RetrofitNY: Portville Square Net Zero Energy Retrofit Schematic Design

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Serve as a catalyst – advancing energy innovation, technology, and investment; transforming New York's economy; and empowering people to choose clean and efficient energy as part of their everyday lives.

RetrofitNY: Portville Square
Net Zero Energy Retrofit Schematic Design

Final Report

Prepared for: RetrofitNY

New York State Energy Research and Development Authority

Albany, NY

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Abstract

Under the NYSERDA RetrofitNY program, we plan to renovate and modernize an existing two-story 24-unit affordable apartment project in Portville, NY called Portville Square. The project is one of five remaining test projects selected across New York State in 2019 to participate in this program. SWBR has been working very closely for over ten months with team members from NYSERDA in an interactive and collaborative design process with the entire design team, energy consultants and exterior panelized wall fabricators to create a cutting edge sustainable, scalable and replicable solution to get the project to or near a Net Zero Energy (NZE) performance level.

Keywords

RetrofitNY. Deep energy retrofit. Net zero energy. Net zero retrofit. Net zero energy building. Energiesprong. Site Energy. Multifamily. Energy Efficiency.

Acknowledgments

Adam Cohen - Team coach appointed by NYSERDA

Michele Knapp and Kim Erle - cocoon construct

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Acronyms and Abbreviations

ft	feet
kWh	kilowatt hours
m/s	meters per second
MW	megawatts
NYS	New York State
NYSERDA	New York State Energy Research and Development Authority
W	watts
EUI	Energy Use Intensity
NZE	Net Zero Energy

Glossary

Energy Use Intensity: The total amount of site energy consumed by the building on an annual basis divided by the gross floor area in kBtu/ft^2/yr.

Multifamily building: residential building with five or more residential units.

Net Zero Energy Performance: Total site energy consumed by the Building being less than or equal to the amount of renewable energy created by solar photovoltaics or other distributed energy resources located on the Building or elsewhere on the site, calculated on an annual basis.

Executive Summary

Overview

Under the NYSERDA RetrofitNY program, the project is to renovate and modernize an existing two-story 24-unit affordable apartment project in Portville, NY called Portville Square. The project is one of five remaining test projects selected across New York State in 2019 to participate in this program. SWBR has been working very closely for 10 months with team members from NYSERDA in an interactive and collaborative design process with the entire design team, energy consultants, and exterior panelized wall fabricators to create a cutting edge sustainable, scalable and replicable solution to get the project to or near a Net Zero Energy (NZE) performance level.

RetrofitNY, a NYSERDA initiative, is revolutionizing the way buildings are renovated in New York State. The goal is to spearhead the creation of standardized, scalable solutions and processes that will improve the aesthetic and comfort of residential buildings while dramatically improving their energy performance. RetrofitNY is working aggressively to bring a large number of affordable housing units to or near net zero energy use by 2025 and improving the quality of life for affordable housing residents.

The goals of the RetrofitNY program for Portville Square are:

- To develop a cutting-edge design that improve living space comfort and indoor air quality, as well as the exterior aesthetics of the current building
- To provide substantial savings on utility and maintenance expenses for building owner and/or residents and use these savings to finance the improvements
- To serve as a model for the industry beyond New York to follow in encouraging energy efficiency in other existing buildings

Portville Square was constructed in 1986 and is a two-story wood framed affordable senior housing project. The exterior walls are 2x6 wood stud framed with face brick and asphalt shingle covered mansard exterior cladding. The ground floor is concrete slab on grade. The second floor and roof structure (flat roof) is composed of premanufactured open web wood floor trusses. The building and apartments are heated via electric resistance baseboard and there is no cooling available for the residents. Domestic hot water is via individual electric water tanks.

A “business as usual” (BAU) renovation scope was created by the project owner as a baseline to use against the RetrofitNY program. The BAU was a limited scope renovation that included basic facility upgrades (finishes, lighting, roofing, siding, windows, etc.). Project costs were developed for the BAU scope as a template to begin to understand any additional costs created by the innovative ideas that were developed for the deep energy RetrofitNY program.

Design concepts for the project were developed in a highly interactive and collaborative design and review process that included all design team members working closely with NYSERDA and their team members. The results of the current schematic design include the following design solutions:

- State-of-the-art exterior panelized pre-insulated cladding design by cocoon construct with integrated triple glazed Passive House rated windows installed in the factory and transported to the field for erection: exterior finishes will be pre-installed, and the panels will be shipped to the site, hoisted into place and fastened to existing building. This will minimize construction schedules and tenant displacement and will allow systems and finishes to be installed in a controlled environment. For this process, cocoon construct will engage with Syracuse University’s Building Energy and Environmental Systems Laboratory and Syracuse Center of Excellence to complete final research and development (R&D) efforts.
- Protected Roof Membrane Assembly (PRMA): low slope roof with R-30 extruded polystyrene insulation with fabric and river rock roof ballast over existing R-11.2 EPDM.
- Individual low-profile, high-efficiency, ducted refrigerant heat pumps for each apartment with associated outdoor units on flat roof.
- Additional ducted or ductless refrigerant heat pumps for common spaces.
- Coordination with architect for new dropped ceiling at apartment entry to accommodate distribution ductwork and refrigerant piping.
- Use of soffits and the ceiling joist space in corridors for exhaust and ventilation air ductwork
- Rooftop dedicated outdoor air unit to supply ventilation air and facility exhaust with total enthalpy recovery wheel for energy recovery from exhaust/relief air. Unit includes refrigerant heat pump for conditioning and dehumidification of ventilation air.
- All existing lighting in apartments, common spaces, and building exterior will be replaced with LED luminaires. Luminaires will use substantially less energy and will be more attractive
- Provide a ground mounted PV solar array on the site and connect to a 208Y/120-volt, 400 ampere, three-phase utility meter. A 134.6 kW system (producing 158,400 kWh/year) to accommodate electric water heaters.
- Utilize energy produced by the solar array to offset the building “house” energy usage; all tenants will pay apartment electrical energy usage.

Of great concern to the design team and NYSERDA were the on-going well-being of the residents that will be living there. We recognized the following health and comfort considerations:

- High R-value walls and Passive House certified windows
- Compartmentalization / air sealing via Aerobarrier
- Tempered & filtered supply air from central ERV

Tenant education was also an important consideration for the team, with the following being integral in the success of the final product:

- Resident engagement and education of the proposed renovations
- On-site meetings providing an “Information Packet”
- Energy usage education
- On-site Q&A sessions during construction
- Ongoing energy monitoring

The Team: The trusted design and manufacturing team members under SWBR on the Portville Square RetrofitNY pilot project include team members listed in this RFQ. They include:

- Turner Engineering P.C., providing mechanical and electrical engineering design services.
- Sustainable Comfort Inc, providing energy modeling and energy program design services.
- cocoon construct, providing the manufacturing of the super insulated exterior wall panels that will be used on the project.
- Conifer LeChase will be the construction manager.
- Conifer Realty is the owner.

HVAC:

Heating and cooling are supplied to HVAC zones by dedicated air source refrigerant heat pumps (i.e., each apartment has an indoor fan coil unit with a dedicated rooftop air cooled heat pump). These refrigerant heat pumps have extremely high-energy efficiency, particularly in heating mode, and include variable capacity for both conditioning and air distribution. This further reduces the conditioning energy burden by trimming the HVAC system output to the building load while limiting equipment cycling. Each zone is controlled by a programmable temperature controller that will provide comfort conditions on an apartment-by-apartment basis.

Ventilation and exhaust for each occupied space is furnished by a Dedicated Outside Air Unit (DOAS) packaged air source heat pump with a total enthalpy energy recovery wheel to pretreat the incoming ventilation air as required before mechanical heating or cooling. This ventilation air is conditioned to room neutral conditions and dehumidified, if required, to keep the overall facility below 60% relative humidity (RH).

All details of the HVAC design are clearly illustrated in the attached document package, including select demolition of the existing electric baseboard, common space cabinet unit heaters, and apartment exhaust systems.

Plumbing

The plumbing fixtures with the dwelling units shall be replaced with low-flow fixtures to reduce the overall water consumption. In addition, this will reduce the domestic hot water demand. Domestic hot water will be provided by individual, electric, 40-gallon storage tank style water heaters. The hot water will be produced at 140°F to reduce the potential of legionella growth and distributed at 120°F. The water temperature will be reduced to 120°F utilizing a thermostatic mixing valve.

Electrical:

A solar photovoltaic (PV) energy production facility equipped with inverters is being provided. An energy model was performed resulting in the estimated annual electrical usage in kWh. The solar plant was then designed to provide this amount of energy on an annual basis. This plant is equipped with inverters that are equipped with metering. This metering will log the amount of power being produced by the system.

The solar plant will be connected to a utility electrical meter, which will also record the amount of power produced. The building itself, with a house meter and 25 apartment meters, will be set up in a community solar system, so the solar power produced can be shared with the house and all apartments. The intent is for the solar system to provide 100% of the power used in the building, on an annual basis.

Additionally, the electrical connections to all mechanical equipment being provided as part of this project have been designed.

