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Evaluating Sefaira: A Research Collaboration

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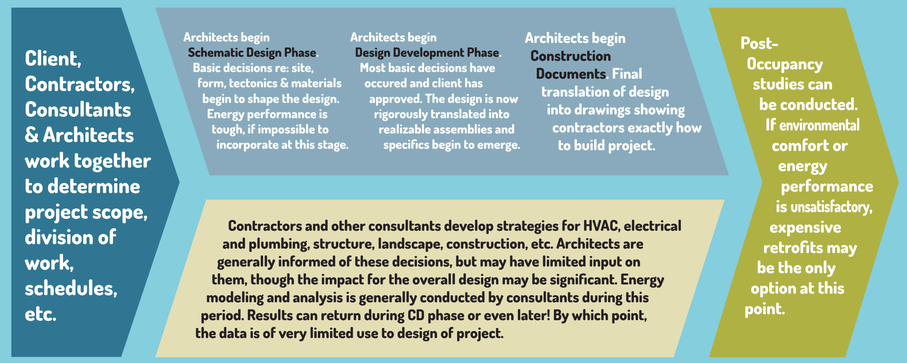
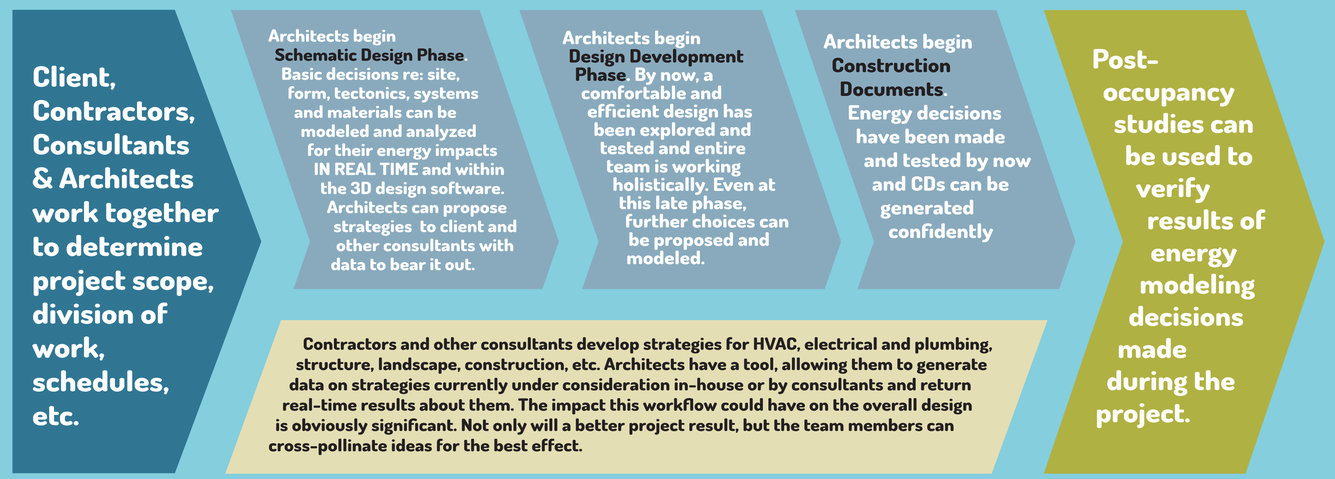
EVALUATING SEFAIRA:

A RESEARCH COLLABORATION

IN A TYPICAL ARCHITECTURE OFFICE, ENERGY MODELING AND ANALYSIS IS OUTSOURCED AND OUT OF SYNC WITH THE PROJECT WORKFLOW.



WITH A TOOL LIKE SEFAIRA CONCEPT, ENERGY MODELING CAN OCCUR DURING SCHEMATIC DESIGN, EARLY ENOUGH TO HAVE A DIRECT IMPACT ON INITIAL PROJECT PLANNING DECISIONS.



