

# Project Green Manual



## About

Project Green is a project making use of optimization to solve a specific problem: To minimize the cost of a selection of project meeting its constraint. Specifically, the City of Greenvale has been mandated by the national government to drastically reduce its pollution footprint, identifying ten (10) specific pollutants to reduce. To achieve these reductions, Greenvale has access to a menu of 30 mitigation options. However, the valid solution only comes with specific combinations of projects. To visualize the problem, including its inputs and outputs, this program is created.

## Libraries and Dependencies

Python, Flask, FlaskSession, NumPy

## How to Run

1. Extract the project folder
2. Open the project folder in a terminal

```
cd path\to\CMSC150_PROJECT
```

3. The folder already includes a virtual environment and the required libraries. Activate that virtual environment using

Windows (Command Prompt): venv\Scripts\activate

Windows (Powershell): venv\Scripts\Activate.ps1

Linux: source venv/bin/activate

You should now see a (venv) at the beginning of the line of your command prompt

4. Just to be sure (hehe), install the dependencies using (venv must be activated):

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

5. Now, run the application using:

```
python app.py
```

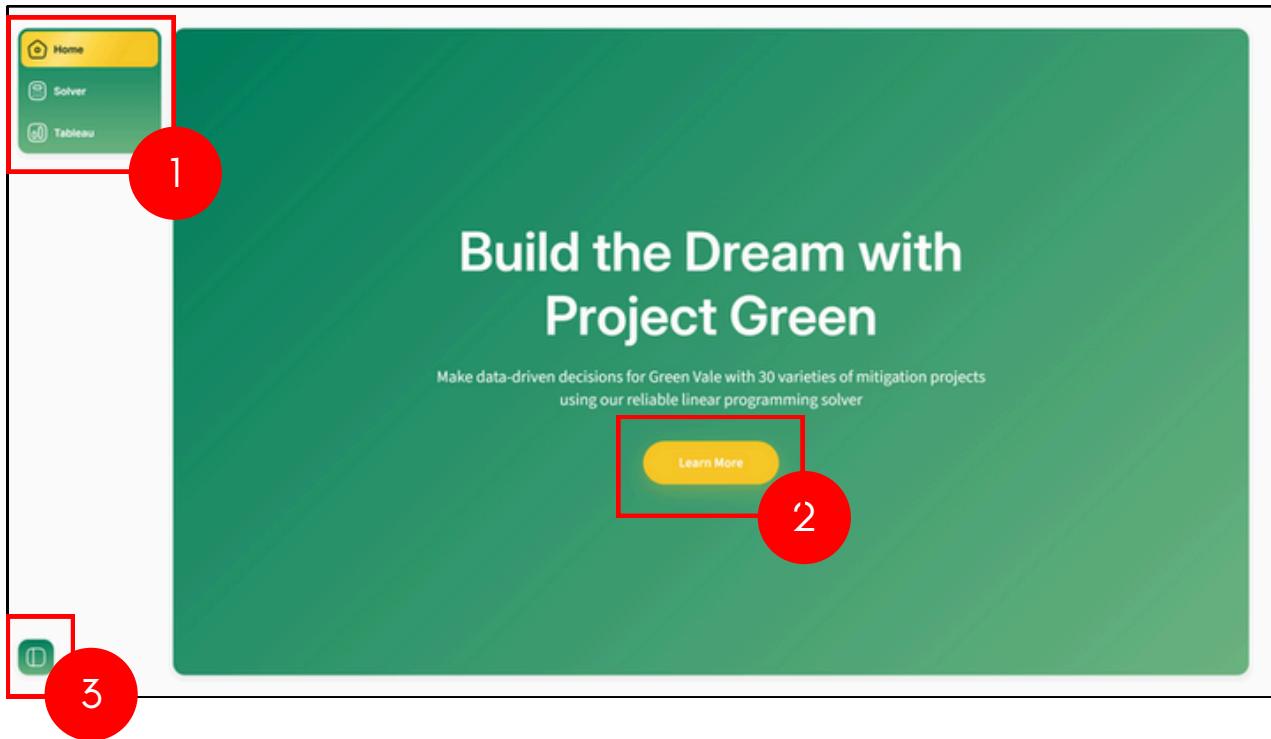
You should see the following in your command prompt

```
* Serving Flask app 'app'  
* Debug mode: on  
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.  
* Running on http://127.0.0.1:5000  
Press CTRL+C to quit  
* Restarting with stat  
* Debugger is active!  
* Debugger PIN: 504-183-845
```

6. Visit <http://127.0.0.1:5000>

## Navigation

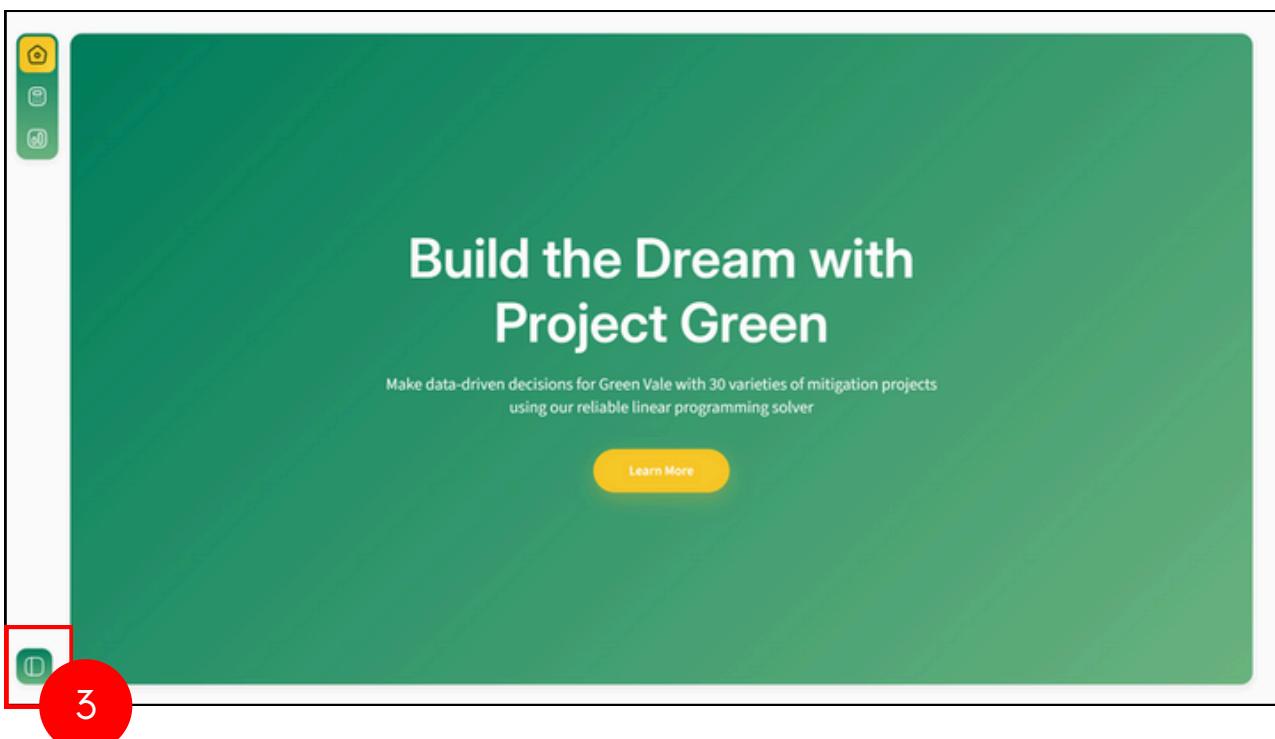
### 1. Home Page



1.1 Sidebar - Click each tab to navigate to its respective page

1.2 Learn More - Click learn more to download the manual

1.3 Toggle Sidebar - Click toggle button to collapse or expand the sidebar



# Navigation

## 2. Solver Page

Projects (30)

Project	CO <sub>2</sub>	NO	SO <sub>2</sub>	CH <sub>4</sub>	PM <sub>2.5</sub>	VOC	CO	NH <sub>3</sub>	BC	N <sub>2</sub> O	Cost
Large Solar Park	60	0	0	0	0	0	0	0	0	0	4000
Small Solar Installations	18	0	0	0	0	0	0	0	0	0	1200
Wind Farm	55	0	0	0	0	0	0	0	0	0	3000
Gas-to-renewables conversion	25	1	0.2	0.1	1.5	0.5	2	0.05	0.01	0.3	3000
Boiler Retrofit	20	0.9	0.4	0.2	0.1	0.05	1.2	0.02	0.01	0.05	3000
Catalytic Converters for Buses	30	2.8	0.6	0.8	0	0.5	5	0.01	0.05	0.02	2000
Diesel Bus Replacement	48	3.2	0.9	1	0	0.7	6	0.02	0.08	0.03	5000
Traffic Signal/Flow Upgrade	12	0.6	0.1	0.4	0.05	0.2	3	0.02	0.02	0.01	2000
Low-Emission Stove Program	2	0.02	0.01	0.7	0	0.01	1.5	0.03	0.2	0	200
Residential Insulation/Efficiency	15	0.1	0.05	0.05	0.02	0.02	0.5	0	0	0.01	900
Industrial Scrubbers	6	0.4	6	0.4	0	0.1	0.6	0.01	0.01	0	4000
Waste Methane Capture System	28	0.2	0.1	0.05	8	0.2	0.1	0	0	0.05	3000
Landfill Gas-to-energy	24	0.15	0.05	0.03	6.5	0.1	0.05	0	0	0.03	3000
Reforestation	3.5	0.04	0.02	0.01	0.8	0.03	0.1	0.01	0.005	0.005	200
Urban Tree Canopy Program	4.2	0.06	0.01	0.03	0.6	0.02	0.15	0.005	0.02	0.002	300
Industrial Energy Efficiency Retrofit	22	0.5	0.3	0.15	0.2	0.1	1	0.01	0.01	0.03	2000
Natural Gas Leak Repair	10	0.05	0.01	0.01	4	0.02	0.02	0	0	0.01	2000
Agricultural Methane Reduction	8	0.02	0.01	0.02	7.2	0.05	0.02	0.1	0	0.05	2000
Clean Cookstove & Fuel Switching	1.2	0.04	0.03	0.9	0.1	0.03	2	0.06	0.04	0	400

Projects (30)

