

Eviroth

User Manual



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Eviroth: Building towards Environmental Growth through Eco-Friendly Projects

About the Project

Eviroth is a project that applies Simplex optimization to identify the lowest-cost combination of mitigation projects that satisfies required environmental targets. The City of Greenvale has been instructed by the national government to significantly reduce its pollution footprint across ten key pollutants. To meet these goals, the city can choose from a portfolio of 30 mitigation options, each with different impacts and costs. However, only certain combinations of projects produce valid, feasible solutions. This program was created to visualize the optimization problem, its inputs, constraints, and resulting outcomes, in an intuitive and interactive way.

Libraries and Dependencies

- Pandas : Data manipulation and structuring
- NumPy : Matrix and numerical computations
- Streamlit : Web-based interactive UI
- Plotly: For Graph visualization

Project Cloning Via Github

You can clone the project through github if you wish to run in your own machine or visit

Clone the repository:

```
git clone https://github.com/Fylows/simplex-project  
cd simplex-project
```

install dependencies

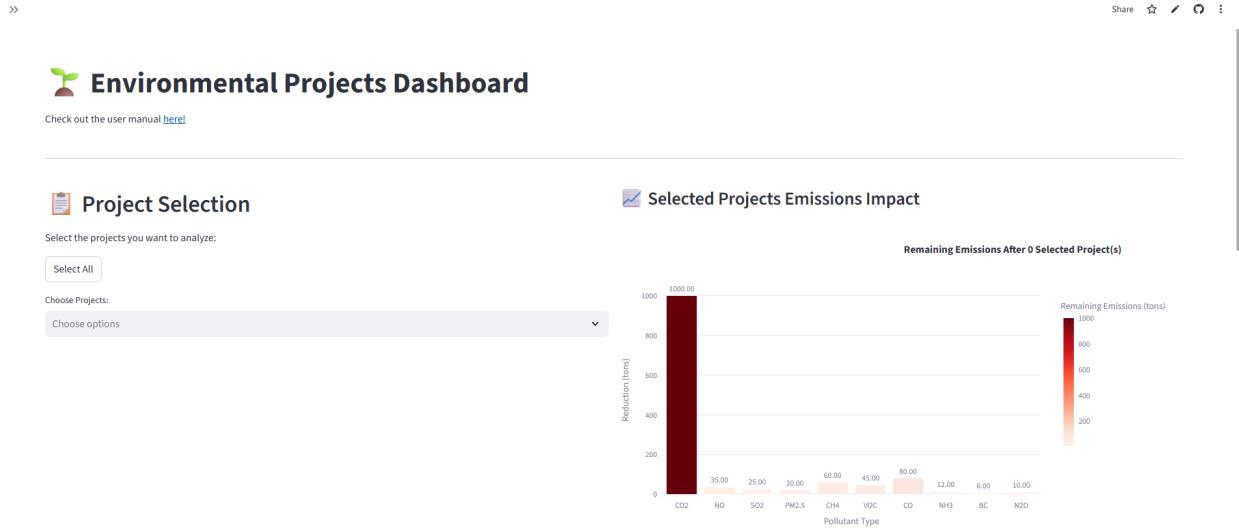
```
pip install -r requirements.txt
```

Run the streamlitapp

```
streamlit run Solver.py
```

WebApp Navigation

Solver Page



s.a.1 Project Selection

This screenshot shows a 'Project Selection' form. It includes a 'Select All' button and a dropdown menu labeled 'Choose Projects:' containing the option 'Choose options'. The dropdown menu is open, showing a list of project names.

s.a.2 Project Selection Dropdown

This screenshot shows the same 'Project Selection' form with the 'Choose options' dropdown open. The list contains ten project names: Large Solar Park, Small Solar Installations, Wind Farm, Gas-to-renewables conversion, Boiler Retrofit, Catalytic Converters for Buses, Diesel Bus Replacement, and Traffic Signal/Cloud Upgrade. The 'Large Solar Park' item is currently selected.

s.a.3 Infeasible Project Selection

Project Selection

Select the projects you want to analyze:

Select All

Choose Projects:

Large Solar Park × Small Solar Insta... × Wind Farm × Gas-to-renewabl... × Boiler Retrofit ×

× ▼

Selected Projects Information

ProjectNames	Cost	CO2	NO	SO2	PM2.5	CH4	VOC	CO	NH3	BC	N2O
Large Solar Park	4000	60	0	0	0	0	0	0	0	0	0
Small Solar Installations	1200	18	0	0	0	0	0	0	0	0	0
Wind Farm	3800	55	0	0	0	0	0	0	0	0	0
Gas-to-renewables conversion	3200	25	1	0.2	0.1	1.5	0.5	2	0.05	0.01	0.3
Boiler Retrofit	1400	20	0.9	0.4	0.2	0.1	0.05	1.2	0.02	0.01	0.05

