

UPCYCLED LABELLING FOR UCL FURNITURE AND ENERGY EFFICIENT SPATIAL ARRANGEMENTS

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Scope 1 – Label Design for UCL Furniture by JPA Repair Scheme

Basic design principles

Currently, there are numerous strategies employed in communicating sustainable values and qualities to customers. Packaging and labelling are generally the most important interface for customer communication, as these are what users see on a direct basis. Therefore, effective communication of environmental qualities of furniture is directly tied to increasing brand/organisation reputation as well as indirectly promoting sustainable behaviours. Through literature review on sustainable packaging communication design and eco-labelling engagement studies, numerous design elements and strategies were found to create successful upcycled furniture labelling, listed here:

1. Use colors associated with sustainability, cool colors
Cool colors (blue, green, purple) should be the underlaying/background of the label, as it is not only closely linked to the environment but also evokes calmness and confidence. Orange and yellow can be used for emphasis/highlights, as these incite emotions of energy, creativity, inspiration and wisdom (Caldwell, 2019).
2. Show aesthetic/positive greenery imagery
This evokes “feel-good” emotions in the users, incentivising users to use furniture more and decrease simply “turning away” from message and problem. This will indirectly incentivise furniture upcycling (Taufique, 2022).
3. Show eco-labelling
Eco-labels certify the sustainability claims of the product, as these labels are awarded by certified 3rd parties which have rigorous standards. These labels increase the trustworthiness of the product in the eyes of the consumers (Ahsan Siraj, 2022), as users are being increasingly critical of sustainability claims made by corporations (Taufique, 2022).
4. Show company logo
In the same way that eco-labelling increases the trustworthiness of the product, including a company logo increases the legitimacy of the label (Green, 2019).

There is an increase in environmental knowledge that causes consumers to be more inclined to buy products that try decreasing their environmental impact. However, because furniture’s complexity, it is not common knowledge to know what makes a piece of furniture sustainable or how to recognise the legitimacy of its environmental claims. Hence, it is paramount that informative campaigns to educate consumers on eco-labelling and furniture sustainability in general be launched alongside the furniture upcycling labels (Taufique, 2022). To be more impactful in the user, these campaigns should also focus on showing the positive behavioural impact to scale, for example, show how many trees can be saved by upcycling furniture rather than simply stating the emissions avoided (Lamb, 2020). Finally, non-verbal communication of the upcycled furniture will be more

effective in spreading information and educating users, as studies show that this is more effective for consumers with low environmental knowledge (Taufique, 2022).

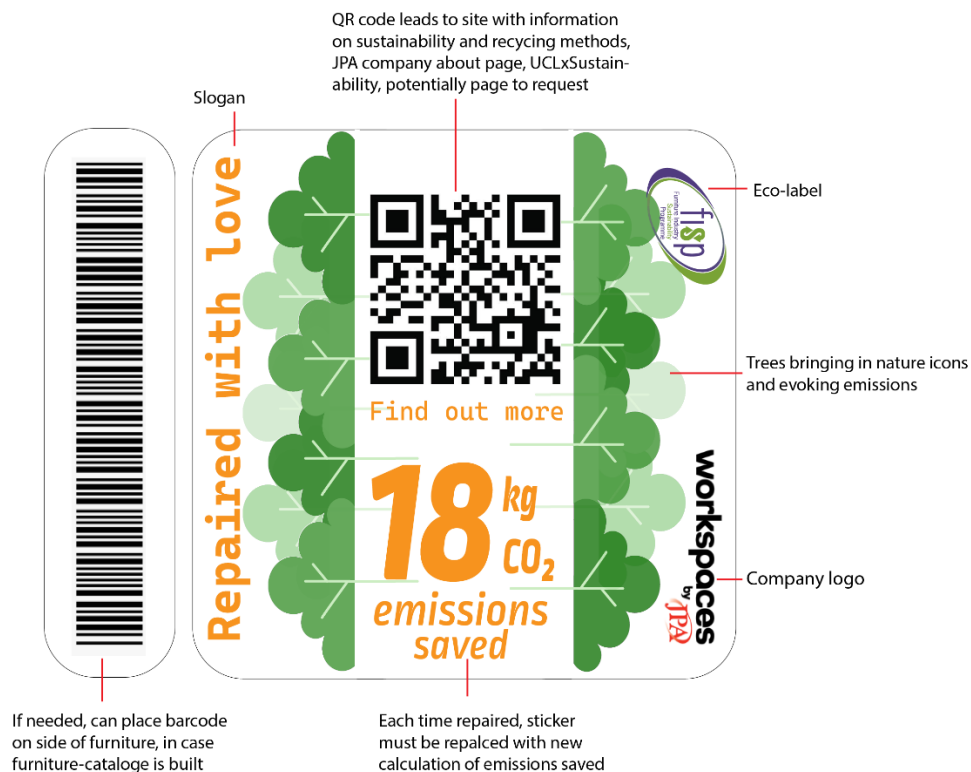


Figure 1, Example of Furniture Sustainability Eco-labelling (Council, 2022).

Proposed Label Designs

Presented are 4 designs for upcycling labels on UCL furniture, with associated comments underneath. Included is also an idea to distinguish upcycled furniture when adding a label is inconvenient or would not be visible.

