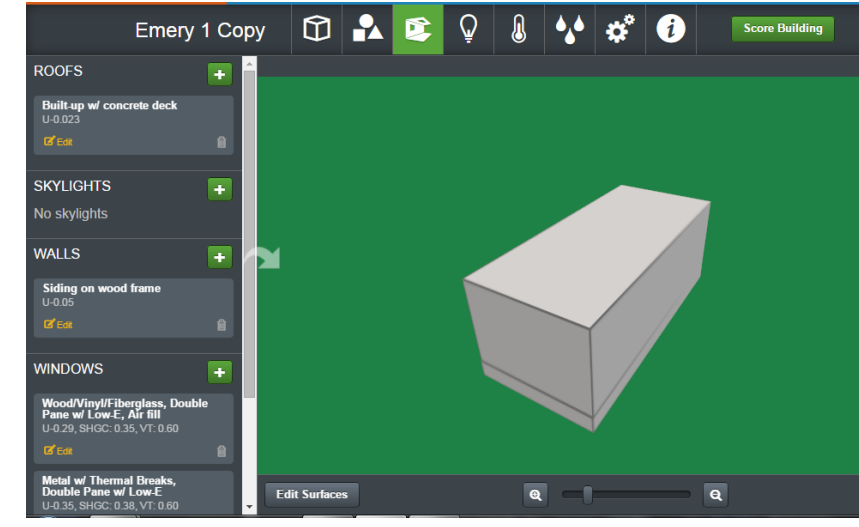


Evaluating energy modeling for early stage design

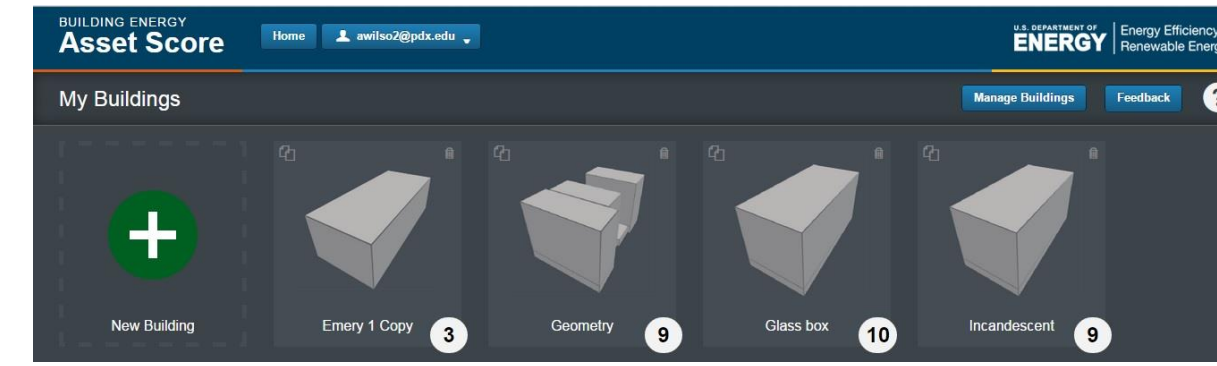
Alexander Wilson, Graduate student, Portland State University
 Nicholas Papaefthimiou, Liz Rhodes, Amy Jarvis, ZGF Architects, LLP.
 Corey Griffin, Assistant Professor, Portland State University



Emery Apartment Building, street view



Initial model in BEAS

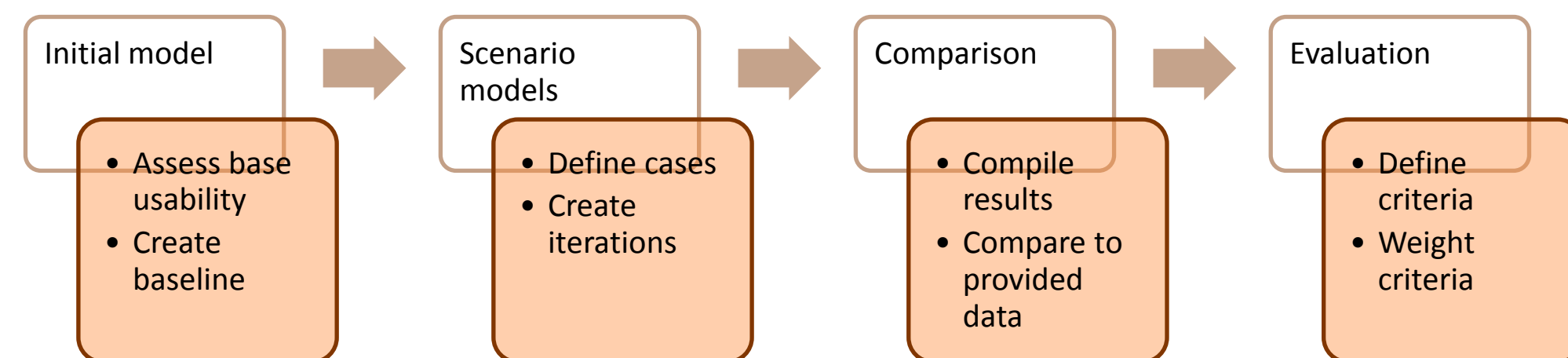


Partial list of models in BEAS

Goal

1. Define a system for evaluating an energy modeling system for early stage energy modeling
2. Apply this system to Building Energy Asset Score