1 Project Narrative

Building Envelope

Key design criteria to consider	How does your design address the criteria?
Thermal performance	Existing 2x6 exterior walls with R-19 fiberglass batt insulation and 6 mil polyethylene vapor retarder (measured with a digital micrometer). We plan to provide an additional R-24 continuous insulation at the exterior walls. Existing two layers of 5/8" gypsum board at the ceiling (no poly vapor retarder) over +/-1'-8" to 1'-10" deep roof trusses with 1/4" per foot sloped top chord with blown in fiberglass insulation for the full depth. On top of the trusses is 3/4" plywood roof decking with R-11.2 polyisocyanurate that is mechanically attached and have a .060" black EPDM roof that was installed within two years ago. Above the existing roof, we will install a PRMA roof that consists of R-30 Extruded Polystyrene insulation (R-40.2 total) with a protection mat and ballasted roof with washed river rock. The windows will be removed, and triple pane Passive House windows will be installed within the wall panels.
Sealing performance	We plan to air seal interior by the use of AeroBarrier which is a revolutionary product that when installed under a blower door test, in an atomized delivery, seals up voids in the envelope. This is typically done at the drywall stage. Because our project also has a Level 1 Alteration, we will have vacant units that will not have cabinets, countertop or finishes in them. A pdf is attached about the product.
Moisture performance	Will provide excellent performance, the roof/ceiling open web floor truss structure is pitched from outside walls to the corridor walls. The roof truss structure is flat between the corridor walls and there are existing roof drains. The EPDM membrane roof will have a minimum 20-year warranty. The walls will be air sealed from the inside. A WUFI or CHAMP analysis will be completed for the roof as well as the wall assembly.
Structural performance and long-term integrity of materials	We feel the design will achieve the same longevity as the existing buildings plus added durability for moisture mitigation. Please keep in mind that the building is brick veneer and vinyl siding, materials that provide a long life.
How will the new design affect resident life? Are there custom/atypical design features that require careful consideration?	No more air infiltration at windows and doors. There will be lower utility bills and providing an envelope and mechanical and electrical system that the residents can be proud to live in. The addition of HVAC cooling to all occupied spaces will improve comfort conditions for residents.
Maintenance of solution	Exterior Insulation Finish System (EIFS) exterior, can be patched and recoated easily. The roof will be a fully ballasted EPDM system which is a very common roofing system. The Owner understands that roof leaks will be more involved with two different roofers and manufacturers potentially, but the team elected to go with this approached to save costs and since there is a new roof in place already.
Sustainability of solution	Very sustainable, very low utility bills and in the event of a power outage, residents can stay at their apartment.
Replication potential at scale	While this is a first of its kind system that we are aware of and the first one that cocoon construct has done, we believe that this system can be replicated, the cost can be reduced in time as we all learn from this.

Other Questions	Team Response
What challenges have you encountered in designing an envelope solution that meets the RFP requirements? How are you addressing them?	Finding a wall panelizer and finding a Passive House certified window that can meet some of the regulatory hurdles. We want to provide a panel delivered to the site and installation with the window and finish provided in the factory similar to EnergieSprong.
Are there any unresolved major issues? What would it take to resolve them?	Yes, there is a trash chute that must remain. Fire rated Passive House doors do not exist, so we need to retrofit the existing trash room door. The solar incentive system is not yet worked out as we have individual tenant electric meters. The existing roof hatch will need to be gasketed. We are working with cocoon construct, a company that at the moment does not meet the risk management issues and not being an official company yet is a concern. At the moment, cocoon construct is going through NYSERDA's application stage and is also working with a testing agency at Syracuse to review a mock up to be built.
Other comments (optional)	We are looking forward to being able to deliver a Net Zero building that is a pioneer to New York State and the design can be used and incorporated to other interested parties, both private and state funded.

Ventilation and Indoor Air Quality

Key design criteria to consider	How does your design address the criteria?
RFP requirement of greater of 20 cfm / bathroom + 25 cfm / kitchen and 18 cfm / person	Our design meets the required criteria with ducted "room neutral" ventilation air to both bathroom and kitchen as required.
Prevention of mold, mildew, pests and other environmental triggers of respiratory or other ailments	The addition of light commercial grade cooling to each space via air source refrigerant heat pumps as well as use of ventilation air that is pre-processed with filtration, temperature, and humidity control will greatly improve the IAQ for residents. The current installation makes use of natural ventilation by operable windows and negative apartment pressurization which can be a huge contributor to humidity problems leading to mold, as well as a pathway for pest infiltration.
Active ventilation to reduce volatile organic compounds and other potential internal air contaminants	As noted, active ventilation is provided in our design using a central rooftop Dedicated Outside Air Unit (DOAS). In addition to the code required constant exhaust from each apartment this should provide sufficient indoor air exchanges to greatly reduce any VOC or indoor contaminants.
Maintenance of solution	All equipment requiring complicated maintenance is located on an accessible rooftop (refrigerant compressors), or in mechanical equipment rooms. The only standard maintenance required from within the apartments will be filter exchanges and (possibly) drain pan cleaning, which should be easy to accomplish using the new entry ceiling plenum where the equipment resides.
Sustainability of solution	The DOAS unit is fitted with a total enthalpy wheel for energy exchange between the apartment exhaust and ventilation air. It utilizes an air source heat pump for heating, cooling and dehumidification of the introduced ventilation air.
Replication potential at scale	All ventilation equipment used in the design are currently commercially available from a variety of manufacturers nationwide.

Domestic Hot Water

Key design criteria to consider	How does your design address the criteria?
DWH system design and sizing	The existing efficient individual dwelling unit electric water heaters are being replaced “as needed” based on the current age and condition of the equipment.
Innovative ways to improve system efficiency (i.e. heat recovery)	N/A
Required sensors and controls	N/A
Maintenance of solution	This system will require no more maintenance than the existing conditions.
Sustainability of solution	This adds no more energy demand than currently exists.
Replication potential at scale	This system uses current technology, so it is very scalable.

Space Heating/Cooling

Key design criteria to consider	How does your design address the criteria?
Space heating/cooling EUI of not more than 11 kBtu/ft^2/year	Per the energy model assessment done by Sustainable Comfort, our design has an overall average space heating/cooling EUI of 7.7 kBTU/SF/YR
Maintaining heating and cooling comfort (including humidity)	Heating and cooling are supplied to occupied spaces by dedicated air source refrigerant heat pumps (i.e. each apartment has an indoor fan coil unit with a dedicated rooftop air cooled heat pump). As previously noted, the DOAS unit includes a dehumidification cycle as well as latent heat recovery for required humidity control.
Innovative ways to improve system efficiency	The selected HVAC system has modulating compressors and fan speed control to allow the system to closely trim to the demand. Total enthalpy recovery greatly improves the efficiency for the ventilation/exhaust component of the system load.
Required sensors and controls	Each apartment and tenant gathering space is fitted with a programmable temperature controller for enhanced comfort condition control.
Maintenance of solution	All equipment requiring complicated maintenance is located on an accessible rooftop (refrigerant compressors), or in mechanical equipment rooms. The only standard maintenance required from within the apartments will be filter exchanges and (possibly) drain pan cleaning, which should be easy to accomplish using the new entry ceiling plenum where the equipment resides.
Sustainability of solution	Use of air source refrigerant heat pumps for maintaining comfort conditions uses one of the most efficient systems available for an installation of this type where separate billing by apartment is required.
Replication potential at scale	All HVAC equipment used in the design are currently commercially available from a variety of manufacturers nationwide. Each different apartment configuration will present a new coordination challenge, but the general design concept should be adaptable to nationwide scope.

2 Schematic Design Documents

Drawing List:

- General:
  - G-000 - Cover Sheet
  - G-001 – General Notes and Legends
- Civil:
  - C1 – Existing Conditions Plan
  - C2 – Site Demolition Plan
  - C3 – Site Remediation Plan
  - C4 – Site Enlargements 1
  - C5 – Site Enlargements 2
- Architectural:
  - A-001 – Overall Site Plan
  - A-100 – Overall Demolition Plans
  - A-101 – Overall Floor Plans
  - A-102 – Enlarged Common Area Floor Plans
  - A-103 – Enlarged Unit Plans
  - A-111 – Overall Roof Plan
  - A-130 – Overall Reflected Ceiling Plans
  - A-200 – Demolition Exterior Elevations and Details
  - A-201 – Exterior Elevations and Details
  - A-310 – Wall Sections and Details
  - A-311 – Walls Sections and Details
  - A-900 – 3D Views
- Plumbing:
  - P-001 – Plumbing General Notes, Symbols and Enlarged Plans
  - P-100 – First and Second Floor Plans – Plumbing
- Mechanical:
  - H-001 – HVAC General Notes Schedules, Legends, and Design Criteria
  - H-101 – First and Second Floor Plans – HVAC
  - H-102 – Roof Plan – HVAC
  - H-201 – Enlarged Plans – HVAC
  - H-500 – HVAC Details
  - HD-101 – First and Second Floor Demolition Plans
  - HD-102 – Typical Enlarged Demolition Plans
- Electrical:
  - E-001 – Electrical General Notes and Symbols
  - E-101 – First and Second Floor Plans – Electrical
  - E-102 – Roof Plan and Enlarged Plans – Electrical
  - ED-101 – First and Second Floor Demolition Plans

- Specifications:
  - 18-12-18-Conifer Portville Specifications MEP
- Cutsheets, Details, and Sample Shop Drawings:
  - Roofing:
    - No. 1_Stone-ballasted PRMA roof system
    - No. 2_PRMA_Owens Corning
    - No. 3_Articles about PRMA
  - Solar Items:
    - 100kW design - helioscope_simulation_2188063_summary
    - 125kW design - helioscope_simulation_2188064_summary
    - Portville 101kW_Proposal
    - Portville 126kW_Proposal
    - Re_ Solar Array – email
  - Wall Systems:
    - 2015 Neopor EnergySavings ExistingHomes
    - 2017 BASF NeoporGPS Brochure
    - 2017 Neopor-HPE-13 ProdDataSheet
    - 2017 Neopor-HPE-13 TechDataSheet
    - AeroBarrier - Portville NY Aug 2018
    - BA-1204_External_Insulation_Masonry_Wood_Walls_ed
    - basf-product-bulletin-senershield-r-senergy
    - FF shop drawing sample 1
    - FF shop drawing sample 2
    - FF shop drawing sample 3
    - FF shop drawing sample 4
    - FF shop drawing sample 5
    - FF shop drawing sample 6
    - FF shop drawing sample 7
    - FF shop drawing sample 8
    - FF standard details 1
    - FF standard details 2
    - FF standard details 3
    - rr-0999_drainage_planes_air_spaces
    - window detail with nailbase
- Additional Enclosures:
  - Portville Square business as usual renovation construction documents and specifications for reference.
  - Combined set of RetrofitNY drawings.

3 Scalability Strategy

3.1 HVAC

Use of variable refrigerant technology for facility conditioning permits distribution of heating and cooling in refrigerant piping, which takes up less space in a retrofit than more conventional hydronic or airside distribution systems. In our experience one of the key constraints for providing energy-efficient renovation of HVAC systems in apartment complexes is the lack of space available for distribution of conditioning to all rooms in the apartment. The solution directly addresses this issue.

All pieces of HVAC equipment selected for the design are currently commercially available from a variety of manufacturers nationwide. The variable refrigerant flow system selected is modular and expandable, with a wide variety of equipment capacities available for different apartment configurations and building loads.

