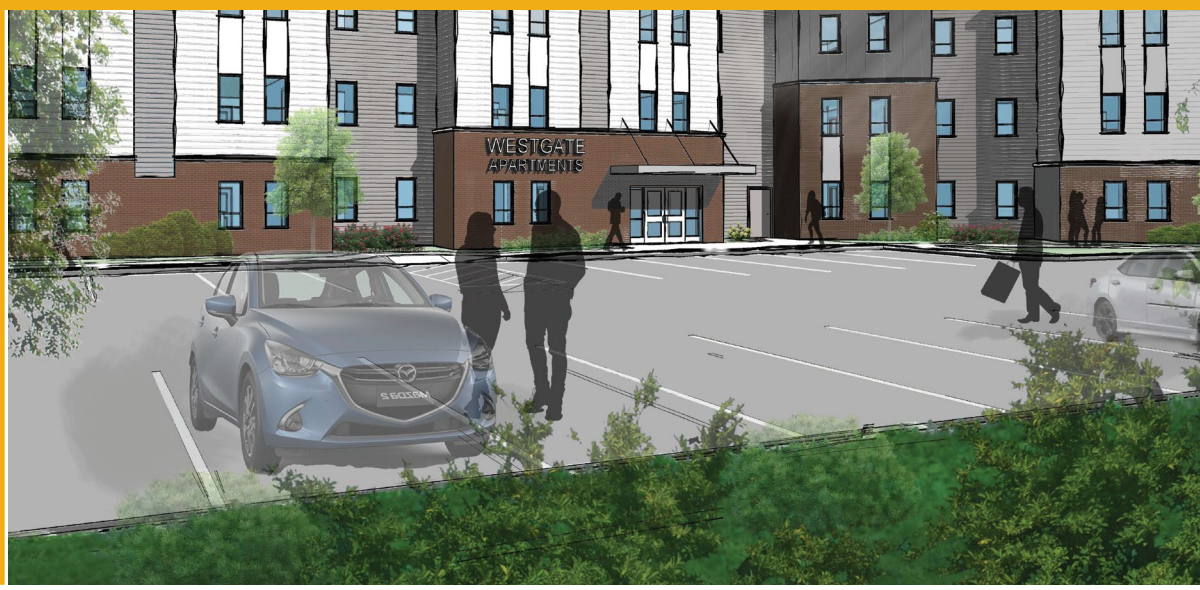
Westgate Apartments

NEW YORK STATE | Buildings of Excellence

As part of the State's effort to achieve a carbon-neutral economy, NYSERDA initiated the Buildings of Excellence (BOE) Competition in early 2019. The competition recognizes and rewards the design, construction, and operation of very low- or zero-carbon emitting multifamily buildings.

nyserda.ny.gov/boe



Project Details

Location:
Rochester, New York

Project Area:
81,000 sq. ft.

Number of Buildings:
1

Number of Stories Per Building:
4

Number of Units:
80

Project Cost:
$19,647,603

Cost per Gross Square Foot:
$242.56

Market Sector:
LMI

Construction Type:
New Contruction

Construction Start Date:
June 2023

Completion Date:
December 2024

REDC Region:
Finger Lakes

Developer:
Providence Housing Development Corporation

Architect & Design Team Lead:
SWBR Architects

Technologies Used:
ASHP for space conditioning, ERV, innovative Sanden CO_2 DHW system, induction cooktop, on-site and off-site PV, on-site electric car-share with EV charging stations, smart building controls, energy monitoring and display

All-electric construction for low- to moderate-income apartments in upstate New York

Background

Westgate Apartments is an all-electric 80-unit, low- to moderate-income (LMI) project in the Town of Brighton just outside of Rochester, NY. Along with serving LMI households, the project also provides housing for individuals with chronic conditions. The development team hopes to inspire other developers to pursue clean energy and Passive House construction. Using an integrated design approach, the full project team was involved from the onset of the design process. The development is transit oriented and will meet Passive House Institute US+ (PHIUS) 2018 and Enterprise Green Communities (EGC) certification.

