The collaboration analysis project was intended to look at the specific design project being researched and understand the context and larger placement of the project in terms of a typical design timeline. The documentation of the integrated design process would then serve as a visual way for students to understand the integrated design process and could inform the firm about where changes in specific activities within the timeline could improve efficacy of the process or speed incorporation of sustainable design goals.

**Collaboration Analysis Tasks:**
1. Participate in project meetings and the collaborative design process; document process timeline and activities.
2. Relate specific project timeline to ZGF’s overall timeline for a more typical design project.
3. Create “Collaboration Timeline” visual graphic to represent the overall design process and the specific project process.

**INITIAL PROJECT GOALS**
1. Embody the principles of the Living Building Challenge as a learning tool for students, faculty, ad the community.
2. Achieve net zero energy and water use.
3. Create comfortable interaction spaces for study and the exchange of ideas.
4. Present an open and inviting front door to the University.
5. Incorporate the latest science and technology for energy and water conservation.
6. Capture the excitement of science education and discovery.

**ARCHITECTURAL IMPERATIVES**
1. Maintain access to the fountain from 4th Ave.
2. Preserve the open public character of the plaza.
3. Create an addition that looks like part of the original concept.
4. Minimize demolition of the existing building.
5. Preserve and respect the Tecotosh sculpture.
6. Build on the existing natural ventilation and daylighting concepts.

*Courtesy of ZGF Architects, 2012.*
To determine whether achieving the Living Building Challenge principles would be feasible for the PSU Engineering Building addition, an initial site solar analysis was necessary to determine potential for energy generation on the building. Autodesk’s Vassari program is an effective tool for modeling solar access and radiation on specific sites, and was utilized in this research to create a basic understanding of the available solar resources.

The existing building model (created in SketchUp by ZGF Architects) was too complex to import into Vassari for solar modeling, so a basic massing model was created over a map of the area. Large buildings immediately to the South and East of the PSU Engineering Building were included to understand the effect of surrounding mass on the shading of the Engineering Building roof. Building facades were not included in the study, given the low performance of most Building Integrated Photovoltaic systems and the high shading factor due to proximity of the adjacent structures.

Limitations of this research include a lack of analysis on the effect of tilted solar panels instead of flat roof area for solar production, and limited site modeling. However, despite limitations, the results indicate that some photovoltaic energy production is possible on the roof of the building. Economic analysis on the costs versus payback of PV panels was not conducted.

INITIAL SITE SOLAR ANALYSIS

The values given in Table 1 indicate that energy production is indeed possible on the roof of the building over the course of the year. The individual values shown demonstrate that the energy is variable over the course of the year, but that in total, the insulation received on the surface of the roof over a year is nearly 25 kWh of energy per square foot of roof area. Not taken into account in this analysis is the efficiency of photovoltaic units at generating energy. The existing Engineering Building atrium is a fully glass wall on both North and West sides. One of the architectural imperatives in designing an addition to the structure is to match the architectural style of the existing walls, but energy performance and solar shading are also important factors to consider. Initial research was conducted into the performance of various facade systems to aid designers in choosing the best product for the addition’s design.

FACADE SYSTEMS RESEARCH

One of the most important pieces of a high performing building is the building facade. To reduce the amount of energy used to condition a building, the facade should be optimized so that energy losses are minimized. The existing Engineering Building atrium is a fully glass wall on both North and West sides. One of the architectural imperatives in designing an addition to the structure is to match the architectural style of the existing walls, but energy performance and solar shading are also important factors to consider. Initial research was conducted into the performance of various facade systems to aid designers in choosing the best product for the addition’s design.

Limitations on the research conducted include lack of accessibility to desired information, including manufacturing location. To meet the Living Building Challenge, products used in building construction must be locally sourced. Without making a direct request to the manufacturer, this information can be difficult to find. In this research, manufacturing information was not available. In addition, manufacturers make material information available at different levels of specification. In order to understand the materials of the product researched, a direct request to the manufacturer must be made. Finally, many manufacturers offer their products in modular form or with many design options. Without specifying all of the details associated with the facade, an accurate representation of the U-value and the performance of the facade system is difficult to achieve.

CONCLUSION

The Portland State University project is a unique project in terms of the typical design timeline used by ZGF and partners. Because it is a feasibility study, the design work happening within the project is occurring in the "Conceptual Design" phase and depending on fundraising solutions, the timeline for creating design documents and construction documents could be lengthy. The project provides an interesting opportunity, however, to understand how pre-design decision like facade choices and an understanding of site solar access can inform sustainability choices during the actual design of the project.

Here, preliminary research into design opportunities for the expansion project shows that facade systems and solar energy generation potential exist and may be enough to help meet the high-performance goals set by the project team. The initial investigation shows that total solar insulation on the roof surface reaches 85,927 BTU/ft² each year, indicating that some of the building’s energy use could be offset by installation of a photovoltaic system. This energy generation could allow the building addition to reach the goal of embodying the Living Building Challenge principles as related to energy use. In addition, high-performance facade systems exist that could allow the addition to maintain the architectural style of the original building while achieving better energy performance than a typical glass system. Further research, however, must be conducted to determine the most appropriate facade and photovoltaic system to meet the needs of the specific design.

REFERENCES:


