Twenty River Terrace

Battery Park City
New York

Highlighting high performance

Breezes off the Hudson River waft through Battery Park City, a planned development of residential and commercial buildings and open space at the tip of lower Manhattan. A riverfront walkway and several connecting public parks sprinkled with public art flank Battery Park City on one side, and New York's busy financial district vibrates on the other. Construction continues on Battery Park's newest building, Twenty River Terrace, the first residential apartment building to embrace sustainable design in a systematic way, and the first to follow the Hugh L. Carey Battery Park City Authority Residential Environmental Guidelines. According to the guidelines, which all future Battery Park City development must follow, they "establish a process for the creation of environmentally responsible residential buildings that are appreciably ahead of current standards and practices for development."

As a result of the guidelines, and the architects' commitment to incorporating best practices, this 27-story apartment building operates 35% more efficiently than required by the New York State Energy Code, and generates some of its own electricity from building-integrated photovoltaics, especially in the summer when New York power plants struggle to keep up with air-conditioning demands. The Authority hopes the guidelines will be a good model for other developments, in Manhattan and across the world, for incorporating energy-efficient design and renewable energy. The principles of environmentally sound, people-centered planning and development addressed by Twenty River Terrace continue to be a focus of the redevelopment of lower Manhattan.

A photo rendering (above) shows Twenty River Terrace from the west. This pond (right) full of goldfish and a playground behind it provide kid-friendly outdoor space next to Twenty River Terrace.

Twenty River Terrace

An apartment building models energy efficiency for a new Manhattan

Water

Twenty River Terrace conserves water through efficient use and reuse. Low-flow plumbing fixtures save water in every apartment. A basement **water recycling plant** purifies wastewater from the building. The recycled water flushes toilets, circulates in the cooling tower, and irrigates parks and gardens. Extensively planted rooftop gardens absorb rain and snow, preventing runoff. A storm water retention tank collects water for later use.

Photovoltaics

On the building's western riverfront facade, the sun bathes 3400 square feet of **photovoltaic (PV) panels** in light. The panels convert enough sunlight into electricity each year to meet about 5% of the building's energy requirements. They provide the most electricity during the summer, when energy demand is highest.

Cooling/Heating

A high-efficiency air conditioning system runs on natural gas rather than electricity and uses water instead of ozone-depleting coolants. The system's heat exchanger recovers heat from the air to heat water for the apartments. Efficient variable-speed pumps, motors, and fans circulate air throughout the building. In response to individual thermostats, **vertical fan coil** units draw air over tubes of hot or cold water to adjust apartment temperatures.