Each different apartment complex configuration will present a new coordination challenge, but the general design concept should be adaptable to nationwide scope. Selection of stand-alone systems per apartment not only allows for easy scalability, but also permits simple tenant energy usage monitoring as well as addressing potential ASHRAE 15 refrigerant management issues. No barriers to scalability for the HVAC systems are anticipated.

Further development by equipment manufacturers would be helpful to provide HVAC equipment suitable for the extremely low building conditioning loads that are anticipated for Net Zero, Passive House-style facilities. Units are currently selected at the lowest practical size, with modulating capacity, but heating and cooling loads are so low due to construction quality that equipment cycling can be anticipated, particularly during swing seasons.

3.2 Plumbing

All pieces of plumbing equipment selected for the design are currently commercially available from a variety of manufacturers nationwide. Each different apartment complex configuration will present a new coordination challenge, but the general design concept should be adaptable to nationwide scope.

Building System	Describe strategy for successfully measuring, producing and installing the solution at scale on similar buildings. Include detail on building system sub-components (i.e. piping, windows, etc.)	If design solutions with a better potential for scalability were considered, describe the solutions and explain why they did not make it to the final design (i.e., cost, product availability, aesthetics, etc.)
Ventilation and IAQ	Code mandated ventilation, exhaust and IAQ air exchanges are supplied by a central rooftop Dedicated Outside Air Unit (DOAS) with energy recovery, appropriately ducted to each occupied space. These units can be scaled, as required, to the size of facility.	
Space Heating/Cooling	Space heating/cooling is by individual air source refrigerant heat pumps with associated outdoor heat recovery units and refrigerant linesets. These units designated for each HVAC zone (i.e., apartment), are available in a range of capacities from a variety of manufacturers and can be easily scaled with size of project.	
Domestic Hot Water	Domestic hot water shall be provided by individual, electric, 40-gallon tank storage water heaters with a minimum efficiency factor (EF) of 0.92 to meet or exceed the requirements of the 2015 International Energy Conservation Code.	A central geothermal domestic hot water plant was considered utilizing a water-to-water heat pump but was not pursued due to the cost constraints associated with the geothermal well field.
Miscellaneous Electric Loads		
Façade		
Roof		
Distributed Energy Resources	Solar power is being provided on site, sized to accommodate all house and apartment loads for the year, based on kWh usage. The estimated energy usage was determined through energy modeling.	

Project unit cost for reproducing the retrofit solution at scale.

Location	Pilot Project (1 unit)	10 units	100 units	1,000 units	10,000 units
Ventilation and IAQ					
Space Heating/Cooling					
Domestic Hot Water					
Miscellaneous Electric Loads					
Façade					
Roof					
Distributed Energy Resources					

4 Budget and Financing Plan

Portville Manor is part of a larger scattered nine-site rehab project. The BAU funding was already in place with USDA-RD state resources. Budget and financing were based upon a construction estimate for all nine sites. The retrofit was over and above that funding. The budget decision-making process was conducted via value-engineering and teamwork to determine best cost scenarios while still achieving parameters set forth by the RetrofitNY program.

Conifer made it clear from the beginning of this exercise that the team wanted to fully explore and adhere as closely as possible to the parameters set forth by NYSERDA. It was the desire to match Energiesprong as close as possible. With that in mind, all net-zero and building envelope possibilities were examined with the intention of covering any gaps in funding with additional sources. Once the full retrofit budget was established, we then reacted accordingly with value-engineering. (Refer to other sections related to cost savings and value-engineering. The largest component was geothermal.) Conifer has always maintained control of the project and budget through our in-house architect and partnership with Conifer-LeChase construction.

Federal Home Loan Bank has a funding round with financial resources that were applied for. The team often utilizes FHLB funding on projects. Cost of operating is anticipated to be lower, refer to other sections for complete descriptions.

Design solution carefully considered the existing building infrastructure, finishes, and overall construction. It is believed that the solution will help maintain the durability of the building for many years – see Section 6 for more information.

5 Projected Construction Schedule

As noted, the BAU scope for this project was already slated as part of overall nine-site project rehab and incorporated within the construction schedule. Conventional planning was utilized but also modified using pull-planning methodology. Due to the delay in getting the design of the exterior panel system finalized we postponed the BAU construction until the end of the schedule in order to accommodate the panel development.

Certain lead times of course need to be factored in. Once the exterior panel system is finalized, we believe that the construction schedule will be relatively easy to replicate. Air-sealing an occupied building during rehab is the most challenging and the product we have selected only works for projects at the drywall installation stage. It is not yet known if the team can eliminate the air barrier product and rely only on the fluid applied air barrier and wall panel system.

6 Building Performance Summary

To demonstrate the projected energy performance of the project, WUFI Passive was used to create a whole building energy model. In the model, various characteristics of the building, including insulation values, window performance, water heater efficiencies and HVAC designs could be tweaked to determine the effects on the overall energy usage. During the design process, this model was used to evaluate different system and enclosure upgrades to establish a configuration that met the energy performance requirements. A projected life cycle cost assessment was performed including basic assumptions for ongoing maintenance and energy costs to determine the overall long-term performance of the project.

The project team met frequently during the design phase to discuss the best way to meet the program performance requirements. Members of the team including owner, architect, contractor, mechanical engineer, and energy consultant have discussed the project from a broad range of perspectives including construction cost, energy performance, long-term maintenance, and tenant satisfaction. Through comprehensive communication, the team was able to determine a scope of work that meets the intent of the RetrofitNY program and provides related but not required benefits to the owner over time.

In order to meet the RetrofitNY program performance requirements and the Passive House Institute US (PHIUS) standards, which require super tight envelope and net zero buildings, both the enclosure and mechanical systems were significantly upgraded. The enclosure upgrades, based around the Energiesprong design, should allow for a large reduction in heating and cooling loads for decades with minimal risk (most likely beyond the term of financing). The Neopor wall panel insulation (the wall panel system to be installed by cocoon construct) and the EPS roof and slab insulation should have negligible degradation over multiple decades. The added layers of external insulation should also help to preserve the building itself, as the materials will act as an additional water control and air barrier layers. Passive House certified windows and compartmentalization via Aerobarrier complete the enclosure upgrades and will aid in lowering air infiltration rates and resulting potential moisture issues.

For HVAC systems, the property owner indicated a desire to employ known technologies with reliable manufacturer support to ensure long-term savings and reliability. Air-source heat pumps were chosen to condition the apartments for their superior energy efficiency, as well as the fact that they meet the owner’s requirements for a proven technology. The dedicated outdoor air system utilizes an air source heat pump for conditioning incoming air and a heat wheel for energy recovery. Though heat pumps

may lose some efficiency over time, it is assumed that these losses will be minimal. At the time of replacement cold climate heat pumps are predicted to be available with improved efficiencies. Additionally, the enclosure upgrades will reduce the heating and cooling loads significantly, potentially increasing the lifespan of the heat pumps.

Other upgrades include LED lighting and low flow water fixtures (showers, lavatory faucets, and toilets.) Lack of cost-effective electric water heating options resulted in a decision to maintain the current electric resistance storage water heater setup. A ground mounted solar PV array was chosen to offset the entire site energy use. Through these upgrades the building is expected to achieve an Energy Use Index (EUI) reduction from 46.7 kbtu/ft^2/year to 26.7 kbtu/ft^2/year (~43% reduction). With the PV array, the project is projected to achieve net zero on the meter.

The numerous iterations of the energy model revealed that the largest reductions in energy use were a result of replacing the electric resistance heat with the air source heat pumps. The electric resistance heat was identified from the start as a high energy user and a number of options were evaluated as upgrades (Minotair, VRF, etc). The desire to have an affordable, proven technology resulted in the air source heat pumps being chosen over the alternatives.

Various wall and roof insulation levels were also evaluated during the design phase. It was found that the high-efficiency of the heat pumps negated most of the benefits of excessive insulation levels. While continuous roof and wall insulation were the preferred method, the amounts of insulation thickness were reduced without significant energy penalties such as not installing below grade insulation at existing concrete slab areas under covered entries.

The evaluation of the DHW system also yielded various potential designs. The initial design included a water loop ground source heat pump (GSHP) supplying a central DHW storage and recirculation system. This system was eventually eliminated due to the high construction cost and a power return on investment (ROI), and the existing in-unit electric resistant tanks were chosen for the DHW system as the most appropriate option.

The GSHP sourced hot water was chosen because early energy models indicated DHW was a high percentage of overall energy use. This was partially due to initially adapting the design for NYSERDA requirements of 21 gallons per person per day of hot water. This assumption was exacerbated by also designing the system with the assumption of a fully occupied building (two people per each

one-bedroom apartment). The building traditionally has a much lower occupancy rate than standard housing due to its status as senior housing and tenants appear to use less water than the assumed average. When these assumptions were reviewed, it was found that they resulted in projected annual DHW water usage in excess of the historical annual total water usage for the building (determined through past bills). Once these assumptions were adjusted, the energy penalty of the less efficient existing water heaters was reduced.

6.1 Distributed Energy Resources Summary

Portville Square is located on a large parcel of land with significant capacity for a ground mounted solar array. The land is relatively flat and contains open, unshaded areas suitable for solar panels. The owner indicated a desire to utilize renewable energy to offset the site energy use to create a net zero project, and PV was deemed to be the most cost effective and reliable source of renewable energy.

A rooftop mounted array was initially considered but eventually disregarded due to concerns with the structural capability of the roof. Additionally, the roof is not large enough to house an array with enough capacity to offset the site energy use and would have required additional ground mounted panels to fulfill the demand.

The PV Array is sized at 134.6 kW, which will produce an estimated 158,400 kWh annually, offsetting the total site electrical usage (tenants and common areas). The PV array was resized throughout design as the overall site usage changed. There is significant land available for additional panels if the owner desires to expand the array's capability, possibly offsetting use at other properties.

6.2 Supplemental Renewables Plan

The current design meets the projected annual energy demand requirements and does not necessitate the planned on-site PV array. The array is included in the design to fulfill the owner's desire to achieve net zero site energy usage.

7 Resident Management Plan

Residents have been informed of the pending project and if the project proceeds there will be on-site resident information meetings that will overview the entire process. Conifer will provide an information packet that outlines the project, the process and all the related information for the tenants. There will be Q&A sessions for the residents during construction and the Community Manager and Conifer Project Manager will be available any other time to address any resident concerns.

It's expected that the residents will respond to this Retrofit in a positive way—there will be a learning curve but with the promise of a better living environment we anticipate full resident support.