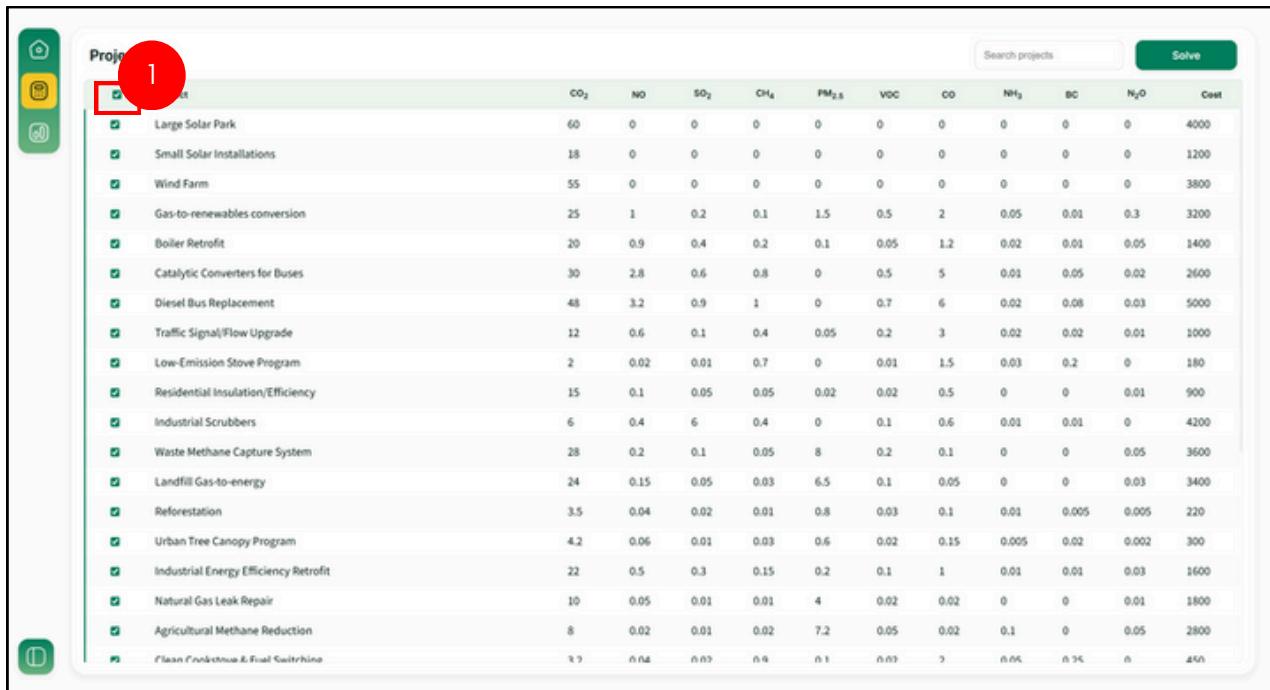
Project	CO <sub>2</sub>	NO	SO <sub>2</sub>	CH <sub>4</sub>	PM <sub>2.5</sub>	VOC	CO	NH <sub>3</sub>	BC	N <sub>2</sub> O	Cost
Large Solar Park	60	0	0	0	0	0	0	0	0	0	4000
Small Solar Installations	18	0	0	0	0	0	0	0	0	0	1200
Wind Farm	55	0	0	0	0	0	0	0	0	0	3800
Gas-to-renewables conversion	25	1	0.2	0.1	1.5	0.5	2	0.05	0.01	0.3	3200
Boiler Retrofit	20	0.9	0.4	0.2	0.1	0.05	1.2	0.02	0.01	0.05	1400
Catalytic Converters for Buses	30	2.8	0.6	0.8	0	0.5	5	0.01	0.05	0.02	2600
Diesel Bus Replacement	48	3.2	0.9	1	0	0.7	6	0.02	0.08	0.03	5000
Traffic Signal/Flow Upgrade	12	0.6	0.1	0.4	0.05	0.2	3	0.02	0.02	0.01	1000
Low-Emission Stove Program	2	0.02	0.01	0.7	0	0.01	1.5	0.03	0.2	0	180
Residential Insulation/Efficiency	15	0.1	0.05	0.05	0.02	0.02	0.5	0	0	0.01	900
Industrial Scrubbers	6	0.4	6	0.4	0	0.1	0.6	0.01	0.01	0	4200
Waste Methane Capture System	28	0.2	0.1	0.05	8	0.2	0.1	0	0	0.05	3600
Landfill Gas-to-energy	24	0.15	0.05	0.03	6.5	0.1	0.05	0	0	0.03	3400
Reforestation	3.5	0.04	0.02	0.01	0.8	0.03	0.1	0.01	0.005	0.005	220
Urban Tree Canopy Program	4.2	0.06	0.01	0.03	0.6	0.02	0.15	0.005	0.02	0.002	300
Industrial Energy Efficiency Retrofit	22	0.5	0.3	0.15	0.2	0.1	1	0.01	0.01	0.03	1600
Natural Gas Leak Repair	10	0.05	0.01	0.01	4	0.02	0.02	0	0	0.01	1800
Agricultural Methane Reduction	8	0.02	0.01	0.02	7.2	0.05	0.02	0.1	0	0.05	2800
Clean Cookstove & Fuel Switching	1.2	0.04	0.03	0.9	0.1	0.03	2	0.06	0.04	0	450

Optimized Cost  
\$ 233,966.99

Mitigation Project	Units	Cost
Traffic Signal/Flow Upgrade	6.99	6,993.23
Low-Emission Stove Program	20.0	3,600.00
Industrial Scrubbers	2.25	9,431.45
Reforestation	20.0	4,400.00
Agricultural Methane Reduction	18.38	51,455.03
Clean Cookstove & Fuel Switching	20.0	9,000.00
Biochar for soils	20.0	28,000.00
Industrial VOC	5.15	13,383.18
Wetlands restoration	20.0	36,000.00
Household LPG conversion program	20.0	14,000.00
Industrial process change	4.34	21,704.09

# Navigation

2.1 Master Checkbox - Click the master checkbox to select/deselect all checkboxes. Clicking a selected master checkbox will deselect all checkboxes, while clicking a deselected master checkbox will select all checkboxes