Methodology



Definitions

Precision – The repeatability of the outcome. If the lighting system is adjusted in two different models is the change in the outcome comparable? Also includes sensitivity, which is the magnitude of the change in the output compared to the change in the input.

Usability – The user friendliness of the program. Some factors included in usability are the complexity of the program layout, the time required to generate a model, the time required to process a model and how well the system works, ie whether there are software bugs present.

Accuracy – How closely does the output of the model compare with established data from either other energy models or post occupancy data?

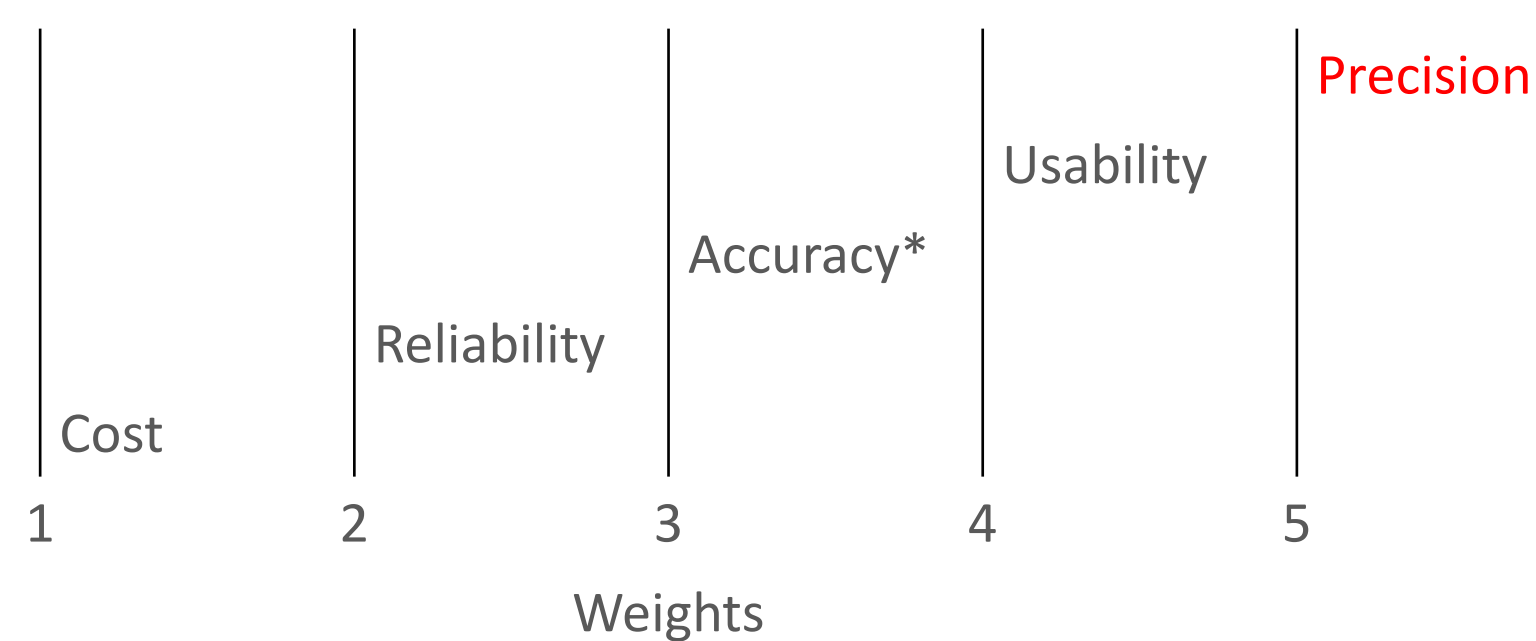
Reliability – Whether the system is available when needed.

Cost – Is the system affordable? Is the cost reasonable relative to its utility?

