# SEQUESTRIX QUICK USER GUIDE

This guide gives a quick and very simple illustration of how to use Sequestrix for analysis. The datasets are mostly arbitrary and are just intended to provide an understanding of navigating the Sequestrix application.

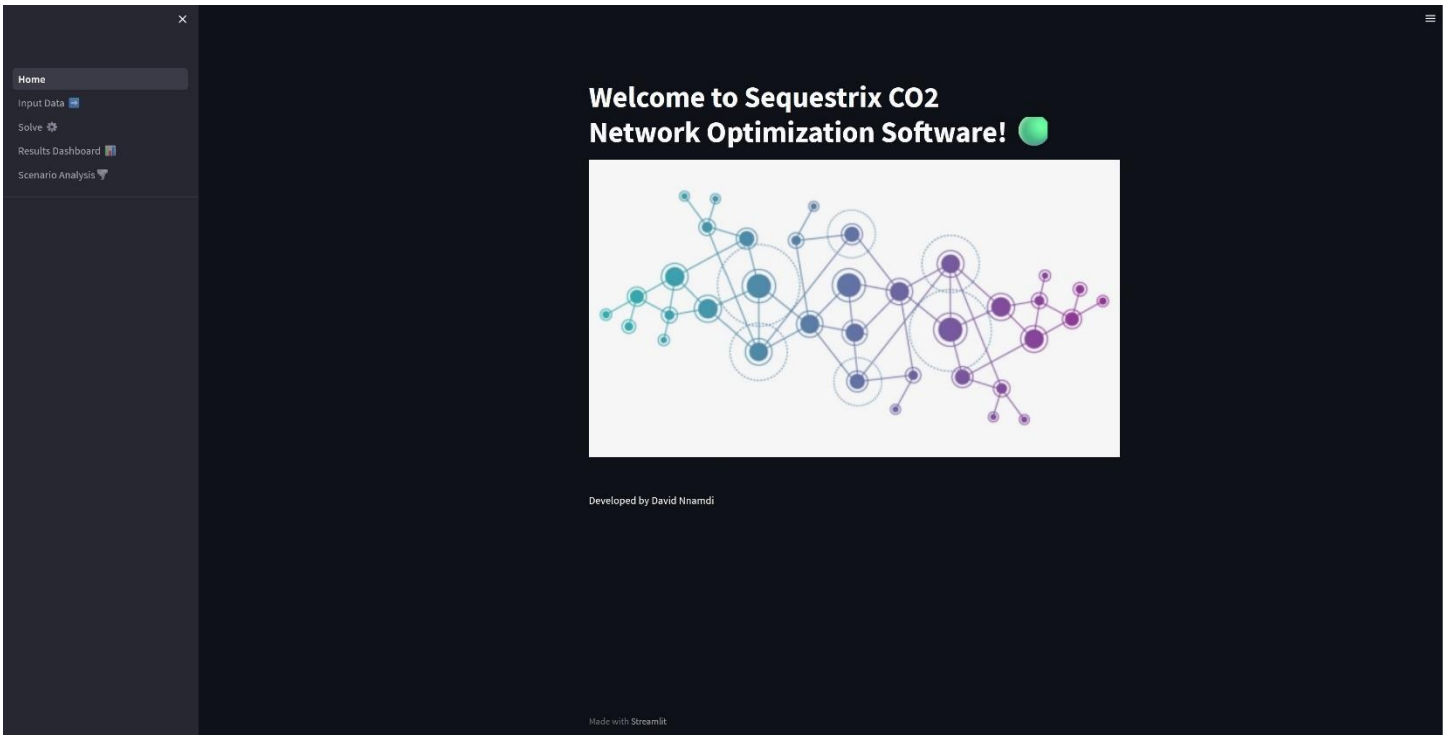
### Problem statement

We have a CO2 Sequestration project that requires us to store at least 14.5MTCO2 annually over a 10 year period. For this project we have identified 3 eligible CO2 sources and 2 Sinks (or storage sites). Details about their names, geolocation, capacity, and unit costs are given in *TestInput.xlsx* file in GitHub Repository.

