Creating a More Efficient Future through Locomotive Design

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Background

Possible Transportation Methods

Sea (cargo ships), Air, Trucking delivery and rail (chosen method)

Possible Improvements

- Sell existing freight and purchase higher tier efficiency locomotives
- Upgrade fleet with exhaust after treatment
- Switch to alternative fuels (Biodiesel, CNG, LNG, etc)

Investment Data

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Tier II >> Tier III	$.75M	Selling of Tier II	$1.5M
After-Treatment	$.1M	Alter. Fuels Locomotive Upgrade	$1M
New Tier III	$3M	Fueling Station	$1B
New Tier IV	$4M		

Emissions Data

Locomotive Emissions

Tier	NOx kg/300 miles	PM kg/300 miles
2	185.625	6.75000
3	185.625	3.71250
4	43.875	0.84375

Goal

Improve the efficiency of locomotive shipping 300 miles, meet the new EPA emission requirements, increase freight capacity all while remaining within reasonable cost range.

Conclusions

The final solution is to use a combination of 22 Tier III and 22 Tier IV level locomotives. 22 of the original Tier II's will be upgraded to Tier IV levels and the remaining 28 Tier II locomotives will be sold to purchase 22 Tier IV locomotives. This solution is effective in the long run and allows for the best correlation between cost, freight weight, and emissions.

Comparisons and Analysis

Rating Method

- Calculate the best option
  - Emissions was ranked a 5 in importance
  - Cost was ranked a 4 in importance
  - Freight Capacity was ranked a 1 in importance
- Account for the long term effects
- Specifically, Tier II after-treatment and Tier II
  - Same amount of emissions, however, Tier III is better in the long run compared to the limited Tier II

Disadvantages of Transportation Methods

- Sea - Delays and Lengthy Shipping Time
- Air - Costly, Limited Capacity, and Poor Environmental Impact
- Truck - Limit Capacity and Poor Environmental Impact
- Alternative Fuels - Very Costly