Energy usage (EU) education course will be conducted via the on-site information meetings with an annual follow-up "EU refresher" each year, this is how Conifer will promote resident engagement for energy conservation.

8 Management Plan

8.1 Goals

Resident engagement from RetrofitNY application acceptance through construction completion and turnover.

Resident action plan to assist in understanding building energy reduction.

8.2 Length of construction phase

Refer to Construction Schedule.

8.3 Length of resident management plan

Entire project and continuing beyond.

8.4 Plan for resident notifications and communication

Resident 'Town' meetings to explain process, goals of program, resident responsibilities. Property management will be assisting overall engagement with residents and has an open-door policy regarding Retrofit questions and process.

8.5 Resident liaison or resident groups

TBD.

8.6 In-unit construction plan

See Construction Schedule

8.7 Exterior construction plan

See Construction Schedule

8.8 Parking impacts

Parking lot will already be completely replaced as part of overall portfolio rehab. Retrofit has no additional impacts.

8.9 Plan for special needs

Any special needs will be addressed by property management as part of typical operations.

8.10 Expected areas of pushback

Residents are very excited about the project. Normal curiosity is expected, and any minimal pushback will be mitigated once the project is fully explained.

9 Residents' Meeting Plan

9.1 Plan for initial resident outreach

Initial outreach meeting has already occurred. Continuing monthly meetings are planned during project implementation.

9.2 Kickoff event

TBD.

9.3 Resident update meetings

See notes above.

9.4 Trainings

Part of Resident engagement plan. There will be a minimum of (2) Retrofit specific training sessions.

9.5 Other Resident Activities

Currently being discussed with Property Management.

9.6 Method to gauge resident participation and track achievements

TBD

10 Residents' Guidelines

Include guidelines directed specifically toward residents beneath each heading or submit the guidelines as separate attachments.

10.1 Operations and maintenance guidelines

These will be included as part of project O&M manual which is standard for Conifer projects. There will be specific sections dedicated to Retrofit.

10.2 Health and safety guidelines

TBD.

10.3 Residents' guide to understanding the utility bill

This will be part of the on-going resident engagement plan.

10.4 Schedule of routine in-unit maintenance

TBD.

11 Performance Guarantee Pathway

Our team strategy for the high-performance guarantee was specifically directed to provide a design solution that was easily maintained. Servicing would be relatively straightforward. Cost for components are already built into standard maintenance practice. There will be extensive training for maintenance personnel in order to ensure long life for all systems. The solar array will be maintained by solar provider.

The challenges we foresee in guaranteeing the long-term performance of the solution are minimal – the HVAC design has proven components. The envelope design, excluding the panels have common construction means and methods. The panels are still TBD but are comprised of standard insulation and finish components fabricated into an assembly. Should the panel fail or be broken in some fashion, repair would be relatively easy with standard EIFS installation practices.

Conifer as a whole owns and manages all of its property sites. Regarding the long-term performance guarantee, Retrofit will be no different in terms of our 360-degree corporate model.

11.1 Maintenance and Warranties

11.1.1 Energy Performance Parameters

Which of your solution's energy performance parameters can be guaranteed (e.g., heat pump COP, on-site kWh production, Btu/person/HDD for heating, BTU/person/CDD for cooling, etc.)? Include a list that maps each parameter to its corresponding building system(s)

(HRU-1 and HRU-2) Outdoor Heat Pump Cooling SEER and EER. (HRU-1 and HRU-2) Outdoor Heat Pump Heating HSPF. (DOAS-1) Dedicated Outside Air System Cooling EER, Heating COP and Energy Wheel Efficiency.

LED Lighting Efficiency

11.1.2 Warranty Term Lengths

What are the warranty term lengths for the various building systems included in your solution?

DOAS-1: One-year parts and labor, five years compressor

HRU-1, HRU-2: Two years parts, six years compressor (if installed by approved technician and commissioning report submitted)

HW-1: Six-year limited tank and parts

LED Lighting: One-year parts and labor.

11.1.3 High-level Maintenance Schedule

List the schedule of high-level maintenance needs through your project's lifetime for each building system including major interventions (i.e., heat pump compressor replacements). Include building systems that are expected to require little to no maintenance and specify as such.

HRU and DOAS heat pump compressors (typ. 15 to20-year lifespan), DOAS air filters (seasonal), FCU air filters (annual).

11.1.4 Maintenance Schedule and Warranties

How should your solution's maintenance schedules and warranties be aligned/coordinated in order to provide a comprehensive extended warranty to last the duration of the project lifetime, ultimately becoming a performance guarantee? Break out by building system.

As part of Conifer's standard maintenance schedule: HVAC, HW, and LED lighting as noted above will all be fully coordinated with warranties.

11.1.5 Maintenance Work and Performance Guarantee

Who will provide the maintenance work and performance guarantee for each building system?

Conifer will provide maintenance. Performance guarantee TBD.

11.1.6 Energy Performance Costs

What is the cost of guaranteeing the energy performance of each building system in the solution beyond the warranty term (provide schedule of annual costs through project lifetime)?

TBD.

11.1.7 Cost Impacts of Maintenance and Guarantee Providers

How would the cost be impacted if the maintenance and guarantee provider is under contract for 100 performance guarantees? For one 1,000?

TBD.

11.2 M&V

11.2.1 Monitoring Building Systems

Who will be responsible for monitoring each of the building systems listed above? (i.e., solution provider, maintenance and guarantee provider, owner, tenant, etc.)?

Owner

11.2.2 Monitoring Building Systems Components

List the components of each building system and of the overall solution that will be monitored.

Components as listed will be monitored by owner - extent TBD.

11.2.3 Technologies, Products, and Protocols

List the technologies, products, and protocols that will be used to monitor/measure each of the components previously listed.

TBD.

11.2.4 Monitoring Technologies

What is the cost of instrumenting the building systems with these monitoring technologies?

TBD.

11.2.5 Analyzing Data

What is the cost of analyzing the data generated by these monitoring technologies?

TBD.

11.2.6 Key Performance Indicators

List the key performance indicators (KPIs) that will be measured corresponding to each of the components listed above

TBD.

11.2.7 KPI Sampling Rate

List the sampling rate for each KPI

TBD.

11.2.8 M&V Program

How is the M&V program expected to improve the operational efficiency of the building systems and mitigate both the frequency and potential emergency nature of major maintenance interventions? Please quantify to the fullest extent possible.

TBD.

11.2.9 Impact of Operational Efficiency Imrovements

What is the expected impact of the above-mentioned operational efficiency improvements and mitigated major maintenance interventions on the cost of providing the performance guarantee? Please quantify to the fullest extent possible.

TBD.

Regulation			Impediment	Action	Resolution		
Code	**Section**	**Description**	**Explain how this regulation impedes your ability to achieve the RetrofitNY criteria.**	**What action has the team taken to date to resolve this barrier?**	**Resolved**	**Resolution in Progress**	**Seeking Assistance with Resolution**
		Zoning Requirements		Contact has been made with the municipality and no barriers have been identified at this time by the town that would inhibit the success of this project.	X		
		Fire Resistance Ratings		All applicable fire safety codes will be conformed with to ensure life safety of the occupants of the building. Shaft enclosures with combination fire and smoke dampers will be needed at large ductwork from roof to lower floors, no variances will be sought.	X		
		Window fall protections devices will need to be installed on operable windows on second floor.	The types of windows required to be installed to meet strict energy requirements are relatively new to the market and the options available for conventional windows are not readily available in this configuration.	Our team has been working with window suppliers to determine the best course of action. Some window suppliers offer accommodations that will me this building code requirement.		X	
		Window and door operability will be required to meet ICC A117.1-2009 requirements for accessible use.	The types of windows required to be installed to meet strict energy requirements typically operate in a manner not typical of conventional window configurations.	Our team has been working with window suppliers to determine the best course of action. Some window suppliers offer accommodations that will me this building code requirement.		X	
		Electric Purveyor Regulations	There is a public service commission requirement for separate utility electric meters, they are also required by the New York State Energy Code. This adds complexity to providing energy to the apartments via solar.				X

Regulation			Impediment	Action	Resolution		
Code	**Section**	**Description**	**Explain how this regulation impedes your ability to achieve the RetrofitNY criteria.**	**What action has the team taken to date to resolve this barrier?**	**Resolved**	**Resolution in Progress**	**Seeking Assistance with Resolution**
		Financing Regulations	State office will require approval of drawings and specifications.	Conifer has reached out and made contact, solution/requirements TBD.		X	
		Financing Regulations	State office needs to approve operating budget, replacement reserves, and utility allowance for rents.	Conifer has reached out and made contact, solution/requirements TBD.		X	
		Financing Regulations	National office approval of operating budget.	Conifer has reached out and made contact, solution/requirements TBD.		X	
		NYS Housing Finance Agency Regulations	Approval of drawings and specifications will be needed.	Conifer has reached out and made contact, solution/requirements TBD.		X	
		NYS Housing Finance Agency Regulations	Approval of operating budget, replacement reserves and utility allowance are required.	Conifer has reached out and made contact, solution/requirements TBD.		X	
		NYS Housing Finance Agency Regulations	Capital funding approval is required.	Conifer has reached out and made contact, solution/requirements TBD.		X	

12 Regulatory Barrier Summary

A team approach was used to compile the list of barriers in order to implement the Retrofit design solution and worked through the issues as a team. Fortunately for this project, zoning codes were not an issue and there is acreage to provide the solar array needed.

In terms of Building Code regulatory barriers, the code requirement for window fall protection devices and ADA compliance for grasp ability and opening force of the Passive House windows was a concern that limited the number of manufacturers that could bid for the project. There are some manufacturers that can comply with the code requirements so no changes to the design were needed.

For the funding agency partners, there are other regulatory barriers. There is a pending review by USDA-RD, the panelized exterior still needs to be fully vetted prior to complete sign-off. The anticipated Federal Home Loan Bank (FHLB) funds to assist with the budgetary shortfall may not be applied per HFA guidelines. This is still to be determined.

In order to clear the path for future RetrofitNY-style projects, this needs to be seen through to fruition and the team learn from the process and document that. This is so new to the United States and there are few people who can or want to do this. For those to do want to supply materials and labor, companies need to be set up. The team is in the process of doing that with the wall panelizer, cocoon construct.