Full-Rectangular Sticker



Other Versions of full-rectangular sticker



Split Square Sticker

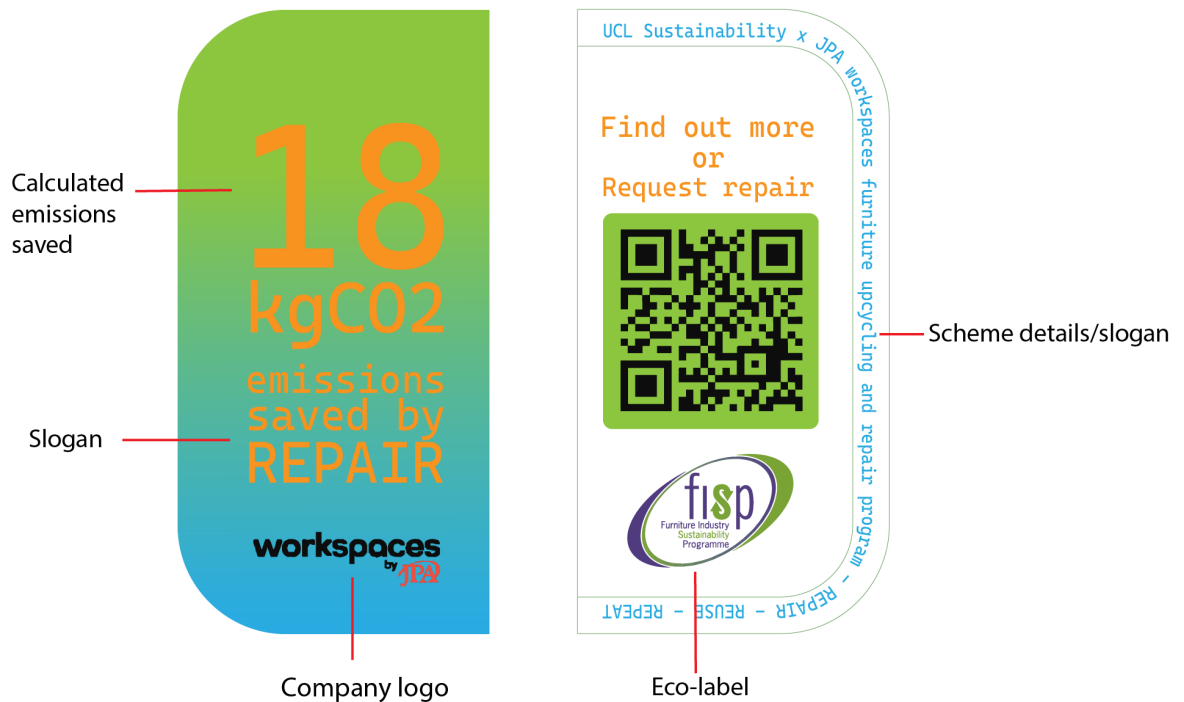


Full label view

Label is composed of 2 stickers:

Right side = permanent, holds qr code for all general information on recycling scheme

Left side = Replaced each time a repair is made, each repair displays new the carbon-emissions saved



Other versions of split-square sticker



QR code accesses all relevant information on recyclability/sustainability, can also request repairs for this furniture if needed



Version with no carbon emission-savings stated in case this is too difficult to calculate.

No eco-labeling to avoid cluttering on label, however can be added on side

Slogan

Company logo



Leaf-Shaped Design

Simple design, background is leaf shaped, might be more eye-catching



Colourful boarder strip



Strip-Sticker Idea - could add colorful strip to leg or boarder of furniture, in addition to label, to distinguish the repaired furniture. This can be more attractive/appealing and add a sense of newness/freshness to furniture. As colorful strips on furnitue are not commmon, this also adds individuality to JPA furniture repair scheme.

SCOPE 2 – Integrating Upcycled Furniture in UCL Buildings

Current Furniture-Ordering System in UCL

Currently, furniture is ordered by single members of staff, for either individual or departmental use. UCL uses numerous suppliers for different types of furniture, all of which meet UCL sustainability requirements and hold 3rd party sustainability certifications, such as the EU Ecolabel. Procurement services published a clear buyer's guide for furniture purchasing, which outlines the requirements and procedures which orders must have in terms of cost and sustainability. It also starts by asking to consider if furniture requirements can be met by re-use or repair (eg re-upholstering), however does not provide the contact details or links to access these services. Nonetheless, UCL's re-use and re-distribution services can be easily found through an internet search and are linked to UCL official webpages.

In terms of reuse and re-distribution, UCL offers numerous services to reduce carbon emissions of furniture:

1. UCL Estates inventory of surplus furniture
UCL estates has a storage of surplus furniture in Claire Hall. Staff are encouraged to contact the estates team to understand if their needs can be met by items in storage. JPA has previously helped undertake a full inventory of the furniture stored in Claire Hall. This service includes transportation and set-up of furniture and can also be used for surplus furniture disposal (UCL Procurement Services, 2019); (Edwards, 2022).
2. Warp-it Platform
Warp-it is an online platform made by UCL to help re-distribute unused furniture, electronic and such objects inside of UCL as well as to external organisations. The aim remains to reduce carbon emissions and all staff can register and upload items, as long as this remains for university use only (UCL Estates, n.d.).
3. JPA On-site Repair
JPA offer as part of their contract an on-site furniture repair service to UCL estates in Bloomsbury. They provide on-request repairs, as well as offer Repair Days in which staff can book slots for fixes. Statistics on these repair days are reported back to UCL Sustainability which helps further promote the service and encourage its use (UCL Procurement Services, 2019); (Edwards, 2022).

Overall, these schemes help reduce carbon emissions from procurement, with UCL sustainability stating that since its start, the JPA repair scheme had re-located over 7470 redundant items and repaired 1030 items of furniture (UCL, 2022). However, some problems were noted, though their effective impact could not be evaluated in this research:

1. Staff is not aware of program
Repair scheme could be more published internally, increasing its usage. As well, visible publicity placed in areas with both high academic and student frequency can

promote positive reactions by showing UCL's effort in improving its environmental impact (Edwards, 2022).

2. Lack of knowledge of furniture adjustment systems are interpreted as breakages
Furniture with adjustable features may re-set or be complicated to use. Some staff may not understand how to use these features and may assume the furniture is broken, promoting the purchase of new equipment (Edwards, 2022).
3. Staff can assume that buying furniture is easier than repairing
 - a. Staff may believe that it is easier to buy new furniture than re-use UCL surplus furniture or believe that the surplus furniture is of low quality. As well, buying new furniture may be a way to use up left-over budget at end of financial year (Edwards, 2022).

Improving UCL Uptake of Upcycled/Reused Furniture

While it was not possible to evaluate the effectiveness and reach of the JPA repair scheme and use of upcycled/reused furniture in this project, suggestions on ways to improve visibility of the scheme were coalited and presented below.

1. Increase knowledge of JPA repair scheme
 - a. Labels - By creating stickers/labels to place on repaired furniture, to act as both an aesthetic and informative feature (as this could contain QR codes to access site explaining the scheme). This can act as a 'badge of honour' for the department, and can communicate the carbon-savings of the repair. This would also improve UCL's and JPA's reputation in terms of positive environmental action.
 - b. Increase internal promotion – creating eye-catching posters to advertise the potential carbon savings and how to request repairs, as well as promoting reuse of UCL surplus furniture and how to access these services. This can be more effective than emails (due to large volumes of emails received by academics), and indirectly improves participating party's' reputations.
 - c. Increasing accessibility of service – the JPA and UCL estates joint services can streamline the repair request process by implementing QR codes on posters/labels so that repairs are easily requested.
 - d. Promotional Event – a fun 1 day event aimed at staff on campus, for example holding an internal 'furniture garage sale' of UCL surplus furniture for staff office use, could incentivise reuse and upcycling schemes. Parallelly, it would raise awareness of carbon savings of reusing to both staff and students. This event should be held in period of furniture orders (end of financial year).