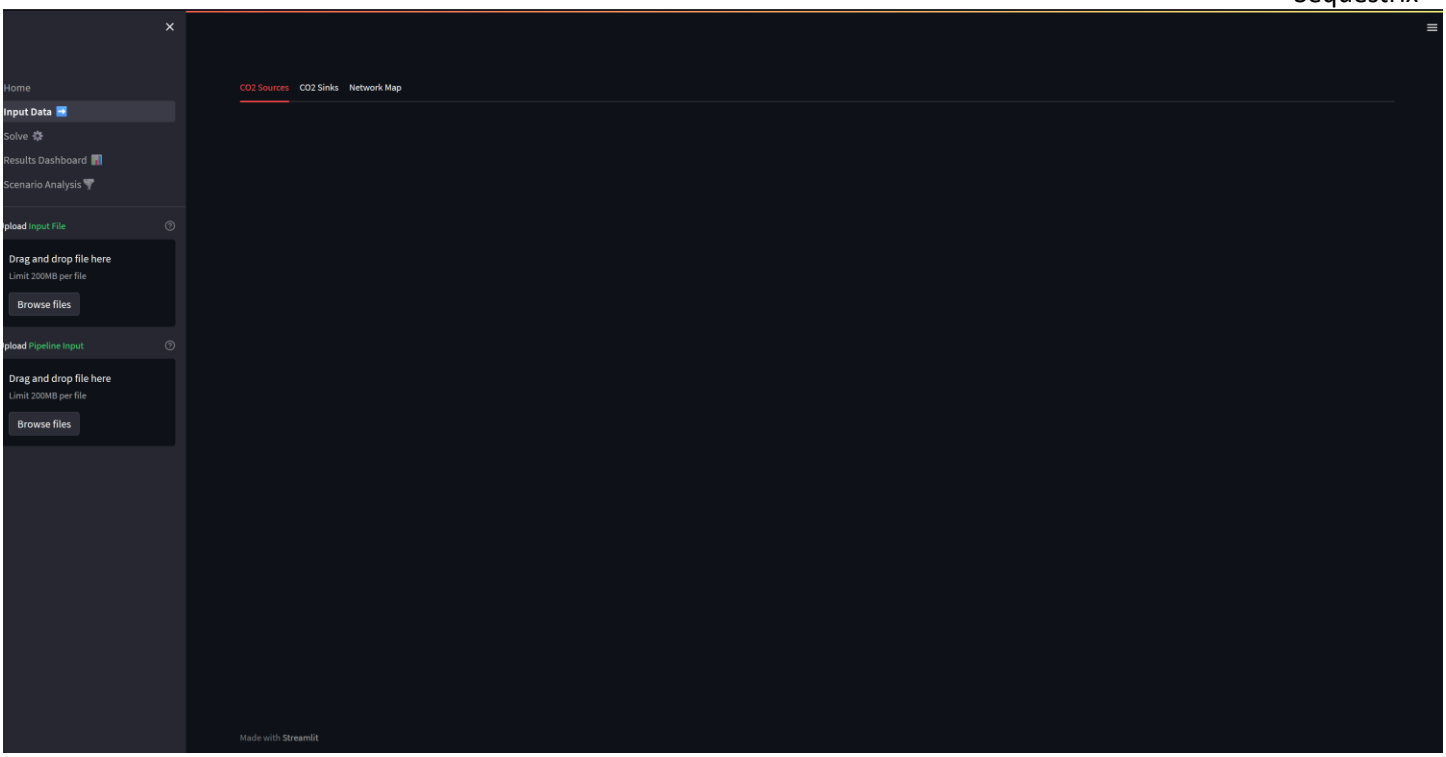
We are tasked with generating project economics for this Sequestration project based on an optimized transport pipeline network.

### Solution Steps

**Step 1:** Assuming Sequestrix has been opened on the web browser using *the streamlit run Sequestrix/Home.py* command in the repository directory as indicated in the repo, user will see a landing page that looks like this:

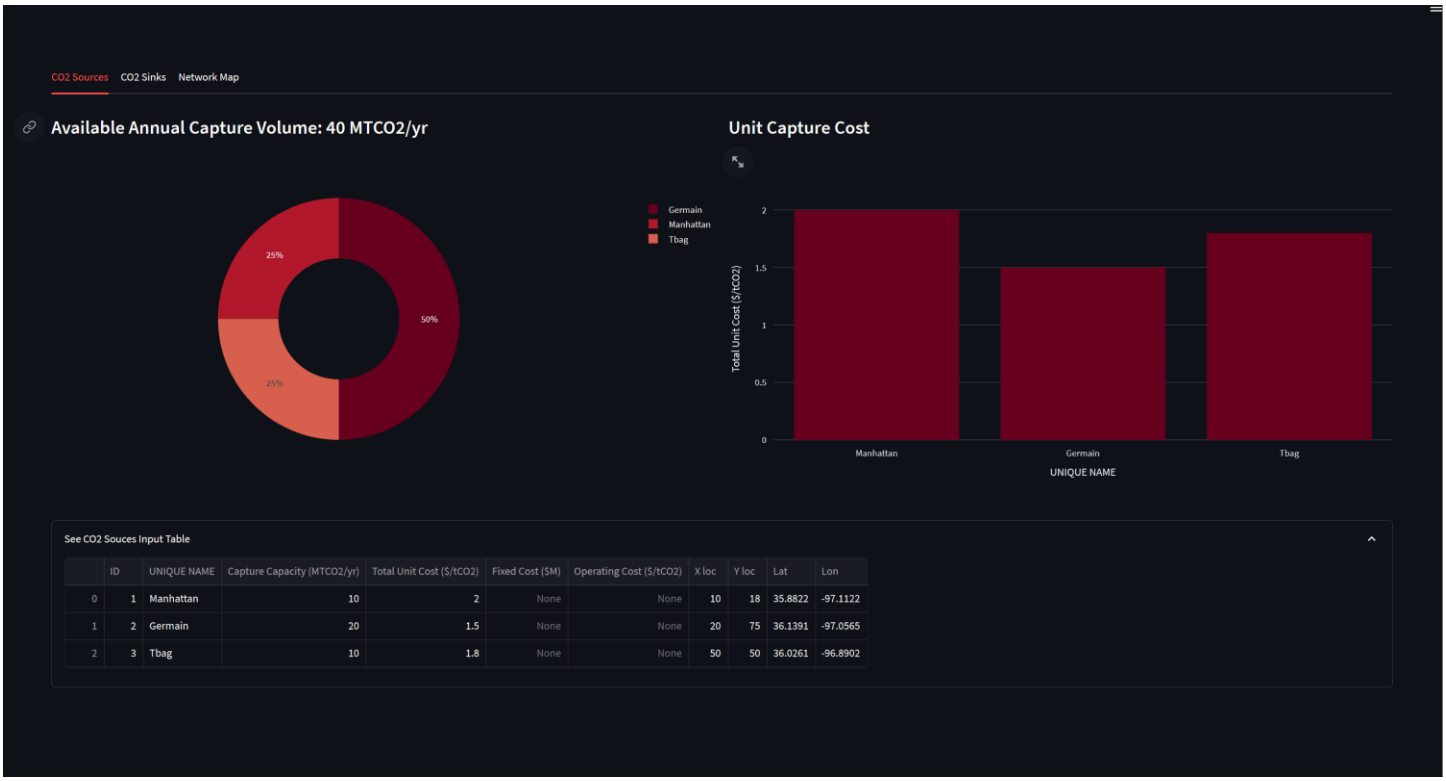



**Step 2:** Next navigate to the **Input Data** Side bar and the following screen should pop up



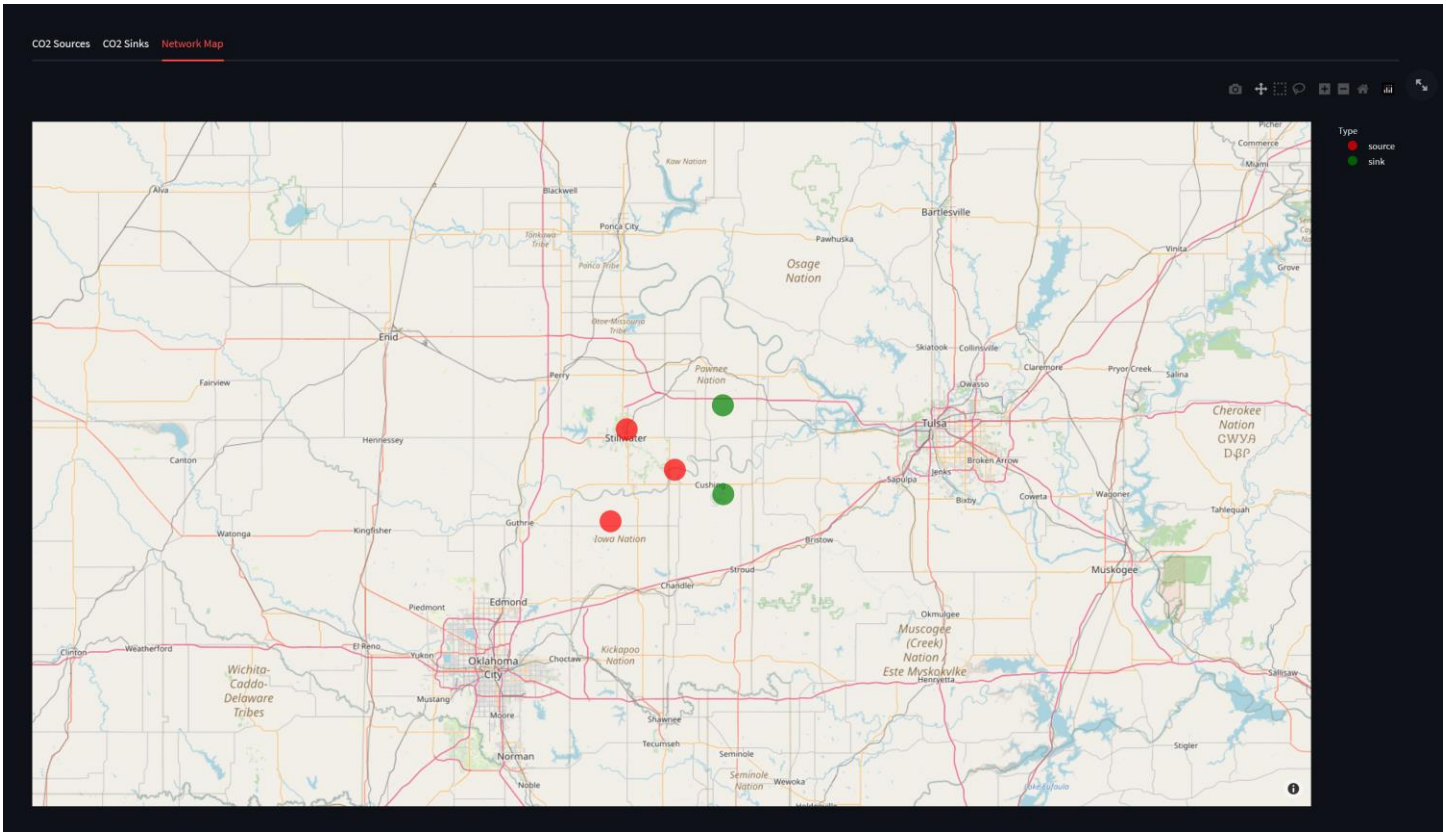

**Step 3:** Under the "Upload Input file" section, browse files and navigate to *TestInput.xlsx* and import it. If you are running an experiment with an existing pipeline, you may import the pipeline file under "Upload Pipeline Input" section.

Doing this will populate the **CO2 Source, CO2 Sinks** and **Network Map** tabs as shown below:



