



ENABLING ENERGY TRANSITION TECH ARTICLE



Optimizing Pipeline Systems to Significantly Improve Energy Efficiency



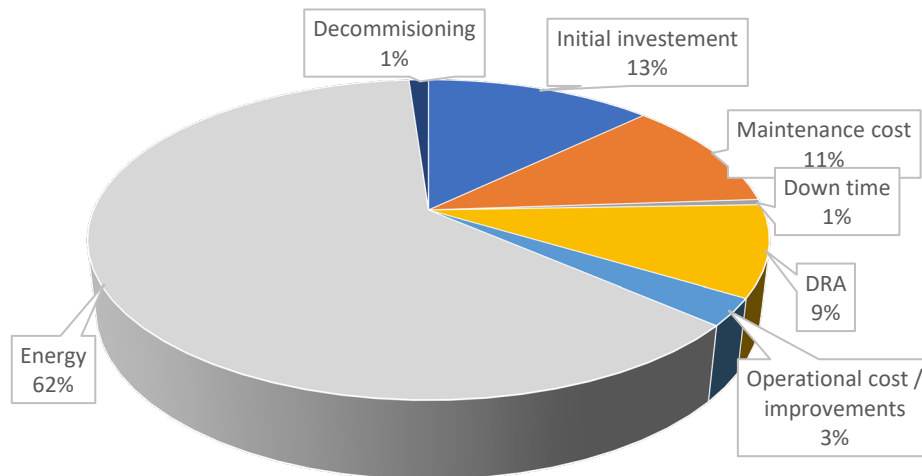
DIVERSIFY | DECARBONIZE | DIGITIZE

Energy Intensive Pipeline Operations

Transportation of gas, crude and petroleum products through pipelines is a highly energy intensive process and increases carbon footprint. As a consequence, pipeline operators bear substantial operating expenses in the form of energy costs. As the global energy transition advances, pipeline operators are actively seeking solutions that allow for improved energy management, reduced emissions and minimized operating costs.

Our experience working with leading crude pipeline operators shows that energy costs can be as much as 75% of the total operating expense with mainline pumps being a leading cause of energy consumption and carbon footprint. Over the life of a pipeline pump, energy accounts for the highest portion of the Lifecycle Cost (LCC) in comparison to other costs as depicted in the figure below.

TYPICAL LIFECYCLE COSTS PER YEAR FOR A PIPELINE PUMPSET



Pipeline operations and conditions tend to change over time, often resulting in pumps that were initially designed and selected for a certain process condition to no longer operate near their optimum design point. This can occur due to considerations related to upset and future operating conditions, market and/ or field production requirements and inclusion of initial design margins for meeting contractual obligations of involved parties - End User, Design Office, OEM etc. Improperly sized equipment over longer periods of time can also have a negative impact on the feed and volume of the medium flowing through the pipeline.

Additional Opex Savings

Closed pipelines with large elevation differences are often primed with fixed speed pumps. Once the line is primed, normal operation requires a significant amount of excess pressure to be throttled at the pipeline terminal due to the siphon effect. This procedure presents an opportunity to recover some of this energy through the use of power recovery turbines.

Depending on the pump and pipeline size, many operators are required to implement expensive solutions such as injection of Drag Reducing Agent (DRA) for limiting the pressure requirement and to optimize operations for a given throughput.

Macro-economic developments require pipeline operators to respond to rapid demand variations which can cause pipeline operations and conditions to change. These changes can have a direct impact on the pump performance and efficiency by causing them to operate far from the design condition. Therefore, these changes need to be managed effectively to ensure that mainline pumps operate as close as possible to their design condition. This would ensure improved energy efficiency with significant improvements in pump reliability and reduced maintenance spend.

Energy consumption of the control systems of a pipeline is also a part of the process owners operating cost. For example in gas pipelines, Control valves and positioners commonly installed in transmission compressor stations and distribution pipelines present opportunities to reduce operating expenses. Analog positioners used in pipeline processing plants, are designed to leak by default to regulate the pressure and position of the valve actuator. This inherent inefficiency undermines efforts to reduce emissions and creates a risk of being non-compliant with environmental regulations.

Zero-bleed digital positioners eliminate this inefficiency and allow operators to gain greater precision and insight into valve, actuator, and positioner performance throughout processing plants, pipelines and distribution centers. Additionally, the use of SMART digital positioners with diagnostic capabilities can improve process reliability, stability and ultimately efficiency by allowing to address equipment issues through early warning signs.

Logix™ 3800 digital positioner

The Logix 3800 digital positioner facilitates improvements in process uptime, reliability and process throughput. Advanced diagnostics not only identify developing problems in the control valve, but also help guide corrective actions to ensure reduced return-to-operation times. Also available in zero-bleed upon request, the Logix 3800 simplifies installation through easy configuration and calibration.



Cost Optimization Challenges

While managing the dynamics related to volume, feed and DRA, operators face a complex cost optimization challenge of minimizing transportation cost across the main pipeline pumping stations. The challenge is further enhanced due to a variety of parameters such as - number of pumps in operation, speeds, control valve positioning , volume of DRA etc.

Considering the interaction between all flow control elements within the process, the cost optimization challenge can only be addressed effectively by implementing solutions at a system level. Optimizing at the asset or the pumping station level rarely delivers the best overall operating scenario for the pipeline.

As an example - running a set of pumps on a single pumping station exactly at their best efficiency point may cause a downstream set of pumps to operate at an unfavorable condition in terms of flow or suction pressure where the latter may have a larger impact on overall pipeline Opex.