2. Allowing students to report repairs

This can be done through QR codes placed on furniture in high student frequentation or by publicising email of service to students, helps prevent breakage degeneration.

3. Making reuse/upcycling the most attractive option

- a. By requiring justification of reasons orders cannot be fulfilled by UCL surplus furniture or restoration of current furniture
- b. Creating furniture 'modernisation' scheme to make aesthetic changes to furniture to create new/refurbished environment feel without buying new furniture (JPA is developing such programs (Edwards, 2022).
- c. Creating incentive programmes, such as awarding budget for an event to department that saves certain quantity of carbon emissions through repair/reuse scheme. This is similar to what was offered in UCL halls (Sustainable UCL, 2021).

Placement of Furniture Effect on Room Thermal Loads Investigation

Introduction and Hypothesis

A superficial study of how the placement of furniture inside of the building could impact the thermal loads of a study space was undertaken, to understand if UCL, specifically the Bartlett school of Architecture faculty in 22 Gordon Street, could decrease the energy required to heat and cool its spaces. A simplified shoebox model of the 6th floor study space 6.12 in 22 Gordon Street was modelled and simulated, to evaluate if the addition of more furniture and its placement further or closer to glazing would impact the heating and cooling loads of the space. As solar radiation is a form of radiative heat transfer which is absorbed by furniture, the hypothesis formed is that:

H1 : The higher the volume of furniture increases the heating and cooling loads.

H2 : The closer the majority of the furniture volume is to the room glazing, the lower the heating load will be.

H1 assumes that furniture absorbs part of the thermal energy in the room, therefore causing a larger amount of energy required to heat and cool the space.

H2 assumes that furniture absorbs most radiant heat from the sun and re-radiate it in the space, therefore decreasing the energy needed to heat the space

Methodology

A simplified shoebox model of the study space was created (Figure 2).

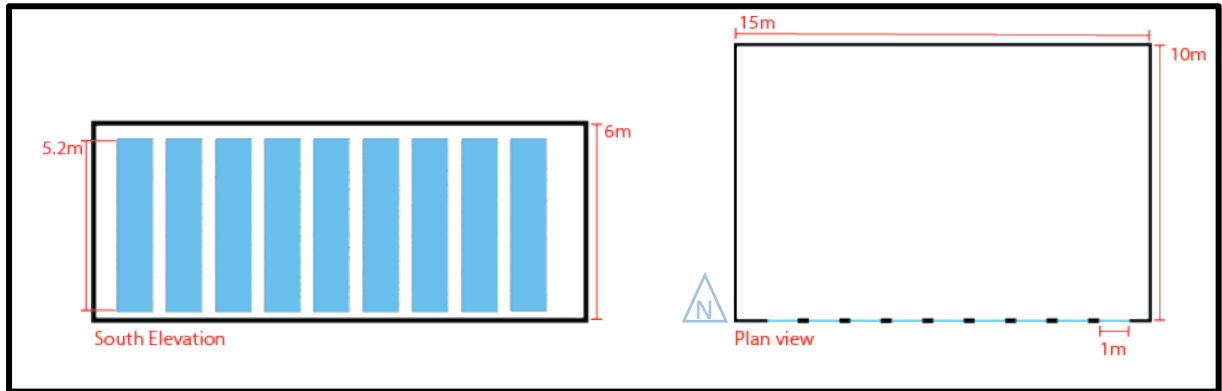


Figure 2, Dimensions of shoebox model.

This was inputted into DesignBuilder (Figure 3).

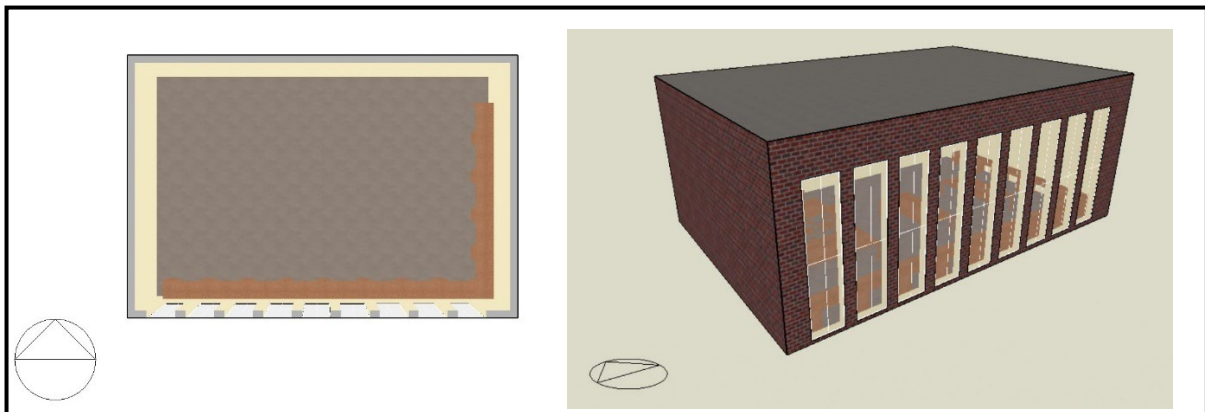


Figure 3, Plan and perspective view of DesignBuilder model.

Two trial simulations, one without furniture and one with furniture were run, however this gave the same values for heating and cooling loads for both simulated.

It was decided then to run the simulation Rhino using the energy simulation plug-ins Ladybug, Honeybee and Honeybee-Radiance (Figure 4).