Summary Statistics

Project is infeasible - no optimal solution exists

S.a.4 Feasable Project Selection

Selected Projects Information

Project Names	Cost	CO2	NO	SO2	PM2.5	CH4	VOC	CO	NH3	BC	N2O
EV Charging Infrastructure	2200	20	0.3	0.05	0.1	0	0.05	0.5	0.01	0.01	0.01
Biochar for soils (per project unit)	1400	6	0.01	0	0.01	2.5	0.01	0.01	0.2	0	0.02
Industrial VOC	2600	2	0.01	0	0	0	6.5	0.1	0	0	0
Heavy-Duty Truck Retrofit	4200	36	2.2	0.6	0.6	0	0.3	4.2	0.01	0.04	0.02
Port/Harbor Electrification	4800	28	1.9	0.8	0.7	0	0.2	3.6	0.01	0.03	0.02
Black Carbon reduction	600	1.8	0.02	0.01	0.6	0.05	0.01	1	0.02	0.9	0
Wetlands restoration	1800	10	0.03	0.02	0.02	3.2	0.01	0.05	0.15	0.02	0.04
Household LPG conversion program	700	2.5	0.03	0.01	0.4	0.05	0.02	1.2	0.03	0.1	0
Industrial process change	5000	3	0.02	0.01	0	0	0	0	0	0	1.5
Behavioral demand-reduction program	400	9	0.4	0.05	0.05	0.01	0.3	2.5	0.01	0.01	0.01

Summary Statistics

Total Cost

\$233,967

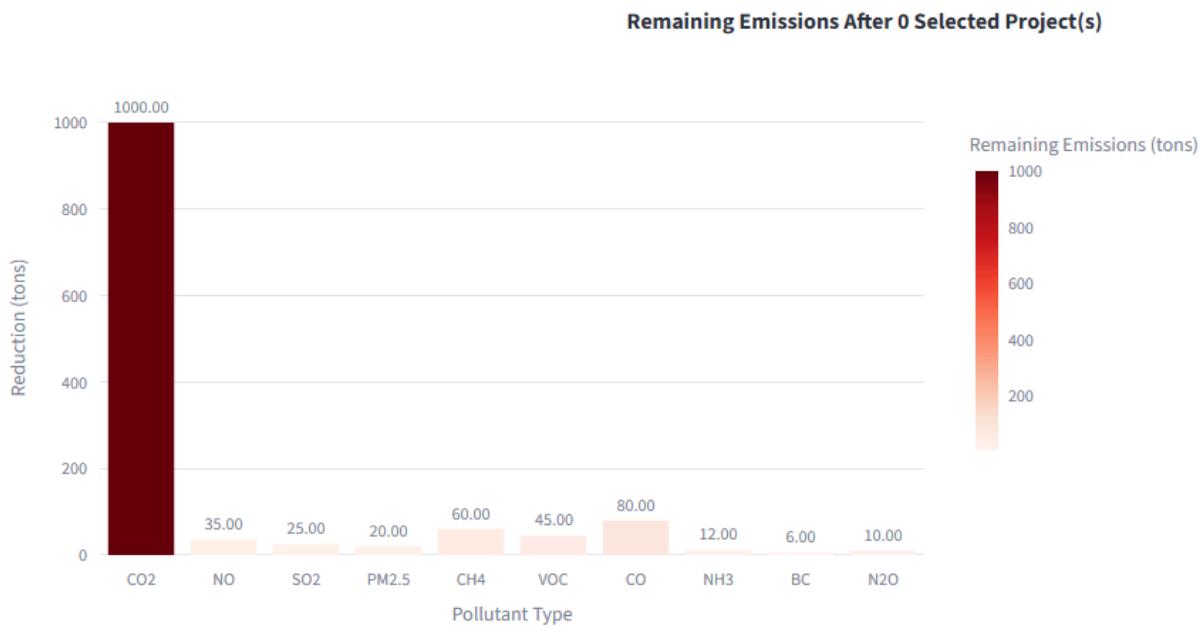
Projects Selected

30

Project	Quantity	Total_Cost
Large Solar Park	0	0
Small Solar Installations	0	0
Wind Farm	0	0
Gas-to-renewables conversion	0	0
Boiler Retrofit	20	28000
Catalytic Converters for Buses	0	0
Diesel Bus Replacement	0	0
Traffic Signal/Flow Upgrade	6.9932	6993.2343
Low-Emission Stove Program	20	3600
Residential Insulation/Efficiency	0	0

