Detailed User Manual

Step 1 — Select the analysis method

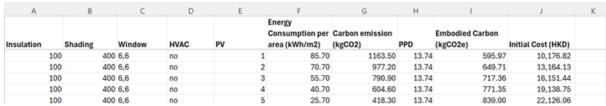
- Select the analysis method from the "Navigation" at the top of the left side of the app.
- LCA Optimization Proposed optimized retrofit strategies focusing on the lifecycle performances of the retrofitted building.
- Annual Optimization Proposed optimized retrofit strategies focusing on the yearly performances of the retrofitted building.

Step 2 — Insert the basic parameters of the existing building

- Enter the basic parameters of the existing building under the relevant rows representing "Parameters" on the left side of the app.
- Energy Consumption Baseline (kWh/m²) Enter the annual energy consumption of the selected building in kWh/m².
- Carbon emissions baseline (kgCO₂) Enter the annual operational carbon emissions from the selected building in kgCO₂).
- PPD Baseline Enter the average percentage of occupant dissatisfaction within the selected building.
- Lifetime (years) Enter the expected lifetime of the selected building after retrofitting in years.
- Energy Cost Enter the average cost per energy unit.
- Area (m²) Enter the gross floor area of the selected building in m².
- Algorithm This app supports three optimization algorithms namely; (1) non-dominated sorting genetic algorithm II (NSGA II), (2) non-dominated sorting genetic algorithm III (NSGA III), and (3) adaptive grid-based evolutionary algorithm (AGE-MOEA). Users can choose one of these three algorithms.

Step 3 — Enter data to the model

- "Data Selection" allows users to select their data or proceed with the sample data
- Select "Upload own data" to upload a data file developed by the users based on the selected building or select "Use Sample Data" to proceed with any of the sample data provided by the developers.
- The data file needs to be an Excel or CSV file.
- The first columns of the datasheet should include the variables (different retrofit measures) while the last five columns should be for the "Energy Consumption per area (kWh/m²)", "Carbon emission (kgCO₂)", "PPD", "Embodied Carbon (kgCO₂e)", "Initial Cost" as indicated below.



Data format example

• There should not be empty cells or cells containing the value "0". Those cells should be filled as "no" in the dataset.

Step 4 — Configuration

- After data is selected for the model, users can observe decision variables are displayed at "Select decision variables".
- The users can add and remove decision variables from the row displaying variables.
- Next, users need to "Map Target Columns." They should map the relevant columns from the uploaded data file to the given descriptions.

Step 5 — Data Analysis and Optimization

- After mapping the target columns "Data Analysis" is displayed.
- Under "Decision Variable Options", the options under each decision variable are displayed.
- "Processed Data Preview" displayed only the first five columns of the data file after processing with carbon saving (Csave) and economic profitability (EP) calculations.
- Click "Start Optimization" to proceed with the optimization.

Step 6 — Download the optimization results

- The model will take a few minutes to run the optimization. After completing the optimization, users can visualize the
- Optimization Results
- Pareto Front
- Solution Space Analysis
- Users can download the results of optimization and figures of Pareto front and space solutions using "Download Pareto Front Plot", "Download Solution Space Plot", and "Download Results CSV".