Design Project 2  
Locomotive System to Reduce Emissions  
Sponsored by: GE

Problem Statement:

Current Situation, Pittsdelphia:
•Approx 165,000-tons of freight or minerals (coal, etc) per day travel in or out of the port city of Pittsdelphia via rail.

•Smog from locomotive emissions is a key complaint of city residents. Smog is generated from engine emitted NOx. ([https://en.wikipedia.org/wiki/NOx](https://en.wikipedia.org/wiki/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 requirements. Pittsdelphia must continue to meet EPA requirements, but is looking for a cost effective solution which reduces smog, while maintaining or increasing freight capacity.

Suggestions have been made to address locomotive emissions (i.e. smog) 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 or lease new Tier IV locomotives  
•Upgrade existing fleet with after-treatment hardware to capture NOx before exhausting  
•Utilize alternate fuels (Biodiesel, CNG, LNG, etc) which may produce less NOx 2) Alternate freight shipping  
  •By sea  
  •By air  
  •By ground- trucking
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. Freight throughput / capacity
2. Emissions/Regulatory req’ts
3. Costs- fuel, infrastructure, etc
4. Public opinion
5. On time delivery

GE project website: [http://sedtapp.psu.edu/design/design_projects/edsgn100/fa15/](http://sedtapp.psu.edu/design/design_projects/edsgn100/fa15/)

3D model:
Main design features:

After taking into account travel time, emissions produced, cost of operations, upgrade cost, capacity, and return on investment upgrading to natural gas and diesel mixture (80% natural gas and 20% diesel) locomotives proved to be the best option. This design involves upgrading the existing locomotive fleet so that the locomotives are able to run on LNG (liquid natural gas) as well as diesel. In order for this to work a natural gas filling station must be added. This station will include a compressor to change the gas from gas to liquid. The gas will then be pumped into the trains, transferred to storage, or sold from here.