



P.S. 62R The Kathleen Grimm School for Leadership and Sustainability

Net-Zero Energy School

Energy Efficiency

The NYC School Construction Authority (SCA), responsible for all school facilities in the nation's largest school district, has a rigorous Green Schools Guide; this project far exceeds those standards. The project goal for the 66,680 SF two-story building was to harvest from renewable on-site sources as much or more energy as it uses annually. To that end, the building incorporates many sustainable and low energy features. The majority of the renewable energy is generated by 2,000 Photovoltaic (PV) panels arranged as a "wrapper" on the building's roof, southern façade, and parking canopy. The PV panels generate electricity from the sun. A solar thermal hot water system—with the use of 40 panels on the building's roof—generate hot water to heat the domestic water used in the building and kitchen. The primary HVAC system is a geo-exchange system serving water-to-water heat pumps.

All outside air is pre-treated by energy recovery ventilators; demand control ventilation and displacement induction units delivering the air to all classrooms further reduce energy use. The building orientation has been optimized for daylight with all classrooms facing the north or south perimeter.

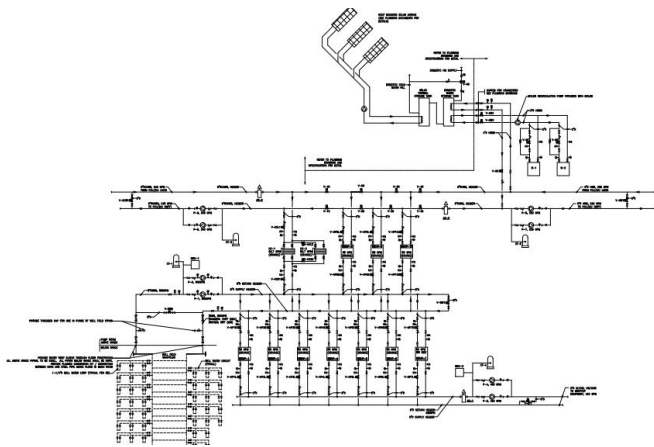
This classroom layout also minimizes HVAC energy consumption for these areas. Lighting systems use primarily LED fixtures to reduce power densities significantly below energy code allowances and all fixtures have dimming and daylight harvesting capability to reduce annual energy used for lighting.

A major focus of the design was the reduction of electrical loads due to equipment. The engineers analyzed energy use in the building and determined that the kitchen would be the single largest energy end use. Working with the project team and SCA, they identified strategies to reduce kitchen equipment energy needs as well as the annual energy use for equipment in the rest of the building.

Because of the specific project goal of total annual Net Zero Energy, peak load was not a design focus. However, the overall load reduction strategies, including but not limited to improved envelope, daylight control, energy recovery, and geothermal heating and cooling significantly contribute to a lower peak than typical buildings. Per SCA standards, the building is designed with heating and cooling set points of 70°F and 78°F

in order to “expand the comfort range” and reduce energy consumption. P.S. 62R achieves a remarkable 50% reduction in energy use over a typical new public school in New York City thanks to its aggressive approach to sustainability.

The school—its architecture, engineering, and operations—builds upon and enlarges the SCA’s energy conservation standards, principles, and goals.



System Diagram / HVAC Water Flow Diagram

Indoor Air Quality

Enhanced Ventilation - 30% more OA than ASHRAE 62.1 provided to space. MERV 13 filtration on all systems, CO₂/particulate sensors in all rooms to control OA volume delivered. All outside air is pre-treated by energy recovery ventilators; demand control ventilation and displacement induction units delivering the air to all classrooms further reduce energy use.

Innovation

The design for P.S. 62R embraces the use of several technologies and integrates them in an innovative way. The ground source heating and cooling, the DOAS ventilation systems with desiccant dehumidification, and the CO₂ based

control of individual spaces work together to provide a properly conditioned building while consuming minimal energy. The energy for the school is generated by PV panels that are applied to the building’s façade in a way that both maximizes the generation potential at the site by prioritizing mounting angles and generating the largest kWh per SF of area; the PV also provides shading in high solar gain areas to maximize the utility of the system.

