Instruction Guide

Python-Based Architectural Design Model

a. How to Use the Model

1. **Starting the Program**

   - Launch the program interface within a Python environment, such as Jupyter Notebook.

   - Execute the program to initiate the application.

2. **Customizing Home Office Design**

   - Navigate through designated categories, including chairs, tables, sofas, coffee tables, bookshelves, and flooring.

   - Each category presents a range of product options accompanied by essential details such as product name, brand, dimensions, images, and environmental impact metrics (Embodied Carbon and lifetime GWP).

   - Select products and specify quantities based on design preferences and functional requirements.

   - Deliberate on key considerations encompassing aesthetics, functionality, cost-effectiveness, and sustainability principles.

3. **Analyzing Design Choices**

   - Upon product selection, the model dynamically computes the aggregate Embodied Carbon and lifetime GWP for each category and for the entire design ensemble.

   - Review the computed results to gain insights into the environmental ramifications of the chosen design components.

4. **Optimizing Design**

   - Factor in GWP metrics alongside considerations such as cost, quality, and sustainability implications.

   - Explore alternative product options with reduced GWP values while upholding standards of quality and functionality.

- Strive for a balanced design approach that minimizes environmental impact while satisfying project requisites.

5. **More information for installation and example**

- Please see the attached "How-to Document" at the end of this document for the installation guide and the example of using the model.

b. Interpreting Results and Making Informed Decisions

Upon completion of the design process, the model furnishes two pivotal metrics for environmental evaluation: Embodied Carbon and Total Global Warming Potential (GWP).

Embodied Carbon

- This metric quantifies the carbon emissions associated with the environmental impact generated during upstream and core processes, including raw material extraction and manufacturing operations.

- Embodied Carbon offers insights into the immediate carbon footprint of the design, thereby facilitating informed decision-making regarding product selections.

Total Global Warming Potential (GWP)

- The GWP calculation encapsulates the entire lifecycle of the design, spanning production, utilization, and disposal phases.

- By providing a comprehensive perspective on environmental impacts over time, GWP enables stakeholders to gauge the broader climate implications of design choices.

The model's presentation of Embodied Carbon and total GWP empowers users to make informed decisions, prioritizing environmentally responsible options while optimizing design selections to minimize ecological impact. This comprehensive understanding facilitates the alignment of design objectives with sustainability goals, thereby fostering environmentally conscientious architectural practices.

c. Data Resource

- The datasets utilized in the program are sourced from product Environmental Product Declarations (EPD).

- These datasets are structured in CSV format, facilitating easy integration and analysis within the model.
- The information extracted from EPDs includes essential product details and environmental impact metrics, ensuring robust environmental assessment capabilities within the design model.

How-To Document

Prerequisite

- The coding is saved in IPYNB format, which is a code developed using Jupyter notebook.
- In order to run this program, you will need to install Jupyter notebook in your system.
- This can be done by either downloading python or anaconda in your system.
- We recommend downloading anaconda, as the interface is user friendly, making it easy to navigate to Jupyter notebook.
- https://www.anaconda.com/download