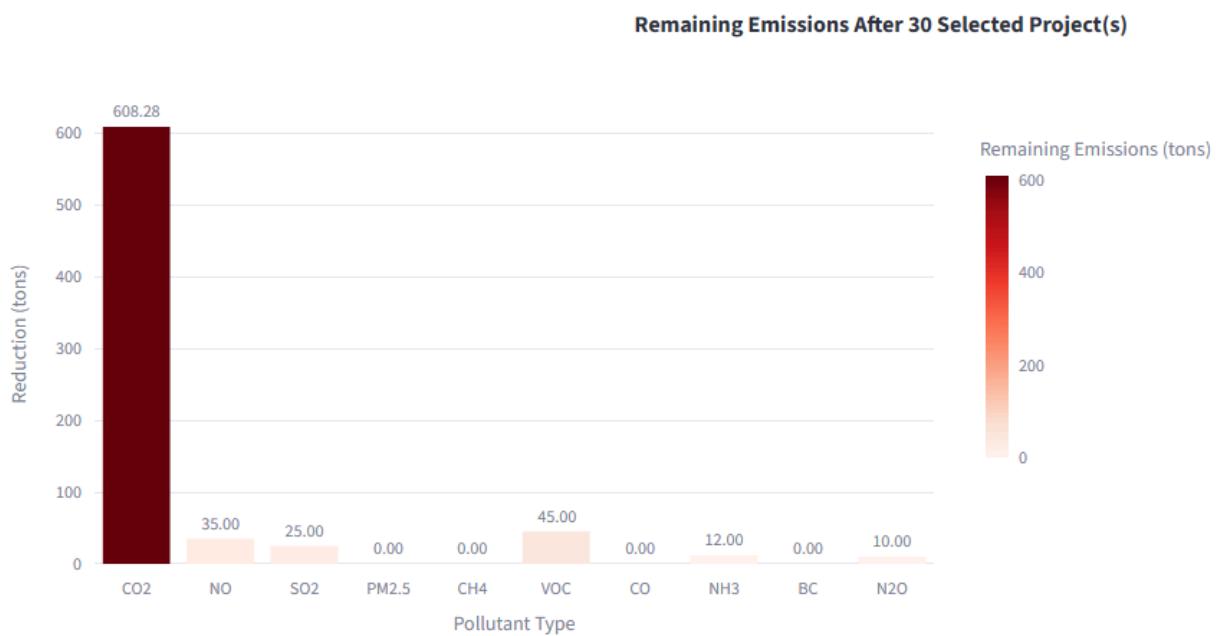
s.b.1 Remaining Emissions Graph

Selected Projects Emissions Impact



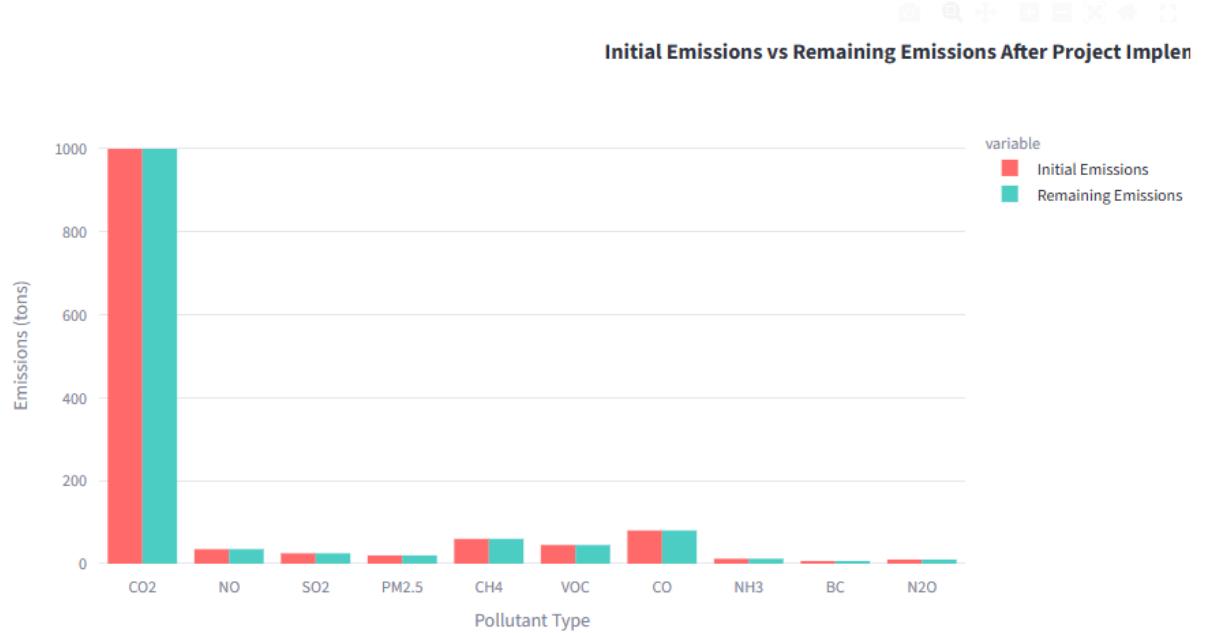
s.b.2 Remaining Emissions Graph after a Feasible Project Selection