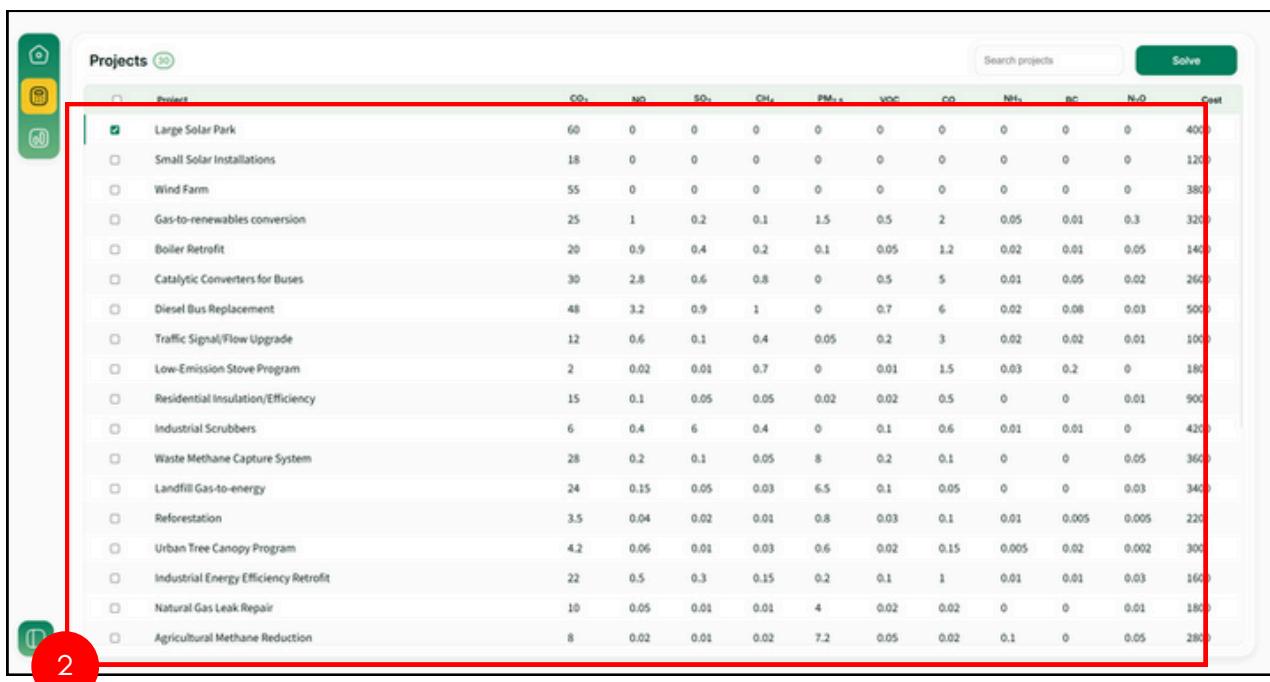


The screenshot shows a table titled "Projects" with 20 rows of project data. The first column contains checkboxes. A red circle with the number "1" is placed over the first checkbox in the first row. The table includes columns for CO<sub>2</sub>, NO, SO<sub>2</sub>, CH<sub>4</sub>, PM<sub>2.5</sub>, VOC, CO, NH<sub>3</sub>, BC, N<sub>2</sub>O, and Cost.

Project	CO <sub>2</sub>	NO	SO <sub>2</sub>	CH <sub>4</sub>	PM <sub>2.5</sub>	VOC	CO	NH <sub>3</sub>	BC	N <sub>2</sub> O	Cost
<input checked="" type="checkbox"/> Large Solar Park	60	0	0	0	0	0	0	0	0	0	4000
<input checked="" type="checkbox"/> Small Solar Installations	18	0	0	0	0	0	0	0	0	0	1200
<input checked="" type="checkbox"/> Wind Farm	55	0	0	0	0	0	0	0	0	0	3800
<input checked="" type="checkbox"/> Gas-to-renewables conversion	25	1	0.2	0.1	1.5	0.5	2	0.05	0.01	0.3	3200
<input checked="" type="checkbox"/> Boiler Retrofit	20	0.9	0.4	0.2	0.1	0.05	1.2	0.02	0.01	0.05	1400
<input checked="" type="checkbox"/> Catalytic Converters for Buses	30	2.8	0.6	0.8	0	0.5	5	0.01	0.05	0.02	2600
<input checked="" type="checkbox"/> Diesel Bus Replacement	48	3.2	0.9	1	0	0.7	6	0.02	0.08	0.03	5000
<input checked="" type="checkbox"/> Traffic Signal/Flow Upgrade	12	0.6	0.1	0.4	0.05	0.2	3	0.02	0.02	0.01	1000
<input checked="" type="checkbox"/> Low-Emission Stove Program	2	0.02	0.01	0.7	0	0.01	1.5	0.03	0.2	0	180
<input checked="" type="checkbox"/> Residential Insulation/Efficiency	15	0.1	0.05	0.05	0.02	0.02	0.5	0	0	0.01	900
<input checked="" type="checkbox"/> Industrial Scrubbers	6	0.4	6	0.4	0	0.1	0.6	0.01	0.01	0	4200
<input checked="" type="checkbox"/> Waste Methane Capture System	28	0.2	0.1	0.05	8	0.2	0.1	0	0	0.05	3600
<input checked="" type="checkbox"/> Landfill Gas-to-energy	24	0.15	0.05	0.03	6.5	0.1	0.05	0	0	0.03	3400
<input checked="" type="checkbox"/> Reforestation	3.5	0.04	0.02	0.01	0.8	0.03	0.1	0.01	0.005	0.005	220
<input checked="" type="checkbox"/> Urban Tree Canopy Program	4.2	0.06	0.01	0.03	0.6	0.02	0.15	0.005	0.02	0.002	300
<input checked="" type="checkbox"/> Industrial Energy Efficiency Retrofit	22	0.5	0.3	0.15	0.2	0.1	1	0.01	0.01	0.03	1600
<input checked="" type="checkbox"/> Natural Gas Leak Repair	10	0.05	0.01	0.01	4	0.02	0.02	0	0	0.01	1800
<input checked="" type="checkbox"/> Agricultural Methane Reduction	8	0.02	0.01	0.02	7.2	0.05	0.02	0.1	0	0.05	2800
<input checked="" type="checkbox"/> Clean Fossil Fuels & Fossil Fuel Phasing	1.2	0.04	0.05	0.04	0.1	0.03	0	0.005	0.05	0	450

2.2.1 Projects - Scroll down to view more projects

2.2.2 Checkbox - Click the checkbox to select the projects and add to the project selections



The screenshot shows the same table as the previous one, but with a red box highlighting the entire first column (checkboxes). A red circle with the number "2" is placed over the second row, next to the checkbox for "Small Solar Installations".

