A decision tool for portfolio selection aiming to replace Air Supply Houses

### Objectives
- Create a decision tool for portfolio selection aiming to retrofit Air Supply Houses on a General Motors’ plant with a sustainable objective in mind:
  - Selecting the Air Supply Houses available for replacement
  - Assess the sustainable impacts of Air Supply Houses: economical, environmental and social impacts
  - Evaluate the different alternatives with the 3 criteria: economical, environmental and social impacts
  - Allocate capital with financial and technological constraints

### Introduction
- Assessing sustainability is a Multi-Criteria Decision Problem
- To simplify the problem, only 3 families of ASHs and only 4 ASHs available for replacement are assumed

### Model Overview: Step 1 & 2

#### 1st step: Creation of potential ASHs
- **Reason**: Difficulties to obtain data from ASH manufacturers
- **Method used**: Selection process developed by ASH manufacturers

#### 2nd step: Sustainable assessment
- **Reason**: These data are needed in order to rank the ASHs
- **Method used**:
  - Social assessment: pairwise comparisons
  - Environmental assessment: energy consumption
  - Economical assessment: Cost present value

### Model Overview: Step 3 & 4

#### 3rd step: Ranking method
- **Reason**: To know the best ASHs for replacement by categories
- **Method used**: PROMETHEE II Method

### Details: Step 1 & 2

#### ASHs available for replacement

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<thead>
<tr>
<th>ASH Model</th>
<th>Creation of ASHs for replacement</th>
<th>Sustainable assessment</th>
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### Details: Step 3

#### Step 1: Ranking of the ASHs

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#### Step 2: Capital allocation

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### Details: Step 4

#### 4th step: Portfolio selection
- **Reason**: Choose the best ASHs with the financial resources available and the CFM capacity needs
- **Method used**: Linear Programming
- **Software used**: LINDO

### Conclusion
- **Case study**
  - 3 families of ASHs: 2,500 CFM / 10,000 CFM and 15,000 CFM
  - 4 different ASHs within each category
  - An investment budget of $45,000 and a CFM need of 30,000
- **3 analysis performed**:
  - 1st analysis: Environmental is the most important criterion,
    Economical the second and Social the least
  - 2nd analysis: Environmental is the most important criterion,
    Economical the second and Social the least
  - 3rd analysis: Criterion are equally important
- **Conclusion**
  3 different portfolios are selected for the 3 different analysis, so weights have huge impact on the final result and should be selected carefully.