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ABSTRACT:

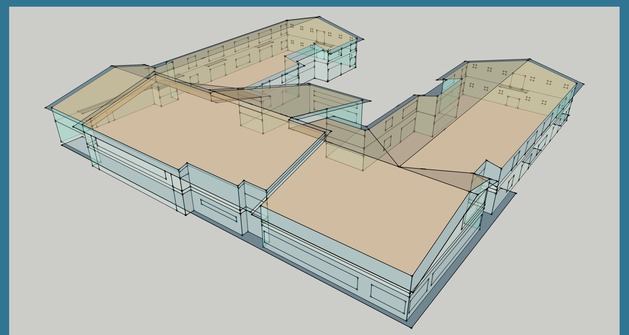
Sefaira Concept is a plug-in that runs in Trimble SketchUp, a 3D modeling program with wide usage in architecture design. Known for its ease of use, SketchUp is particularly useful during a project's schematic design phase. Until now, however, it lacked robust analysis tools. Sefaira Concept fills that gap and allows designers to explore a variety of options for reducing energy impact early in a project's life. Before a tool of this nature existed, energy modeling and analysis would be done by consultants with more specialized knowledge and at a point in the design process where it was too late to inform the design. A program like Sefaira Concept could have a major impact on the ease with which a firm can bring sustainable design practices into their workflow. While far from being a perfect solution, having easy access to reliable energy analysis data could someday make principles of sustainable design as obvious and integrated into the design process as formal and spatial principles are now. This collaboration between Boora Architects and Portland State University tests Sefaira Concept with real-world data from a project currently in development by Boora in order to gain firsthand experience of the plug-in's potential for deployment within the firm.

EVALUATING SEFAIRA:

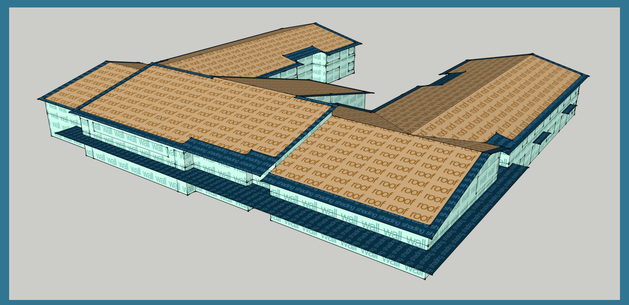
A RESEARCH COLLABORATION, CONT.

RESEARCH PROJECT WORKFLOW:

- Rework SketchUp model to suggested Sefaira guidelines for import compatibility (remove all extra detail, walls cannot have any thickness assigned, no interior walls or other structure, correct all surface normals, verify model is "water-tight", etc.)

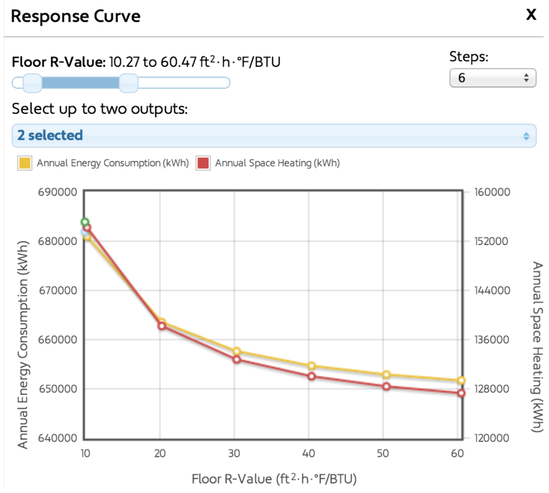


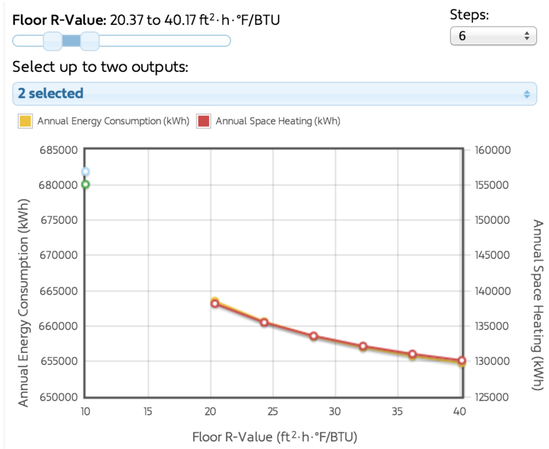
- Assign entity types to appropriate SketchUp model parts (Sefaira recognizes 7 entity types: floor, wall, internal wall, party wall, roof, glazing and shading).