Project	CO <sub>2</sub>	NO	SO <sub>2</sub>	CH <sub>4</sub>	PM <sub>2.5</sub>	VOC	CO	NH <sub>3</sub>	BC	N <sub>2</sub> O	Cost
<input checked="" type="checkbox"/> Large Solar Park	60	0	0	0	0	0	0	0	0	0	4000
<input type="checkbox"/> Small Solar Installations	18	0	0	0	0	0	0	0	0	0	1200
<input type="checkbox"/> Wind Farm	55	0	0	0	0	0	0	0	0	0	3800
<input type="checkbox"/> Gas-to-renewables conversion	25	1	0.2	0.1	1.5	0.5	2	0.05	0.01	0.3	3200
<input type="checkbox"/> Boiler Retrofit	20	0.9	0.4	0.2	0.1	0.05	1.2	0.02	0.01	0.05	1400
<input type="checkbox"/> Catalytic Converters for Buses	30	2.8	0.6	0.8	0	0.5	5	0.01	0.05	0.02	2600
<input type="checkbox"/> Diesel Bus Replacement	48	3.2	0.9	1	0	0.7	6	0.02	0.08	0.03	5000
<input type="checkbox"/> Traffic Signal/Flow Upgrade	12	0.6	0.1	0.4	0.05	0.2	3	0.02	0.02	0.01	1000
<input type="checkbox"/> Low-Emission Stove Program	2	0.02	0.01	0.7	0	0.01	1.5	0.03	0.2	0	180
<input type="checkbox"/> Residential Insulation/Efficiency	15	0.1	0.05	0.05	0.02	0.02	0.5	0	0	0.01	900
<input type="checkbox"/> Industrial Scrubbers	6	0.4	6	0.4	0	0.1	0.6	0.01	0.01	0	4200
<input type="checkbox"/> Waste Methane Capture System	28	0.2	0.1	0.05	8	0.2	0.1	0	0	0.05	3600
<input type="checkbox"/> Landfill Gas-to-energy	24	0.15	0.05	0.03	6.5	0.1	0.05	0	0	0.03	3400
<input type="checkbox"/> Reforestation	3.5	0.04	0.02	0.01	0.8	0.03	0.1	0.01	0.005	0.005	220
<input type="checkbox"/> Urban Tree Canopy Program	4.2	0.06	0.01	0.03	0.6	0.02	0.15	0.005	0.02	0.002	300
<input type="checkbox"/> Industrial Energy Efficiency Retrofit	22	0.5	0.3	0.15	0.2	0.1	1	0.01	0.01	0.03	1600
<input type="checkbox"/> Natural Gas Leak Repair	10	0.05	0.01	0.01	4	0.02	0.02	0	0	0.01	1800
<input type="checkbox"/> Agricultural Methane Reduction	8	0.02	0.01	0.02	7.2	0.05	0.02	0.1	0	0.05	2800
<input type="checkbox"/> Clean Fossil Fuels & Fossil Fuel Phasing	1.2	0.04	0.05	0.04	0.1	0.03	0	0.005	0.05	0	450

# Navigation

2.3 Search - Click the search bar and type an input to search for specific projects

The screenshot shows a user interface for selecting projects. On the left, there's a sidebar with icons for home, projects, and help. The main area is titled 'Projects' with a count of 20. A table lists projects with columns for CO<sub>2</sub>, NO, SO<sub>2</sub>, CH<sub>4</sub>, PM<sub>2.5</sub>, VOC, CO, NH<sub>3</sub>, BC, N<sub>2</sub>O, and Cost. A single project, 'Large Solar Park', is selected, highlighted by a red box and the number '3'. The 'Solve' button is at the bottom right.

Project	CO <sub>2</sub>	NO	SO <sub>2</sub>	CH <sub>4</sub>	PM <sub>2.5</sub>	VOC	CO	NH <sub>3</sub>	BC	N <sub>2</sub> O	Cost
Large Solar Park	60	0	0	0	0	0	0	0	0	0	4000

2.4 Solve - Click the solve button to start optimizing based on the selection

The screenshot shows the same interface after selecting multiple projects. The 'Projects' count is now 20. The 'Solve' button is highlighted with a red box and the number '4'. The table shows the selected projects: Large Solar Park, Small Solar Installations, Wind Farm, Gas-to-renewables conversion, Boiler Retrofit, Catalytic Converters for Buses, Diesel Bus Replacement, Traffic Signal/Flow Upgrade, Low-Emission Stove Program, Residential Insulation/Efficiency, Industrial Scrubbers, Waste Methane Capture System, Landfill Gas-to-energy, Reforestation, Urban Tree Canopy Program, Industrial Energy Efficiency Retrofit, Natural Gas Leak Repair, Agricultural Methane Reduction, and Clean Coal/Hydro & Fuel Switching.

Project	CO <sub>2</sub>	NO	SO <sub>2</sub>	CH <sub>4</sub>	PM <sub>2.5</sub>	VOC	CO	NH <sub>3</sub>	BC	N <sub>2</sub> O	Cost
Large Solar Park	60	0	0	0	0	0	0	0	0	0	4000
Small Solar Installations	18	0	0	0	0	0	0	0	0	0	1200
Wind Farm	55	0	0	0	0	0	0	0	0	0	3800
Gas-to-renewables conversion	25	1	0.2	0.1	1.5	0.5	2	0.05	0.01	0.3	3200
Boiler Retrofit	20	0.9	0.4	0.2	0.1	0.05	1.2	0.02	0.01	0.05	1400
Catalytic Converters for Buses	30	2.8	0.6	0.8	0	0.5	5	0.01	0.05	0.02	2600
Diesel Bus Replacement	48	3.2	0.9	1	0	0.7	6	0.02	0.08	0.03	5000
Traffic Signal/Flow Upgrade	12	0.6	0.1	0.4	0.05	0.2	3	0.02	0.02	0.01	1000
Low-Emission Stove Program	2	0.02	0.01	0.7	0	0.01	1.5	0.03	0.2	0	180
Residential Insulation/Efficiency	15	0.1	0.05	0.05	0.02	0.02	0.5	0	0	0.01	900
Industrial Scrubbers	6	0.4	6	0.4	0	0.1	0.6	0.01	0.01	0	4200
Waste Methane Capture System	28	0.2	0.1	0.05	8	0.2	0.1	0	0	0.05	3600
Landfill Gas-to-energy	24	0.15	0.05	0.03	6.5	0.1	0.05	0	0	0.03	3400
Reforestation	3.5	0.04	0.02	0.01	0.8	0.03	0.1	0.01	0.005	0.005	220
Urban Tree Canopy Program	4.2	0.06	0.01	0.03	0.6	0.02	0.15	0.005	0.02	0.002	300
Industrial Energy Efficiency Retrofit	22	0.5	0.3	0.15	0.2	0.1	1	0.01	0.01	0.03	1600
Natural Gas Leak Repair	10	0.05	0.01	0.01	4	0.02	0.02	0	0	0.01	1800
Agricultural Methane Reduction	8	0.02	0.01	0.02	7.2	0.05	0.02	0.1	0	0.05	2800
Clean Coal/Hydro & Fuel Switching	1.2	0.04	0.03	0.04	0.1	0.03	0	0.05	0.04	0	450

## Navigation

2.4 A card and table will appear upon a successful optimization. The card will indicate the optimized cost and the table will display the cost per all units and pollutants breakdown.

The screenshot shows the Climate CoLab platform. On the left, there's a sidebar with icons for Home, Projects (30), and Help. The main area has a 'Projects' header with a search bar and a 'Solve' button. Below is a table of projects with columns for CO<sub>2</sub>, NO, SO<sub>2</sub>, CH<sub>4</sub>, PM<sub>2.5</sub>, VOC, CO, NH<sub>3</sub>, BC, N<sub>2</sub>O, and Cost. Several projects are checked, including Large Solar Park, Small Solar Installations, Wind Farm, Gas-to-renewables conversion, Boiler Retrofit, Catalytic Converters for Buses, Diesel Bus Replacement, Traffic Signal/Flow Upgrade, Low-Emission Stove Program, Residential Insulation/Efficiency, Industrial Scrubbers, Waste Methane Capture System, Landfill Gas-to-energy, Reforestation, Urban Tree Canopy Program, Industrial Energy Efficiency Retrofit, Natural Gas Leak Repair, Agricultural Methane Reduction, and Clean Infrastructure & Fuel Switching. To the right, a large green card displays the 'Optimized Cost' as \$233,966.99. Below it is a table titled 'Cost' and 'Pollutants' showing the breakdown of costs for various mitigation projects like Traffic Signal/Flow Upgrade, Low-Emission Stove Program, Industrial Scrubbers, etc.

2.4 Upon an infeasible selection, a card indicating *Infeasible* will be displayed along with a message.

This screenshot shows the same Climate CoLab interface as above, but with a different selection of projects. Most projects have their checkboxes unchecked, except for 'Large Solar Park'. The right side features a yellow 'Infeasible' card with a red border. Inside the card, a message reads: 'These project selections aren't compatible. Please pick another selection.' This indicates that the current set of selected projects cannot be optimized together.

## Navigation

2.5 Cost Breakdown – Clicking the cost tab will display a table indicating the total units to be implemented and the total cost of the specific project

The screenshot shows the software's main interface with a sidebar on the left containing icons for Home, Projects, and Help. The main area has tabs for 'Projects' (selected), 'Search projects', and 'Solve'. To the right is a large green box displaying '\$ 233,966.99'. Below this are two tabs: 'Cost' (selected) and 'Pollutants'. The 'Cost' tab displays a table with columns for Mitigation Project, Units, and Cost. The table lists various projects with their respective costs.

Mitigation Project	Units	Cost
Traffic Signal/Flow Upgrade	6.99	\$6,993.23
Low-Emission Stove Program	20.0	\$3,600.00
Industrial Scrubbers	2.25	\$9,431.45
Reforestation	20.0	\$4,400.00
Agricultural Methane Reduction	18.38	\$14,555.03
Clean Cookstove & Fuel Switching	20.0	\$9,000.00
Biochar for soils	20.0	\$21,000.00
Industrial VOC	5.15	\$13,383.18
Wetlands restoration	20.0	\$36,000.00
Household LPG conversion program	20.0	\$14,000.00
Industrial process change	4.34	\$21,704.09

2.6 Pollutants Breakdown – Clicking the pollutants tab will display a table indicating the target pollutants and the amount of pollutants produced by the optimized solution

The screenshot shows the same software interface as above, but the 'Pollutants' tab is selected. A red circle with the number '6' is placed over the 'Pollutants' tab. The 'Pollutants' table displays columns for Pollutant, Target, and Amount. The table lists various pollutants with their respective targets and amounts.