12.1 HVAC:

The existing facility utilizes a combination of natural ventilation and exhaust/infiltration to provide the code required ventilation to most of the occupied spaces. This strategy, while complying with the strict letter of the mechanical code, does not meet Passive House guidelines for optimizing energy efficiency. Also, with the proposed improvements in building envelope, this approach to ventilation can lead to issues with mold growth within the building fascia as well as poor quality ventilation. Our design provides conditioned makeup air to ventilate occupied spaces, meeting Passive House guidelines, and allowing for an efficient net zero installation while circumventing this potential problem.

Authority Having Jurisdiction (AHJ) interpretations for the coordination between code requirements for optimizing energy efficiency and provision of correct IAQ ventilation will be required to move forward with future RetrofitNY projects.

12.2 PV Solar Array:

Currently, utility tariffs regarding the connection of PV solar power for an installation similar to this require the creation of a “Community Solar Project.” This is a cumbersome and logistically difficult process, requiring all meters to be recorded monthly. This results in substantial man-hours of time invested, which increases the cost of the system. Most solar PV firms will not create a community solar project with less than 300 subscribers, as a magnitude of scale is required to make this financially feasible.

13 Resiliency Summary

While resiliency was not the ultimate goal of the design, the enclosure upgrades have the added benefit of improving the overall resiliency of the building. The designed solution significantly improves the thermal performance of the building enclosure, which will benefit both tenants and the building owner during extreme weather events. It is the building owner's priority to keep tenants safe, healthy and comfortable during adverse weather, and to allow the tenants to stay in their residences during extended events.

As the property is located in climate zone 6, the primary resiliency consideration is cold weather and power outages due to winter storms. Following renovations, the building will be better equipped to maintain comfortable temperatures during cold spells and power outages and should allow tenants to shelter in place for longer periods without the need to move tenants to shelters or hotels.

The primary driver for this added resiliency is the panelized exterior insulation and strong focus on air-sealing. The continuous insulation and lower infiltration rates will appreciably reduce thermal losses during cold weather. Additionally, these measures have the added effect of reducing potential moisture buildup in wall assemblies, reducing the risk of rot, mold and pests. With proper maintenance, this should significantly extend the lifespan of the building. Limiting mold, rot, and pests also allows for a healthier environment for the residents.

The enclosure upgrades will have additional positive impacts on the residents. The enclosure upgrades (windows, slab insulation, walls, and roof) will maintain internal surface temperatures closer to the thermostat setpoint. Keeping surface temperatures higher helps to reduce drafts and improve tenant comfort, which is especially important in senior housing. The building will also have reduced incidental air infiltration (between outdoors and adjacent units) and have a dedicated filtered supply and exhaust ventilation. These measures will lead to improved indoor air quality as the units will now have fully tempered and filtered fresh air.

Indicator	Design Solution
Protection: Identify strategies to reduce a building's vulnerability to extreme weather:	
Floodproofing or Flood Control	None
Sewer Backflow Prevention	Existing building sewer system is being utilized.

Mechanical Equipment Protection and Location	Rooftop location of heat pump heat recovery units on manufacturer's specialty stands to be elevated to ensure operation under winter snow conditions. Rooftop location of dedicated outside air unit on manufacturer's insulated roof curb.
Electrical Equipment Protect and Location	All electrical equipment is located in the existing main electrical room. The solar plant and inverters are designed to be installed outdoors.
Backup Power Location and Protection	Emergency battery packs are provided for building egress.
Communications	None
Envelope Protection	The significant amounts of continuous insulation combined with air sealing measures (aerobarrier) will minimize heat loss. These improvements to the enclosure will allow the building to maintain comfortable temperatures for extended periods during extreme cold or hot weather, even in the event of power loss.
Fire Protection	The fire alarm system is equipped with a battery plant sized for 60 hours of continuous operation.
Adaptation: Identify strategies that improve a facility's ability to adapt to changing climate conditions:	
Envelope Design	Panelized system allows for a significant layer of continuous insulation. Combined with the existing walls, the building should be able to maintain comfortable temperatures during extreme heat waves or cold snaps.
Mechanical Equipment	HVAC zone conditioning units are fully modulating with electronic thermostatic expansion valves to provide variable capacity for both heating and cooling for each zone.
Passive Cooling or Ventilation Strategies	Windows are fully operable allowing for natural ventilation during moderate weather. High-efficiency ERVs will allow for minimized conditioning loads.
In-unit	High-efficiency HVAC equipment better condition and ventilate apartments. Additionally, compartmentalization measures allow tenants better control of their apartment conditions, resulting in less open windows and a healthier environment.
Site	On site solar array will allow the building to produce 100% of annual electricity use. This minimizes the building's impact on the climate, as well as makes the building resilient during power outages.
Backup: Identify strategies that provide critical needs for when a facility loses power or other services:	
Critical Systems with Backup	Battery powered backup is provided for egress and exit lighting, along with Fire Alarm
Backup Power Type	Lithion Ion and Nickel Cadmium
Access to Potable Water and Sanitary Services	Connected to town water should allow for potable water access even during power outages
Safety Precautions for Mechanical Equipment Operations	Heat pumps and ERV are able to operate in cold conditions and effectively defrost themselves automatically.
Community: Identify strategies that encourage behavior which enhances resilience:	
Emergency Management Awareness for Residents	None
Access to Manuals, Emergency Event Guidelines	None

14 Resident Health Impact Summary

Maintaining indoor air quality was a strong consideration for the team. The levels of incidental air infiltration will be significantly reduced through the strict air tightness goals (achieved through Aerobarrier and external air barriers). The units will be compartmentalized as well, preventing transfer of air between apartments. Finally, the balanced ventilation system provided by the DOAS unit, will exhaust apartment air while supplying filtered and conditioned fresh air. This constant exchange will greatly reduce levels of volatile organic compounds, air pollutants and outdoor contaminants (pollen, dust, etc.). As mentioned previously, the enclosure upgrades will should also greatly reduce the risk of moisture buildup in the wall. This has the added benefit of reducing the resident's exposure to unhealthy mold and mildew.

All features of the RetrofitNY project will improve the residents' health and comfort from the increased thermal insulation on the walls and roof, the air sealing and super windows will eliminate drafts and condensation around windows. The LED lights will emit little heat and use very little energy. The HVAC will include heating and cooling and a central Energy Recovery Ventilator will provide constant fresh air into the apartments and exhaust pollutants continuously.

14.1 HVAC

The addition of light commercial grade cooling to each space via air source refrigerant heat pumps as well as use of ventilation air that is pre-processed with filtration, temperature, and humidity control will greatly improve the indoor air quality (IAQ) for residents. The current installation makes use of natural ventilation by operable windows and negative apartment pressurization, which can be a huge contributor to humidity problems leading to mold, as well as a pathway for pest infiltration. Under less than ideal outdoor conditions in the current configuration, residents are unlikely to open their windows, limiting the ventilation supplied to occupied spaces with consequent negative impact on the residents.

The design meets the required ventilation criteria with ducted "room neutral" ventilation air to all occupied spaces in the facility as required by code. Active ventilation is provided in our design using a central rooftop Dedicated Outside Air Unit (DOAS). In addition to the code required constant exhaust from each apartment, this should provide sufficient indoor air exchanges to greatly reduce any VOC or indoor contaminants.

14.2 Plumbing:

In order to decrease the potential of Legionella within the dwelling units, the domestic hot water will be produced and stored at 140°F. This temperature has been proven to kill the legionella bacteria that exist in all water. By killing the bacteria within the domestic hot water system, the odds of contracting Legionnaires Disease are greatly reduced as the bacteria must be inhaled into the lungs in order to pose a health risk. The dwelling shower units is the most common place this could occur.

14.3 Indoor Air Quality:

Maintaining indoor air quality was a strong consideration of the team. The levels of incidental air infiltration will be significantly reduced through the strict air tightness goals (achieved through Aerobarrier and external air barriers). The units will be compartmentalized as well, preventing transfer of air between apartments. Finally, the balanced ventilation system provided by the DOAS unit, will exhaust apartment air while supplying filtered and conditioned fresh air. This constant exchange will greatly reduce levels of volatile organic compounds, air pollutants and outdoor contaminants (pollen, dust, etc.). As mentioned previously, the enclosure upgrades will should also greatly reduce the risk of moisture buildup in the wall. This has the added benefit of reducing the resident's exposure to unhealthy mold and mildew.

Indicator	Location	Intervention	
		Design Solution	**Maintenance Plan**
Mold	Units - Kitchens	Continuous code required exhaust, dehumidification capability for central makeup air unit to maintain average facility indoor humidity below 60% RH. In unit cooling will also allow for dehumidification.	Standard maintenance plan for all equipment (filters, component / coil inspection, etc.)
	Units - Bathrooms	Continuous code required exhaust, dehumidification capability for central makeup air unit to maintain average facility indoor humidity below 60% RH	Standard maintenance plan for all equipment (filters, component / coil inspection, etc.)
	Units - Windows and Exterior Doors	Triple pane windows and thermally broken exterior doors will minimize condensation risks, lowering the chance of mold	Standard maintenance plan—periodic inspection of weatherstripping, seals, and joints will identify any potential issues
	Units - Mechanical Rooms	Unit mechanical rooms house only the domestic water heater. Since inside the apartment vapor barrier, and having no significant moisture production, these rooms humidity should match the balance of the facility. Above ceiling fan coil units have cooling coil drain pans with integral condensate pumps and condensate drain alarm and unit shutdown.	Periodic inspections and maintenance
	Common Areas - Windows and Exterior Doors	Triple pane windows and thermally broken exterior doors will minimize condensation risks, lowering the chance of mold	Standard maintenance plan—periodic inspection of weatherstripping, seals, and joints will identify any potential issues
	Common Areas - Mechanical Rooms	N/A	
	Below Grade	Building is slab on grade	
Pests	Units	Compartmentalization measures will greatly reduce pathways for pests between units	Respond to tenant input as needed
	Common Areas	Compartmentalization measures will greatly reduce pathways for pests between spaces.	Periodic inspection of common areas should identify pest intrusion. Standard maintenance of exterior and interior surfaces should prevent pest intrusions.
	Below Grade	Building is slab on grade	
	Exterior	Continuous insulation and finishing reduce the number of openings for rodents or other pests, limiting opportunities to enter the building. Exterior insulation should also minimize the chances of water infiltration, keeping structure dry and free from rot.	Periodic inspection for damage or entry by pests should be done by staff