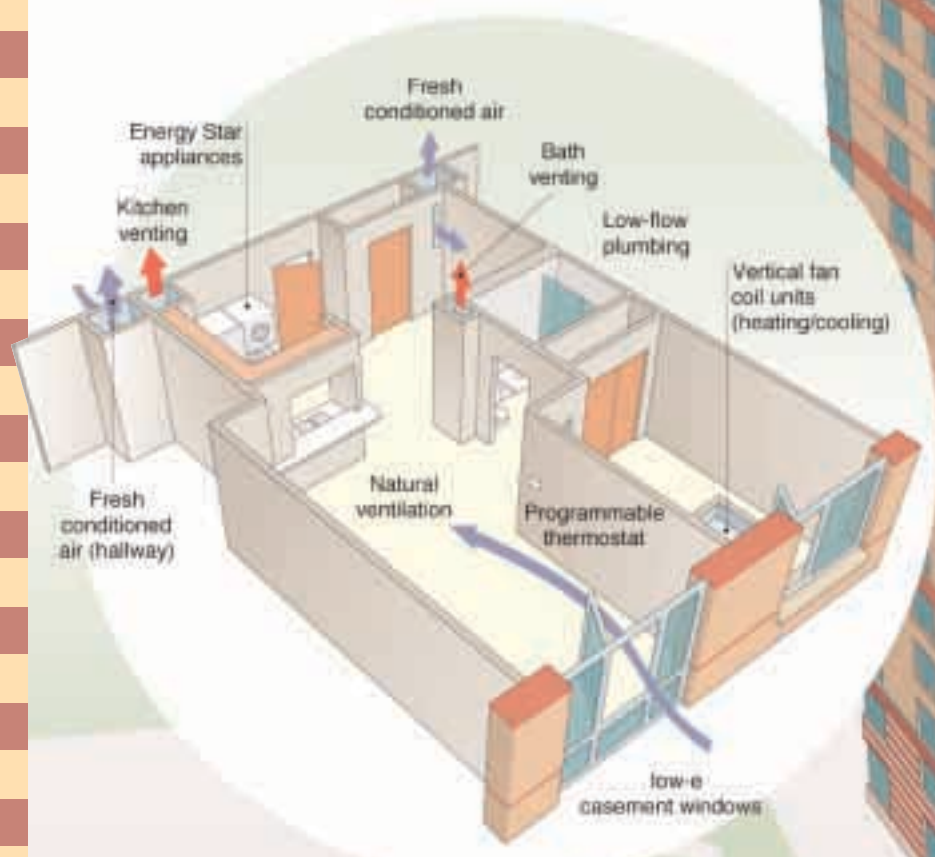
Indoor Air Quality

The air quality inside Twenty River Terrace is better than the air outside—an important feature because many New York residents suffer from asthma or allergies. A centralized air system filters air, humidifies or dehumidifies it depending on the season, and provides plenty of fresh air even in winter. Low-emission materials were used in construction. Operable windows allow for fresh air and cross-ventilation.

An Individual Apartment

Every apartment contains many energy-saving features:

- A master switch turns off all lights in the apartment.
- Energy-efficient lamps and fixtures conserve electricity.
- Casement windows open to provide fresh air while preventing unwanted drafts. The windows feature low-e glass that allows sunlight in while preventing heat loss.
- Energy Star® appliances (range, refrigerator, dishwasher, washer & dryer) conserve energy and water.
- Programmable thermostats, vertical fan coil units, bath & kitchen vents, and fresh, filtered, and conditioned air combine to enhance indoor environmental quality and save energy.