Pollutant	Target	Amount
CO <sub>2</sub>	1000	1,391.72
NO	35	35.00
SO <sub>2</sub>	25	25.00
PM <sub>2.5</sub>	20	49.86
CH <sub>4</sub>	60	267.86
VOC	45	45.00
CO	80	194.41
NH <sub>3</sub>	12	12.00
BC	6	12.06
N <sub>2</sub> O	10	10.00

# Navigation

## 3. Tableau Page

Iteration ①

Tableau

S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	Z	Solution
60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4000.0	
18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	-1.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1200.0	
55.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	-0.0	-1.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3800.0	
25.0	1.0	0.2	0.1	1.5	0.5	2.0	0.05	0.01	0.3	-0.0	-0.0	-0.0	-1.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3200.0
20.0	0.9	0.4	0.2	0.1	0.05	1.2	0.02	0.01	0.05	-0.0	-0.0	-0.0	-1.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1400.0
30.0	2.8	0.6	0.8	0.0	0.5	5.0	0.01	0.05	0.02	-0.0	-0.0	-0.0	-1.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2600.0
48.0	3.2	0.9	1.0	0.0	0.7	6.0	0.02	0.08	0.03	-0.0	-0.0	-0.0	-1.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5000.0
12.0	0.6	0.1	0.4	0.05	0.2	3.0	0.02	0.02	0.01	-0.0	-0.0	-0.0	-1.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1000.0
2.0	0.02	0.01	0.7	0.0	0.01	1.5	0.03	0.2	0.0	-0.0	-0.0	-0.0	-1.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1000.0
15.0	0.1	0.05	0.05	0.02	0.02	0.5	0.0	0.0	0.01	-0.0	-0.0	-0.0	-1.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	900.0
-1000.0	-35.0	-25.0	-20.0	-60.0	-45.0	-80.0	-12.0	-6.0	-10.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	-0.0

Basic Solution

S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	Solution
-1000.0	-35.0	-25.0	-20.0	-60.0	-45.0	-80.0	-12.0	-6.0	-10.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	

Iteration ②

Tableau

S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	Z	Solution
0.0	-0.4	-0.2	-0.2	-0.08	-0.08	-2.0	0.0	0.0	-0.04	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-4.0	0.0	400.0	
0.0	-0.12	-0.06	-0.06	-0.02	-0.02	-0.6	0.0	0.0	-0.01	0.0	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	0.0	120.0	
0.0	-0.37	-0.18	-0.18	-0.07	-0.07	-1.83	0.0	0.0	-0.04	0.0	0.0	-1.0	0.0	0.0	0.0	0.0	3.67	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.67	0.0	500.0		
0.0	0.83	0.12	0.02	1.47	0.47	1.17	0.05	0.01	0.28	0.0	0.0	0.0	-1.0	0.0	0.0	0.0	1.67	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	-1.67	0.0	1700.0		
0.0	-0.32	-0.12	-0.12	-0.09	-0.09	-0.29	-0.05	-0.04	-0.01	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	1.32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.32	0.0	300.0		

Download

3.0 Blank Page – Upon visiting with an empty tableau iterations, a blank page is displayed

Oops! Nothing to see here.

# Navigation

3.1. Iteration Display - Users will be able to view a specific iteration of the solution, displaying the iteration number, the tableau, and its basic solution. Labels at the top of each tables include the slack variables, the unknown project variables, the (Z) solution variable, and the solution value.

3.2. Iteration Selection Dropdown – Whether infeasible or not, users will be able to see each iteration of the solution (stops at the final tableau for infeasible solution). Users can choose to view all iterations, or a specific iteration depending on their preference.

**Iteration 2**

**Tableau**

S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	Z	Solution	
60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4000.0		
18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	-1.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1200.0		
55.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	-0.0	-1.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3800.0	
25.0	1.0	0.2	0.1	1.5	0.5	2.0	0.05	0.01	0.3	-0.0	-0.0	-0.0	-1.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3200.0	
20.0	0.9	0.4	0.2	0.1	0.05	1.2	0.02	0.01	0.05	-0.0	-0.0	-0.0	-1.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1400.0	
30.0	2.8	0.6	0.8	0.0	0.5	5.0	0.01	0.05	0.02	-0.0	-0.0	-0.0	-0.0	-0.0	-1.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2600.0		
48.0	3.2	0.9	1.0	0.0	0.7	6.0	0.02	0.08	0.03	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-1.0	-0.0	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5000.0		
12.0	0.6	0.1	0.4	0.05	0.2	3.0	0.02	0.02	0.01	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-1.0	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1000.0		
2.0	0.02	0.01	0.7	0.0	0.01	1.5	0.03	0.2	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-1.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	180.0		
15.0	0.1	0.05	0.05	0.02	0.02	0.5	0.0	0.0	0.01	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	900.0
-1000.0	-35.0	-25.0	-20.0	-60.0	-45.0	-80.0	-12.0	-6.0	-10.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	-0.0	

**Basic Solution**

S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	Solution
1000.0	-35.0	-25.0	-20.0	-60.0	-45.0	-80.0	-12.0	-6.0	-10.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0

**Iteration 1**

**Tableau**

S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	Z	Solution
0.0	-0.4	-0.2	-0.2	-0.08	-0.08	-2.0	0.0	0.0	-0.04	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	-4.0	0.0	400.0		
0.0	-0.12	-0.06	-0.06	-0.02	-0.02	-0.6	0.0	0.0	-0.01	0.0	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	0.0	120.0	
0.0	-0.37	-0.18	-0.18	-0.07	-0.07	-1.83	0.0	0.0	-0.04	0.0	0.0	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	3.67	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	-3.67	0.0	500.0	
0.0	0.83	0.12	0.02	1.47	0.47	1.17	0.05	0.01	0.28	0.0	0.0	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.67	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	-1.67	0.0	1700.0	

# Navigation

3.2. Iteration 0 displays the initial tableau of the system of linear equations of the problem. The final iteration displays either the solution of the problem or the final tableau before concluding the problem's infeasibility.