VOCs (enter level of VOCs in products: conventional, low- or no-VOC)	Units - Paints	All be low or no VOC	Specify that maintenance and contractors continue to use similar products
	Units - Coatings	All be low or no VOC	Specify that maintenance and contractors continue to use similar products
	Units - Primers	All be low or no VOC	Specify that maintenance and contractors continue to use similar products
	Units - Adhesives and Sealants	All be low or no VOC	Specify that maintenance and contractors continue to use similar products
	Units - Flooring Materials	All be low or no VOC	Specify that maintenance and contractors continue to use similar products
	Common Areas - Paints	All be low or no VOC	Specify that maintenance and contractors continue to use similar products
	Common Areas - Coatings	All be low or no VOC	Specify that maintenance and contractors continue to use similar products
	Common Areas - Primers	All be low or no VOC	Specify that maintenance and contractors continue to use similar products
	Common Areas - Adhesives and Sealants	All be low or no VOC	Specify that maintenance and contractors continue to use similar products
	Common Areas - Flooring Materials	All be low or no VOC	Specify that maintenance and contractors continue to use similar products
Other Contaminants	Units	All be low or no VOC	Specify that maintenance and contractors continue to use similar products
	Common Areas	All be low or no VOC	Specify that maintenance and contractors continue to use similar products

15 Overall Rehab Proposal

15.1 Portville Square – A NYSERDA RetrofitNY Pilot Project.

SWBR is currently the design architect for a test pilot project that is utilizing the current NYSERDA RetrofitNY program to renovate and modernize an existing two-story, 24-unit affordable apartment project in Portville, NY called Portville Square. The project is one of five remaining test projects selected across New York State in 2018 to participate in this program. SWBR has been working very closely for more than 10 months with team members from NYSERDA in an interactive and collaborative design process with the entire design team, energy consultants and exterior panelized wall fabricators to create a cutting edge sustainable, scalable and replicable solution to get the project to or near a net zero energy performance level.

RetrofitNY, a NYSERDA initiative, is revolutionizing the way buildings are renovated in New York State. The goal is to spearhead the creation of standardized, scalable solutions and processes that will improve the aesthetic and comfort of residential buildings while dramatically improving their energy performance. RetrofitNY is working aggressively to bring a large number of affordable housing units to or near net zero energy use by 2025 and improving the quality of life for affordable housing residents.

The goals of the RetrofitNY program for Portville Square are:

- To develop a cutting-edge design that improve living space comfort and indoor air quality, as well as the exterior aesthetics of the current building.
- To provide substantial savings on utility and maintenance expenses for building owner and/or residents, and use these savings to finance the improvements
- To serve as a model for the industry beyond New York to follow in encouraging energy efficiency in other existing buildings

Background: Portville Square was constructed in 1986 and is a two-story wood framed affordable senior housing project. The exterior walls are 2x6 wood stud framed with face brick and asphalt shingle covered mansard exterior cladding. The ground floor is concrete slab on grade. The second floor and roof structure (flat roof) is composed of premanufactured open web wood floor trusses. The building and apartments are heated via electric resistance baseboard and there is no cooling available for the residents. Domestic hot water is via individual electric water tanks.

A BAU renovation scope was created by the project owner as a baseline to use against the RetrofitNY program. The BAU was a limited scope renovation that included basic facility upgrades (finishes, lighting, roofing, siding, windows, etc). Project costs were developed for the BAU scope as a template to begin to understand any additional costs created by the innovative ideas that were developed for the deep energy RetrofitNY program.

Design concepts for the project were developed in a highly interactive and collaborative design and review process that included all design team members working closely with NYSERDA and their team members. The results of the current schematic design include the following design solutions:

- A state-of-the-art exterior panelized pre-insulated cladding design by cocoon construct with integrated triple glazed Passive House rated windows installed in the factory and transported to the field for erection. Exterior finishes would be pre-installed, and the panels will be hoisted into place and fastened to existing building. This will minimize construction schedules and tenant displacement and will allow systems and finishes to be installed in a controlled environment. For this process, cocoon construct will engage with Syracuse University's Building Energy and Environmental Systems Laboratory and Syracuse Center of Excellence to complete final R&D efforts.
- Protected Roof Membrane Assembly (PRMA). Low Slope Roof w/ R-40 Extruded Polystyrene Insulation w/ fabric and river roof ballast over existing R11.2 EPDM below.
- Individual low profile, high-efficiency, ducted refrigerant heat pumps for each apartment with associated outdoor units on flat roof.
- Additional ducted or ductless refrigerant heat pumps for common spaces.
- Coordination with architect for new dropped ceiling at apartment entry to accommodate distribution ductwork and refrigerant piping.
- Use of soffits and the ceiling joist space in corridors for exhaust and ventilation air ductwork
- Rooftop dedicated outdoor air unit to supply ventilation air and facility exhaust with total enthalpy recovery wheel for energy recovery from exhaust/relief air. Unit includes refrigerant heat pump for conditioning and dehumidification of ventilation air.
- All existing lighting in apartments, common spaces, and building exterior will be replace with LED luminaires. Luminaires will use substantially less energy, and will be more attractive
- Provide a ground mounted PV solar array on the site and connect to a 208Y/120-volt, 400 ampere, three phase utility meter. A 134.6kW System (producing 158,400 kWh/yr) to accommodate electric water heaters.
- Utilize energy produced by the solar array to offset the building "House" energy usage; all tenants pay apartment electrical energy usage.

Of great concern to the design team and NYSERDA were the on-going well-being of the residents that will be living there. This is one of the challenges of working around the residents and minimize their disturbance. The following Health and Comfort considerations have been recognized:

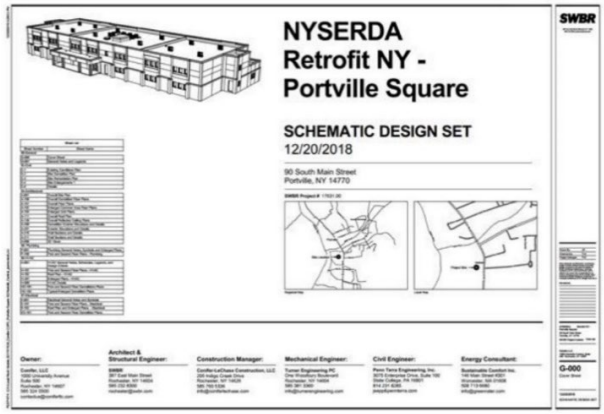
- High R-value walls and PH certified windows
- Compartmentalization/air sealing via Aerobarrier
- Tempered and filtered supply air from central ERV

Tenant education was also an important consideration for the team, with the following being integral in the success of the final product:

- Resident engagement and education of the proposed renovations
- On-site meetings providing an “Information Packet”
- Energy usage education
- On-site Q&A sessions during Construction
- Ongoing energy monitoring

In addition to minimizing the impact on the residents, we hope to work through the regulatory barriers, cocoon construct and the owner’s and contractor’s risk management items associated with cocoon construct as well as the budget gap funding. Obviously with this building the first of its kind, there will be some challenges going through the construction process, but the team members are fully invested in this. Our Team looks forward to having this RetrofitNY project completed, this is a wonderful opportunity to deliver a 1986 building to a net zero building for many years to come.

Appendix A. Schematic Design Documents



CONIFER PORTVILLE RETROFIT
TE PROJECT NO. 18118
DECEMBER 19, 2018

SPECIFICATION LIST

DIVISION 22 - PLUMBING

2 2 00 10	BASIC PLUMBING REQUIREMENTS
22 05 20	VALVES
22 05 30	PLUMBING IDENTIFICATION
22 07 00	INSULATION
22 10 10	PIPING SYSTEMS AND ACCESSORIES
22 30 20	DOMESTIC WATER HEATERS
22 50 00	PLUMBING FIXTURES AND TRIM
22 70 00	NATURAL GAS SYSTEMS

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING

23 00 10	BASIC MECHANICAL REQUIREMENTS
23 00 30	ELECTRIC WIRING
23 07 50	INSULATION
23 09 90	TESTING, ADJUSTING AND BALANCING
23 21 10	PIPING SYSTEMS AND ACCESSORIES
23 31 00	SHEET METAL AND DUCTWORK ACCESSORIES CONSTRUCTION
23 55 10	UNIT HEATERS AND CABINET UNIT HEATERS (HYDRONIC AND ELECTRIC)
23 74 33	PACKAGED ROOFTOP DEDICATED OUTDOOR AIR SYSTEMS
23 81 55	AIR SOURCE REFRIGERANT HEAT PUMPS

Cut sheets
Project Manual
Rendering
Schematic Design Drawings
Specifications

(Click on links to access the Schematic Design Documents)

Appendix B. Scalability Strategy

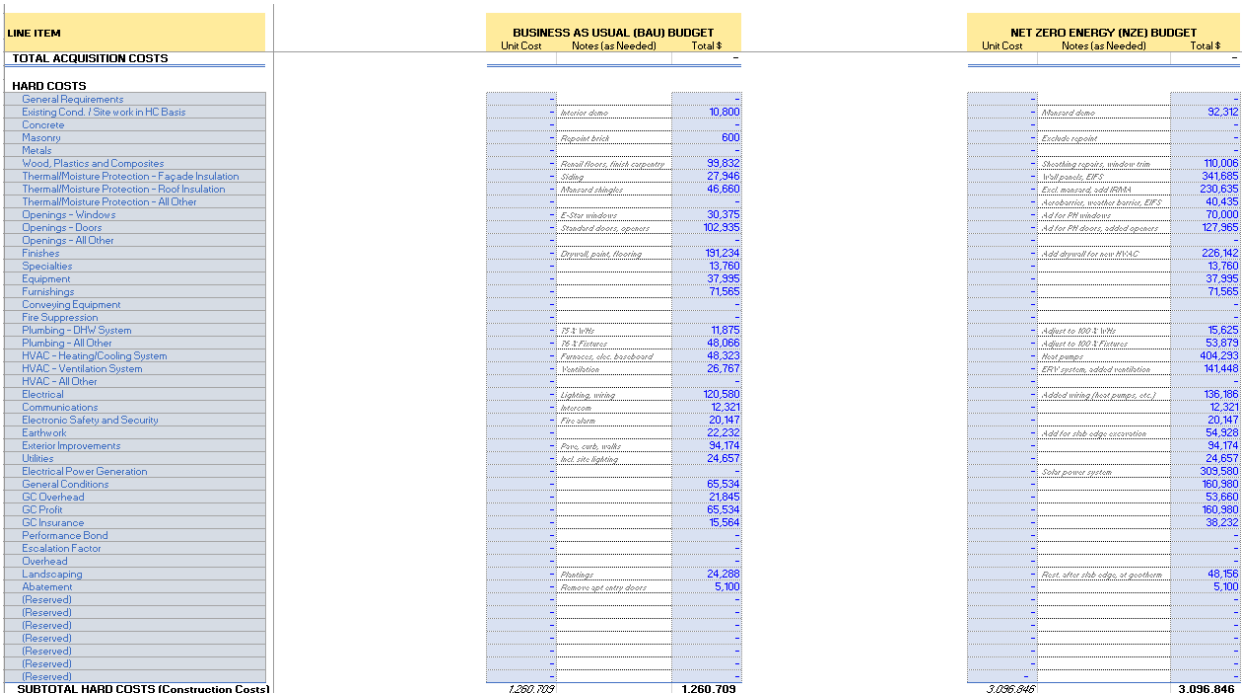
NYSERDA RetrofitNY – Schematic Design
Scalability Strategy
Team:

Building System	Describe strategy for successfully measuring, producing and installing the solution at scale on similar buildings. Include detail on building system sub-components (i.e. piping, windows, etc.)	If design solutions with a better potential for scalability were considered, describe the solutions and explain why they did not make it to the final design (i.e., cost, product availability, aesthetics, etc.)
Ventilation and IAQ	Code mandated ventilation, exhaust and IAQ air exchanges are supplied by a central rooftop Dedicated Outside Air Unit (DOAS) with energy recovery, appropriately ducted to each occupied space. These units can be scaled, as required, to the size of facility.	
Space Heating/Cooling	Space heating/cooling is by individual air source refrigerant heat pumps with associated outdoor heat recovery units and refrigerant linesets. These units designated for each HVAC zone (i.e. apartment), are available in a range of capacities from a variety of manufacturers, and can be easily scaled with size of project.	
Domestic Hot Water	Domestic hot water shall be provided by individual, electric, 40 gallon tank storage water heaters with a minimum efficiency factor (EF) of 0.92 to meet or exceed the requirements of the 2015 International Energy Conservation Code.	A central geothermal domestic hot water plant was considered utilizing a water-to-water heat pump, but was not pursued due to the cost constraints associated with the geothermal well field.
Miscellaneous Electric Loads		
Façade		
Roof		
Distributed Energy Resources	Solar power is being provided on site, sized to accommodate all house and apartment loads for the year, based on kWh usage. The estimated energy usage was determined through energy modelling.	

Project unit cost for reproducing the retrofit solution at scale.

Location	Pilot Project (1 unit)	10 units	100 units	1,000 units	10,000 units

Appendix C. Budget and Financing Plan



LINE ITEM	BUSINESS AS USUAL (BAU) BUDGET Unit Cost	Notes (as Needed)	Total $	NET ZERO ENERGY (NZE) BUDGET Unit Cost	Notes (as Needed)	Total $
TOTAL ACQUISITION COSTS			-			-
HARD COSTS						
General Requirements	-		-	-		-
Existing Cond. / Site work in HC Basis	-	Interior demo	10,800	-	Measured demo	92,312
Concrete	-		-	-		-
Masonry	-	Repoint brick	600	-	Exclude repoint	-
Metals	-		-			-
Wood, Plastics and Composites	-	Retail floors, finish carpentry	99,832	-	Sheathing repairs, window trim	110,006
Thermal/Moisture Protection - Façade Insulation	-	Siding	27,946	-	Wall panels, EIFS	341,685
Thermal/Moisture Protection - Roof Insulation	-	Measured shingles	46,660	-	Excl measured, add RINA	230,635
Thermal/Moisture Protection - All Other	-		-	-	Aerobarrier, weather barrier, EIFS	40,435
Openings - Windows	-	E-Star windows	30,375	-	Adj for PH windows	70,000
Openings - Doors	-	Standard doors, openers	102,935	-	Adj for PH doors, added openers	127,965
Openings - All Other	-		-	-		-
Finishes	-	Drywall, paint, flooring	191,234	-	Add drywall for new HVAC	226,142
Specialties	-		13,760	-		13,760
Equipment	-		37,995	-		37,995
Furnishings	-		71,565	-		71,565
Conveying Equipment	-		-			-
Fire Suppression	-		-	-		-
Plumbing - DHW System	-	DI & WHr	11,875	-	Adjust to 100 & WHr	15,625
Plumbing - All Other	-	DI & Fixtures	48,066	-	Adjust to 100 & Fixtures	53,879
HVAC - Heating/Cooling System	-	Furnaces, elec. baseboard	48,323	-	Heat pumps	404,293
HVAC - Ventilation System	-	Ventilation	26,767	-	ERV system, added ventilation	141,448
HVAC - All Other	-		-	-		-
Electrical	-	Lighting, wiring	120,580	-	Added wiring (heat pumps, etc.)	136,186
Communications	-	Intercom	12,321	-		12,321
Electronic Safety and Security	-	Fire alarm	20,147	-		20,147
Earthwork	-		22,232	-	Add for slab edge excavation	54,928
Exterior Improvements	-	Pave, curb, walks	94,174	-		94,174
Utilities	-	Incl. site lighting	24,657	-		24,657
Electrical Power Generation	-		-	-	Solar power system	309,580
General Conditions	-		65,534	-		160,380
GC Overhead	-		21,845	-		53,660
GC Profit	-		65,534	-		160,380
GC Insurance	-		15,564	-		38,232
Performance Bond	-		-	-		-
Escalation Factor	-		-	-		-
Overhead	-		-	-		-
Landscaping	-	Plantings	24,288	-	Rust, after slab edge, at geotherm	48,156
Abatement	-	Remove spt entry doors	5,100	-		5,100
(Reserved)	-		-	-		-
(Reserved)	-		-	-		-
(Reserved)	-		-	-		-
(Reserved)	-		-	-		-
(Reserved)	-		-	-		-
(Reserved)	-		-	-		-
(Reserved)	-		-	-		-
SUBTOTAL HARD COSTS (Construction Costs)	1,260,709		1,260,709	3,096,946		3,096,846

(Click on image to access the Budget and Financing Plan)

Appendix D. Projected Construction Schedule

Work Package	Task	Start	Days	Completion
PRECONSTRUCTION	CDs Complete	T 10/30/18	4	M 11/05/18
	Permits Pulled	S		S
	Construction Contract Finalized	S		S
	Project Closing Date	S		S
PROCUREMENT	Procurement Period	S		S
CONSTRUCTION	Site Prep and Demolition	M 3/11/19	73	F 6/21/19
	-Building Envelope	S		S
	-Mechanical Systems	S		S
	Exterior Renovation	S		S
	-Building Envelope	M 3/4/19	117	F 8/16/19
	-Mechanical Systems	S		S
	Interior Renovation	M 4/15/19	87	F 8/16/19
	-Building Envelope	S		S
	-Mechanical Systems	M 4/15/19	87	F 8/16/19
	Installation Onsite Renewables	S		S
CLOSEOUT	Equipment Start up and Testing	S		S
	Commissioning of Systems	S		S
	Punchlist Inspection	S		S
	Correction of Punchlist Items	S		S
	Final Inspection	S		S
	Project Complete	S		S

(Click on image to access the Projected Construction Schedule)

Appendix E. Building Performance Summary

			Design/Rating	Manufacturer	Model	
Envelope	Above Grade Wall - Mechanical Shed	Construction	2x4 wood frame @ 16" OC with mineral wool insulation, 2" ZIP-R sheathing, fibercement clapboard siding	Huber Rockwool	Zip R-Sheathing Comfortbatt	Shop fabricate façade per buil
		U-value	0.05			
	Above Grade Wall - Existing	Construction	2x6 wood frame @ 15" OC with fiberglass insulation, OSB sheathing, engineered wood siding			Existing wall (n
		U-value	0.089			
	Continuity Insulation and Sealing	Penetrations through envelope	Ceiling/Attic Floor: Spray foam (exg.) Walls: Caulk and seal outlet boxes, sill plate at drywall Windows: New windows will be taped and sealed to rough openings.			Buildings unde the Weatheriza
		Air tightness (ACH_{50})	< 2.0 ACH50 verified through blower door testing			
	Slab on Grade - Existing	Construction	Slab on grade, 2" XPS on interior of foundation wall to footer and 1" XPS thermal break at slab edge			Existing slab or
		U-value	U-0.2			
	Floor Adjacent to Outdoors - Mechanical Shed	Construction	2x8 wood frame @ 16" OC with mineral wool insulation	Rockwool	Comfortbatt	Shop fabricate
		U-value	0.044			
	Ceiling - Existing	Construction	Wood truss, attic floor insulated with 18" blown cellulose (exg.)			Existing ceiling Buildings unde the Weatheriza
		U-value	0.016			
	Ceiling - Corridor	Construction	Wood truss, attic floor insulated with 18" blown cellulose			Insulation will b above the new insulation all pe
		U-value	0.016			
	Ceiling - Shed	Construction	Wood framed, ceiling insulated with 12" blown cellulose			Shop fabricate
		U-value	0.025			
	Fenestration	Framing	0.193	Zola uPVC	Thermo uPVC	Manufacture st communicating European Arch
		Glazing	0.09			
		Assembly U-factor	0.15			
		Assembly SHGC	0.34			
	Doors - Patio/Porch	Type/description	Outswing patio, low or no threshold at sill, uPVC	Zola uPVC	Thermo uPVC	See above cor Challenging to 6'-8" RO at apa with above mar when locked). I expensive, so r
		U-factor	0.16			
	Doors - Main Entry	Type/description	Outswing Entry, ADA compliant, uPVC or Aluminum	Zola uPVC	Thermo uPVC	ADA compliant option might ha

(Click on images to access the Building Performance Summary and Modeling Report)

Appendix F. Resident Management Plan

NYSERDA RetrofitNY – Schematic Design
Resident Management Plan
Team:

Please use this template to complete the Resident Management Plan. Click on the text boxes below each heading to find additional instructions.

