St. Joseph School

Program Area:
Net Zero Program

County:
DuPage

Grantee:
St. Joseph School

Grant Date:
2018

Grant Amount:
1,000,000

Location:
Downers Grove, IL 60515

Project: Net Zero Energy Addition – New Construction
Gross Square Footage: 7,500 sq ft
Delivery Method: Design-Bid-Build
Total Cost: $5,062,000
Funding: Illinois Clean Energy Community Foundation, Diocese of Joliet, St. Joseph Capital Campaign
Incremental Net Zero Energy Cost:
Building Net Zero Upgrades: $1,456,282
PV Array: $ 195,518
Total: $1,651,800
Incremental Net Zero Energy Cost (% of total):33%
PV Array: 36.3 kW DC
Predicted Annual Energy Consumption: 32,493 kWh
Predicted Annual Energy Generation: 41,820 kWh
Certifications: PHIUS+ 2018 Source Zero
Contact: Beth Harbauer, Business Manager, bharbauer@sjpdg.org

St. Joseph School (SJS) provides PK-8 elementary education to approximately 435 students in and around Downers Grove, IL. The school was established in 1910, and in 1949 the Parish and School were integrated within the newly formed Diocese of Joliet.

In 2017, the school took steps to design a new addition. The architect and staff met with key stakeholders and decision-making bodies at St. Joseph Parish and the Diocese of Joliet. Although the shift to net zero required a larger investment of funding and staff time, the concept of making this new building a showcase for best management practices in energy performance was enthusiastically approved.

The project was completed in 2 phases. Phase 1 installed a fire suppression system into an existing 16,630 sf elementary school building and prepared it and a separate existing junior high wing to be handicap accessible. Phase 2 added a 7,500 sf separately metered, net-zero, PHIUS+ certified, expansion with an accessible entry and restrooms, administrative offices and classrooms, centered around a strategically placed elevator and ramps that knit together seven previously inaccessible floors of existing school facilities. The building addition footprint occupies a previously underused portion of a parking lot, which was redesigned to expand green space for native landscape, an outdoor classroom and an elongated covered entry for student pick-up and drop-off. Building materials were scrutinized and selected for their durability, health benefits, and low environmental impact.

The new addition mates its north and east walls to existing school buildings. Its window/fixed-exterior-shade-populated south façade and its exit-stair-hiding, heat resistant, west wall are exposed to public view. Nearly cubic in its building massing and constructed with an **advanced thermal envelope** *(please see below)*, the addition's design allowed for a modestly sized, extremely efficient, variable refrigerant flow (VRF) system and HVAC system with energy recovery. Daylight from high-performance, operable, windows and centrally positioned skylights that illuminate two stories of corridors which contain interior planters, minimize use of the LED lighting system with occupancy controls.
The envelope of the new building utilized an existing exterior brick wall that was converted to an interior wall. This made passing the required PHIUS tests challenging due to its age and lack of air tightnes and required testing, assessment, and remediation of the existing walls at several stages. Furthermore, the addition had open hallways from the new building to the existing school building and was required to remain open to meet fire codes. The inability to close the addition raised challenges in balancing systems while mixing air and energy with the adjacent 100-year-old facility. However, the mechanical systems work very well to efficiently manage the needs of hallways, classrooms, and office space.

The addition faced numerous challenges trying to achieve and maintain net zero energy performance. One such challenge included unique operations protocols for the facility during COVID. The onset of the pandemic changed the way the building was being used and presented unique and unexpected challenges with energy consumption and systems balancing.

The new addition, powered by a 36.3 kW east/west facing roof-mounted photovoltaic (PV) array installed with panels tilted at 10%, consistently generated less electricity than projected by the energy model. Annual production was estimated at 41,820 kWh per year. Staff and volunteers carefully monitored module performance, removed snow/dirt, and the installer re-strung the modules to improve output.