**Iteration 0**

**Tableau**

S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	Z		
1.152921504606847e+17	0.13	0.08	-0.0	0.0	0.0	1.35	-0.0	-0.0	0.01	-1921535841011411.8	0.0	0.0	0.0	0.0	-0.02	0.0	0.0	1.0	1921535841011411.8	0.0	0.0	0.0	0.0	0.02	0.0	0.0	-1.0	0.1				
48.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0	0.0	-0.5	-1.0	0.0	0.0	0.0	-0.0	0.0	0.5	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
115.0	0.0	0.0	-0.0	0.0	0.0	0.0	-0.0	-0.0	0.0	-1.0	0.0	-1.0	0.0	0.0	-0.0	0.0	0.0	1.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
4.29	-0.51	0.04	-0.09	0.0	0.0	-0.71	0.0	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.0	0.71	0.0	0.0	0.0
64607523034237e+18	7.14	5.04	0.92	1.0	0.0	83.81	-0.06	-0.11	0.85	-9.607679205057061e+16	0.0	0.0	0.0	0.0	0.48	0.0	0.0	9.607679205057061e+16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.48	0.0	0.0	0.0			
0.2303761517115e+17	0.67	0.41	-0.07	0.0	0.0	2.9	-0.02	-0.0	0.04	-4803839602528524.0	0.0	0.0	0.0	0.0	-0.26	1.0	0.0	4803839602528524.0	0.0	0.0	0.0	0.0	0.26	-1.0	0.0	0.0	0.0	0.0	0.0			
8.646911284551353e+18	12.0	8.0	2.0	0.0	0.0	128.0	-0.12	-0.12	1.0	-1.4411518807585587e+17	0.0	0.0	1.0	0.0	0.0	0.0	0.0	1.4411518807585587e+17	0.0	0.0	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
68.57	4.57	1.29	1.43	0.0	1.0	8.57	0.03	0.11	0.04	0.0	0.0	0.0	0.0	0.0	-1.43	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
1.31	-0.03	-0.0	0.69	0.0	0.0	1.41	0.03	0.2	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.0	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.01	0.0	1.0	0.0	0.0	
5.764607523034235e+17	0.04	0.17	-0.04	0.0	0.0	7.61	-0.02	-0.02	0.04	-9607679205057058.0	0.0	0.0	0.0	1.0	0.0	-0.02	0.0	0.0	9607679205057058.0	0.0	0.0	0.0	-1.0	0.0	0.02	0.0	0.0	0.0	0.0	0.0		
1.5333856011271068e+20	352.6	161.21	63.57	0.0	0.0	2551.31	-11.02	-5.01	21.31	-2.5556426685451776e+18	20.0	20.0	0.0	0.0	4.67	0.0	20.0	0.0	2.5556426685451776e+18	0.0	0.0	20.0	20.0	15.33	20.0	0.0	20.0	1.0	0.0			

**Basic Solution**

S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	S
1.5333856011271068e+20	352.6	161.21	63.57	0.0	0.0	2551.31	-11.02	-5.01	21.31	-2.5556426685451776e+18	20.0	20.0	0.0	0.0	4.67	0.0	20.0	0.0	2.5556426685451776e+18	0.0	0.0	20.0	20.0	15.33	20.0	0.0	20.0	1.0	0.0	

3.3. Download – Click the Download button to download the table content as a .csv file

**Iteration 0**

**Tableau**

S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	Z	Solution
60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4000.0	
18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	-1.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1200.0	
55.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3800.0	
25.0	1.0	0.2	0.1	1.5	0.5	2.0	0.05	0.01	0.3	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3200.0	
20.0	0.9	0.4	0.2	0.1	0.05	1.2	0.02	0.01	0.05	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1400.0	
30.0	2.8	0.6	0.8	0.0	0.5	5.0	0.01	0.05	0.02	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2600.0	
48.0	3.2	0.9	1.0	0.0	0.7	6.0	0.02	0.08	0.03	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5000.0	
12.0	0.6	0.1	0.4	0.05	0.2	3.0	0.02	0.02	0.01	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1000.0	
2.0	0.02	0.01	0.7	0.0	0.01	1.5	0.03	0.2	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	180.0	
15.0	0.1	0.05	0.05	0.02	0.02	0.5	0.0	0.0	0.01	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	900.0	
-1000.0	-35.0	-25.0	-20.0	-60.0	-45.0	-80.0	-12.0	-6.0	-10.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	-0.0	

**Basic Solution**

S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	Solution
-1000.0	-35.0	-25.0	-20.0	-60.0	-45.0	-80.0	-12.0	-6.0	-10.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	

**Iteration 1**

**Tableau**

S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	Z	Solution
0.0	-0.4	-0.2	-0.2	-0.08	-0.08	-2.0	0.0	0.0	-0.04	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	-4.0	0.0	400.0		
0.0	-0.12	-0.06	-0.06	-0.02	-0.02	-0.6	0.0	0.0	-0.01	0.0	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	1.0	0.0	0.0	0.0	0.0	0.0	-1.2	0.0	120.0		
0.0	-0.37	-0.18	-0.18	-0.07	-0.07	-1.83	0.0	0.0	-0.04	0.0	0.0	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	3.67	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	500.0		
0.0	0.83	0.12	0.02	1.47	0.47	1.17	0.05	0.01	0.28	0.0	0.0	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.67	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1700.0		
0.0	0.73	0.33	0.19	0.07	0.07	0.14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	300.0		

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