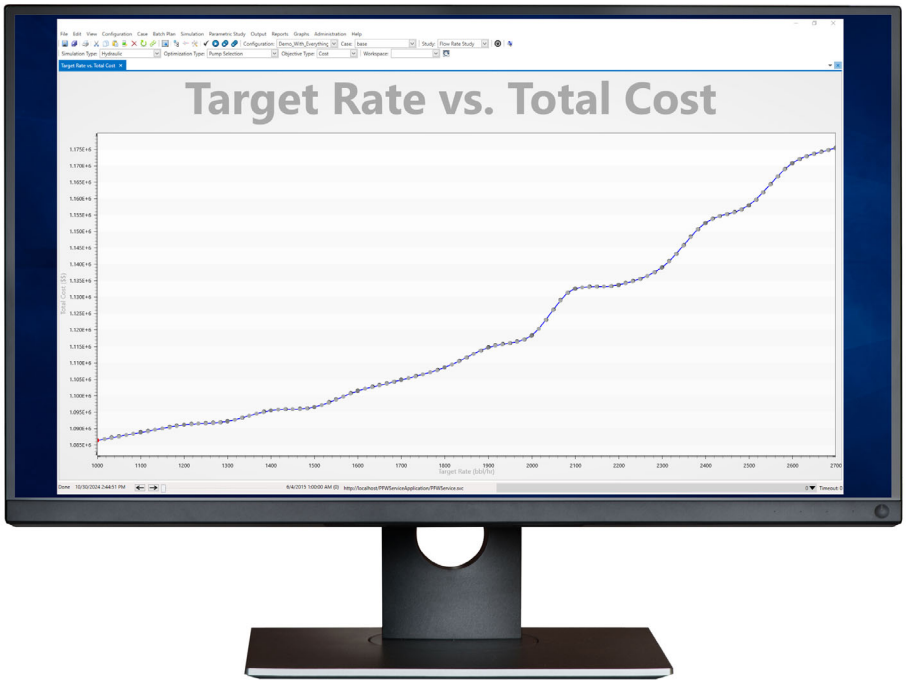


Figure 4: Accurately calculate the incremental cost of additional throughput.

Automatically Run Batched Pipeline Operations

Take the guesswork out of deciding when to switch pumps or if a batch should be run at a lower flow rate by running simulations using our DeltaV PipelineManager Software for Optimization. Factors including density, viscosity, vapor pressure, and other physical properties of each batch are used by the application during simulation. These simulations can determine pipeline capacity with unit selection, taking into account unique product properties to fully optimize pump operations. Our DeltaV PipelineManager Software for Optimization easily integrates with other DeltaV Pipeline Management Software solutions such as our DeltaV SchedulingManager™ Software for Liquids Pipelines for effective batch planning. Our scheduling application develops the batch plan and the volumes that need to be transported over a specified period.

This batch plan is then imported into our optimization application where flow rates and other factors are optimized. The optimized plan is then imported back into our scheduling application, enabling operators to visualize what will happen in their pipeline over the specified period. Flow limit rules can be generated from our optimization application during the batch plan import to enforce flow rate restrictions on the supply rate optimization. Scheduling data can also be input manually, though it is less efficient and more prone to data entry errors. Our application runs calculations on the most efficient way to transport different batches, making the pipeline more effective at moving product and streamlining the workflow to give operators the time to focus on value-added tasks.

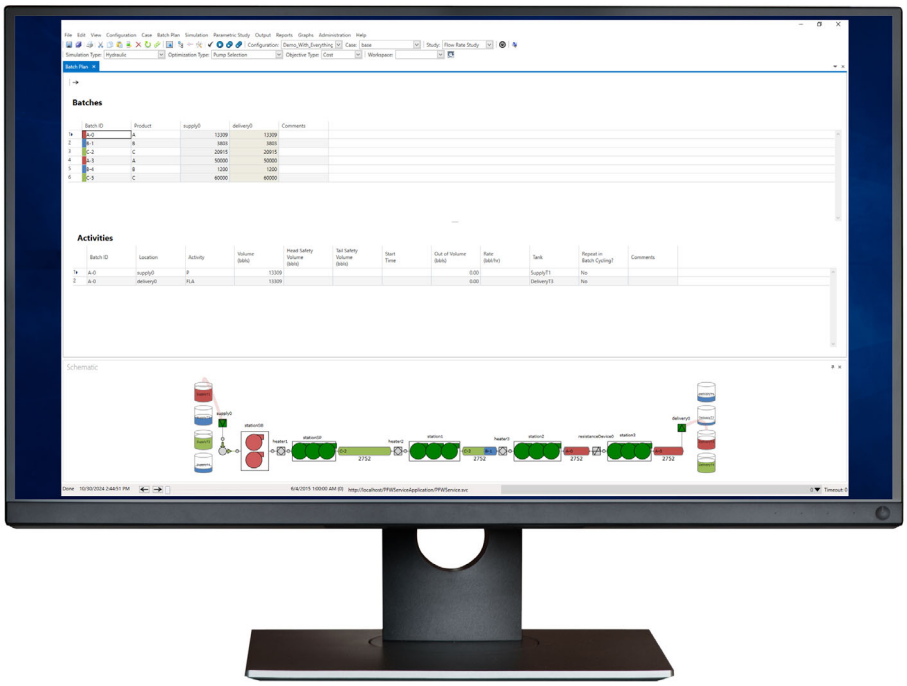


Figure 5: Optimize flow rates and DRA injection rates for systems with complex power contracts.