How to execute the code

- Download the 'ipynb' file tiled '**Embodied carbon calculator for home office**' along with all the 'csv' files into your folder in your system.
- Open the anaconda navigator.
- Launch Jupyter notebook from available packages.
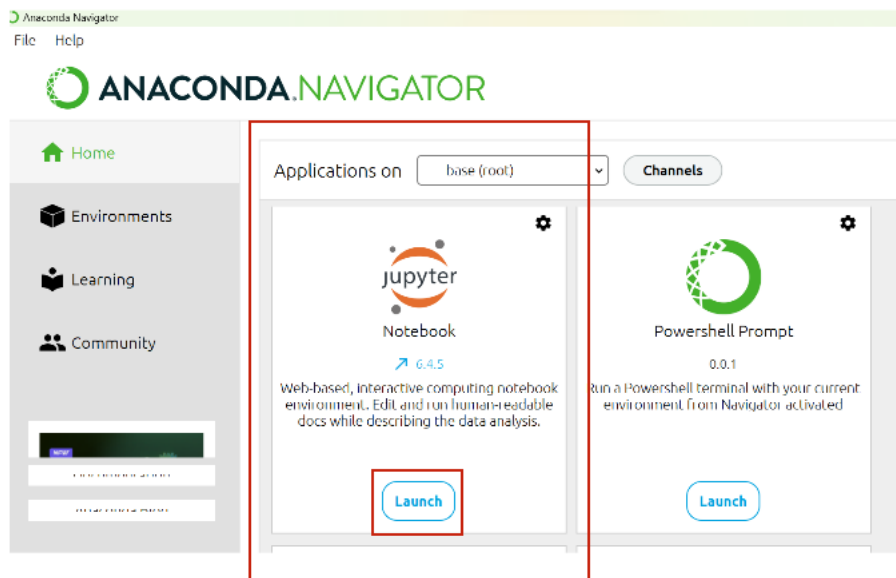
- Navigate to the location where 'Embodied carbon calculator for home office' is saved and open it.
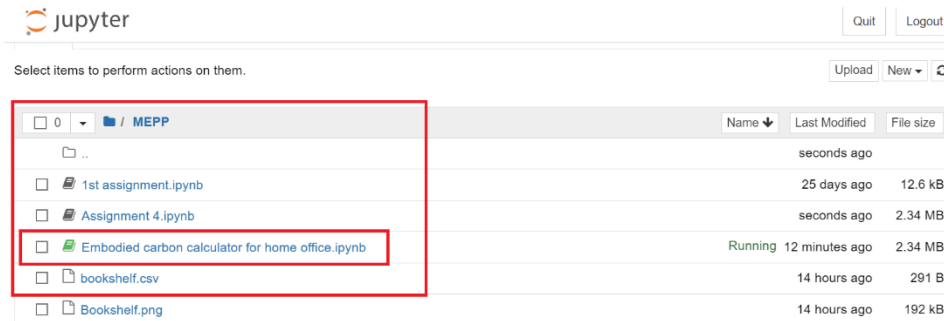
- Once opened, click on the fast-forward icon in the panel above the code to execute the program.
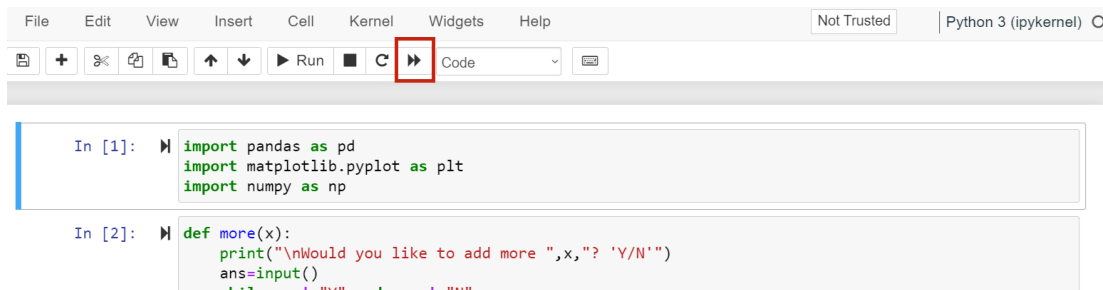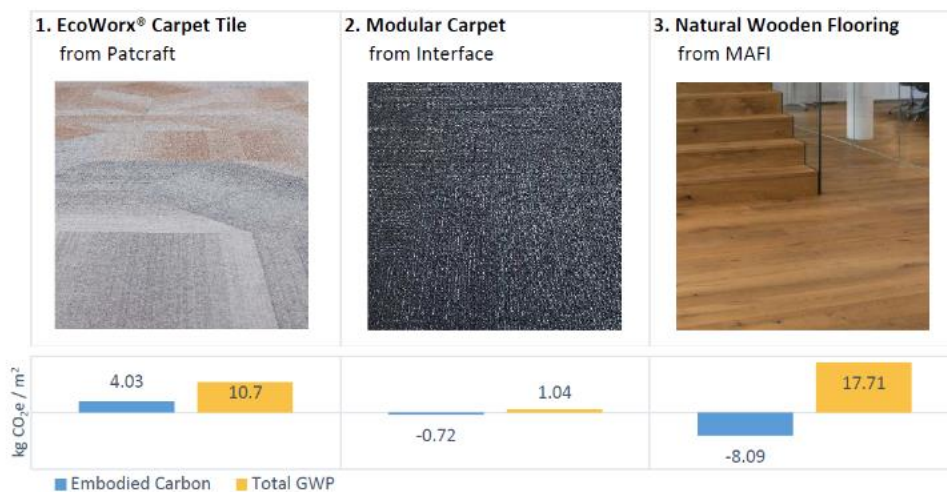