Management Plan

Goals

Resident engagement from RetrofitNY application acceptance through construction completion and turnover.
Resident action plan to assist in understanding building energy reduction.

Length of construction phase

Refer to Construction Schedule.

Length of resident management plan

Entire project and continuing beyond.

Plan for resident notifications and communication

Resident 'Town' meetings to explain process, goals of program, resident responsibilities. Property management will be assisting overall engagement with residents and has an open-door policy regarding Retrofit questions and process.

Resident liaison or resident groups

TBD.

In-unit construction plan

See Construction Schedule

Exterior construction plan

See Construction Schedule

Parking impacts

Parking lot will already be completely replaced as part of overall portfolio rehab. Retrofit has no additional impacts.

Plan for special needs

Any special needs will be addressed by Property Management as part of typical operations.

Expected areas of pushback

Residents are very excited about the project. Normal curiosity is expected, and any minimal pushback will be mitigated once the project is fully explained.

Residents' Meeting Plan

Plan for initial resident outreach

Initial Outreach meeting has already occurred. Continuing monthly meetings are planned during project implementation.

Kickoff event

TBD.

Resident update meetings

See notes above.

(Click on image to access the Resident Management Plan)

Appendix G. Performance Guarantee Pathway

NYSERDA RetrofitNY – Schematic Design Performance Guarantee Pathway Team:

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Please complete both the Maintenance and Warranties section as well as the M&V section below.

Maintenance and Warranties

Which of your solution's energy performance parameters can be guaranteed (e.g. heat pump COP, on-site kWh production, Btu/person/HDD for heating, BTU/person/CDD for cooling, etc.)? Include a list that maps each parameter to its corresponding building system(s)

(HRU-1 and HRU-2) Outdoor Heat Pump Cooling SEER and EER. (HRU-1 and HRU-2) Outdoor Heat Pump Heating HSPF. (DOAS-1) Dedicated Outside Air System Cooling EER, Heating COP and Energy Wheel Efficiency.

LED Lighting Efficiency

What are the warranty term lengths for the various building systems included in your solution?

DOAS-1: 1 year parts and labor, 5 years compressor

HRU-1, HRU-2: 2 years parts, 6 years compressor (if installed by approved technician and commissioning report submitted)

HW-1: 6 year limited tank and parts

LED Lighting: 1 year parts and labor.

List the schedule of high-level maintenance needs through your project's lifetime for each building system including major interventions (i.e. heat pump compressor replacements). Include building systems that are expected to require little to no maintenance and specify as such

HRU and DOAS heat pump compressors (typ. 15-20 year lifespan), DOAS air filters (seasonal), FCU air filters (annual)

How should your solution's maintenance schedules and warranties be aligned/coordinated in order to provide a comprehensive extended warranty to last the duration of the project lifetime, ultimately becoming a performance guarantee? Break out by building system

As part of Conifer's standard maintenance schedule: HVAC, HW & LED lighting as noted above will all be fully coordinated with warranties.

Who will provide the maintenance work and performance guarantee for each building system?

Conifer will provide maintenance. Performance guarantee TBD.

(Click on image to access the Performance Guarantee Pathway)

Appendix H. Regulatory Barrier Summary

NYSERDA RetrofitNY – Schematic Design
Regulatory Barrier Summary
Team: Conifer - Portville Square

Regulation			Impediment	Action	Resolution		
Code	Section	Description	Explain how this regulation impedes your ability to achieve the RetrofitNY criteria.	What action has the team taken to date to resolve this barrier?	Resolved	Resolution in Progress	Seeking Assistance with Resolution
		Zoning Requirements		Contact has been made with the municipality and no barriers have been identified at this time by the town that would inhibit the success of this project.	X		
		Fire Resistance Ratings		All applicable fire safety codes will be conformed with to ensure life safety of the occupants of the building. Shaft enclosures with combination fire and smoke dampers will be needed at large ductwork from roof to lower floors, no variances will be sought.	X		
		Window fall protections devices will need to be installed on operable windows on second floor.	The types of windows required to be installed to meet strict energy requirements are relatively new to the market and the options available for conventional windows are not readily available in this configuration.	Our team has been working with window suppliers to determine the best course of action. Some window suppliers offer accommodations that will me this building code requirement.		X	
		Window and door operability will be required to meet ICC A117.1-2009 requirements for accessible use.	The types of windows required to be installed to meet strict energy requirements typically operate in a manner not typical of conventional window configurations.	Our team has been working with window suppliers to determine the best course of action. Some window suppliers offer accommodations that will me this building code requirement.		X	
		Electric Purveyor Regulations	There is a public service commission requirement for separate utility electric meters, they are also required by the New York State Energy Code. This adds complexity to providing energy to the apartments via solar.				X
		Financing Regulations	State office will require approval of drawings and specifications.	Conifer has reached out and made contact, solution/requirements TBD.		X	
		Financing Regulations	State office needs to approve operating budget, replacement reserves, and utility allowance for rents.	Conifer has reached out and made contact, solution/requirements TBD.		X	

(Click on image to access the Regulatory Barrier Summary)

Appendix I. Resiliency Summary

NYSERDA RetrofitNY – Schematic Design
Resiliency Summary
Team:

NEW YORK STATE OF OPPORTUNITY. NYSERDA

Indicator	Design Solution
Protection: Identify strategies to reduce a building's vulnerability to extreme weather:	
Floodproofing or Flood Control	None
Sewer Backflow Prevention	Existing building sewer system is being utilized.
Mechanical Equipment Protection and Location	Rooftop location of heat pump heat recovery units on manufacturer's specialty stands to be elevated to ensure operation under winter snow conditions. Rooftop location of dedicated outside air unit on manufacturer's insulated roof curb.
Electrical Equipment Protect and Location	All electrical equipment is located in the existing main electrical room. The solar plant and inverters are designed to be installed outdoors.
Backup Power Location and Protection	Emergency battery packs are provided for building egress.
Communications	None
Envelope Protection	The significant amounts of continuous insulation combined with air sealing measures (aerobarrier) will minimize heat loss. These improvements to the enclosure will allow the building to maintain comfortable temperatures for extended periods during extreme cold or hot weather, even in the event of power loss.
Fire Protection	The fire alarm system is equipped with a battery plant sized for 60 hours of continuous operation.
Adaptation: Identify strategies that improve a facility's ability to adapt to changing climate conditions:	
Envelope Design	Panelized system allows for a significant layer of continuous insulation. Combined with the existing walls, the building should be able to maintain comfortable temperatures during extreme heat waves or cold snaps.
Mechanical Equipment	HVAC zone conditioning units are fully modulating with electronic thermostatic expansion valves to provide variable capacity for both heating and cooling for each zone.
Passive Cooling or Ventilation Strategies	Windows are fully operable allowing for natural ventilation during moderate weather. High efficiency ERVs will allow for minimized conditioning loads.
In-unit	High efficiency HVAC equipment better condition and ventilate apartments. Additionally, compartmentalization measures allow tenants better control of their apartment conditions, resulting in less open windows and a healthier environment.
Site	On site solar array will allow the building to produce 100% of annual electricity use. This minimizes the building's impact on the climate, as well as makes the building resilient during power outages.
Backup: Identify strategies that provide critical needs for when a facility loses power or other services:	
Critical Systems with Backup	Battery powered backup is provided for egress and exit lighting, along with Fire Alarm
Backup Power Type	Lithion Ion and Nickel Cadmium
Access to Potable Water and Sanitary Services	Connected to town water should allow for potable water access even during power outages

(Click on image to access the Resiliency Summary)

Appendix J. Resident Health Impact Summary

NYSERDA RetrofitNY – Schematic Design
Resident Health Impact Summary
Team:

Indicator	Location	Intervention	
		Design Solution	Maintenance Plan
Mold	Units - Kitchens	Continuous code required exhaust, dehumidification capability for central makeup air unit to maintain average facility indoor humidity below 60% RH. In unit cooling will also allow for dehumidification.	Standard maintenance plan for all equipment (filters, component / coil inspection, etc)
	Units - Bathrooms	Continuous code required exhaust, dehumidification capability for central makeup air unit to maintain average facility indoor humidity below 60% RH	Standard maintenance plan for all equipment (filters, component / coil inspection, etc)
	Units - Windows and Exterior Doors	Triple pane windows and thermally broken exterior doors will minimize condensation risks, lowering the chance of mold	Standard maintenance plan – periodic inspection of weatherstripping, seals and joints will identify any potential issues
	Units - Mechanical Rooms	Unit mechanical rooms house only the domestic water heater. Since inside the apartment vapor barrier, and having no significant moisture production, these rooms humidity should match the balance of the facility. Above ceiling fan coil units have cooling coil drain pans with integral condensate pumps and condensate drain alarm and unit shutdown.	Periodic inspections and maintenance
	Common Areas - Windows and Exterior Doors	Triple pane windows and thermally broken exterior doors will minimize condensation risks, lowering the chance of mold	Standard maintenance plan – periodic inspection of weatherstripping, seals and joints will identify any potential issues
	Common Areas - Mechanical Rooms	N/A	
	Below Grade	Building is slab on grade	
Pests	Units	Compartmentalization measures will greatly reduce pathways for pests between units	Respond to tenant input as needed
	Common Areas	Compartmentalization measures will greatly reduce pathways for pests between spaces.	Periodic inspection of common areas should identify pest intrusion. Standard maintenance of exterior and interior surfaces should prevent pest intrusions.
	Below Grade	Building is slab on grade	
	Exterior	Continuous insulation and finishing reduces # of openings for rodents or other pests, limiting opportunities to enter the building. Exterior insulation should also minimize the chances of water infiltration, keeping structure dry and free from rot	Periodic inspection for damage or entry by pests should be done by staff
VOCs	Units - Paints	All be low or no VOC	Specify that maintenance and contractors continue to use similar products

(Click on image to access the Resident Health Impact Summary

NYSERDA, a public benefit corporation, offers objective information and analysis, innovative programs, technical expertise, and support to help New Yorkers increase energy efficiency, save money, use renewable energy, and reduce reliance on fossil fuels. NYSERDA professionals work to protect the environment and create clean-energy jobs. NYSERDA has been developing partnerships to advance innovative energy solutions in New York State since 1975.

To learn more about NYSERDA's programs and funding opportunities, visit nyserda.ny.gov or follow us on Twitter, Facebook, YouTube, or Instagram.

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