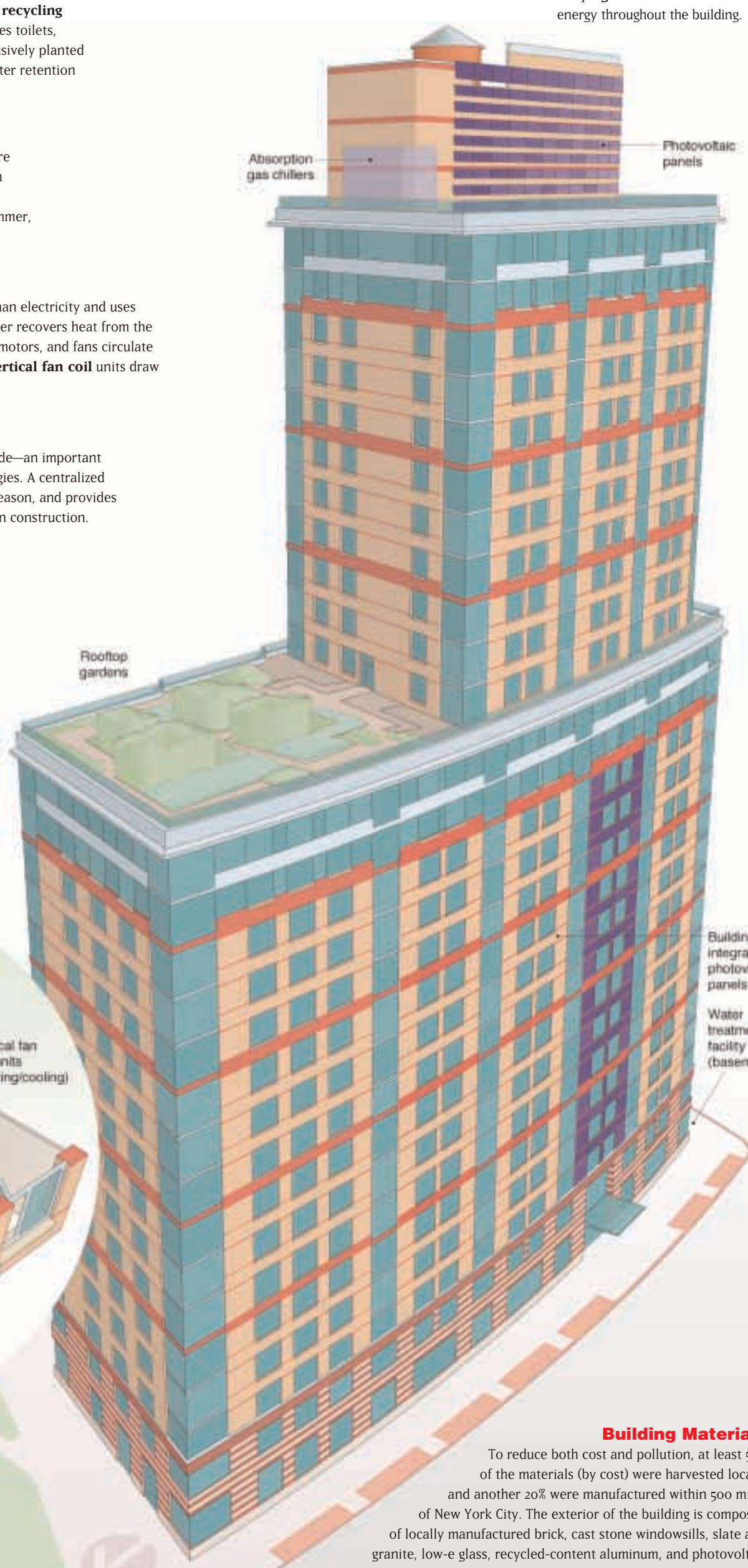


Building Envelope

An airtight, insulated, exterior brick-and-concrete block wall reduces both heating and cooling requirements. Extensively planted rooftop gardens insulate the building by creating shade in the summer and holding in heat in the winter. These **'green roofs'** help reduce the heat island effect in which urban area temperatures can soar 10 degrees above surrounding areas, creating greater demand for air conditioning. They also reduce storm water runoff. The actual effect of a green roof on heating and cooling and on a roof's service life is debated by architects and engineers, but the beauty and appeal of the green roof for residents is unquestionable.

Lighting

Daylight sensors lower or brighten lobby lights in response to increasing or fading natural light. **Occupancy sensors** switch lights on when people enter common spaces like stairs or corridors and switch them off again when they leave. **High efficiency lights and fixtures** save energy throughout the building.



Building Materials

To reduce both cost and pollution, at least 50% of the materials (by cost) were harvested locally and another 20% were manufactured within 500 miles of New York City. The exterior of the building is composed of locally manufactured brick, cast stone windowsills, slate and granite, low-e glass, recycled-content aluminum, and photovoltaic modules. The lobby contains limestone floors, Forest Stewardship Council (FSC)-certified wood millwork, stainless steel, glass, and granite. Public interior areas are finished with recycled-content carpeting, ceramic tile, low-VOC-painted recycled-content gypsum board, mirrored walls, and recycled-content acoustic tile ceilings. The residences have FSC-certified low-VOC wood flooring, recycled-content carpeting with low-VOC adhesive, low-VOC paints, Kohler low-flow plumbing fixtures, remanufactured marble baths using stone diverted from waste-streams, recycled-content wood trim, FSC-certified wood kitchen cabinetry, granite kitchen countertops, and stainless steel sinks.

Buildings for the 21st Century

Buildings that are more energy efficient, comfortable, and affordable…that's the goal of the U.S. Department of Energy's Building Technologies Program. To accelerate development and wide application of energy-efficiency measures, the Program:

- Conducts R&D on technologies and concepts for energy-efficiency, working closely with the building industry and with manufacturers of materials, equipment, and appliances
- Promotes energy/money saving opportunities to both builders and buyers of homes and commercial buildings
- Works with state and local regulatory groups to improve building codes, appliance standards, and guidelines for efficient energy use

Adopting Best Practices

Never before has a building of this scale embodied so many environmental and energy-efficiency guidelines. Architects and builders had to meet the Hugh L. Carey Battery Park City Authority Residential Environmental Guidelines. They also decided to qualify for both a New York State Green Building Tax Credit and a Leadership in Energy and Environmental Design (LEED) Gold rating from the U.S. Green Building Council. Faced with varied and sometimes conflicting guidelines, the designers focused on best practices.

For example, the building's owner commissioned an air-infiltration laboratory to locate areas where a conventional brick and concrete block wall allows airflow. Modeling showed air getting in behind the brick and in between the concrete block and the concrete slab. Extra sealant now keeps that air out. These and other improvements were modest by themselves, yet they combined to create an airtight exterior wall. "We made 50 small decisions that really added up," says architect Rafael Pelli.

Yet, the success of a high-performing building depends on more than the architecture itself. The guidelines include and require a stringent commissioning process—a systematic process of ensuring that a building performs in accordance with the design intent, contract documents, and the owner's operational needs. The guidelines also require ongoing training for building managers who will oversee operations of the building, and written resources and information for residents about sustainability features they will be responsible for and participate in as they reside there.

Key Energy-Efficiency Features

	Base Case	Twenty River Terrace
Windows		
— Shading coefficient =		0.43
— Visible transmittance =		0.68
— Solar heat gain coefficient =		0.35
U-value (Fixed) =		0.41
U-value (Operable) =		0.47
Exterior Walls		R-value = 8.43
Roof		R-value = 22.7

A recent aerial shot of Manhattan shows Battery Park City, on the Lower West Side, in context. Residents, visitors, and office workers in lower Manhattan have access to many of the engaging open spaces within Battery Park City.

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www.eren.doe.gov/buildings/highperformance

National Renewable Energy Laboratory
Center for Buildings and Thermal Systems
www.nrel.gov/buildings/highperformance

U.S. Green Building Council
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