After some trial and error, a team composed of campus staff, volunteer parishioners and consultants met regularly to monitor building energy production and usage. The consistency and committed involvement of this team became a perfect match to monitor facilities used 7 days a week, often for long hours by diverse user groups (education, sports, meetings, etc.). Early inconsistencies in performance were addressed, leading to a disciplined facility operation not often realized by a non-profit organization with limited staff and resources. With the help of outside consultants and parishioners (engineering, IT, architects, HVAC, electrical) St. Joseph staff found the expertise needed reach net zero energy performance and eventually, when building energy use was fine-tuned, site energy consumption fell below production.

St. Joseph staff also realized that it was important to sensitize diverse user groups to building protocols which was done via education by staff, volunteer monitoring, student advocacy, and promotional materials (display boards, website, etc.). Occupant behavior shifted with the addition of staff “experts” who work in the building daily and educate their colleagues on the benefits of the net zero upgrades in building design. These individuals encourage thoughtful use of the building systems and promote these concepts to students, families, and visitors throughout the year.

The Building Automation System (BAS) allows SJS to sense and control changes to the environment and respond accordingly. The systems integration and data analytics help optimize energy production and reduce consumption. It took a great deal of effort to get to the desired settings, but once the appropriate system control settings were determined, staff rarely

needed to adjust the settings. Staff continues to monitor the building performance data on a daily basis.

St. Joseph School is educating its students and the larger community by serving as an example of a successful net zero energy project. The energy efficient systems and building construction combined with the on-site PV panels are a model for others looking to achieve these worthy goals. As part of the project, St. Joseph built a STEM lab and hired a dedicated staff member to spearhead the education effort. The STEM lab will assist in educating the public and other professionals in schools, businesses, and government. The school and parish are setting an example for others to encourage the shift to sustainable building construction.

Pope Francis in his 2015 Encyclical Letter, Laudato Si', asks each of us to "protect our common home", and "seek sustainable and integral development." The Net Zero Addition at St. Joseph has given us this opportunity and the ability to educate the next generation and our community learn first-hand about renewable resources and conservation.
–Linda Burk, STEM Teacher, St. Joseph School
Suggestion from Beth Harbauer: Start by assembling a team that includes key staff members – IT, Facilities Manager, Financial Manager, and any other staff member responsible for operating the facility and key stakeholders. Each member will have a unique responsibility critical to the success of the project. Next determine the goals for your facility and then select a design firm that has net zero design experience. Have each of your team members speak with others in their respective field who have done similar projects. The knowledge gained from other individuals will be invaluable.

Lessons Learned:
• Meet monthly with the entire team throughout construction and the first year

of occupancy to ensure the building is operating at the desired level of efficiency.
• Having staff that know how to manage the specific HVAC, lighting, plug loads, and all the associated controls is essential.
• Achieving net zero energy building performance takes a lot of education and staff buy-in.
• Monitor your building performance data daily!
• Consultation with other entities that have designed and built a net zero facility is critical. This should begin as part of the design phase and continue throughout construction and beyond.
• You must understand and manage ALL systems that consume energy, not just the core systems. For example: We focused heavily on the HVAC system but during investigation of all systems found that our lighting system was not operating as efficiently as expected and adjustments had to be made.
• Continual evaluation and management of ALL systems impacting energy efficiency is critical to the building's net zero performance.