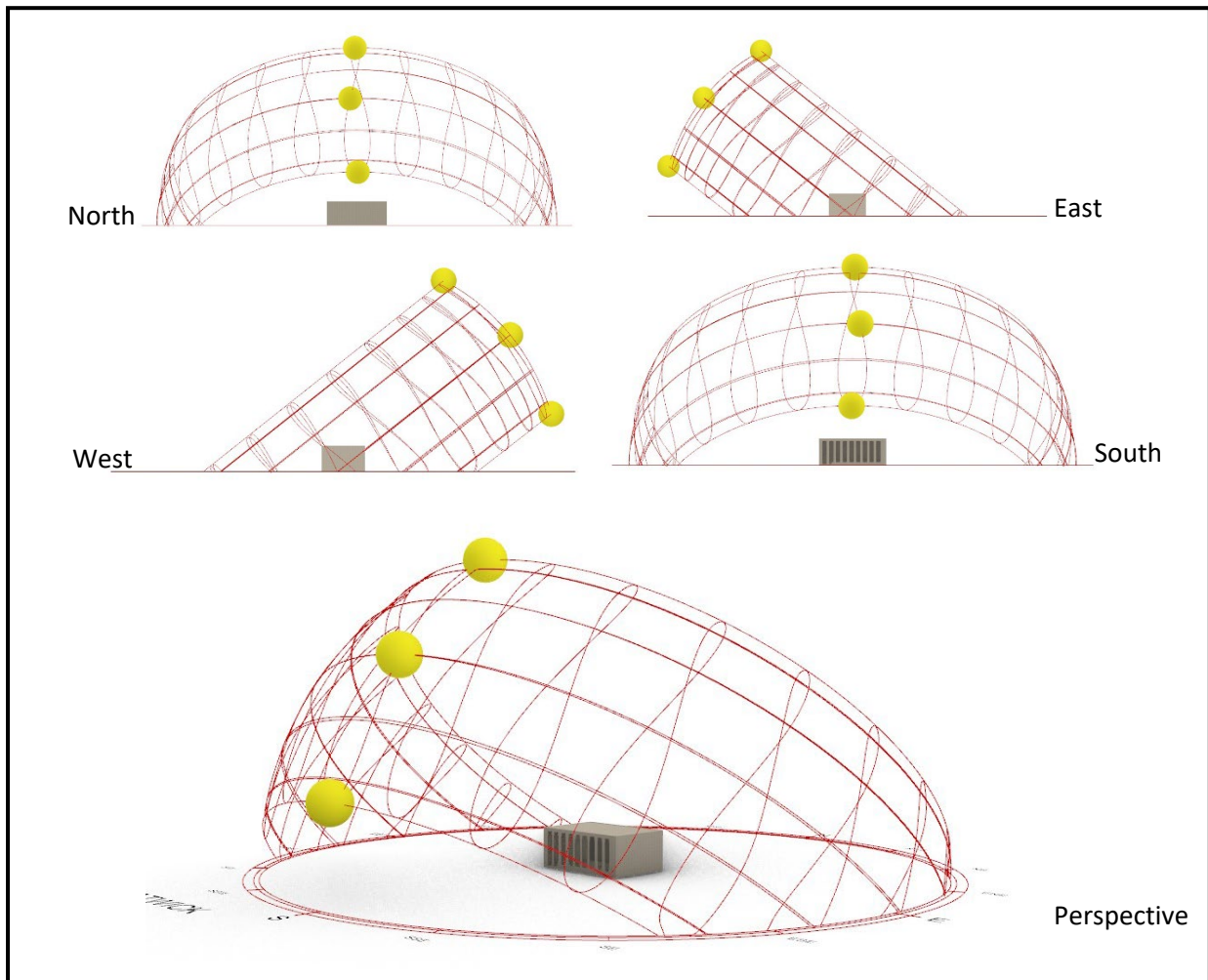


Figure 4, Cardinal and perspective views of the Rhino model.

The control model was always that with no furniture in the space.

The DesignBuilder model used the default constructions and default programmes. Default 'assemblies', which simulate furniture and people, were added to the physical model (Figure 5). Heating and cooling loads simulation was then run, giving the same results for both trials (Figure 6), as previously mentioned.

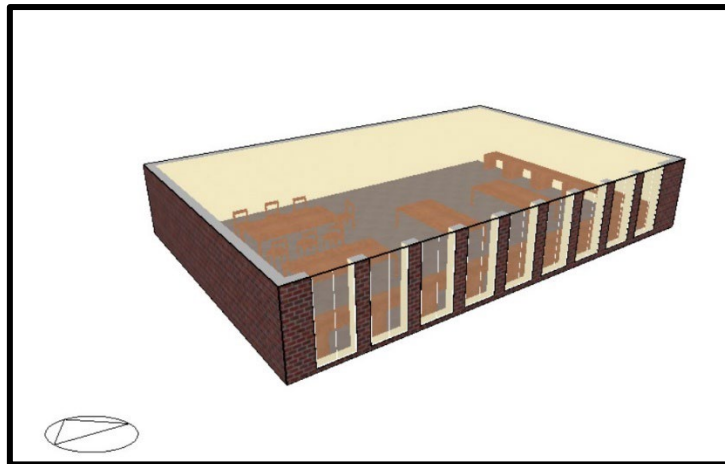


Figure 5, Assemblies added to the DesignBuilder model.

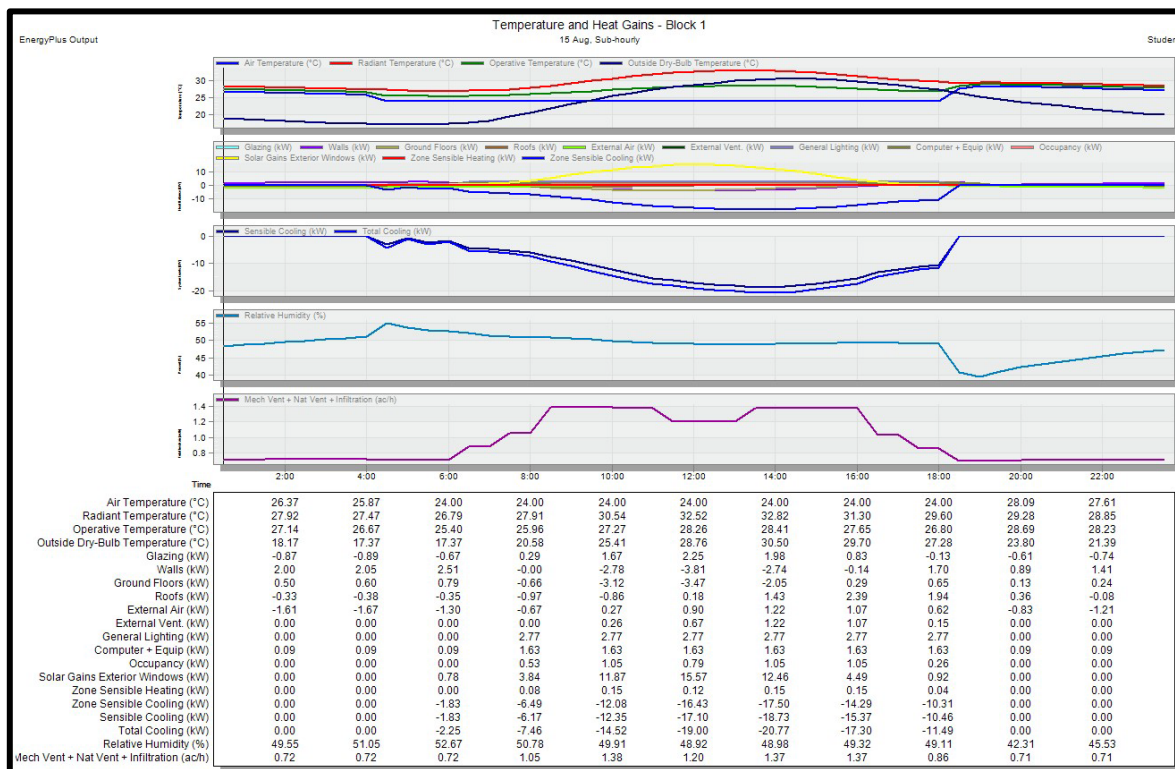


Figure 6, Baseline heating and cooling loads of DesignBuilder yearly simulation.