In addition to the innovation of specific technical systems, the design process itself was an innovative process. As the first Net Zero Energy school built in New York State and one of the first of its kind in the Eastern United States, this highly visible project has been closely followed by educators, facilities managers, and the public. The teachers, administrators, and students have a rare opportunity to grasp the relationship between behavior and energy consumption and to participate in the development of a first-of-its-kind 21st-century curriculum. Rather than positioning the building occupants as the passive objects of energy-reduction measures, the Net Zero Energy targets of P.S. 62R require that they be active agents. Students are constantly informed of the relationship between their choices and behaviors and the functioning of their school, with the twin goals of reaching Net Zero Energy and teaching the children to become responsible citizens and stewards of the environment. The novel relationship between pedagogy and building design and technology illustrates the vital role sustainability plays in shaping a generation that takes energy-awareness as a fundamental responsibility.

The school building is intended as a living laboratory for teaching students about energy—its sources, uses, and effect on the environment. Thus a custom dashboard system was prepared for student and teacher use. The dashboards are located throughout the building and engage students and faculty in friendly competition to save energy and learn how the building works. The school also features four “sustainability nodes” which are curated educational spaces with seating and a touchscreen monitor connected to the building’s dashboard system for impromptu lessons.



The design process on PS62R has led AKF to start implementing a regular Design Charrette process on all large MEP design projects, engaging multiple stake holders at the early stage of design to solicit input and inform the design concept.

Maintenance & Operation

The systems for the facility have been set up in a way to maximize operational efficiencies; this results in some complicated control sequences, but specific setpoints are all adjustable to allow for tuning of the facility during actual operation. In terms of maintenance, one of the key components requiring significant maintenance tracking is the CO₂ controls. In order to minimize the

maintenance effort here, a CO₂ sensor system was installed, which uses central industrial quality sensors that are easily maintained and calibrated through manufacturer programs.

In terms of operations, among the most challenging and complex efforts in reaching the Net Zero Energy goal was the process of determining exactly what was needed by each of the school’s functions, how different constituencies would use the facility, and the extent to which individual behavior could be predicted and factored into the planning and design. Because the building itself is intended as a teaching tool, the project team developed and incorporated elements and processes that would contribute to the pedagogical objectives. Building occupants are educated on best practices for post-occupancy to achieve the lowest possible energy usage – simple, everyday tasks such as not placing furniture in front of diffusers.

Cost Effectiveness

The final cost of the project, which the SCA requires be kept confidential, met with the anticipated budget. While that budget exceeded the cost of a typical New York City school, return on the investment will be significant, since the lessons learned set a new standard for the City’s schools and will be applied across the entire district. P.S. 62R is expected to deliver considerable savings in energy costs by using exclusively renewable energy harvested on site. The anticipated goals include:

- Predicted Energy Use Intensity (EUI) ~ 29.5 kBtu/sf/yr
- Total predicted annual energy use ~ 564,000 kWh
- Total estimated annual energy produced ~ 658,000 kWh

Environmental Impact

The advances made with this project have shown promise by driving down energy use and reducing the carbon footprint of NYC's more than 1,400 school buildings. As the SCA's first "sustainability lab," P.S. 62R also helps the City reach the goals set forth in "OneNYC" for reduction in carbon emissions. As the first of its kind in New York City and the Northeast, the project has inevitably drawn much positive attention to the contributions of the profession to the highest standards of engineering design in the pursuit of Net Zero Energy.

As school buildings in New York City represent one of the largest contributors to greenhouse emissions for municipally owned buildings, the reduction in energy use represented by P.S. 62R sets a standard for the potential of the City's schools to influence positively the municipal carbon footprint. As a case in point, the primary HVAC design component, displacement induction units in the classrooms, is now being adopted by the SCA as the standard on all future schools. The SCA intends P.S. 62R to serve as a laboratory for future school design—not only for New York City schools, but



for school districts around the country—and for the development of a curriculum that uses the building and its operations.

The success of the project in every respect was the result of an exceptional collaboration by all parties and particularly the involvement of the SCA and educators—the former contributing vast expertise in school planning, design, and construction, the latter ensuring that fundamental educational goals would be addressed and enhanced.

