

Design Project 2: Locomotive System to Reduce Emissions

Project Description:

Project Objective

Pittsadelphia is looking for the design of a cost-effective freight shipping system that reduces smog and meets EPA requirements, while maintaining or increasing freight capacity into and out of this important port city.

Project background

Every day into and out of the port city of Pittsadelphia, approx. 165,000 tons of freight or minerals (coal, etc.) per day travel via rail. Smog from locomotive emissions is a key complaint of city residents. Smog is generated from engine-emitted NOx. Tier 2 locomotives used to haul freight are approaching age for overhaul, at which time investments will be required to meet EPA Tier 3 (or higher) requirements. Suggestions have been made to address locomotive emissions (i.e., smog) by

1) Upgrade the locomotive fleet to meet more recent emissions guidelines set by the EPA.

A few options may exist to meet the new guidelines:

- Sell existing fleet and purchase new locomotives
- Upgrade fleet with exhaust after-treatment hardware
- Utilize alternate fuels (Biodiesel, CNG, LNG, etc.) which may produce less NOx

2) Alternate freight shipping methods:

- By water
- By air
- By ground, i.e., trucking

Sponsor Background

GE Transportation, a unit of GE (NYSE: GE), solves the world's toughest transportation challenges. GE Transportation builds equipment that moves the rail, mining, and marine industries. GE's fuel-efficient and lower-emissions freight and passenger locomotives; diesel engines for rail; marine and stationary power applications; signaling and software solutions; drive systems for mining trucks; and value-added services help customers grow. GE Transportation is headquartered in Chicago, IL, and employs approximately 13,000 employees worldwide.

Project Description

Each design team should research and evaluate the suggestions made for fleet upgrade or alternate shipping methods. For upgrades, consider physical constraints of new hardware, as well as fuel storage requirements. Provide your recommendations, commenting on impact to:

1. Emissions/Regulatory requirements
2. Costs: fuel, infrastructure, etc.
3. Freight throughput/capacity
4. Public opinion
5. On-time delivery

Project Deliverables

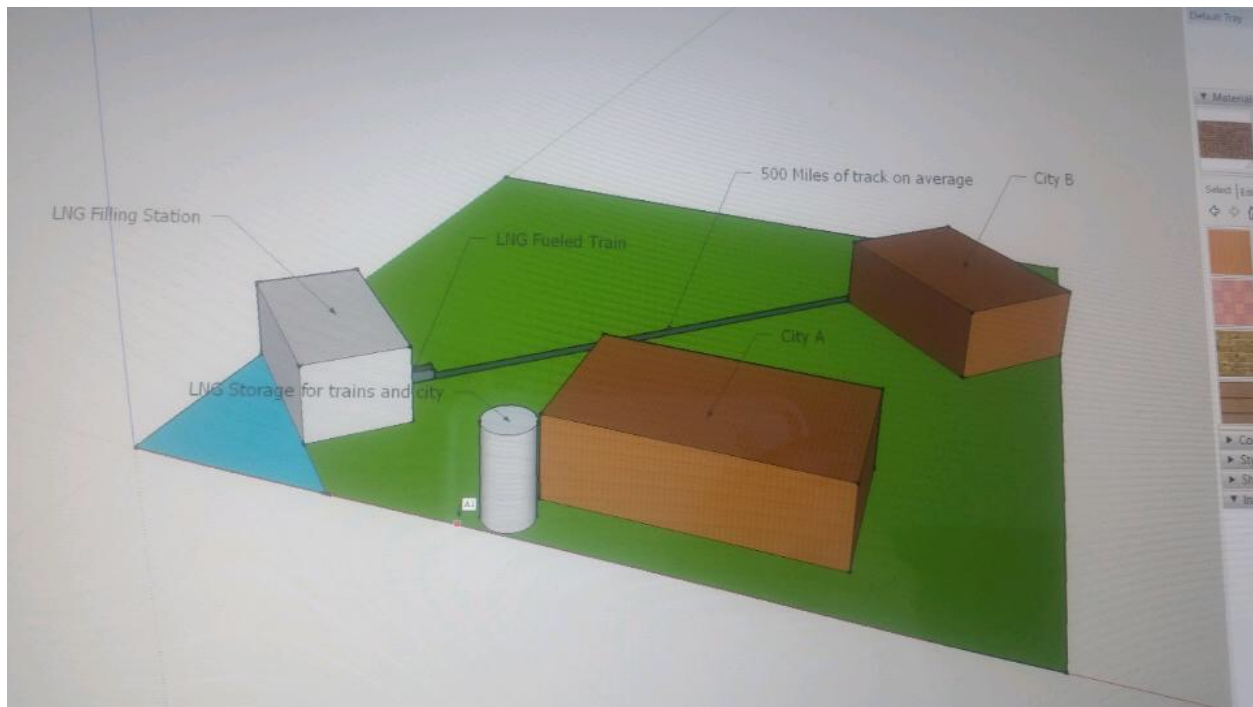
Note: Your instructor will clarify her or his expectations for these deliverables and respective due dates.

- Technical report containing the following elements
 - Rationale for the recommendation
 - Description of alternative concepts and their evaluation
 - Systems diagram
 - Concept of Operations
 - Environmental analysis
 - Assessment of important aspects of your system for feasibility and adoption, including public opinion
 - Economic viability of the system
 - CAD drawings
- Model or prototype of a component of the overall system

Additional Resources

- EDSGN 100 Project Website:
http://sedtapp.psu.edu/design/design_projects/edsgn100/fa15
- GE Transportation website: <http://www.getransportation.com/>

3D Model:



Design Features:

In order to reduce emissions in Pittsdelphia we opted to upgrade from diesel locomotives to dual-fuel locomotives. The upgraded locomotives run on a diesel and natural gas mixture rather than on just diesel. The mixture is 80% natural gas and 20% diesel. Natural gas produces less emissions than diesel and therefore is a more environmentally friendly option. Natural gas is also up to 50% cheaper than diesel and will therefore decrease fuel price. In order for the switch from diesel to dual-fuel to occur a natural gas fueling station must be implemented. The natural gas fueling station must be capable of compressing gaseous natural gas into the liquid state or LNG (liquid natural gas). The excess fuel produced by this fueling station will be sold for extra profit. The whole system should pay for its self in approximately 10 years, but more importantly will significantly reduce emissions. The locomotives will reach the emissions standards of tier 4 locomotives.