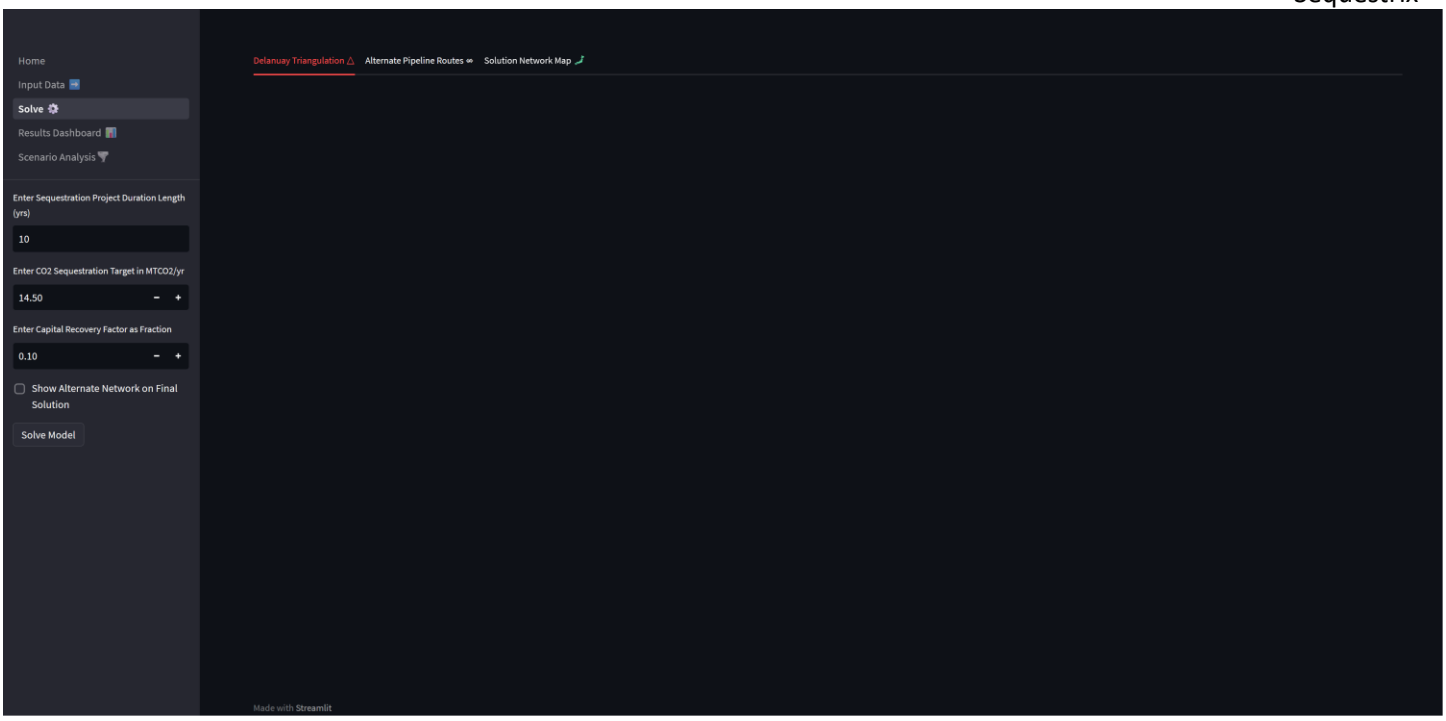

| | ID | UNIQUE NAME | Capture Capacity (MTCO2/yr) | Total Unit Cost ($/tCO2) | Fixed Cost ($M) | Operating Cost ($/tCO2) | X loc | Y loc | Lat | Lon |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | Manhattan | 10 | 2 | None | None | 10 | 18 | 35.8822 | -97.1122 |
| 1 | 2 | Germain | 20 | 1.5 | None | None | 20 | 75 | 36.1391 | -97.0565 |
| 2 | 3 | Tbag | 10 | 1.8 | None | None | 50 | 50 | 36.0261 | -96.8902 |


| | ID | UNIQUE NAME | Storage Capacity (MTCO2) | Total Unit Cost ($/tCO2) | Fixed Cost ($M) | Operating Cost ($/tCO2) | X loc | Y loc | Lat | Lon |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 3 | carlos1 | 80 | -55 | None | None | 40 | 85 | 35.9581 | -96.7228 |
| 1 | 4 | carlos1-2h | 65 | -80 | None | None | 25 | 60 | 36.2059 | -96.7242 |



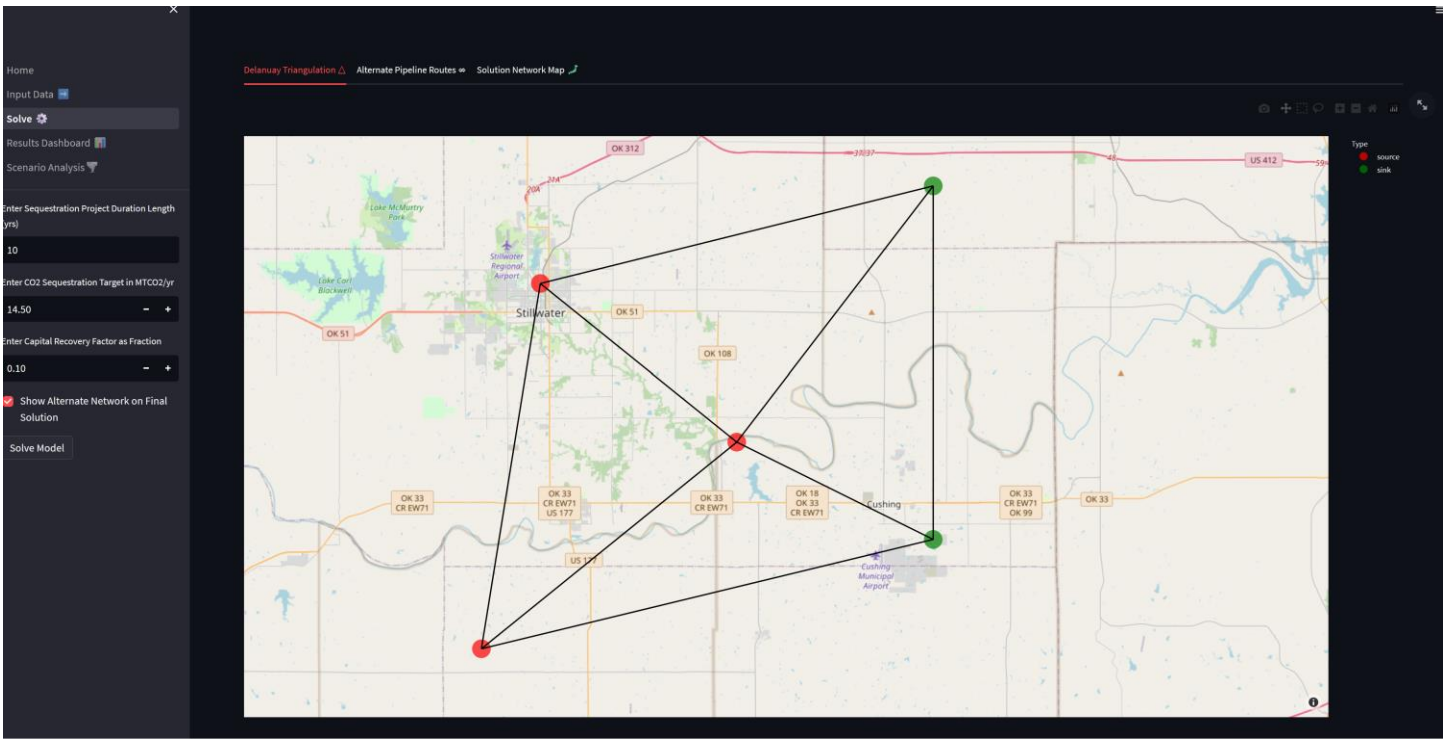

**Step 4:** Next navigate to the Solve sidebar. Populate the following inputs into the screen *a) duration of project = 10 years, b) CO2 Sequestration target = 14.5, c) Capital recovery factor = 0.1 (10%).* This value is project dependent and is determined by calculating the ratio of a constant annuity to the present value of receiving that annuity for a given period, considering a specific interest rate.