Key Project Features

This project is all-electric and utilizes high-performing air source heat pumps (ASHP) and energy recovery ventilation (ERV) systems. The electrical load is mostly offset by a combination of on-site and off-site solar photovoltaic (PV) arrays.

- ✓ **HVAC:** Minisplit ASHP, ERV
- ✓ **Water Heating**: Sanden CO_2 central ASHP
- ✓ **Envelope:** ZIP System R-Sheathing
- ✓ **Passive:** PHIUS+ 2018
- ✓ **Lighting:** Light emitting diode (LED), daylighting
- ✓ **Appliances:** Induction cooktops
- ✓ **Renewables:** On-site & remote solar PV
- ✓ **Resilience Strategies:** High-performance envelope

Predicted Site Energy Use Intensity (EUI): 26.0 kBtu/SF/yr

Net Site Energy Use Intensity (EUI): 9.6 kBtu/SF/yr

Predicted Renewable Production Intensity (RPI): 16.5 kBtu/SF/yr

Energy Code Baseline: 2016 NYS Energy Conservation Construction Code (ECCC)

Performance Path: PHIUS

Certification: EGC, PHIUS+ 2018

Planning and Design Approach

Project Goals

The development team hopes that Westgate Apartments will stimulate interest and demand for clean and resilient buildings in upstate New York. Furthermore, it hopes the project will inspire other local development companies to pursue Passive House construction. It anticipates that sharing the information gathered throughout the design, construction, and occupation of Westgate Apartments will help the building industry understand and accelerate the design, construction, and operation of high-performance buildings.

Project Team

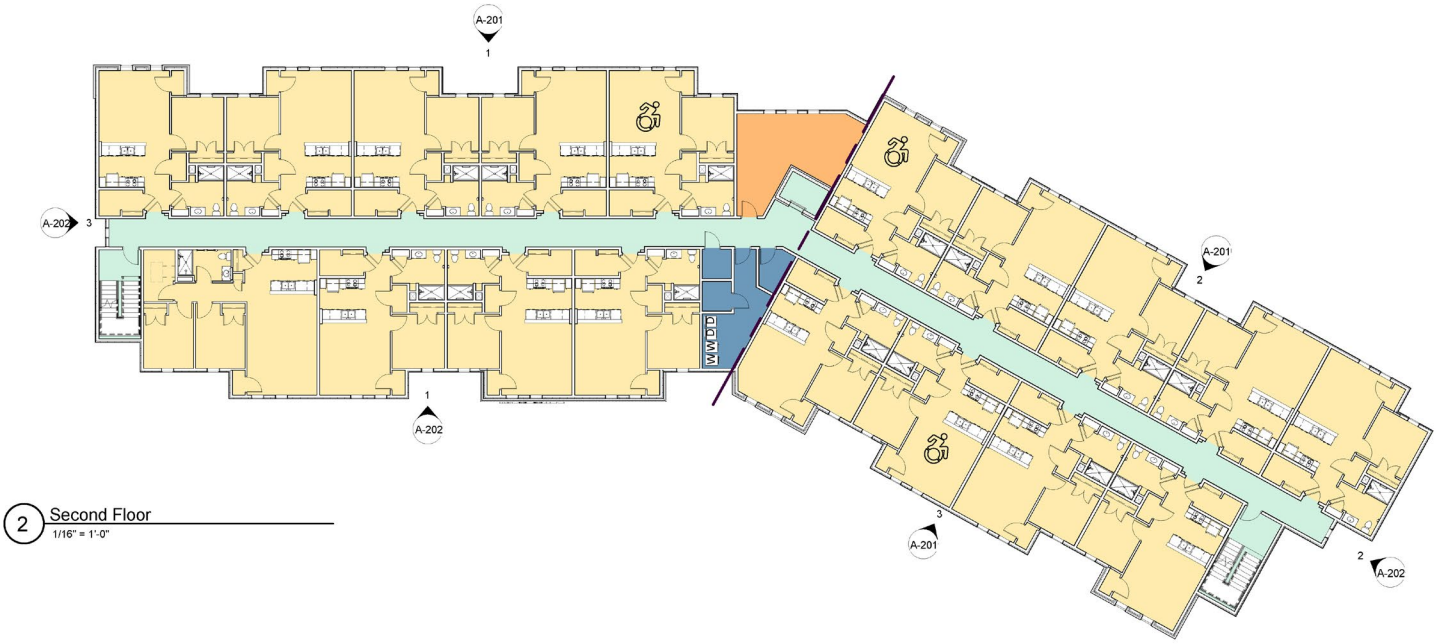
The project team is following an integrated project delivery approach, which includes the early involvement of contractors and subcontractors in all decision making to help reduce cost and optimize design. The team worked collaboratively through weekly meetings to refine the design and meet the high performance project goals, and specifically involved:

- Providence Housing Development Corporation, the developer
- SWBR Architects, the architect of record and design team lead
- ME Engineering, the mechanical, electrical, and plumbing (MEP) engineer
- Sustainable Comfort, the primary energy consultant
- Home Leasing Construction, the general contractor
- LTHS Solar, the solar consultant

The development team also partnered with Marty Wallace from Creative Dimensions Marketing and Design to provide marketing and outreach assistance.

Building Design

This four-story new construction is an infill apartment building in the Town of Brighton just outside of Rochester, NY. The units in Westgate Apartments will be reserved for LMI households and individuals with chronic conditions. Along with meeting the standards of PHIUS+ 2018, the project is designed to be fossil fuel-free and all-electric and is set to achieve certification for EGC. The development team will reduce vehicle emissions from building users by creating a transit-oriented project, providing bike storage for each unit, and partnering with an onsite electric car-share program. The design also features preservation of open space, water use reduction through an enhanced plumbing design, and American Disabilities Act (ADA) universal design techniques that ensure at least 15% of the units are fully accessible.



Second-floor plan by SWBR Architects

Energy Modeling

The original project design with three stories and 50 units was modeled to meet both PHIUS+ 2018 and ENERGY STAR® Multifamily New Construction (MFNC) requirements. The on-site PV system is sized to generate 36% of annual site energy consumption, and off-site PV was procured to offset an additional 24% of annual site energy consumption. The building meets all requirements for PHIUS+ 2018 and has unit energy rating index (ERI) values 46% better than the ENERGY STAR target. The additional one floor and 30 units was added to the design after the initial energy model was submitted, but will be built to the same specifications. The results may change with different building dimensions, but the inputs should generally remain the same.

Energy Model Inputs	
Certification Path	PHIUS+ 2018, ENERGY STAR MFNC
Software	WUFI v3.2.0.1, Ekotrope v3.1.1.2183
TFA (% of Gross)	47,715 ft2 (80%)
HVAC	Ducted ASHPs, 3.16 COP, 18 SEER
ERV	Aldes ERV, SRE of 0.83
DHW	Central Sanden CO_2 HPWH, 2.79 COP
Windows	U-factor: 0.199, SHGC: 0.33
Walls	U-factor: 0.031
Cellar Slab	U-factor: 0.72
Roof	U-factor: 0.014
Thermal Bridges	Not included
Additional Loads	Electric exhaust dryers, induction ranges

Energy Model Resultes	Target	Modeled
Source Energy (kWh/person-yr)	3,840	2,377
Heating Demand (kBtu/ft²-yr)	4.6	3.73
Peak Heating Load (Btu/hr-ft²)	2.9	2.78
Cooling Demand (kBtu/ft²-yr)	2.1	1.11
Peak Cooling Load (Btu/hr-ft²)	1.7	1.37
Air Leakage (ACH at 50 Pascals)	0.5	0.5
1BR HERS Index (Pre-PV)	63	34
1BR HERS Index (Post-PV)	10	10

Energy Efficient, All-Electric Design

High-Efficiency Lighting Fixtures and Appliances

Westgate Apartments will have LED lights throughout the building and induction cooktops and ENERGY STAR appliances in each unit.

