# Greenvale City Pollution Reduction Planner

***User's Manual and Documentation***

## 1. Introduction

### a. Objective

The **Greenvale City Pollution Reduction Planner** serves as a strategic decision-making tool for the City of Greenvale. Its main goal is to help the city council decide how many units of each mitigation project option should be implemented to meet the annual reduction target of each priority pollutant.

### b. Specification of the Problem

Greenvale City is required by the national government to drastically **reduce 10 major pollutants**, but each pollutant has its own minimum reduction target that must be met. Although the city has 30 mitigation options available, **each project can only be implemented at most 20 units,** which makes it difficult to determine the best combination.

### c. Solution

The Pollution Reduction Planner uses the **Simplex minimization method** to compute the most cost-efficient combination of mitigation projects that still meets all required pollutant reduction targets.

## 2. Prerequisites

**Hardware :**Basic computer with standard processing power (Window, Mac, Linux).
**Software:** Installed **Python, Custom Tkinter, and Numpy**

Moreover, the application relies on the following modules. To install them, run these commands in your command prompt:

| | |
|---|---|
| **pip install tkinter** | : for User's Interface |
| **pip install customtkinter** | : for User's Interface |
| **pip install numpy** | : for matrix representation/operations |

## 4. How to Run

1. Download **JJMBaez_CMSC150Project.zip** and extract it to your preferred directory.
2. Open **Command Prompt** and change directory**.** Use cd -yourpreferedfiledirectory- (e.g **cd Documents\BaezProject**)
3. Run the main by the input **python main.py**
4. The system will display the application and you may maximize the window.

## 5. How to Use

### Selecting Projects

On the left frame, you'll see the **Mitigation Projects**. This displays all available pollution reduction options with their costs.

- **Select Projects**: Click any project checkbox to select it.
  - **Checked**: The project is SELECTED and will be included in the calculation.
  - **Unchecked**: The project is EXCLUDED.
- **Bulk Controls**: Use the "Select All" button to choose all projects at once, or "Reset" to deselect everything.

### Optimization

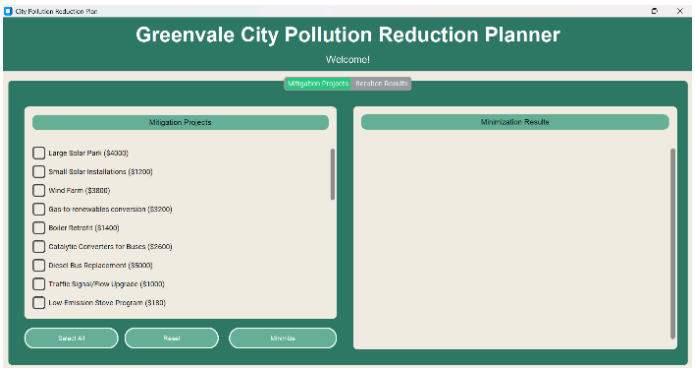
Once you're satisfied with your selection, click the **Minimize** button at the bottom of the frame to calculate the optimal solution.

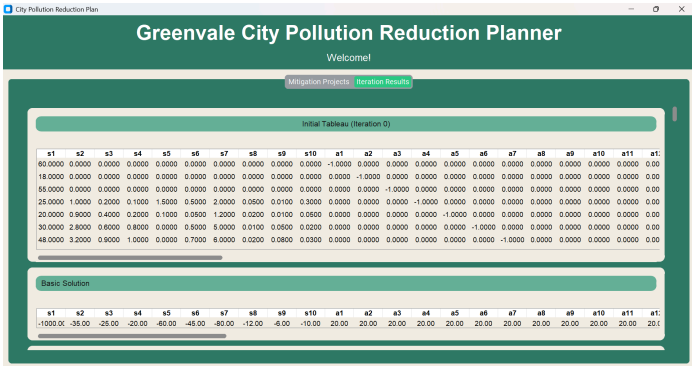
### Reading Results

On the right frame , you'll see the **Minimization Results.** This displays the results of the minimization including the projects that has more than 1 unit after optimization (column 1), the required units (column 2), and the total cost of each projects (column 3).

Switch to the **Iteration Results** tab to view detailed updates in iterations.

- **Initial Tableau**: · Displays the raw mathematical matrix (simplex tableau) representing the constraints before solving. Shows the initial setup with constraint coefficients and values.
- **Iteration (i)** : Displays the updated tableau after an iteration in simplex is applied. It includes the slacks, additional, decision variables, Z and RHS
- **Basic Solution**: Shows the final optimal solution after an iteration completes. Moreover, the last basic solution table indicates how many units(x1-x30) of each project to implement for minimum cost while meeting pollution reduction targets.




## 6. Troubleshooting

**Issue:** No Selection

**Reason:** You likely clicked **Minimize** without selecting any project.
**Fix:** Select at least one project.

**Issue:** Optimization Error

**Reason:** The project you selected do not have enough combined capacity to meet one or more pollutant targets.
**Fix:** Select all mitigation projects or manually select possible combination projects that will meet the target of each pollutants.

## 7. Credits

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**Year :** 2025
**Institution :** University of the Philippines Los Baños

## 8. References

1. **CMSC 150 Final Project (1st Sem 2025-2026).pdf**
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2. **CMSC 150 Laboratory Topic 5_Simplex Method.pdf**
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3. **[FULL VERSION] CMSC 150 Laboratory Topic 5_Simplex Method.pdf**
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