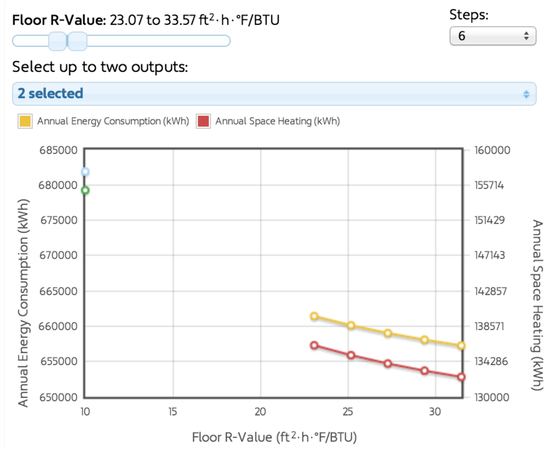


- Input baseline data as required to meet Oregon Energy Efficiency Specialty Code (incl. utility rates, occupancy and space usage, local energy resource mix, climate data, etc.)
- Establish baseline concepts and interpret results to determine new strategies (see Research Results)
- Troubleshoot process as necessary
- Present results of research process & make purchase recommendation

USING RESPONSE CURVES TO ISOLATE THE "SWEET SPOT" FOR FLOOR R-VALUE







BEST STRATEGIES DETAILED, % & RAW DATA

Run Analysis / New Strategy	Annual Energy Consumption kWh	Annual Space Heating kWh	Annual Occupied Hours Above 82.4°F: Classrooms	Gym & Music	Commons	Admin
Nov14A	**681,906**	**155,075**	**278**	**248**	**216**	**286**
▼ Improved R-Values	636,763 ↓7%	113,395 ↓27%	275 ↓1%	247 ↓<1%	216 0%	282 ↓1%
▷ Roof	667,480 ↓2%	141,737 ↓9%	279 ↑<1%	247 ↓<1%	216 0%	286 0%
▷ Slab	660,227 ↓3%	135,146 ↓13%	278 0%	248 0%	216 0%	286 0%
▷ Wall Better R	670,632 ↓2%	144,634 ↓7%	277 ↓<1%	248 0%	215 ↓<1%	286 0%
▼ Better Glazing	660,585 ↓3%	135,500 ↓13%	300 ↑8%	264 ↑6%	234 ↑8%	305 ↑7%
▷ Glazing SHGC	670,426 ↓2%	144,625 ↓7%	296 ↑6%	260 ↑5%	230 ↑6%	299 ↑5%
▷ Triple Pane	671,357 ↓2%	145,322 ↓6%	282 ↑1%	249 ↑<1%	219 ↑1%	294 ↑3%
▼ All 5	619,536 ↓9%	97,533 ↓37%	297 ↑7%	265 ↑7%	237 ↑10%	305 ↑7%
▷ Roof	667,480 ↓2%	141,737 ↓9%	279 ↑<1%	247 ↓<1%	216 0%	286 0%
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[All] Wall R-Value (35.00 ft²·h·						
▽ Triple Pane	671,357 ↓2%	145,322 ↓6%	282 ↑1%	249 ↑<1%	219 ↑1%	294 ↑3%
[All] Facade Glazing U-Factor (						
▽ Glazing SHGC	670,426 ↓2%	144,625 ↓7%	296 ↑6%	260 ↑5%	230 ↑6%	299 ↑5%
[A:0.4, B:0.6, C:0.6, D:0.4] Facac						
▽ Slab	660,227 ↓3%	135,146 ↓13%	278 0%	248 0%	216 0%	286 0%
Floor R-Value (25.00 ft²·h·°F/B						
▽ Roof	667,480 ↓2%	141,737 ↓9%	279 ↑<1%	247 ↓<1%	216 0%	286 0%
Roof R-Value (35.00 ft²·h·°F/B						

RESEARCH RESULTS:

- Two major strategies were explored: improved R-values for materials and better performing glazing.
- **Improved R-values strategy** could contribute **up to 7% reduction in Annual Energy Consumption & a 27% reduction in Annual Space Heating**.
- **Better Glazing strategy** could contribute **up to 3% reduction in Annual Energy Consumption & a 13% reduction in Annual Space Heating**.
- Sefaira showed that **little benefit would be gained from** spending a lot of time on **overhang or brise-soleil** configurations.
- These results were delivered to Boora team early in Design Development phase. This was early enough to impact design decisions and can help inform future choices.
- Sefaira software has some severe issues & limitations, but is **probably worth investing in** for its future potential impact on early schematic design phase energy modeling.