P1

Starts from "start" tab for the global structure, then Form0
Single unit - detached house for a big family (6 people).

- Change "heating system efficiency" to more than 100% (heat pump). (IdEHDD graph)
- Keep default value in User0
- Reduce WWR to 25%. Then checks the Marimekko chart and SuCoBRU charts. P1 said, "it's a big change because a window has really big impacts and is an expensive element based on Marimekko chart. “
- P1 checks intermediate results during input.
- Check SuCoBRU chart (CBEE value) when element types are changed.
- In User 1, some parts of Set point temperature changed to check the influence on energy. (IdEHDD graph)
- In Form 2, the location is changed, and IdEHDD graph is checked.

Positive

- Reference of compactness provides the input value in Form 0.
- “It's cool to select the frame and glazing separately.”
- “Showing design history in Dashboard is important.””
- Orientation and obstruction can be changed.
- “It is good for a terraced house because materials of each facade can be changed in Form2.”
- “Selection of different locations is good.”
- “Pareto Front is interesting.” "It's interesting the results of Pareto Front. Lowest impact materials and geometry are different from my expectation."
- "I see that it is good information for the client. As budget is important for the client, Parallel coordinate (PCP) is useful to filter by different types of costs. It's very clear".
- “Sankey diagram is good to show impacts of different lifetime stages.”
- “The tool is easy to use, but we need explanations of how to use graph.”
- “Input is easy, so it's better to shorten input explanation but more explanation of how to read graphs for architects.”
- “Once I understand how to use graphs, I can show clients well.”
- “PCP is very powerful to understand design for everyone (even clients).”

Negative

- In Form1, no orientation?
- P1 asked about the material database (only these choices?).
- In User 2, it seems it is a bit difficult to input per person and per week.
- P1 asked what is included in initial financial cost(IF) (only major construction) while checking the result value because P1 felt cheaper than P1's experiences.
- “The tool is easy to use, but we need explanations of how to use graphs.”

P2

Starts from Form 2, back to Form1 to input materials -> combination
Test Single-unit terraced house with family (3 people).

- Check Marimekko chart when geometry is changed in Form1
- Tested the filtering function of PCP

Positive

- Combining element type + insulation material (thickness) is good.
- Selecting material for each component is easier. (Form1)
- “Very useful in a volume study stage, similar to "spacemaker" but this tool considers more sustainable aspects. “
- They notice that they start taking into account LCA in the design process sooner or later, so this tool can be helpful for architects in an early design stage.

Negative

- Require more flexibility of material database, e.g., adjusting own construction types.
- Asking for geometry input by 3D software like SketchUp.
- Not only residential. Adaptable for more functions (office, school..)
- Link to Revit (BIM) is useful.
- “Environmental costs are not yet reflected in direct clients’ benefits today.”

P3

Starts from Form 0 -> Form 1 -> Form 2 -> combination
Apartment terraced

- Clients are not interested in environmental impacts yet. So initially, regulation should be implemented.

Positive

- “This tool is useful, especially for educational purposes (not only students but also architects learn the effects of materials, design etc.).”
- It follows a design process in an early design stage.
- “Pareto Front provides different results than expectation.”
- Parallel coordinates assist in discovering potential design choices by considering various objectives.

Negative

- Different shapes and functions
- Architects need some time to learn how to use visualisation.
- It could be better to link with a 3D programme.

P4

Starts from Form 0, back to Form1 to input materials
Test apartment - corner with a couple (2 people).

- After input in Form1, P4 recognised influences of thicker insulation of external wall compared to Form0 via IdEHDD graph.
- High-insulation apartment with default user behaviour results in no heating demand. But if user behaviour is changed (laundry hanging in the heating area), heating demand increases. P4 said, "Surprise. It's super big difference. It's like way more than changing insulation. This is eye-opening.".
- Combination can check and show the impact of different choices. Design doesn't focus only on energy efficiency or low environmental impact. Triple glazing is more energy efficient, but some clients (architects) prefer double glazing for a visual comfortable aspect.