The shoebox model in Rhino was made dimensionally equal to that of the DesignBuilder. In the energy simulation, the construction set given was the default wood-frame, and furniture objects

were assigned plywood material. The Grasshopper code for the simulation can be found in Appendix 1. Four furniture configurations were tested, see Figure 7.

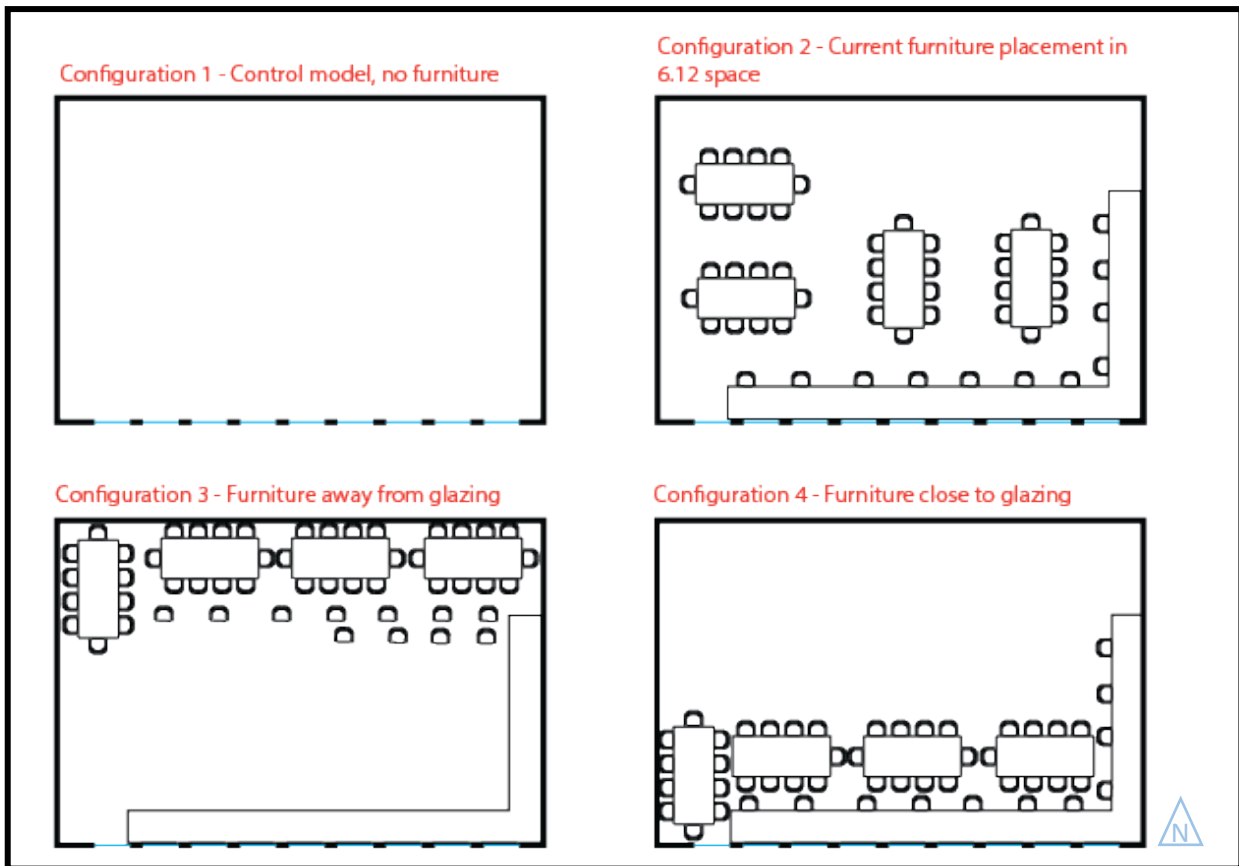


Figure 7, Furniture Configurations.

Results

The findings of this project clearly show that there is almost no effect of furniture on heating and cooling loads of the space. The control model, configuration 1, heating load was found to be 125.296 kWh/m² and the cooling load 34.056 kWh/m² (Figure 8). When furniture was taken into account with configuration 2, the heating loads decreased minimally by 0.037 kWh/m², and the cooling by 0.167 kWh/m² (Figure 9). When changing the configuration of the furniture inside of the space, configuration 3 had not effect on the thermal loads while configuration 4 produced the same values as the control model. These results disprove H1, indicating instead that increasing the volume of furniture decreases the thermal loads of a space. Further research is needed to confirm H2.

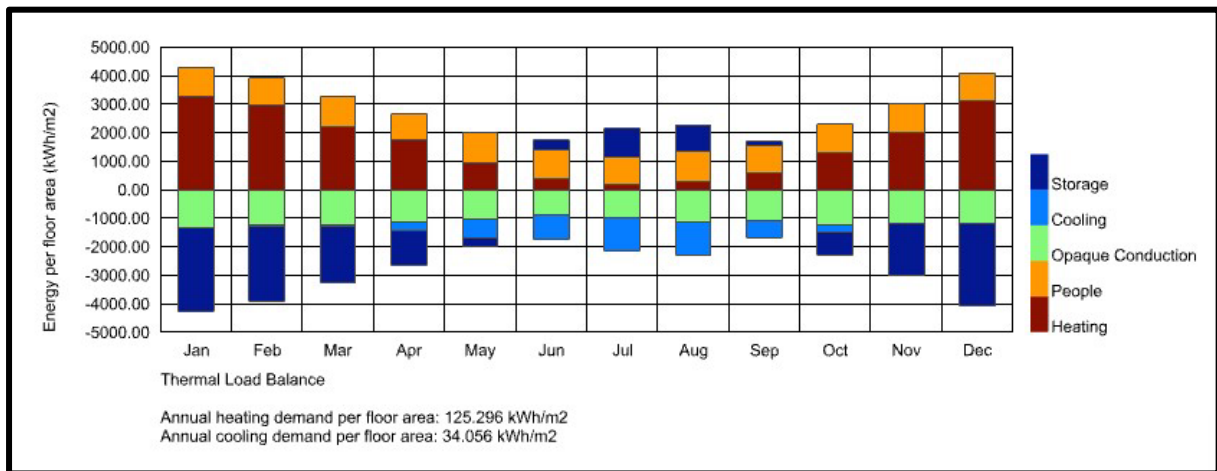


Figure 8, Control model heating and cooling loads from Ladybug energy simulation.