Project Team

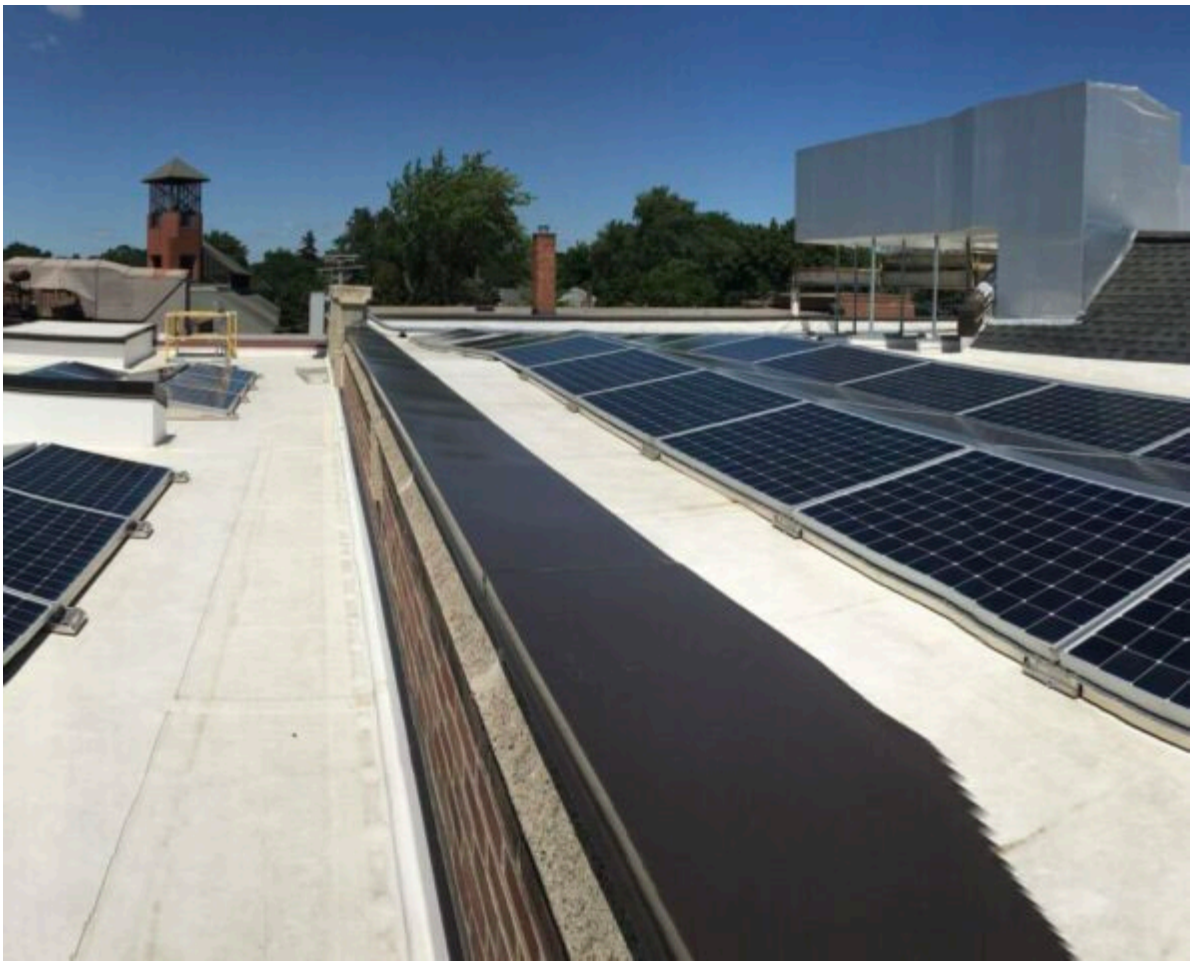
Architect: Serena Sturm Architects
Civil Engineer: V3 Companies of IL
Landscaping: Green Grass Landscaping
Structural Engineer: REX Engineering
MEP Engineer: Elara Engineering
CPHC (Certified Passive House Consultant): Tom Basset-Dilley, TBD Architects
Commissioning: Eco Achievers
PV System: Hardt Electric, Inc.

Links to Building Data

St. Joseph School's energy production = http://sjsdg.org/energy-production
St. Joseph School's energy consumption dashboard = http://sjsdg.org/energy-consumption

Advanced thermal envelope

Walls: Masonry, 3.5" XPS rigid insul., 6" mtl. studs w/ spray foam insulation, R=58
Roof: TPO, 8" XPS rigid insulation, metal deck, R=43
Floors: 4" polished concrete slab, 4" XPS rigid insulation, R=21
Windows: WASCO "Geneo" vinyl, LoE 180 3P 3&4/41, Argon 3P, R=6.7
Mechanicals: Variable Refrigerant Flow heat pump w/ Energy Recovery Ventilation




FOAMULAR
250
R-10


OWENS CORNING
HOHMANN & BARNARD
EXTRAFLASH