— FLOWSERVE —
ENERGY
 ADVANTAGE PROGRAM
DECARBONIZE BY DESIGN

Accelerate your energy transition plan

Optimizing pump efficiency is an increasingly important consideration toward the achievement of sustainability goals. The Energy Advantage Program from Flowserve offers a suite of solutions focused on enabling significant efficiency, reliability and carbon reduction improvements from the optimization of flow control loops.

The Energy Advantage Program can quickly enable your company to start achieving operational cost objectives and accelerate progress toward realizing your decarbonization goals. Partner with Flowserve to implement the program and then monitor the savings on an ongoing basis to ensure that your company continues to meet energy efficiency targets.

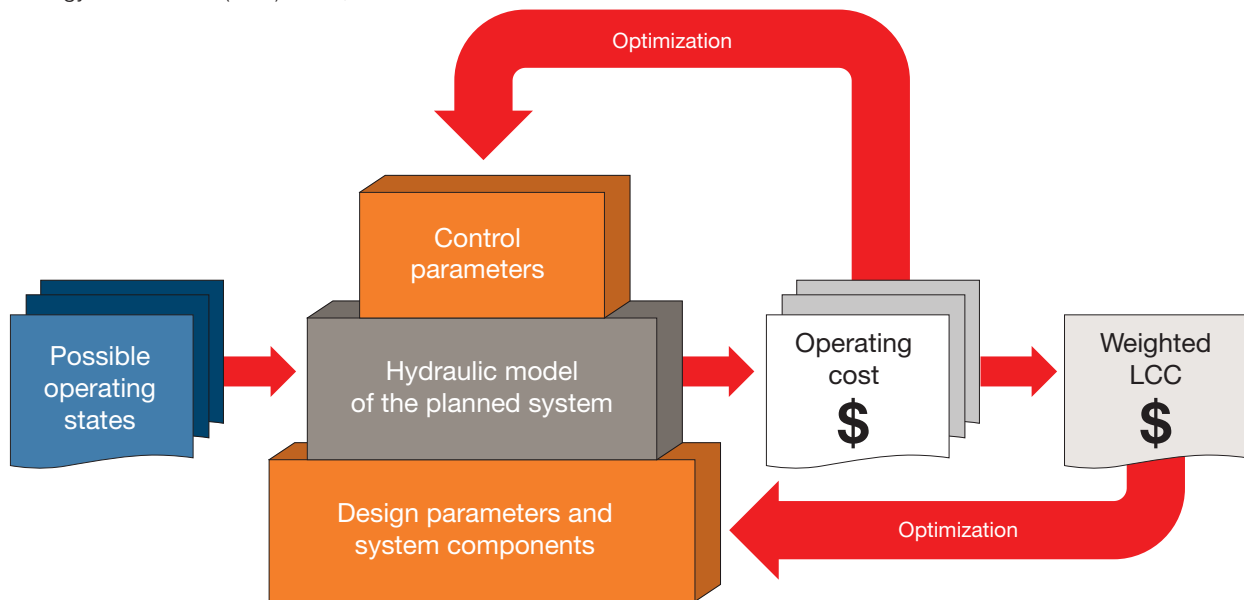
Flowserve specialists share our unparalleled experience in implementing solutions to optimize pump efficiency around your process needs.

Contact us today to see how we can support you at EnergyAdvantage@Flowserve.com

Flowserve proprietary tool for system design, control selection, logistic optimization and pipeline evaluation

We are committed to support our customers in achieving their sustainability and energy transition goals. We utilize our unparalleled technical expertise to develop optimized pumping solutions while constantly seeking opportunities to reduce operational costs and carbon footprint. Flowserve has developed a proprietary, hydraulic modeling and optimization tool to support pipeline operators in ensuring correct selection of pump and operational control as well as system design. The tool allows operators to gain a better understanding of existing conditions within the pipeline system. Additionally, it also provides real-time, realistic operational and LCC estimates for our solutions which allows for better management of operating costs over the lifecycle of the equipment.

Our pump systems experts work alongside pipeline operators to evaluate the best path forward for optimizing design, operations and logistics. To learn more about Flowserve’s proprietary tool for pipeline optimization, please consult our paper on - [Optimization of the pipeline transport system for operating cost reduction](#), published at the Pipeline Technology Conference (PTC) 2022, Berlin.



Leverage decades of pipeline expertise

Advanced optimization methods can support the quick re-evaluation of cost-effective design and operation of pipelines in the present economic environment with rapidly changing energy and DRA costs. By using innovative tools and methodologies, Flowserve demonstrates its global leadership in critical energy transition initiatives.

Pipeline operators can leverage our 225 years of flow control experience and comprehensive portfolio of product and service solutions to diversify their energy mix, decarbonize their operations, and digitize their plant processes. As your partner, Flowserve also can help you to enhance operational efficiency and reliability while supporting your energy transition goals.





Our commitment to energy transition

At Flowserve, our approach to energy transition begins and ends with our purpose: to make the world better for everyone. We understand that when we enable our customers to tackle climate change and address increasing energy demands through our innovative flow control solutions, we can make the world better — now and for generations to come.

Our approach is threefold. We are diversifying, decarbonizing and digitizing to support the global energy sector's transformation toward low-carbon sources.



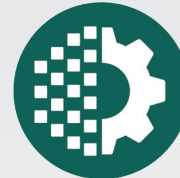
DIVERSIFICATION

Our innovative portfolio of flow control solutions and services will support energy systems around the world to diversify the energy mix and adopt cleaner sources of energy.



DECARBONIZATION

We will support the reduction of energy-related CO₂ emissions across the mix of energy sources through our innovative portfolio of flow control solutions and services.



DIGITIZATION

We will enable improvements in efficiency, productivity, sustainability and safety of energy systems around the world through our digital solutions and services.

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