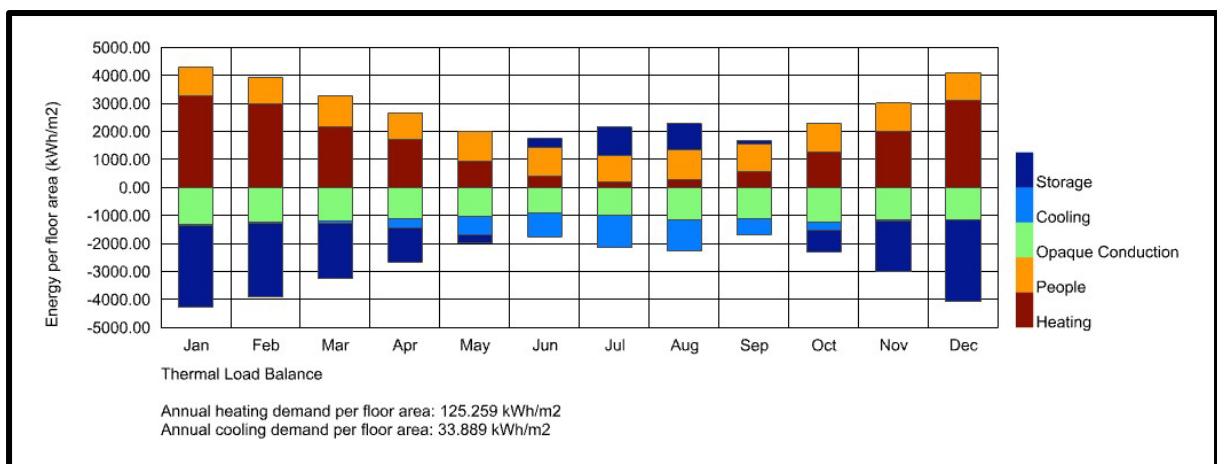


Figure 9, Configuration 2 heating and cooling loads from Ladybug energy simulation.

Conclusion and Evaluation

Due to time constraints of the project, further experimentation could not be carried out to better understand the results. Data disproved H1 and gave inconclusive findings for H2. The unexpected outcomes may also be due to errors in the simulation. However, these findings confirm that furniture plays a small role in the heating and cooling loads of a room, where it is likely that the insulation, airtightness, wall constructions and glazing area of a room principally influence these values. Due to the variety of room dimensions, furniture configurations and fabric parameters (airtightness, materials, solar gain, thermal resistance) present in 22 Gordon Street, it is impossible to define a set of tips to inform furniture placements to reduce heating and cooling loads. However, their impact on airflow inside the space should be investigated, as this could affect the efficiency of HVAC systems inside the rooms. This would require CFD analysis, which due to time constraints, could not be explored in this project.

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CDF analysis : computational fluid dynamics

HVAC systems : Heating, ventilation, air conditioning systems.

Operative temperature : average of mean radiant temperature and air ambient temperature; the temperature that humans experience in a space

Room fabric : materials and layering of wall, floor, glazing and their thermal properties of a room.

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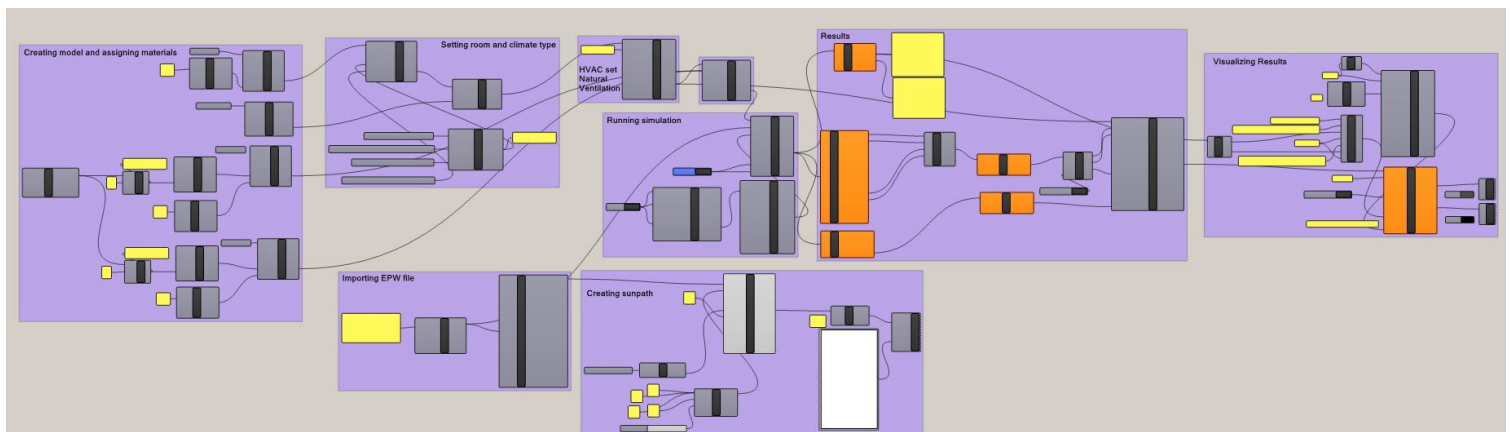
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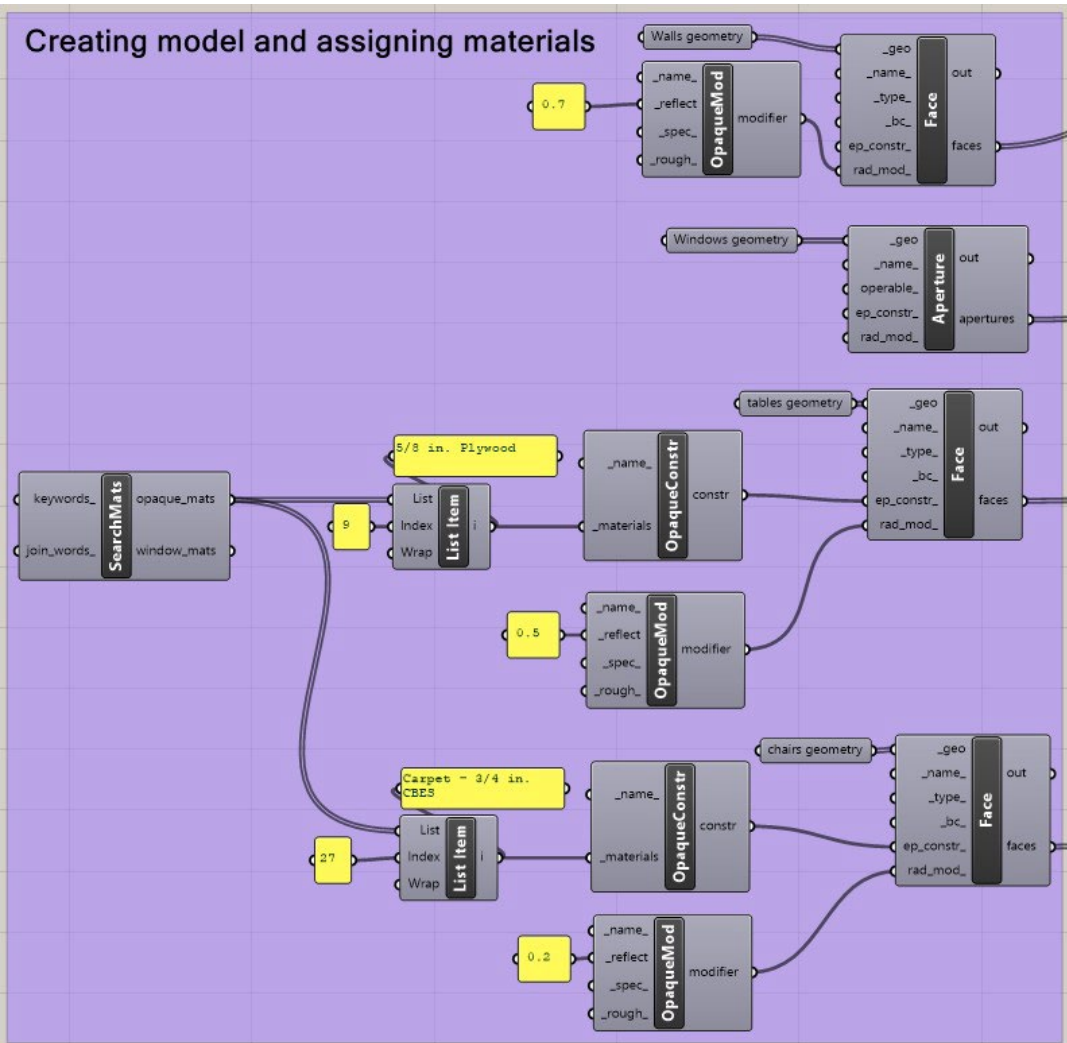
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Appendix

