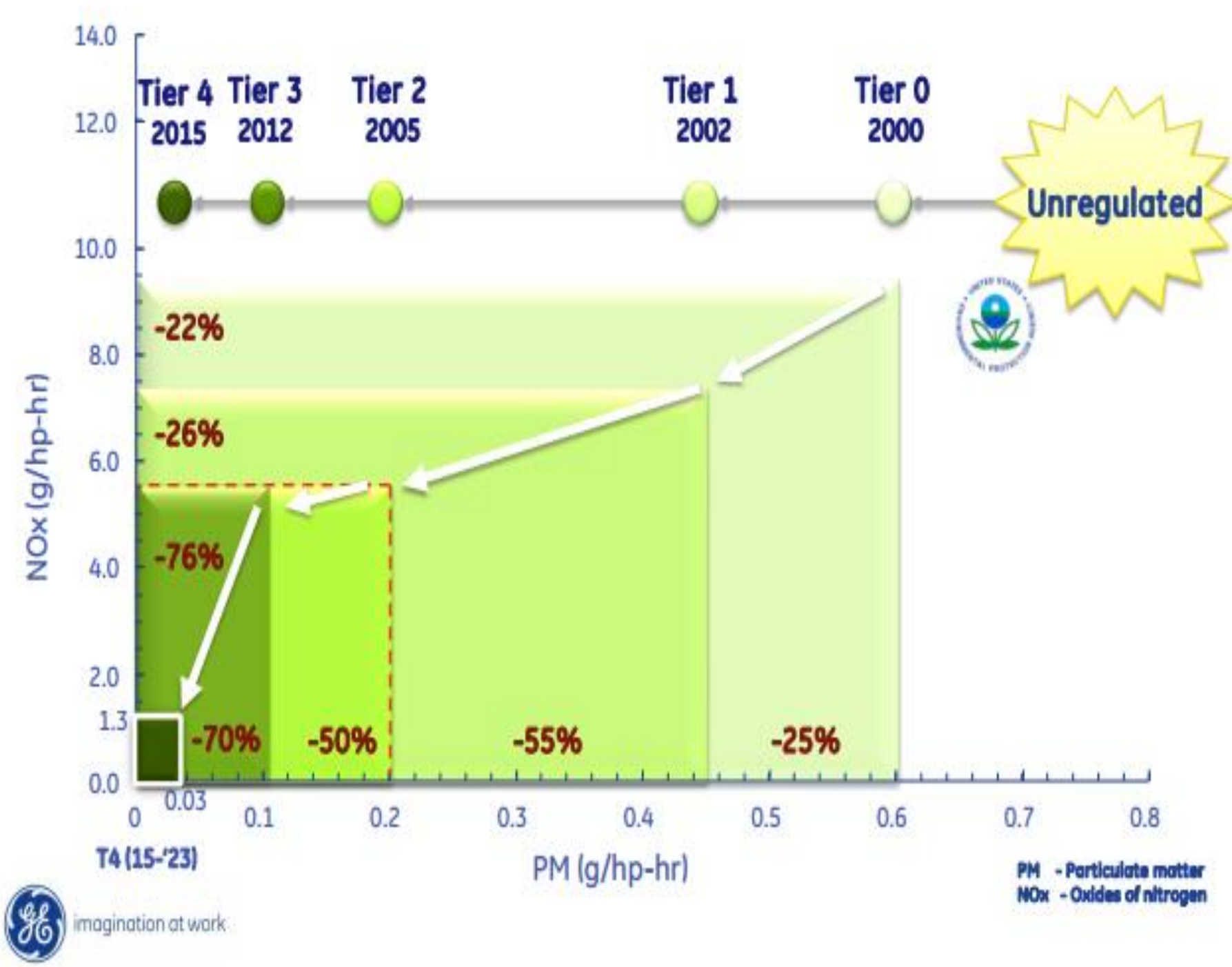


The environmental Protection agency (EPA) set progressive emission standards for all types of trains, with 4 tiers of increasing standards.

Locomotive EPA emissions



Using the Ranking Method and The Ideal Value method, it is decided that the best solution is to....

SELL ALL THE TIER II LOCOMOTIVES AND BUY NEW TIER IV LOCOMOTIVES



Why TIER IV?

- Less emission of NOx, CO, and Other Pollutant (fulfills EPA regulations)
- More cost efficient than the other options (assuming that maintenance cost is the same for all option)
- Increased carrying capacity

RANKING TABLE

Train Option	Cost: 6	Carrying capacity: 5	Emission: 3	Public Opinion: 3	Operating costs: 4	Score
After Treatment	1	0.5	0.24	0.75	0.2	0.5843
Tier III	0.5	0.5	0.24	0.625	0.3	0.4426
Tier IV	0.3	1	1	1	0.5	0.7048
LNG	0.04	0.5	0.24	0.5	0.6	0.3505

LIST OF FACTS

	After Treatment Option	Buy Tier IIIs	Buy Tier IVs	LNG
Cost	37.5M	75M + Maintenance Costs	125M + Maintenance Costs	1B +50M + Maintenance Costs
C C	Same	Same	Increased	Same
Emission	.1 PM, 5.5NOx	.1 PM, 5.5. NOx	.03 PM, 1.3 NOx completely eliminates urea emissions (carboxylic acid)	.1 PM, 5.5 NOx
Public Opinion	Lowest short term cost, Slightly better emissions	More expensive short term, same emission decrease	Even more expensive short term, but much better emissions, eliminates urea	Most expensive short term, same emissions, controversial fuel, could be considered forward thinking
On Time Delivery	Same	Same	Same	Same

Possible Solutions:
After treatment on Tier II.
Buy tier III
Buy tier IV (after selling tier II)
LNG as alternative fuel

Cost Breakdown

TIER IV vs After-treatment system

SELL ALL TIER II and BUY TIER IVs

Cost = + USD 75,000,000.00 (selling the whole fleet) –
USD 200,000,000.00 (buying the exact same number of locomotives)
= **USD 125,000,000.00**

INSTALL AFTER-TREATMENT SYSTEM ON EXISTING TIER IIs

Cost = **50 x USD 750,000.00** (UPGRADING TIER II → III, WHOLE FLEET) + **50 x USD 100,000.00** (INSTALLING AFTER TREATMENT, WHOLE FLEET)
= **USD 42,500,000.00**

GOAL
IMPROVE PITTSADDELPHIA'S FREIGHT DELIVERY SYSTEM TO FULFILL CURRENT ECONOMIC AND ENVIRONMENTAL REQUIREMENT.



RESTRAINTS

