GE Transportation
Freight, Fuel, and Emissions

Sponsored By GE
Design Team #3
Jack It Up
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Presented to Professor Berezniak
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Executive Summary

- GE locomotive fleet in Pittsburgh needs to be upgraded
- Looking for the most efficient way to reduce smog while maintaining or increasing freight capacity
Introduction

- GE Transportation works to build equipment that drives the rail and marine industries
- Locomotives should either be replaced, upgraded, or an alternate shipping method should be used
Transportation Infrastructure Condition and Capacity

- Pennsylvania infrastructures were given grades by the American Society of Civil Engineers:
  - Bridges D+
  - Inland Waterways D+
  - Ports C+
  - Transit D
  - Roads D-
  - Freight Rail B
Standard Capacity for Alternate Transportation Modes

Compare...

Cargo Capacity

- **One Barge**
  - 1,500 TON
  - 62,500 BUSHELS
  - 825,600 GALLONS

- **One 15 Barge Tow**
  - 22,500 TON
  - 725,000 BUSHELS
  - 8,904,000 GALLONS

- **Jumbo Hopper Car**
  - 100 TON
  - 3,500 BUSHELS
  - 30,000 GALLONS

- **100 Car Train Unit**
  - 10,000 TON
  - 350,000 BUSHELS
  - 3,025,000 GALLONS

- **Large Semi**
  - 26 TON
  - 950 BUSHELS
  - 7,005 GALLONS

Equivalent Units

- **One Barge**
- 15 Jumbo Hopper Cars
- 58 Large Semis

Equivalent Lengths

- **One 15 Barge Tow**
  - 0.25 MILES

- **2.25 100 Car Train Unit**
  - 2.75 MILES

- **870 Large Semis**
  - 11.5 MILES
    - (Bumper to Bumper)
Transportation Costs and ConOps

- Three options for transportation:
  - **Trucks**: $1.68 per mile
  - **Barges**: between $.005 - $.01 per ton per mile of cargo moved
  - **Railroad**: $0.03 per ton-kilometer
EPA Diesel Emission Standards

- EPA set up a standard on allowed emissions produced by a diesel locomotive.
- Percentages represent amount of emissions removed compared to previous tier train.
Diesel Engine Exhaust Emissions (DEEE)

- NO\textsubscript{x}, particulate matter, CO\textsubscript{2}, and hydrocarbons
- Modification of engines, other technologies, and alternative fuel methods can be used to reduce emissions
Locomotive Fleet Upgrade

- Three options for upgrading the fleet:
  - Selling existing fleet and purchasing new trains
  - Upgrading the train with exhaust after-treatment hardware
  - Utilizing alternative fuels
Summary

- EPA now requires all trains to be at least Tier 3 or Tier 4
- Solution:
  - Upgrade fleet groups A and B
  - Replace group C with Tier 3 and group D with Tier 4 locomotives
  - Use barges to transport group E’s cargo and sell group E locomotives

<table>
<thead>
<tr>
<th>No. of Existing Locomotives</th>
<th>Locomotive Group Designation</th>
<th>Assumed Existing Locomotive Mileage Range</th>
<th>Assumed Existing Diesel Type</th>
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<td>A</td>
<td>&lt;150,000</td>
<td>Tier 2</td>
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<tr>
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<tr>
<td>10</td>
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