Plan Confidently with Offline Hydraulic Simulations

Easily simulate the operational and financial impacts of adding new or upgraded system assets by running offline hydraulic simulations to determine the impacts of 'what if' scenarios (as in, what will happen if something is changed in the operating plan). Our DeltaV PipelineManager Software for Optimization enables your engineers to use advanced visualization to review and assess operations for the next three-to-five days, providing insights to improve outcomes while accounting for planned maintenance and equipment outages. By confirming the maintenance schedule, your engineers can use our application to perform complex future scheduling of equipment, such as turning on a pump early, to ensure the schedule is met. Engineers can also accurately assess and study realistic operating schedules and perform 'what if' scenarios that address real-world operations.

Simulations of temperature changes, unplanned pump maintenance, or lineup changes provide data for engineering studies. These studies can improve the understanding of incremental costs of new transport volumes while providing estimates on power consumption and the anticipated outlay for electricity.

The simulation of a pumping station upgrade, with fixed speed pumps replaced by variable speed pumps, reveals the potential long-term savings of updating pumps despite the higher upfront costs. Our application simplifies this cost analysis based on the difference in power consumption, providing the clarity and data needed to make the best pump decision for your business. Simulations run on our DeltaV PipelineManager Software for Optimization have proven to help companies minimize cost, improve margins, and maximize output long term, particularly when multiple pumping stations are in operation.

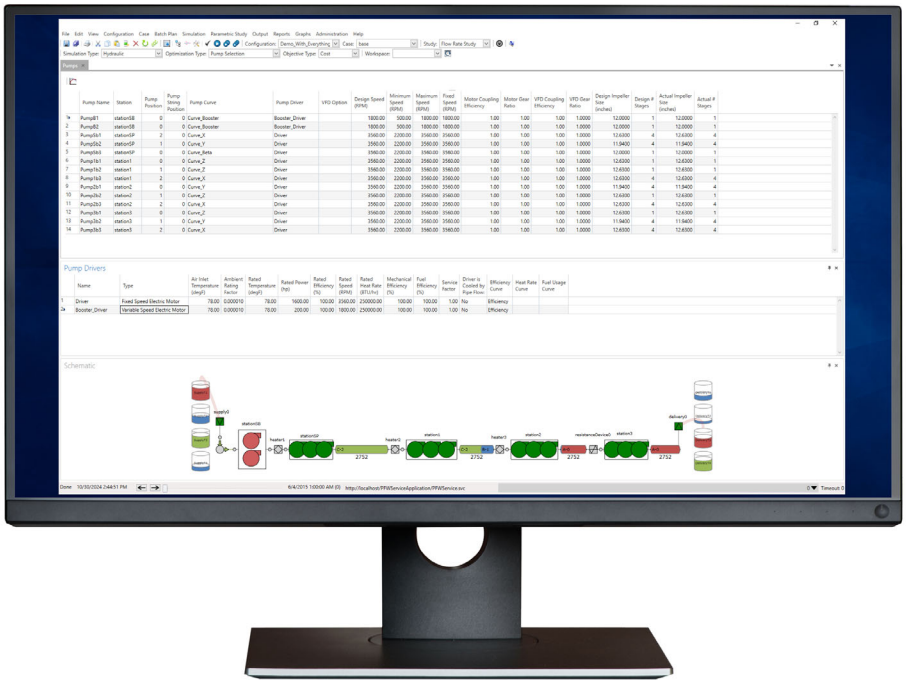
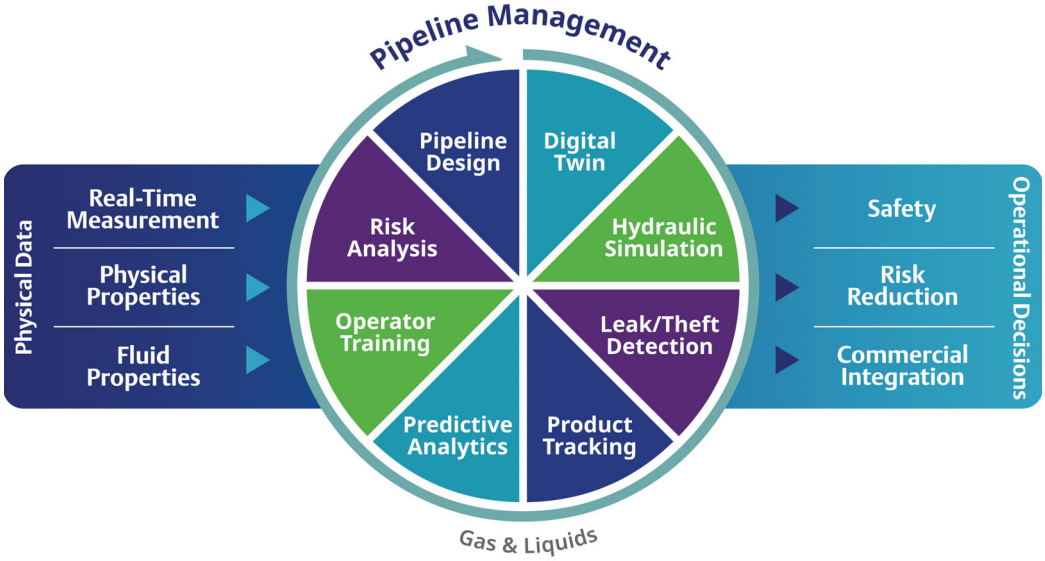


Figure 6: Simulate asset upgrades easily to assess cost implications.

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 CO_2 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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