Distribution Infrastructure – Geospatial Considerations and Implementation Challenges

Federal mandates to increase the use of biofuels in our transportation fuels will result in a dramatic and unprecedented increase in the production, movement, and use of biofuels by 2022. This increase requires the integration of existing and future biofuels and fossil fuels; each with their own challenges.

A steady but rapid increase in fuels will be driven by the availability of feedstocks, conversion technologies, and vehicles capable of using increased concentrations of biofuels. Production and consumption will vary in different regions. The geospatial relationship between where feedstocks are available, conversion technologies are constructed, and populations consuming fuels are located, will influence the life cycle greenhouse gas emissions, energy and costs required to transport materials and product, and the mode of transportation that will be employed.

Much attention has been given to technical and economic feasibility of producing biofuels, but it is also critical to ensure that distribution infrastructures have the carrying capacity, and to identify economic and technical challenges in using and expanding existing systems, and developing new systems.

Below is a brief summary of current and future production of biofuels, existing and potential modes of distributing product, factors that will influence the viability of these modes, and brief mention of some environment, health, and safety considerations.

Corn and sugar cane ethanol are the only biofuels currently in use, predominantly at E10 concentrations. However, to meet RFS mandated volumes higher ethanol concentrations and use of cellulosic and advanced biofuels will be required. As volumes of cellulosic and advanced biofuels increase, the geography of where they are produced and transported will change. The infrastructure to distribute all biofuels will also evolve.

Year	BG/year	Fuel Types
Present – 2010	12.95BG	12 BG Corn
2010 – 2015	20.5 BG	15 BG corn 3 BG cellulosic 3 BG advanced
2015 – 2022	36 BG	15 BG corn 16 BG cellulosic 5 BG advanced

Currently, the fossil fuel refineries are predominantly located in the south, the ethanol refineries are located in the Midwest, and the blending terminals are located in closer proximity to the user populations. The East coast consumes 36% of transportation fuels, the Midwest consumes 28%, the central south consumes 15%, the West consumes 17.5%, and the Rocky Mountain region consumes 3.5%.

Approximately 80% of fossil fuels are transported via pipeline, and 70% of ethanol is distributed by rail, 20% by truck, and 10% by barge. Given its chemical characteristics and affinity to water, ethanol cannot be blended at the fossil fuel refineries, as it would impact fuel quality. Instead, fossil fuels are transported to terminals via pipeline and ethanol via rail or barge. At the terminal jobbers blend the two and transport the blended fuel (via trucks) to retail stations**.**

What infrastructure changes will be needed to transport and store increased volumes of biofuels?

Rail – could continue to be the predominant mode of transport. By 2022 rail shipments (currently at 164,000 carloads) will increase to 800,000 carloads per year. Current and future volumes of ethanol would be a small percentage of rail carrying capacity.

- More tank cars will need to be built, purchased (34,000 by 2021)
- Unit trains (mega-trains hauling just ethanol) will increase

Barge – demand is expected to increase for barge capacity. It is the most efficient mode of transport compared to rail or truck. (One barge has equivalent carrying capacity to 15 jumbo hopper cars or 58 large semis.)

- More barge vessels will be needed that are compliant with requirements for transporting these fuels.

Trucks – will always play a role in delivering fuels from the blending terminals to the retail stations.

- A significant shortage of security cleared drivers certified to transport hazardous materials

Pipelines – hold potential to be the most efficient to move large volumes of ethanol, but have several challenges:

- Material incompatibilities with potential for stress corrosion cracking (SCC)
- Current pipelines are near capacity and expansions could be needed
- Current pipelines move volumes in opposite directions to where ethanol needs to move
- Chemical characteristics of ethanol can lead to diminished product quality
- New dedicated ethanol pipelines would require eminent domain authority and could pass through sensitive lands

Tanks – 600,000 underground storage tanks will need to be modified to store higher concentrations of ethanol blends

- Material incompatibilities with increased potential for corrosion
- Verification that existing leak detection systems will detect leaks of ethanol blends
- New ground water remediation methods following spills

Dispensers – Although there are 160,000 retail vehicle fueling locations in the U.S., just 1,800 have E85 pumps available. These pumps need to be UL certified.

Terminals – Will need to expand with new equipment for unloading unit trains. Currently 19 terminals have unit train capabilities. All terminals will need to expand.

Regardless of the mode of transport and storage the following actions are needed:

- Increased training in emergency response procedures
- Increased safety training in handling ethanol in all parts of the distribution system
- Mitigation of material incompatibility of pipelines and underground storage tank systems
- Mechanisms to mitigate small business cost and liability
- Identify potential impacts of expanded infrastructure to sensitive lands
- Development and permitting of future infrastructure – since significant lead time is needed
- Green hydrocarbons would not have the same incompatibility issues as ethanol and should be more aggressively explored.