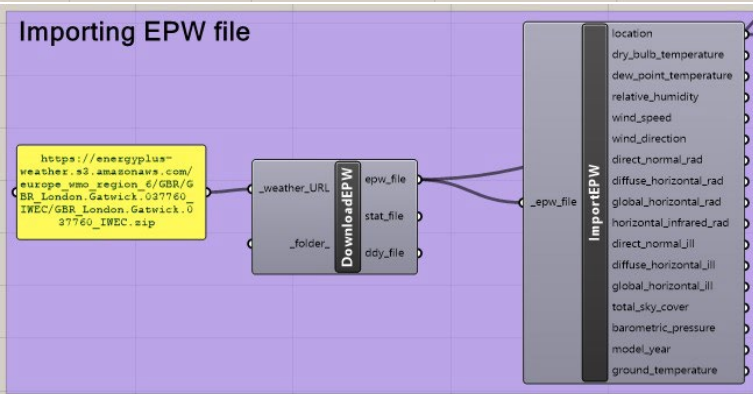
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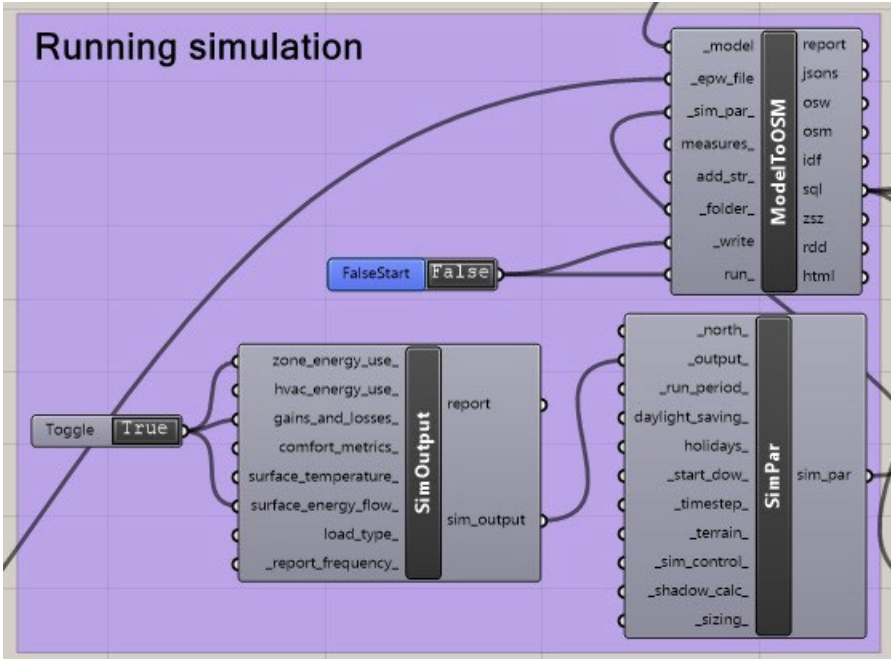
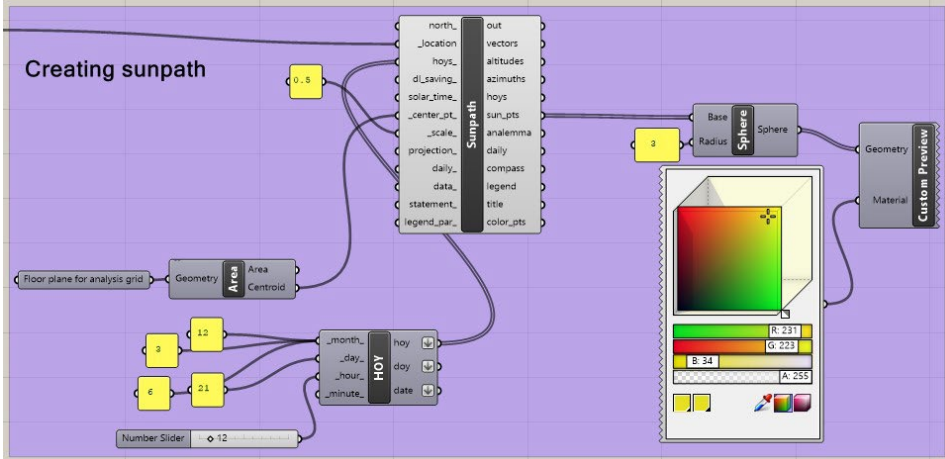
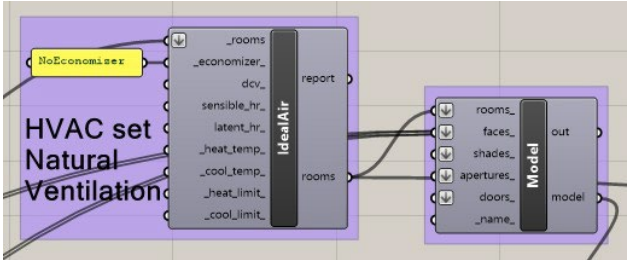
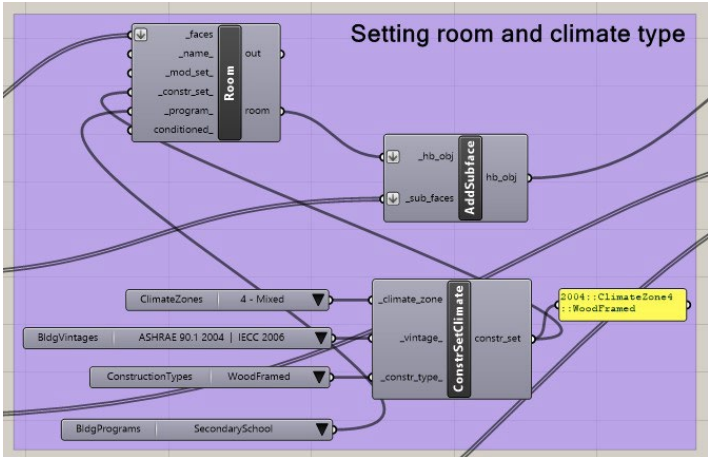