Building Envelope

The high-performing envelope system includes:

- Triple-pane Kohltech windows, operable casement windows above fixed windows, with U-factors of 0.18 and solar heat gain coefficient (SHGC) of 0.332
- 2.5-inch, R-12.6 continuous ZIP-R sheathing
- 2x6 wood stud walls with R-21 insulation in the cavities
- R-70 roof assembly

The ZIP-R sheathing provides a continuous exterior drainage plane, weather barrier, and exterior air barrier. The project team partnered with US Ceilings, an AeroBarrier provider in Rochester, to provide additional air sealing of the whole building and each individual unit. This process finds and seals gaps by pressurizing the building and then sealing leaks in real time. Commissioning will include blower door testing and thermal imaging to identify any inconsistencies with insulation or air barrier insulation.

All-Electric Systems

Space conditioning is provided through a high-efficiency ASHP. Each unit will have its own mini split heat pump for individual access and control. Domestic hot water (DHW) will be provided through a Sanden CO_2 centralized ASHP. The system includes ten outdoor units serving five central storage tanks and has a coefficient of performance (COP) of 2.79, meaning it is nearly three times more efficient than an electric resistance water heating system. Continuous fresh air is delivered through an ERV system with 83% sensible heat recovery efficiency (SRE). The electrical load is partially offset by solar panels.

Exterior rendering by SWBR Architects

Renewable Energy

Westgate Apartments will utilize both onsite and remote solar PV arrays. The purchased onsite array has the capacity to produce 800,000 kBtu/yr, which is 36% of the total annual electrical use. The remote array is leased via a 20-year contract and has the capacity to produce an additional 24% of the total annual electrical use. Westgate Apartments also plans to offset additional electric load of the building via off site purchase of renewable energy and solar PV panels to achieve the NYSERDA Low Rise New Construction Program targets.

Smart Building Technologies and Energy Consumption Feedback

The project will be equipped with occupancy sensors for the lighting in common spaces, an energy monitoring system (EMS) in all apartments and common areas, and individual HVAC controls, ERV units, and heat pumps in each apartment.

The project will utilize Shark Meter, a utility reporting system that allows the management team to benchmark utility usage for each unit. The system is a low-cost and scalable strategy that utilizes behavioral economics, game theory, and real-time data displays in the lobby to encourage residents to reduce their energy use. The information that is collected can be used to log data on the energy server for historic analysis and to export data for summary reports, analysis, or third-party services. Any data, reports, and analysis will be anonymized and made public on the project's website.

Building Operations

Leasing Structure

Westgate Apartments will function as an LMI rental property, with spaces reserved for households with income levels at or below 50% Area Median Income (AMI) and households at or below 30% AMI. A portion of these units are set aside for residents with chronic conditions, such as asthma, emphysema, or HIV/AIDS. With an "all in" rental model, the owner will pay the utilities, allowing the owner to benefit from the utility bill savings, while providing the residents with fixed monthly costs.

Cost Reduction

While the relative construction cost for Westgate Apartments is 15–20% greater than the construction costs of comparable buildings, energy costs per resident are expected to be 56% lower. Between energy efficiency savings and onsite PV production, the owner expects utility billing savings of over $25,000 per year. These savings will allow the development and management teams to offset the larger debt needed to cover the increased construction costs. Westgate Apartments is a tax credit project, so the project has access to funding sources providing capital at only 1% per year. So, for every $1 the project saves in operating costs each year, it can leverage $100 In capital funding. Therefore, the estimated savings of $25,000/yr can be leveraged into an additional $2.5 million in capital funding. Comparing the construction cost to other comparable buildings, this additional capital will more than cover the cost increase.

Other cost-reduction strategies the team is pursuing include:

- Integrated design meetings to enhance coordination
- Simplification of the building's geometry and envelope for easier construction
- Use of ZIP-R sheathing for a singular air, weather, and moisture barrier in lieu of multiple products for labor savings
- Use of AeroBarrier to reduce uncertainty of air tightness
- Preliminary blower door testing to target air sealing inefficiencies

