Siting

The development of our project began with the strategic siting of our building. The site, adjacent to the Gowanus canal, offers opportunities for resiliency, electrical and thermal energy production, and connectivity to the rest of the city. This former industrial area has been transforming into a vibrant and diverse neighborhood. Tree-lined streets and reduced density make it a desirable residential area. Open, adjacent lots provide opportunity for park development and urban farming. The site is within walking distance from the subway, Prospect park, and Whole Foods.

This location was also inspired by other innovative projects in the region. Recently built designs have proven that tidal power generation is feasible from the current of the East River without disturbing wildlife or shipping. Ten (10) slowly spinning, 20' turbines can provide 600 MWh of clean energy to the building, reducing the source energy consumption by nearly 20%. In addition, the river acts as a heat source/sink for the water-source heat pumps. The efficiency of the heat exchanges outperforms the geothermal system in the shoulder seasons while providing redundancy.

Adaptive Reuse

A major component of the design strategy is adaptive reuse. Rather than working with demolition and ground up construction our team chose a site that has an abandoned, brick power plant. Our proposal includes the restoration of the structure with a focus on energy efficient construction and locally sourced materials. The existing building will serve as the entry and public portion of the project, hosting the retail and lobby areas, with an improved envelope.

The new portion of the building is lifted 80ft off the ground, hovering above the existing structure. This not only preserves the existing building and highlights its historic significance but also locates the residential and mechanical floors above the 500-year flood plain. In addition, the plaza beneath is home to the geothermal wells. The 1,500 feet deep geothermal wells act as a reliable source of energy for heating and cooling, independent of the ambient weather. Traditional air-cooled chiller will provide backup heating and cooling when required. The remaining area beneath the plaza will contain a potable water storage tank (90 days), a waste-water storage tank (90 days), and liquid hydrogen storage tanks. The hydrogen storage tanks are buried underground in compliance with NFPA 55 and provide backup power in the event of an emergency blackout or for demand shedding. Flood retention gardens are positioned strategically throughout plaza to mitigate potential flood damage.

Façade Strategy

The window-to-wall ratio on all facades is kept at below 30%, and high-performance glazing minimizes heat transfer and energy loss. The façade and shading strategies maximize solar exposure in the winter and reduce heat gain in the summer. The stepped façade provides shelter from the sun and creates outdoor balcony spaces for the apartments. The project is designed to have an R-50 roof, tightly sealed R-30 walls, and U-0.19 triple-pane windows with 0.25 SHGC for envelope assemblies.

The roof is fitted out with over 20,000 square feet of dual-tracking photovoltaic cells. These cells can produce approximately 600 MWh of electricity in addition to tidal power generation.

Green Spaces

The roof of the existing structure serves as a green roof and public garden. This space encourages social gathering and links the project to the surrounding community. It is also part of a larger strategy for rainwater retention, natural cooling (green roofs can reduce sensible heat transfer through a roof by ~1/3), and on-site food cultivation. The top of the new building serves as a green roof as well, with outdoor restaurant seating overlooking the water and city skyline. Ground level gardens underneath the building and along the waterfront help with flood retention, and the green roofs contribute to storm water retention. Irrigation is served from condensate and rainwater recollection and reuse. Excess condensate and storm water is used to reduce building water usage, along with low flow fixtures.

Atrium

Another design component that taps into several WELL features is the large atrium. This light well allows natural light to travel into the center of the building, supporting circadian rhythms on residential floors. The north wall of the atrium is a giant green wall which terminates at an indoor garden at the base. This provides a space for community strengthening, a refuge for the mind and body, improved air quality, circadian lighting, and a natural sound buffer.

Air Handling Unit (AHU) with Energy Recovery

All AHUs are dedicated outdoor air systems that provide ventilation air to the zones. Dual regenerative core air-side energy recovery allows for latent and sensible heat recovery of up to 95% in the winter, removing the need for humidification, and reducing the supplemental heating load to the point where it can be satisfied using waste heat. A wrap-around heat pipe is used on typical units, as well as UV lights and MERV 15 filters. Heat recovery chillers are used to balance simultaneous heating and cooling loads. All units are over-sized in order to meet the needs of an extreme heat event or period of extended cold weather.

AHUs serving the fitness centers, which are dehumidification and ventilation air driven, will also have an active desiccant wheel fired by waste heat collected by the heat recovery chillers off the precool coil. This allows dehumidification work to be done at an elevated chilled water temperature and eliminates the need for reheat from over-cooling.

Space Ventilation and Conditioning

Active chilled beams (ACB) served by fan-powered boxes will provide heating and cooling to the zones by decoupling ventilation air and sensible loads. ACB systems reduce the shaft sizes and amount of ductwork needed to supply 100% outside air. In addition, they are significantly more efficient than traditional VAV systems. Demand control ventilation at the zone level is controlled fan-powered boxes integrated with room-level sensors (temperature, RH%, and CO_2) and advanced BMS systems. Each fan powered box can determine how much outside air it needs based on air contamination levels.

Supplemental Power Production

The remaining electric load will be generated using fuel cells rather than supplementing power from the grid. Fuel cells create clean energy powered by hydrogen. Hydrogen is typically sourced from methane while sequestering CO_2 as a byproduct of the reaction. Once a hydrogen economy is achieved, this building will rely solely on renewable hydrogen as a fuel source. The other energy streams leaving the fuel cell are high-grade heat, low-grade heat, and sequestered CO_2. High grade heat is used for domestic hot water heating and zone-level reheat loops and the low-grade heat is used to supplement the preheat load. Lastly, the sequestered CO_2 is piped to the restaurant, where it will be used to produce the frizzy seltzers we will drink in celebration of this wonderful building!