- Follow the prompts on screen to compute the embodied carbon and GWP values for selection.
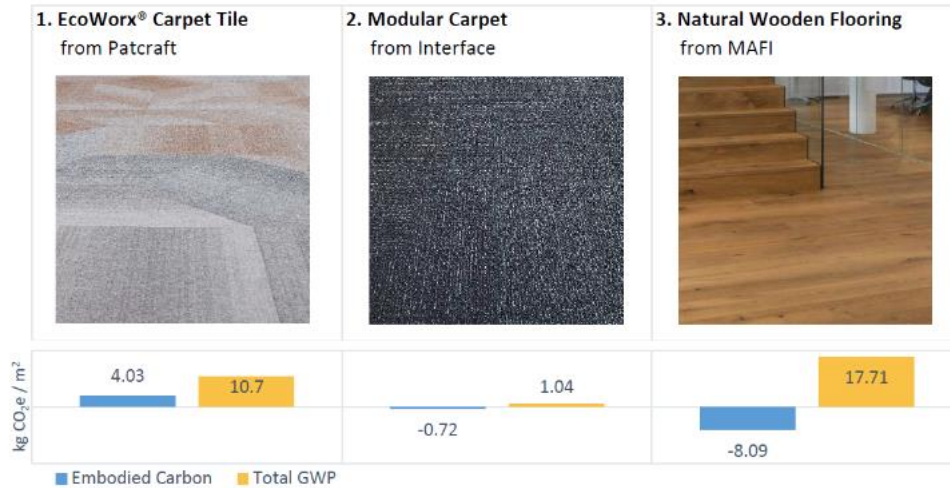
Example

Once you execute the code, you will be prompted like this.

Suppose we would like to choose 500 square feet of modular carpet. Input '2' and follow the prompts.

```
Please select the flooring design you would like to use(Input 0 to skip)
2
Please enter the square footage of design  2  flooring you would like to use
500

Would you like to add more  flooring ? 'Y/N'
N
```


Next you will be prompted to enter the type of chair you would like.

```
Please select the chair design you would like to use(Input 0 to skip)
```
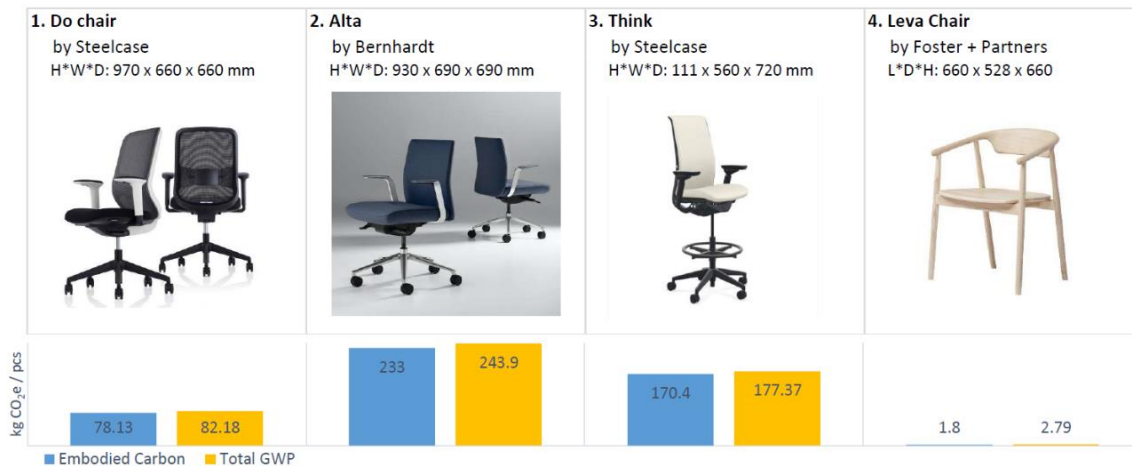
Suppose your design idea requires that you use 1 quantity of chair design 3 and 2 quantities of chair design 4, you can follow the prompts and choose accordingly.

```
Please select the chair design you would like to use(Input 0 to skip)
2
Please enter the quantity of design  2  chair you would like to use
1

Would you like to add more  chairs ? 'Y/N'
Y
Please select the chair design you would like to use(Input 0 to skip)
4
Please enter the quantity of design  4  chair you would like to use
2

Would you like to add more  chairs ? 'Y/N'
N
```