Limitations

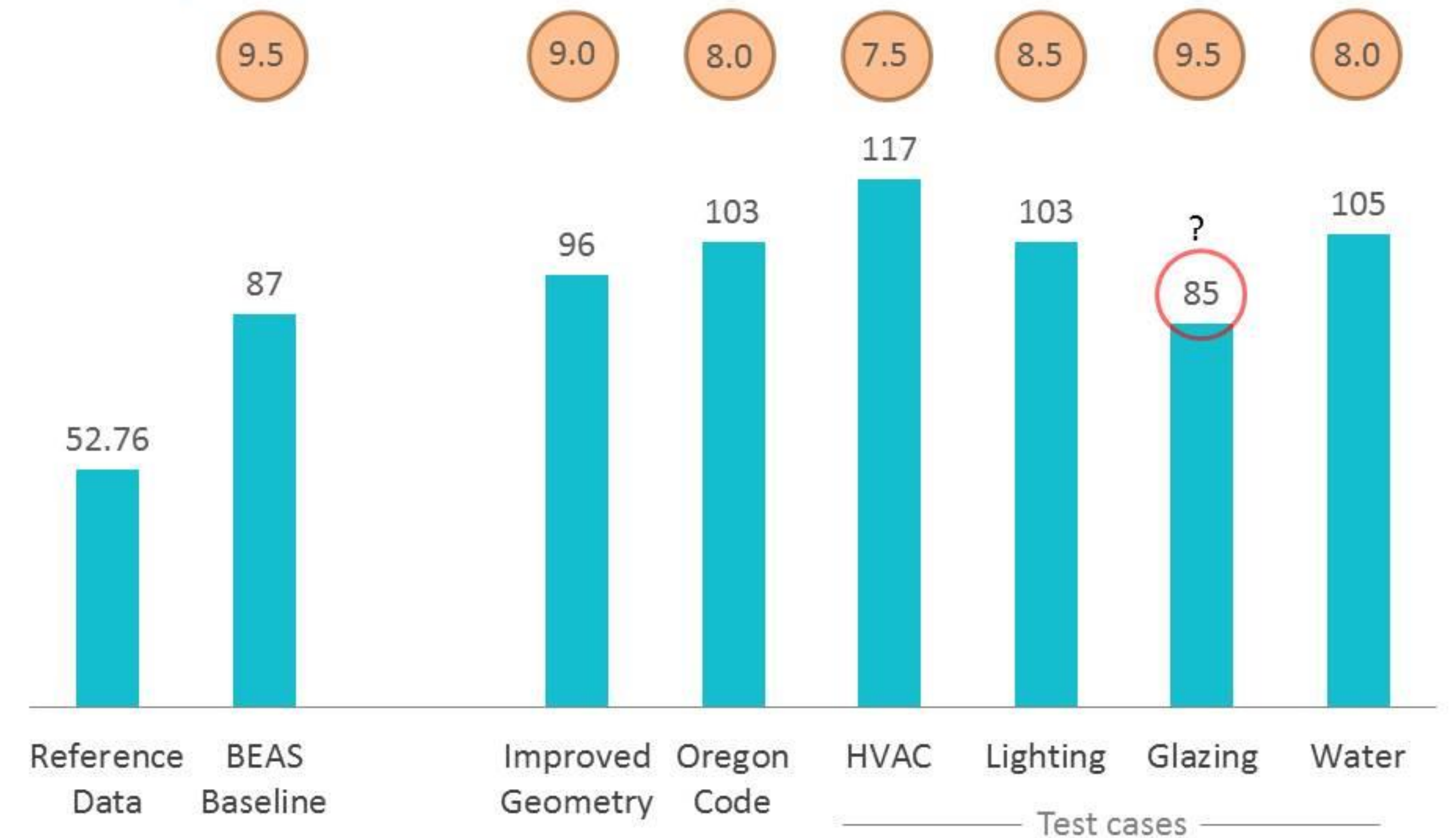
This study was limited in sample size to just the Emery building. Further studies with a much larger sample size are recommended.

The study was also limited by the availability of BEAS.



Results

Energy use intensity (EUI) in kbtu/ft²-year
 Building Energy Asset Score



Overall EUI and Asset score results. Note the abnormally low EUI for the glazing scenario. Modifying the original model from 23 to 90% glazing resulted in a **decrease** in the EUI of the model. This demonstrates that BEAS is not accounting for conduction heat transfer through glazing which is a critical omission.

Summary

The intent of this project was to develop a framework for evaluating energy modeling systems for use during early stage design. This allows for energy modeling to inform design decisions earlier which results in better building performance. For this study the recent Department of Energy program Building Energy Asset Score was chosen due to its intended simplicity as well as being unknown. It was determined that these criteria would be used to evaluate BEAS.

Criterion	Initial score	Influencing factors
Precision	15/50*	Disparity between models, few data points
Usability	20/40	Relatively quick, currently has numerous bugs
Accuracy	Fail	Unrealistic result from glazing model
Reliability	4/20	~2 week system downtime during study
Cost	10/10	Free

As the results show, currently BEAS is not viable for use in early stage design modeling. This is due to failing to meet the minimum threshold of accuracy required. In the future, further study should be performed to keep up with updated versions of BEAS as well as increasing the number of buildings modeled with the program to increase the confidence of the result.