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Evaluating Sefaira: A Research Collaboration

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FVAILJATING SEFAIRA:

A RESEARCH COLLABORATION

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

Client, Contractors, Consultants & Architects work together to determine project scope, division of work, schedules,

form, tectonics & materials

Architects begin Construction **Documents. Final** contractors exactly how

Contractors and other consultants develop strategies for HVAC, electrical and plumbing, structure, landscape, construction, etc. Architects are generally informed of these decisions, but may have limited input on them, though the impact for the overall design may be significant. Energy modeling and analysis is generally conducted by consultants during this period. Results can return during CD phase or even later! By which point, the data is of very limited use to design of project.

Occupancy studies can be conducted. If environmental comfort or energy performance is unsatisfactory expensive retrofits may be the only option at this

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.

Client, Contractors, Consultants & Architects work together to determine project scope, division of work, schedules, etc.

Architects begin Schematic Design Phase Basic decisions re: site,

form, tectonics, systems and materials can be modeled and analyzed for their energy impacts IN REAL TIME and within the 3D design software. Architects can propose strategies to client and other consultants with data to bear it out.

Architects begin **Design Development** Phase. By now, a

efficient design has been explored and tested and entire team is working holistically. Even at this late phase, further choices can be proposed and modeled.

Architects begin Construction

Documents.

Energy decisions have been made and tested by now and CDs can be generated confidently

Contractors and other consultants develop strategies for HVAC, electrical and plumbing, structure, landscape, construction, etc. Architects have a tool, allowing them to generate data on strategies currently under consideration in-house or by consultants and return real-time results about them. The impact this workflow could have on the overall design is obviously significant. Not only will a better project result, but the team members can cross-pollinate ideas for the best effect.

Postoccupancy studies can be used to verify results of energy modeling decisions made during the project.



SCHOOL OF ARCHITECTURE



MART SCHAEFER, GRADUATE STUDENT

with Professors SERGIO PALLERONI & HUAFEN HU, and BEN DEINES. Graduate Assistant

MIKE MANZI & TEDDY HUYCK

ABSTRACT:

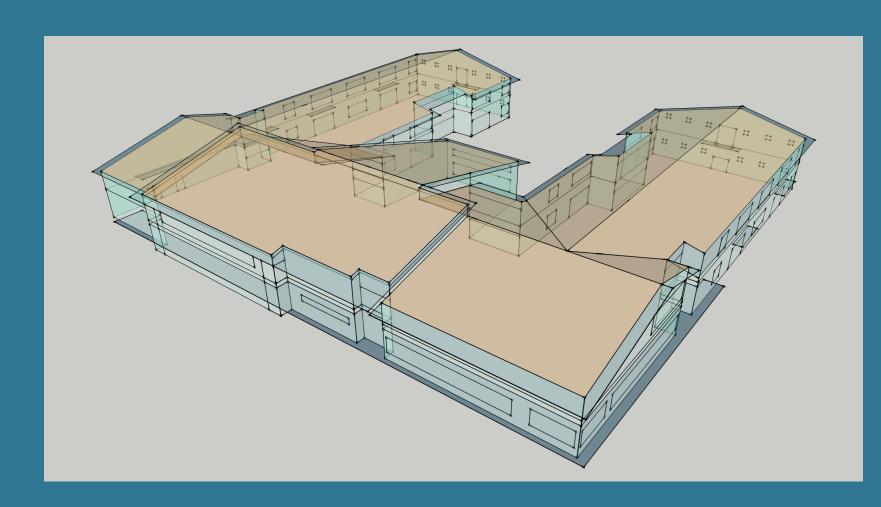
Sefaira Concept is a plug-in that runs in Trimble SketchUp, a 3D modeling program with wide usage in architecture design. Known for its ease of use, SketchUp is particularly useful during a project's schematic design phase. Until now, however, it lacked robust analysis tools. Sefaira Concept fills that 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 realworld 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:

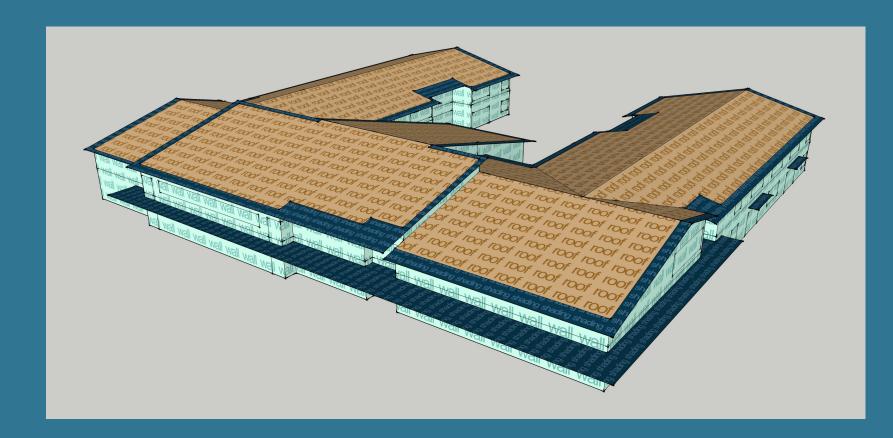
A RESEARCH COLLABORATION, CONT.

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.)