Positive

- “Results Immediately shown in IdEHDD graph help understand impacts of decisions.”
- “Marimekko chart shows the most impact element, which P4 didn't think before.”
- “Dashboard illustrates the process of improvement of a design. (good direction).”
- “It's good to see impacts of different user behaviour on energy. “
- “It is interesting to select different locations (weather conditions).”
- “User 2 can be used to stimulate client's eyes-opening the impact of user behaviour on energy. (Sustainable behaviour is not uncomfortable, comfortable sustainable behaviour is possible).”
- ”Pareto front can check the different materials.
- “Sankey Diagram is good for knowing the initial impact of materials.”
- It is an advantage of this simple tool considering 17 indicators, not only CO2.”
- Considering economic aspects (interest rate).
- “Already this tool considers insulation materials and user behaviours. It's useful for renovation. P4 hopes this tool extends for renovation as soon as possible.”
- “It's a good balanced tool for architects in an early design stage, existing tools are too details or too simple.”

Negative

- “An explanation of name of element (what is "adiabatic wall"?) is needed.”
- “Graphical representation of element construction is easy to check choices.”
- “Input for ventilation strategy is a bit complicated.”
- Not including any index for overheating.
- Input in combination sheet needs a bit more explanation.
- Different form (L shape etc…)

P5

Starts from Form 0 and moved to Form 2.
Test apartment-corner.

- Input of compactness is by checking the reference.
- After input Form0, check IdEHDD graph and dashboard (stacked bar chart).
- In Form0, check different compactness (one façade and corner). Numeric results are checked and think the influence of input on results by changing.
- Keep user behaviours default values.
- First design stage, P5'office focuses on geometry and size of window, not so much on materials.

Positive

- “Pareto front is interesting for an architect.”
- “Random and complete combinations are good.”
- “Providing energy and detailed user behaviour to clients is good for educating clients.”
- Not a black box model.
- “As number of clients who consider sustainability is slightly increasing these days (if materials are similar in cost, more sustainable materials are chosen), a demand for this kind of tool for architects can be increasing.”

Negative

- “As solar gains have a huge impact on heating energy in the first stage, Form 0 and 1 are too rough.”
- For designing, user behaviour is far details.
- Only box buildings. (other geometry like an L shape).
- Only major elements are considered.
- “More visual input is better for architects.”
- “Intermediate results make it complicated to input. input sheet looks too busy.”

P6

Starts from Form 0 to combination to Form2
Test apartment-corner.

- Form2 is design change small things, and designer can get results quickly and fluently. It can be useful after selecting a few options by Pareto front.
- Request for filter via slider of parameter for Pareto Front.
- Request one-click input into Form2 from the selection from Pareto Front.
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Positive

- "Pareto front gives me very easily visible information. We don't have to even think about top ones."
- “Architects cannot have so much time to design, so that Pareto Front can save a lot of time.”
- Pareto Front can be used for different scenarios.
- “Intermediate results are interesting to understand more details.”

Negative

- “Form 0 and 1 are unclear on "solar gain" levels, which are high, medium and low. “
- “Numeric input of combination is a bit complicated for a designer.”
- “It is not sure whether user behaviour is needed or not in an early design stage.”
- “Total LCTC per element could be an interesting result.”

P7

Starts from Form 0 (User0), Form 1 (User 1) and combination to Form 2
Test single-unit terraced

- Check the reference of compactness
- In User1, check the different user types (IdEHDD graph).
- In user 1, checking the different types of ventilation (IdEHDD graph)
- Check selected design options via Pareto Front in the dashboard (stacked bar chart and line chart). Then check more detailed components via Marimekko chart in Form 2.

Positive

- Two different types of combinations are included.
- “Pareto Front is useful.”
- “LCTC per building gives an overview, not only LTCT per m2.”
- “As a tool fit for early design stage, it looks very nice.”

Negative

- Limited element type and insulation materials.
- “Text description of element layers is difficult.”
- Not including cooling.
- Want to transfer Input in Form 1 to combination sheets.

P8

Starts from Form 0
Test apartment-terraced.

- Not only Form sheet but also User sheet was changed and checked the results via IdEHDD and Dashboard.

Positive

- “Input is not complicated.”
- “Pareto Front indicates potential design options immediately.”
- White box (transparent) model for calculation and showing intermediate results.

Negative

- “This tool doesn’t consider overheating.”
- “Some building types (apartments with roofs/floors) are not considered.”