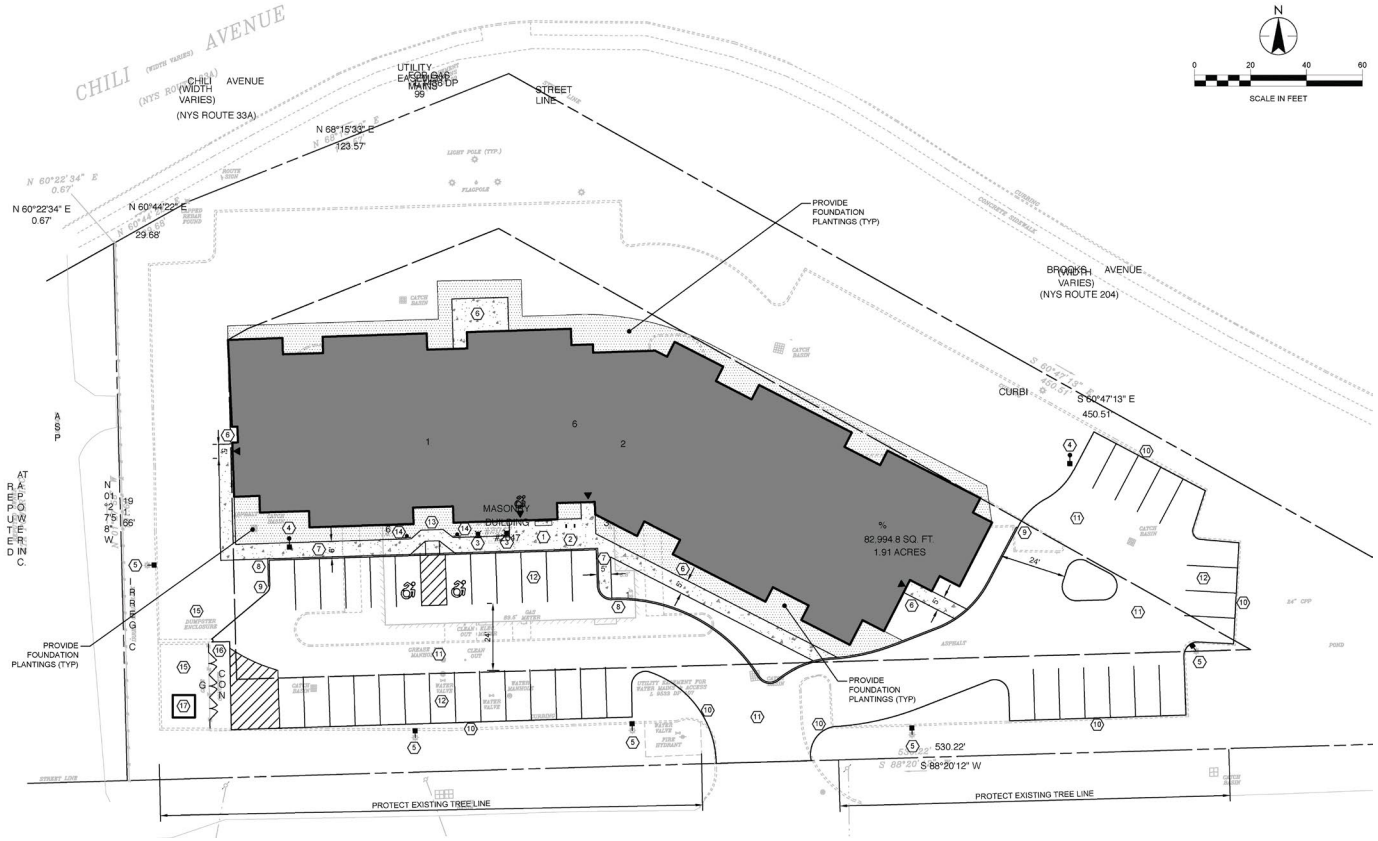
Manuals and Training

A manual will be developed and provided to tenants upon their moving in. This will explain the intent, benefits, use, and maintenance of the apartment building's green features and practices. The guide will also encourage green and healthy occupant activity. A building operations and maintenance manual will also be developed and provided to the building staff. An emergency operations manual will be provided to the maintenance staff that will address how to respond to various emergency situations and provide guidance on how to sustain safe, adequate housing for the duration of the emergency.