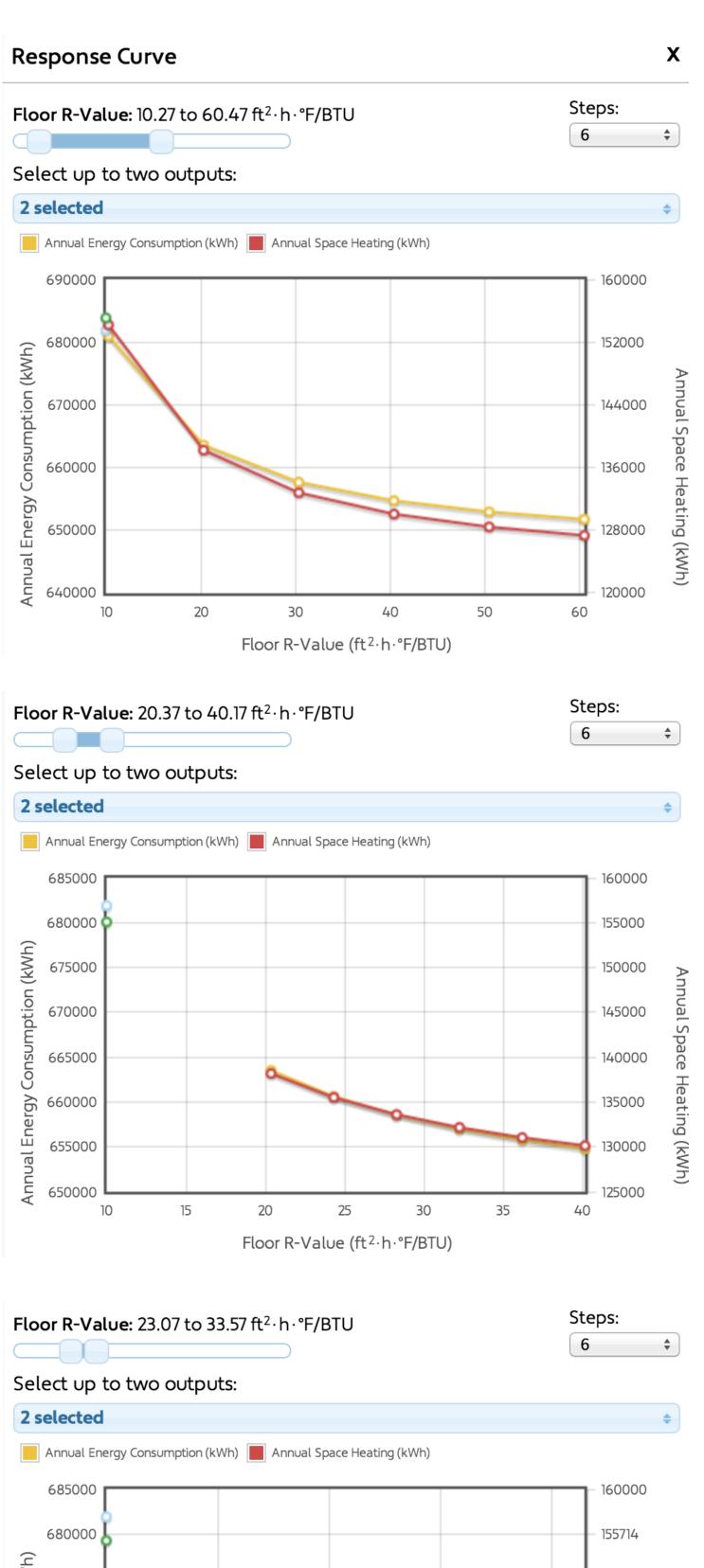


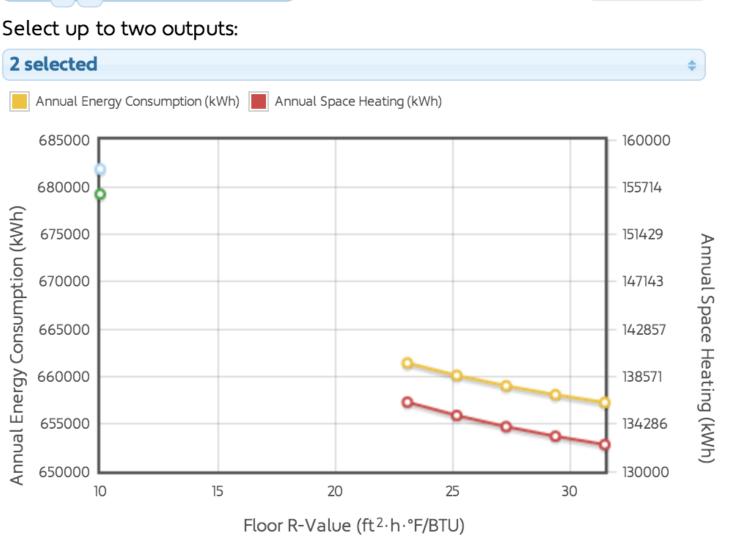
Assign entity types to appropriate SketchUp model parts
(Sefaira recognizes 7 entity types: floor, wall, internal wall, party
wall, roof, glazing and shading).



- 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		Annual Space Heating		Annual Occupied Hours Above 82.4°F							
Nov14A ▼ Improved R-Values		kWh 681,906		kWh 155,075		Classrooms 278		Gym & Music 248		Commons 216		Admin 286	
		▶ Roof		667,480	4 2%	141,737	4 9%	279	1 <1%	247	- <1%	216	0%
Slab		660,227	4 3%	135,146	4 13%	278	0%	248	0%	216	0%	286	0%
		670,632	4 2%	144,634	4 7%	277	- <1%	248	0%	215	- <1%	286	0%
▼ Better Glazing		660,585	4 3%	135,500	13 %	300	1 8%	264	1 6%	234	1 8%	305	1 7%
		670,426	\$ 2%	144,625	4 7%	296	1 6%	260	1 5%	230	1 6%	299	1 5%
▶ Triple Pane		671,357	\$ 2%	145,322	4 6%	282	1 %	249	1 <1%	219	1 %	294	1 3%
▼ All 5		619,536	\$ 9%	97,533	♣ 37%	297	1 7%	265	1 7%	237	1 10%	305	1 7%
▶ Roof		667,480	\$ 2%	141,737	\$ 9%	279	1 <1%	247	- <1%	216	0%	286	0%
▷ Slab		660,227	4 3%	135,146	13 %	278	0%	248	0%	216	0%	286	0%
		670,426	\$ 2%	144,625	₽ 7%	296	1 6%	260	1 5%	230	1 6%	299	1 5%
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		670,632	\$ 2%	144,634	₽ 7%	277	- <1%	248	0%	215	- <1%	286	0%
▽ Wall Better R		670,632	\$ 2%	144,634	- 7%	277	- <1%	248	0%	215	- <1%	286	0%
[All] Wall R	-Value (35.00 ft²·h·					-							
▽ Triple Pane		671,357	\$ 2%	145,322	₽ 6%	282	1 %	249	1 <1%	219	1 %	294	1 3%
[All] Facade	e Glazing U-Factor	(-							
▽ Glazing SHGC		670,426	\$ 2%	144,625	₽ 7%	296	1 6%	260	1 5%	230	1 6%	299	1 5%
[A:0.4, B:0.6	5, C:0.6, D:0.4] Faca	C				,							
▽ Slab		660,227	4 3%	135,146	13 %	278	0%	248	0%	216	0%	286	0%
Floor R-Val	ue (25.00 ft²·h·°F/I	3		,		,							
▽ Roof		667,480	₽ 2%	141,737	₽ 9%	279	1 <1%	247	↓ <1%	216	0%	286	0%

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.