Sol design + consulting

Blooming Grove Wind – Integrative Process August 7, 2020

Project Team,

This letter summarizes our team's approach to implementing an Integrative Process on the design of the Blooming Grove Wind Operations and Maintenance Facility, pursuant to the requirements of the LEED BD+C credit "Integrative Process."

1. Background

The project is a 7,953 square foot operations and maintenance facility for the Blooming Grove Wind Farm located in McClean County, northeast of Bloomington-Normal, Illinois. The building will house both offices and an equipment maintenance area. The project is targeting LEED BD+C v4 Silver Certification.

2. Approach & Process

The benefit of an Integrative Process is that early analysis can inform design decisions, resulting in more effective and informed design decisions. To this end, Sol Design + Consulting worked closely with Jon Steven Ditter (architect), Maestros Ventures, LLC (MEP engineer), and Invenergy (Owner) to: (1) establish project targets, (2) perform early energy and water analysis to evaluate how best to meet those targets, and (3) evaluate the impact of proposed changes as the design evolved.

Sol led a LEED Charrette at which initial project targets were established, and subsequently provided initial energy- and water-related analyses to guide design decisions. These analyses are discussed further below, and are also summarized in the enclosed *Preliminary Energy & Water Analysis Report*.

Once the design direction was established, Sol created a detailed energy model to verify that the project's performance was on track. As design changes were proposed, this energy model was revised to understand the impact of changes on energy performance.

3. Energy Performance Target

We established a performance target of 46 kBTU/sf/yr. This was generated by applying a 24% percent reduction to an early ASHRAE 90.1-2010 baseline case EUI of 60.25 kBTU/sf/yr. This target aligned with the owner's desire to achieve LEED Silver certification.

4. Energy-Related Systems

To achieve the 24% energy reduction targets, a number of energy efficiency strategies were considered. Key opportunities included increasing the R-value of the envelope, improving the U-value of the windows, and lowing lighting energy use through LED fixtures, occupancy sensors, and improved daylighting. While not required for the Integrative Process credit, the team also evaluated several mechanical system options, including ground source heat pumps, high-efficiency packaged units, and ductless mini-splits.

The LEED Integrative Process credit requires the analysis of specific energy-related strategies. Details regarding each of these strategies are provided below, including the analysis that was undertaken, and how each influenced the design. Early analysis findings are also outlined in the enclosed report.

Table 1: Energy-Related Strategies

Site Conditions	**Analysis** – Shading on the site was analyzed for the site. **Results & design impact** – Best- case shading on the West and South facades could reduce annual energy use by 2.7%. Architectural overhangs on these orientations were included in the design.
Massing and Orientation	**Analysis** – The building was rotated to determine optimum orientation. The massing was not studied, as the baseline case massing was already very compact, with little opportunity for improvement. **Results & design impact** – Optimum orientation is 52 degrees East of South, and could reduce energy use by 2.6%. However, orientation was largely dictated by site conditions, access, and drainage.
Basic Envelope Attributes	**Analysis** – We investigated adding 1" continuous insulation to wall, improving windows U-value, and increased roof insulation. **Results & design impact** – These improved envelope attributes could lead to a 5.5% reduction from the baseline. Several of these were integrated into the design, including the addition of continuous insulation in the exterior walls and changing from aluminum storefront-style glazing to fiberglass windows with better U-values.
Lighting Levels	**Analysis** – We explored increasing window sizes in break room, technicians room, and offices, as well as adding occupancy sensors. **Results & design impact** – Lighting power density was reduced by 25% and a 5.5% energy savings from baseline was projected. Occupancy sensors were included throughout the project.
Thermal Comfort Ranges	**Analysis** – We investigated expanding the setpoint range to 68 F° for heating and 76 F° for cooling. **Results & design impact** – This expanded thermal comfort range showed a potential 10.1% decrease from the baseline. Implementation is an operational question that will be addressed by the owner.
Plug and Process Loads	**Analysis** – We decreased the plug loads of equipment based upon recommendations from NREL and the New Buildings Institute. **Results & design impact** – This had a large potential impact on the project's energy efficiency, with a projected 13.2% reduction from the baseline. Some of these measures were implemented in the design, including specifying EnergySTAR appliances and equipment where applicable.
Programmatic and Operational Parameters	**Analysis** – While the program is small and already compact, we looked at decreasing the square footage of the conference room and the conditioned storage space. **Results & design impact** – This had minimal impact on the project's projected energy profile and was not pursued further.

5. Water-Related Analyses

It was determined that the greatest potential savings for the project was reducing the outdoor water demand and decreasing the flow of plumbing fixtures. We analyzed different flow rates and the use of graywater. We set a target of reducing indoor water consumption by 45% and reducing the landscape water requirement for the project by 50%.

The LEED Integrative Process credit requires the analysis of specific water-related strategies. Details regarding each of these strategies are provided below, including the analysis that was undertaken, and how each influenced the design. Early analysis findings are also outlined in the enclosed report.

Table 2: Water-Related Strategies

Indoor Water Demand	**Analysis** – We investigated several scenarios for reducing indoor water use, including various combinations of low-flow fixtures and waterless urinals. We also looked at the potential for reusing graywater. **Results & design impact** – The design at this stage was 40% lower than the baseline. The best-case scenario we investigated resulted in a 66% reduction in water use. The analysis led to the selection of lower-flow fixtures that resulted in a 45% reduction. Graywater reuse was not cost-effective and was not pursued further.
Outdoor Water Demand	**Analysis** – We investigated the impact of planting all landscaped areas with native and adaptive species that have low irrigation demand (in place of conventional turfgrass). We also looked at the potential for utilizing rainwater for landscape use. **Results & design impact** – The best-case outdoor water scenario we investigated showed a potential reduction of 93% from the baseline. The design was revised to incorporate native and adapted species for a significant portion of the landscaped area; and a rainwater storage basin was included in the design. The current design case shows a 64% reduction in outdoor water use.
Process Water Demand	**Analysis** – We investigated the impact of improving the water efficiency of dishwasher and clothes washer uses. The anticipated HVAC system did not include any process water use. **Results & design impact** – The proposed improvements reduced process water use by 2%. This is because projected process water use is dominated by hose bib use in the Maintenance area. While the total water use impact of these measures was was small, high-efficiency appliances also had a positive impact on energy use, as discussed above, and so were incorporated into the design.
Supply Sources	**Analysis** – Use of graywater and rainwater as supply sources was evaluated as part of the Indoor Water Demand and Outdoor Water Demand studies. **Results & design impact** – The project could capture enough rainwater and graywater to meet 100% of its water needs. However, graywater reuse and rainwater capture for indoor or process uses was not economically feasible and was not pursued further. Site rainwater capture was implemented as discussed in "Outdoor Water Demand" above.

At the time of this writing, the project is on track to achieve a 24% reduction in annual energy use, a 45% reduction in indoor water use, and a 65% reduction in outdoor water use.

Sincerely,

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Enclosures:
Preliminary Energy & Water Analysis Report