1. Do chair	2. Alta	3. Think	4. Leva Chair
by Steelcase	by Bernhardt	by Steelcase	by Foster + Partners
H*W*D: 970 x 660 x 660 mm	H*W*D: 930 x 690 x 690 mm	H*W*D: 111 x 560 x 720 mm	L*D*H: 660 x 528 x 660

In a similar manner, you can continue following the prompts to input the design and quantity of tables, coffee-tables, sofas and bookshelves you would like. You can also input 0 if you would like to skip any of the options.

Suppose you chose 1 quantity of design 1 for tables, coffee-tables, sofas and bookshelves, you will get the following output in the end.

	Furniture	Embodied Carbon	Lifetime GWP
0	Flooring	-33.445	48.31
1	Chair	469.600	493.38
2	Table	98.900	107.75
3	Bookshelf	335.100	344.27
4	Coffee Table	13.150	16.35
5	Sofa	52.100	62.00
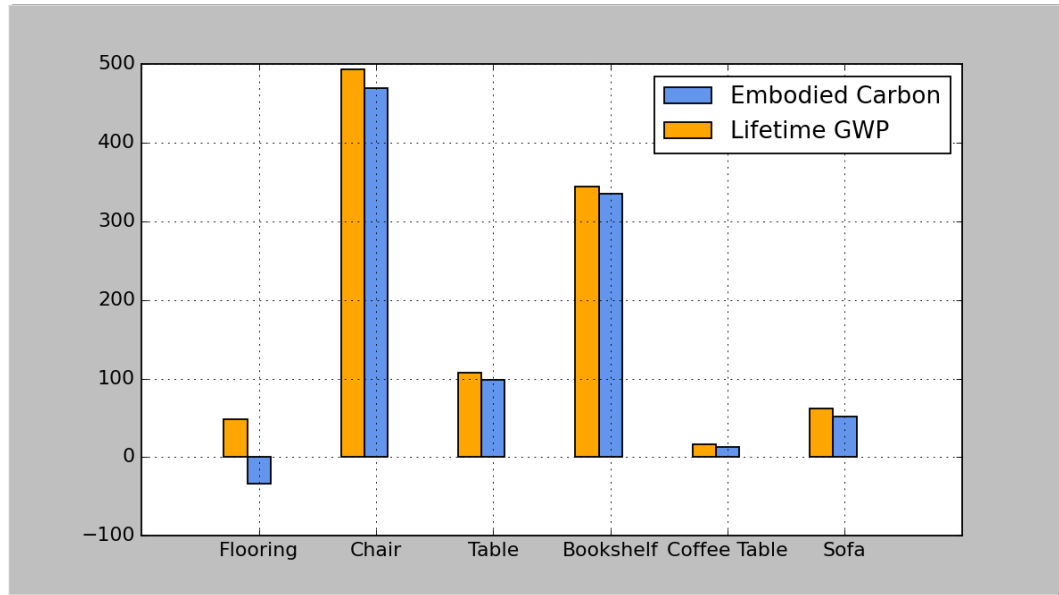
The Embodied carbon of all the furniture is = 935.405 CO_2e

GWP during the lifetime of all the furniture is = 1072.06 CO_2e

This output can then be used to evaluate the compatibility of your choices with your climate goals and targets.