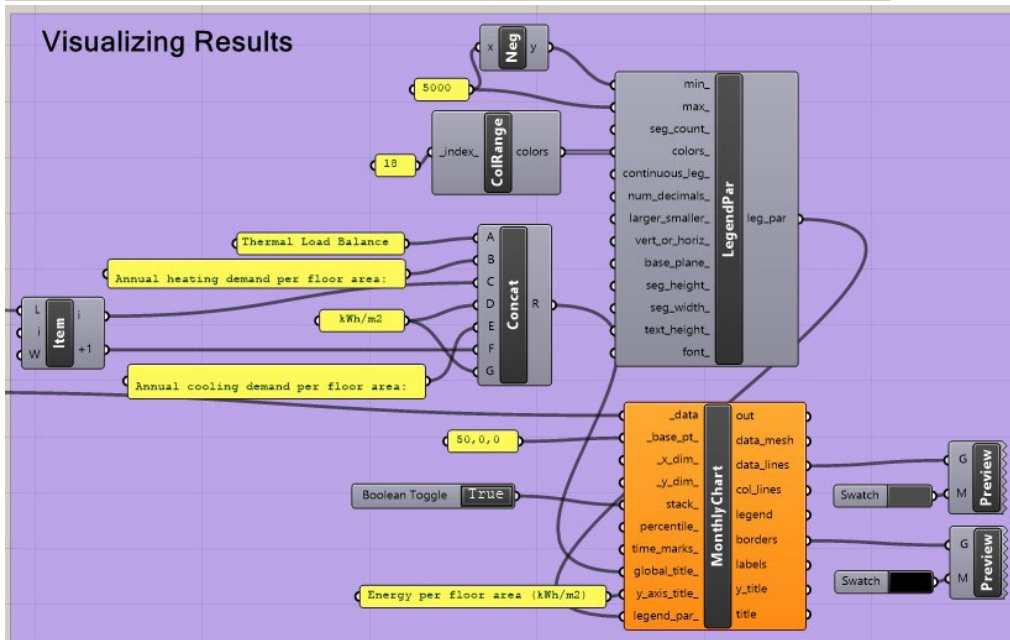
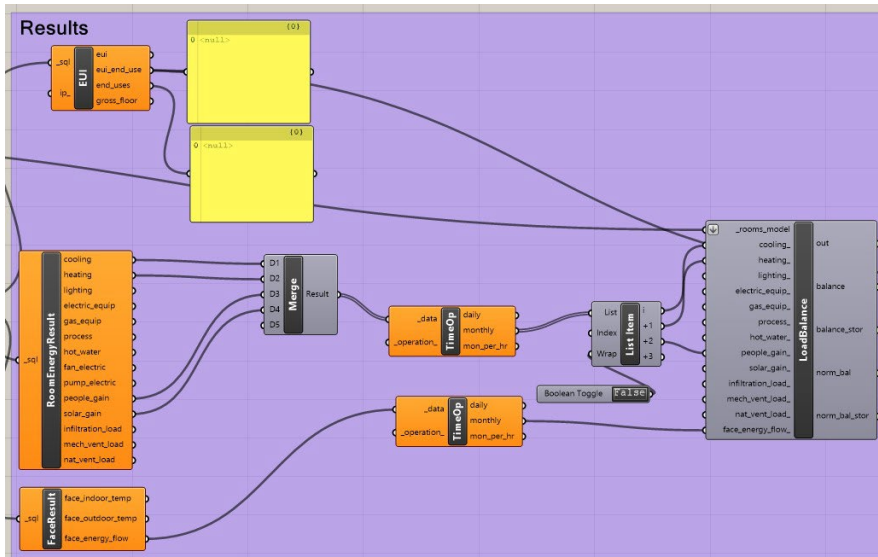
Creating model and assigning materials



Importing EPW file







2. Project Schedule

workplan summer research	activity	time predicted	time spent
Miscellaneous	planning/defining research areas & methodology)	1	1
	Document preparing/formatting	1	0.8
scope1	design theory	2	2.8
	upcycled furniture CS labelling	2	1
	proposed design	4	5.6
	executive conclusion	0.5	3
scope2	current ucl furniture system	2	1.6
	second interview jpa	1	0.6
	interview jpa	1	1
	improvements to system	1	1.3
	current room layout diagram	1	0.5
	research simulation	2	4
	config.1 energy simu	2	2.3
	config.1 diagram	0.5	0.1
	config.2 energy simu	1	0.2
	config.2 diagram	0.5	0.1
	config.3 energy simu	1	0.2
	config.3 diagram	0.5	0.1
	config.4 energy simu	1	0.2
	config. 4 space diagram	0.5	0.1
	analysising results + conclusion	1	1.5
	total left	1.5	0