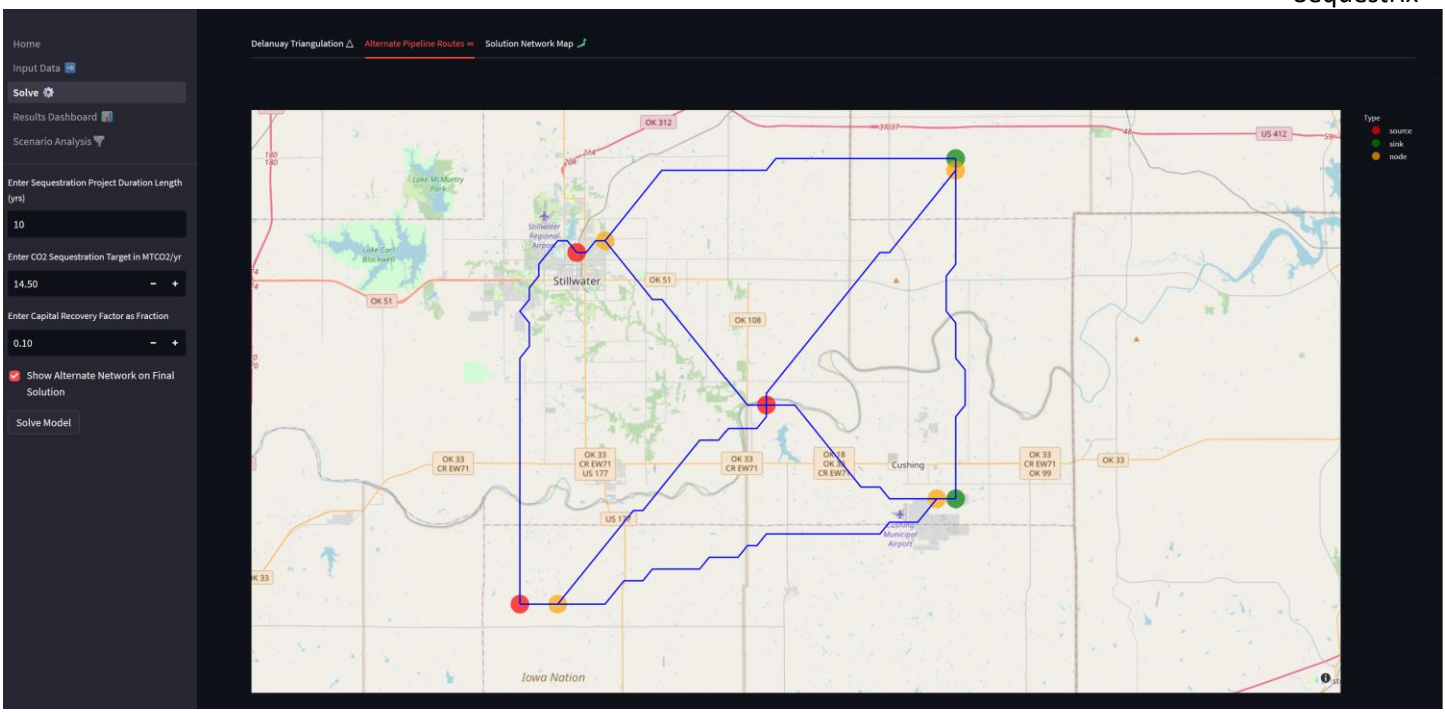
The window should now look like this:

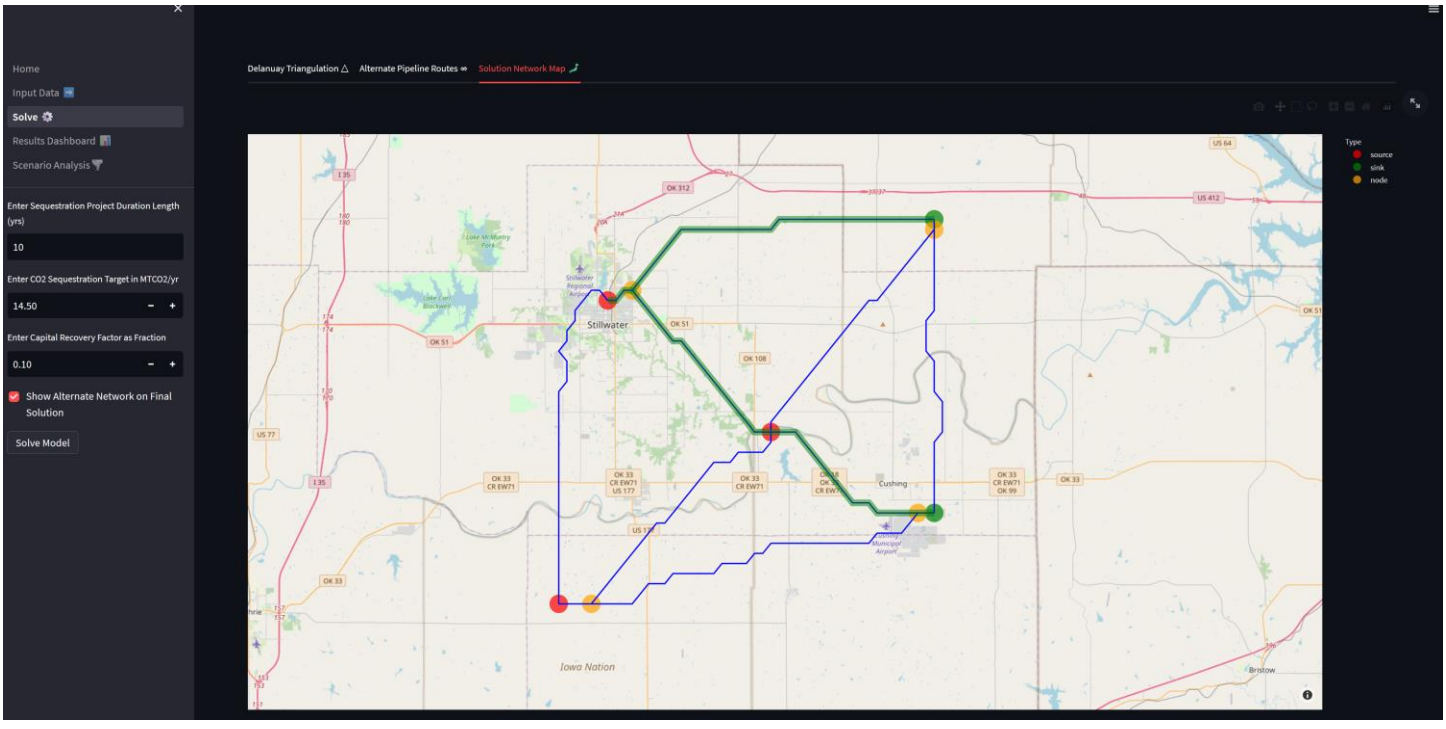



**Step 5:** Click on solve and wait for it to finish solving. Prior to doing that you may or may not toggle the show network on final solution, that is an optional input. For this example, I will toggle it on. Once the computations are done, results will be shown.

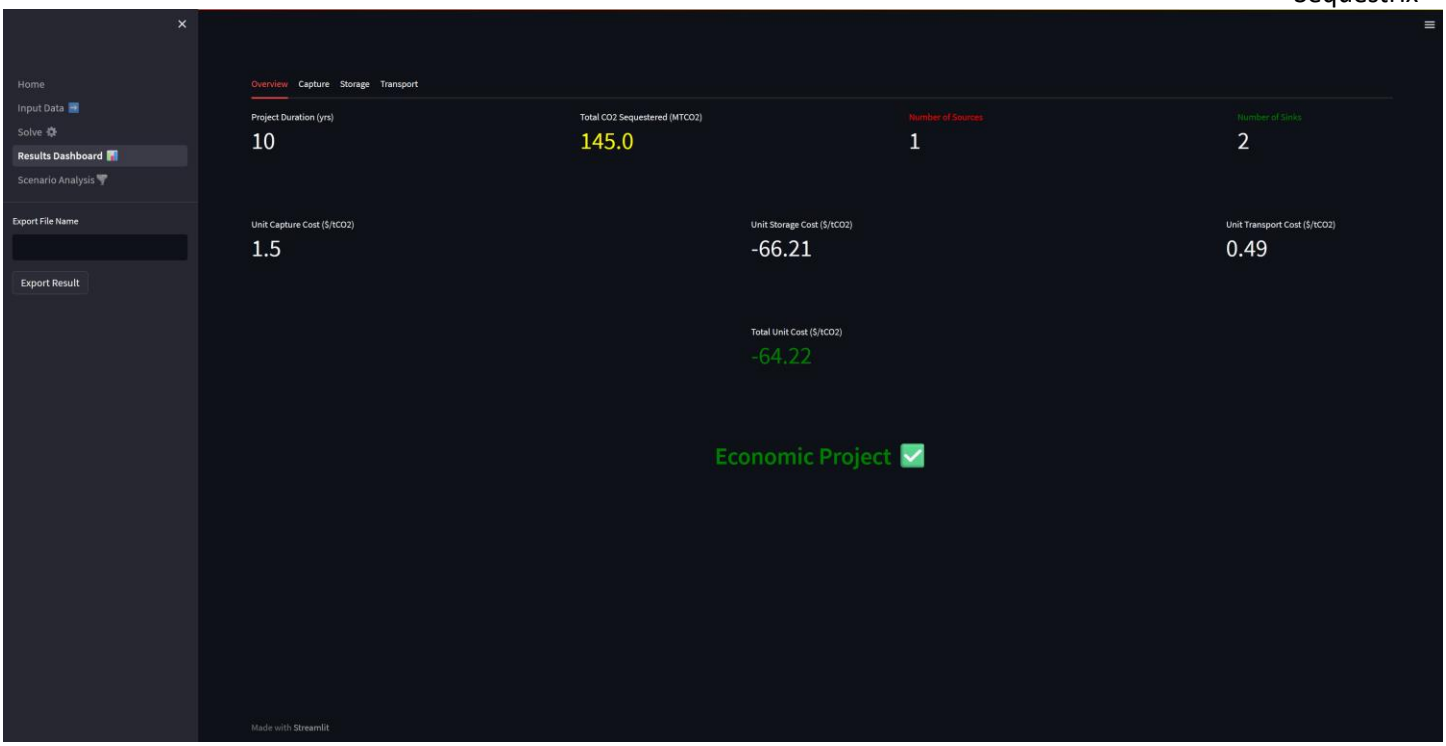
3 Tabs will be populated, **Delaunay Triangulation**, **Alternate Pipeline Route** (or candidate network), **Solution Network Map**. The results will be displayed as follows:






**Step 6**: Visualize results on the Results Dashboard. This also has 3 tabs, the first gives an overview of the project, shows the key metrics such as number of sinks and sources used, total CO2 sequestered and the unit costs. It also gives an indication of project economics based on the total unit cost. A very negative total unit cost means that revenue from tax credits which are captured in the storage costs, are greater than transportation cost. This indicates an economic project.




Next tabs contains details about capture, storage, and transport pipelines.



The results can be exported as a csv file by entering file name and clicking export. A sample exported result looks like this

| SEQUESTRIX CO2 NETWORK OPTIMIZATION SOLUTION | | | | | |
|---|---|---|---|---|---|
| Project Duration (yrs) | 10 | | | | |
| Captal Recovery Factor (%) | 10 | | | | |
| Annual Target Capture (MTCO2/yr) | 14.5 | | | | |
| Annual Actual Capture (MTCO2/yr) | 14.5 | If different from Target, there is a limiting constraint - see logs for details | | | |
| Annual Storage Amount (MTCO2/yr) | 14.5 | | | | |
| Total Cost ($M/yr) | -931.1232939 | | | | |
| Capture Cost ($M/yr) | 21.75 | | | | |
| Transport Cost ($M/yr) | 7.126706099 | | | | |
| Storage Cost ($M/yr) | -960 | | | | |
| | | | | | |
| CO2 CAPTURE SOURCES SOLUTION BREAKDOWN | | | | | |
| CO2 Source ID | CO2 Source Name | Capture Amount (MTCO2/yr) | Capture Cost ($M/yr) | | |
| source_2 | Germain | 14.5 | 21.75 | | |
| | | | | | |
| CO2 STORAGE SINKS SOLUTION BREAKDOWN | | | | | |
| CO2 Sink ID | CO2 Sink Name | Storage Amount (MTCO2/yr) | Storage Cost ($M/yr) | | |
| sink_4 | carlos1-2h | 6.5 | -520 | | |
| sink_3 | carlos1 | 8 | -440 | | |
| | | | | | |
| CO2 TRANSPORT PIPELINES SOLUTION BREAKDOWN | | | | | |
| Start Point | End Point | Length (km) | Weight | CO2 Transported (MTCO2/yr) | Transport Cost ($M/yr) |
| source_3 | TS1 | 17.04716573 | 12.19 | 8 | 1.654681205 |
| source_2 | TS4 | 2.690696766 | 5.82 | 14.5 | 1.108991775 |
| TS4 | source_3 | 18.92580179 | 14.14 | 8 | 1.919375902 |
| TS4 | sink_4 | 30.81709699 | 19.61 | 6.5 | 2.321490434 |
| TS1 | sink_3 | 1.503475336 | 0.9 | 8 | 0.122166783 |

**Results Explanation:**

In this case, we wanted to store a 14.5MTCO2 annually over 10 years to match the storage capacity. This was achieved by taking CO2 from the Germain plant and storing it in Carlos1 and Carlos1-2h units. To do this, we need to construct ~71km (44 miles) of pipeline. The Annual carbon capture cost will be $21.75M, Transportation will cost an annualized $7.2M And storage will generate close to $1B in revenue annually.