Iowa DOT Statewide Freight Transportation Network Optimization Strategy Development: Propane Supply Chain Optimization

Project Overview

What is the Project Goal?

Iowa DOT is in the process of launching a Propane Supply Chain Optimization study to:

- Create an efficient propane supply chain for the State of Iowa; and
- Prioritize investments in infrastructure to lower propane supply chain costs for the State and its constituents.

The effort is an extension of a current project to develop a Statewide Freight Transportation Network Optimization Strategy. The goal of the overall project is to effectively identify and prioritize investment opportunities for an optimized freight transportation network to lower transportation costs for Iowa's businesses across commodities and to promote business growth in Iowa.

Why is the Project Needed?

In the winter of 2013-2014, residential and commercial users of propane in Iowa and other states were challenged by a severe propane shortage and sharp price increases driven by:

- An agricultural shortage for propane for drying with the late harvest of grains in the fall;
- Colder than normal winter temperatures further stressing the supply of propane for home heating use and increasing the cost to consumers;
- Closing of the Cochin pipeline, a primary source of supply, for several weeks during peak demand;
- Rail disruptions and lack of truck capacity limiting the ability to replenish inventories; and
- Increased U.S. exports of propane with no strategic plan for long term management of propane supply and demand across the nation.

What is the Project Approach?

The Propane Supply Chain Optimization analysis will evaluate short- and long-term optimization scenarios to better handle these fluctuations in supply and demand. It will update the demand-based supply chain network design and optimization analysis from the core project, and enhance the existing database with propane supply and demand data, to:

- Analyze propane supply and demand in Iowa and surrounding regions to identify supply chain constraints;
- Develop and prioritize optimization strategies for an optimized propane supply chain network in Iowa;
- Recommend a strategy and create a business case on how to create an efficient propane supply chain for the State of Iowa.

The scope of the analysis is:

- Commodities: Propane
- Modes of transportation: Truck, rail, barge and pipeline
- Geographic locations: 99 counties in the State of Iowa, any U.S. counties shipping propane in or out of Iowa, and transportation traffic through Iowa from/to North Dakota, South Dakota, Minnesota, Wisconsin, Illinois, Kansas, Nebraska and Missouri.

The Project Working Group will be expanded to identify subject matters experts within the State on both the infrastructure and data essential to adapt the analysis for propane, including:

- Demand and fluctuations by region/county within Iowa;
- Storage requirements (e.g. capacity, reorder points, safety stock, redline thresholds);
- Transportation fulfillment capacity across modes (truck, pipeline, rail, barge); and
- Pipeline network infrastructure and costs.

The analysis will follow the same **demand-based** supply chain network design and optimization approach used to create short term and long

term freight transportation network optimization strategies (e.g. enabling lower cost shipment modes, creating alternative routes) in the core project. The approach is proven in the private sector to optimize complex global supply chain networks for large shippers, and is also an effective and efficient approach to optimize the publicly-owned elements of the freight transportation network.

The approach includes four fundamental steps below:

- Step 1 – **Analysis of network demand and capacity.** Demand, or transportation demand, is the quantity of commodities desired to ship from origin to destination. The demand-based network optimization approach focuses on the top priority freight transportation demand to create an optimized network that addresses capacity bottlenecks in order to lower the overall transportation costs and maximize return on investment.
- Step 2 – **Performance measurement and constraints analysis**. A computer model is built to represent the network demand and capacity. Current network performance will be measured and scenarios will be examined in the computer model to analyze performance constraints in the network.
- Step 3 – **Creation of optimization strategies.** Optimization will be run using a computer network design and optimization tool to identify strategies to address the network constraints and improve network performance by lowering transportation costs and improving service levels.
- Step 4 – **Business case development.** Financial analysis will be done and business cases will be developed for the prioritized optimization strategies.

What are the Project Outcomes?

The project will conduct what-if analysis and deliver optimization strategies in order to:

- Be better informed when critical inventory levels for propane are reached and Iowa faces potential shortages; and
- Proactively define viable contingencies to handle these extreme fluctuations and disruptions in supply.

The focus is on completely this analysis before the next peak demand period in the fall of 2014.

What are the Project Benefits?

- Ability to identify potential disruptions in propane supply before reaching crisis levels
- Model impact of fluctuations in supply and demand to identify contingencies, while minimizing cost impact to users
- Ensure consistent supply of propane to residential and commercial users of propane in Iowa
- Prioritize investments based on objective measurement criteria
- Developing reusable framework for future studies
- Recommending specific and actionable optimization strategies