Selected Projects Emissions Impact



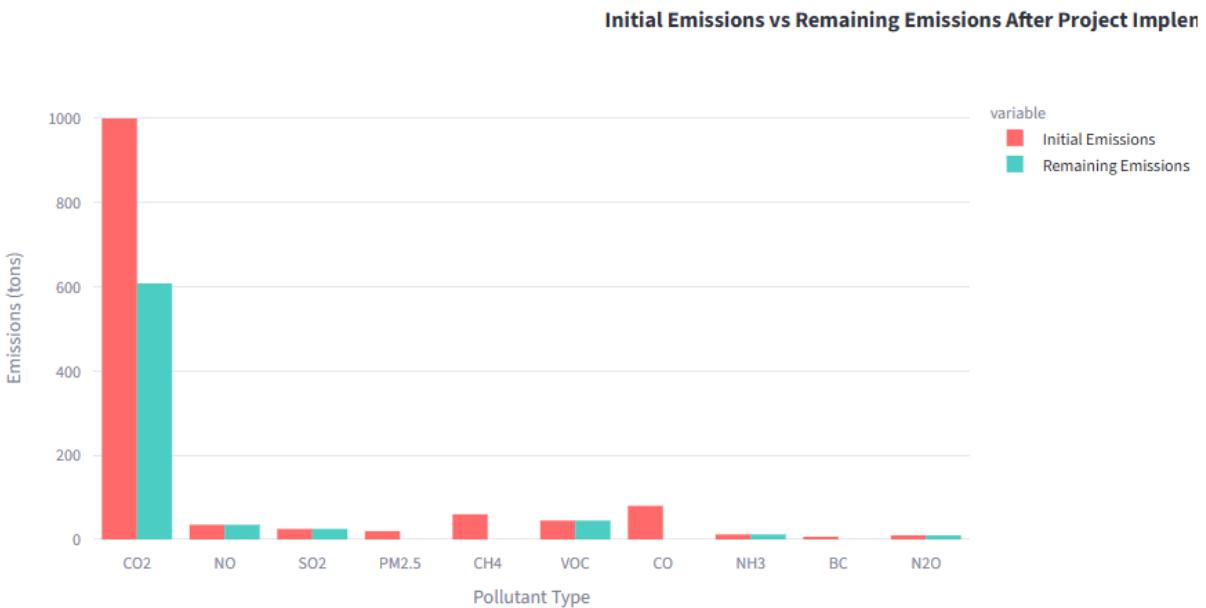
s.b.3 Initial (Red) and Remaining (Green) Emissions comparison

Comparison: Initial vs Remaining Emissions



s.b.4 Initial (Red) and Remaining (Green) Emissions comparison after a Feasible Project Selection

Comparison: Initial vs Remaining Emissions



Verbose Page

v.1 Verbose page without selected Projects

The screenshot shows a web-based application interface. On the left, there is a sidebar with tabs for 'Solver' and 'Verbose'. The 'Verbose' tab is selected. In the main content area, there is a header '12 34 Verbose Output'. Below it, a sub-header reads: 'In this page you can view all the iterations of the Simplex Algorithm. The Variable Cn represents the count of a specific project, and the variable Sn represents the slack variables.' A message box states: 'No computation yet. Please select projects in the Selection page.' At the top right, there are sharing options: 'Share' with icons for Google+, LinkedIn, Facebook, and Twitter.

v.2 Verbose page with an infeasible project selection

The screenshot shows the same application interface as above. The 'Verbose' tab is selected. The main content area features a header '12 34 Verbose Output' and a sub-header about the Simplex Algorithm. A prominent red error message box at the top states: 'Project is infeasible - no optimal solution exists'. At the top right, there are sharing options: 'Share' with icons for Google+, LinkedIn, Facebook, and Twitter.

v.3 Verbose page with a feasible project selection

The screenshot shows the application interface again. The 'Verbose' tab is selected. The main content area includes a header '12 34 Verbose Output' and a sub-header about the Simplex Algorithm. Below this, there is a section titled 'Initial Tableau' containing a large table with numerical values for various columns and rows. At the bottom of the tableau, there is a note: 'The initial tableau is set up for the Simplex algorithm. The objective function is maximized, and the constraints are converted into equalities by adding slack variables. The tableau is in row echelon form, ready for pivoting.' Below the tableau, there is a section titled 'Basic Solution' with a table showing the values for CO2 and NOx. The total value is listed as 391.7239. At the top right, there are sharing options: 'Share' with icons for Google+, LinkedIn, Facebook, and Twitter.