Additional Benefits

Site Context

The site is adjacent to Westgate Plaza, allowing residents direct and walkable access to numerous amenities including a grocery store, pharmacy, banks, and other services. Westgate Apartments is also situated on a high-frequency bus route that provides 24-hour service. The project has a proposed density of 25 units per acre, whereas the surrounding area has a much lower density of 2.5 units per acre.



Site plan by SWBR Architects

Community Engagement

Along with its commitment to provide housing to lower income households, the development team is also committed to educating the community. The development team will host sessions at various municipalities to discuss the advantages of going Passive and Net Zero in the built environment. They plan to hold onsite and offsite public workshops to educate local professionals and train the community on energy efficient practices and passive house construction techniques. Their trainings will emphasize the following Passive House principles:

- Continuously insulated envelope
- Thermal bridge free construction
- High performance windows and doors
- Constant fresh air supply
- Internal loads management
- Efficient lighting, appliances, and renewables
- Onsite PV to meet PHIUS energy demands target and Net Zero performance

Occupant Health, Comfort, and Productivity

The design of Westgate Apartments focused on improving indoor air quality and interior comfort levels for occupants. Since apartment units will be set aside for residents with chronic conditions such as asthma, emphysema, or HIV/AIDS—populations particularly at risk for airborne illnesses—the building's enhanced indoor quality is an especially important design feature.

The building is smoke free and the ERV system provides each unit with continuous fresh air ventilation. To meet the requirements of the Environmental Protection Agency's (EPA) Indoor AirPLUS program, the design team carefully selected materials that would reduce indoor air pollutants. All paints, adhesives, and sealants will be low VOC, all composite wood products will be low/no formaldehyde, and all flooring will be certified low emission. With an all-electric design, there is no combustion equipment, which is especially important for occupants with respiratory conditions. The design also include a passive radon mitigation system.

The high performance building envelope, specifically the triple-pane windows and thicker insulation, ensure consistent interior temperatures. It also provides improved acoustic comfort by reducing noise transfer between the interior and exterior, which will drastically reduce noise disturbances from the nearby Rochester Airport. Careful air sealing between units—compartmentalization—also reduces noise transfer between adjacent units. At least 15% of units will be fully ADA accessible.

Resiliency

With the changing climate in the Rochester area, extreme weather events are expected to happen more frequently, requiring preparation for both winter and summer grid outages. High-performance envelopes help buildings remain at a stable and safe interior temperature in the event of a prolonged power outage. With high insulation levels and careful air sealing, the envelope prevents heat gain during heat waves, while in the winter it provides protection against freezing. With ZIP-R sheathing—which provides a continuous exterior drainage plane and thermal bridge free design—the envelope is designed for general durability and decreased risk of mold. The team is still considering whether to pair the PV system with a backup battery option to provide power in the case of grid failure. Sealing all wall, floor, and joint penetrations with low-VOC caulking sealing methods also prevents pest entry.

Lessons Learned

Through the process of designing a high-performance, all-electric infill project, the Westgate Apartment team had several important lessons learned.

- Integrated design:
  - Involving the entire team from the very beginning allowed the project to start off well, fostering trust, openness, discussion, and cooperation. Integrated design, as opposed to design bid build, allows for clear, unified, and respectful decision making.
  - Experience working on Leadership in Energy and Environmental Design (LEED) projects in the past taught the team to include the building management team very early in the design process because they can alert the development team of operation issues that may not be considered in the design phase.
  - The development team worked closely with plumbing contractors to evaluate the DHW system and determined that a centralized system would be the most conservative from a cost perspective with the incorporation of recirculation and plumbing efficiencies.
- An experienced general contractor should be selected who can meet the schedule and deadline, and who selects products that will help them to reliably meet expectations.
- A standard unit design is used across projects, allowing for efficiencies to be identified and carried into future projects, allowing the team to successfully implement new standards and run a smoother design process.
- ZIP-R sheathing simplifies construction and field checks. Few re-inspections are necessary, which would have impacted critical schedule and timing.
- Triple-pane windows required for Passive House level performance are very expensive. The team worked to find the most cost-effective version and make trade-off decisions, which substantially reduce overall cost.

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