# The Philosophy of Fuel Savings in Natural Gas Transportation and Optimization

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## Optimization

The French word *optimiste* is the root word from which both optimization and optimism were formed. *Optimiste* roughly translates into English as "the best option." The primary difference between these two words is that optimization implements the best of the available options where optimism is a hope for the best.

Optimization, by definition, is only possible when there are alternatives to chose from. But it also requires one to define what is considered "the best." In practical implementation, the goal often is dynamic as are the options. Under certain conditions, the goal may be to maximize transportation volume while minimizing fuel costs or it may be minimizing equipment operating costs and the number of starts and stops on the equipment.

All optimization is subject to constraints, both physical and procedural. For example, a delivery pressure requirement limits how low a pressure may go and the pressure must not exceed a maximum allowable limit. There may be outages on the system that eliminate or restrict some operating options. In many cases, there are conflicting goals and/or goals such as minimizing operating costs while maximizing throughput. In those cases, one of the goals has a higher priority. In this example, maximizing throughput typically has a higher priority than reduced operating costs at the time of peak demand but may have a lower priority for non-peak periods.

Goals are often combined to resolve potential conflicts. For example, a goal to minimize fuel consumption may indicate a particular compressor unit should run but a goal to minimize operation and maintenance costs (for overhauls, oil usage, electrical usage, etc.) would indicate another unit should operate. The conflict can be resolved by developing, net operating cost as a new goal, which combines the economic impact of both the fuel and operating costs goals. When defining goals, take time to identify and prioritize all of the constraints that can impact the operation of the system. Factors to consider include:

- Age and reliability of the equipment
- Fixed operating costs
- Variable operating costs including fuel
- Ambient weather conditions
- Response time to man or support a facility

## Why a focus on fuel savings is important

When gas costs $5.00/Dth, a fuel rate of 5.0% equates to $0.25/Dth addition to the cost of gas transportation. This can be a significant portion of a shippers transportation cost. Even though many intrastate pipeline systems have a fuel tracking mechanism in their rate structure, they can directly benefit by reducing fuel when operating in a competitive market. For production and midstream markets, fuel savings result in incremental gas available for sale.

But focusing on reducing fuel consumption also ensures the equipment is in peak performance when maximizing throughput is critical. Finding and eliminating piping, regulation, measurement or compression constraints will reduce operating costs under normal flow conditions and allow for additional capacity under peak conditions.

Often equipment will undergo mechanical damage or have a control failure that will reduce operating performance. Examples include mechanical problems with a compressor engine (such as a bad fuel valve, ignition system, etc.), with the compressor (such as a damaged impeller or compressor valve), and valves (when it fails to fully open or close). Under low to moderate flow rates, these conditions can be tolerated and likely will not be noticed unless continuous performance monitoring is utilized. These performance issues will be noticed when the system is called upon to deliver maximum capacity as the system will not be capable of delivering that capacity. By then, it will be too late to rectify these issues.

A focus on fuel savings often reduces operating costs. A configuration change to save fuel that reduces compression overall requirements will also reduce operating costs. For example, a compressor unit that is operated at reduced speed and torque reduces the wear on the unit and therefore extends the interval between overhauls. Even more savings is achieved if the unit can be shut down entirely. This will also result in reduced emissions.

## Summary

A continuous focus on monitoring system performance with the proper optimization goals can significantly reduce operating costs. It can also ensure that the system can achieve maximum design capacity.