FOUR TIMES SQUARE

Rethinking the Skyscraper

PROJECT SNAPSHOT

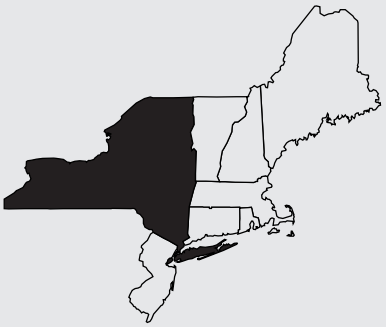
PROJECT
48-story office complex

TECHNOLOGY
Advanced computer modeling of energy and ventilation systems; use of natural light; centralized natural gas cooling system; fuel cells and photovoltaic power generation

CO_2 EMISSION REDUCTIONS
More than 92 tons a year

LESSONS LEARNED
- Alternative power sources require early planning.
- Developer must communicate objectives to tenant design teams, and explain the details.
- Cost-effectiveness of energy efficiency measures needs to be demonstrated using proven economic.

FUNDING SOURCES
Developer: Durst Organization; New York State Energy Research Development Authority; Fuel cell subsidy of $400,000 from U.S. DOE



INTRODUCTION

Although a number of energy-efficient, "green" buildings are scattered across the United States, only one so far is a green skyscraper. That's because tall buildings present heightened environmental challenges. They are huge consumers of energy, especially electricity. And their very shape – the massive curtain walls terminating in a tiny roof – erects a major structural obstacle. What's often as problematic, separate design teams (one organized by the developer to build the building itself, the others to craft interior space for what can amount to hundreds of tenants) must coordinate their efforts if goals for energy efficiency, indoor air quality and the use of sustainable materials are to be achieved.

THE PROJECT

The office tower at Four Times Square in Manhattan is a new $500 million, 48-story complex of commercial and retail space developed by the Durst Organization. Occupied by its first tenants in July 1999, Four Times Square demonstrates a wide variety of green innovations, including extensive use of daylighting, natural gas-powered cooling, two 200-kilowatt (kW) phosphoric acid ONSI fuel cells, building-integrated photovoltaics (PV) and a sophisticated system for controlling indoor air quality. Consider a specific example, the glass façade. The facade provides daylighting for about a quarter of the building's total floor area with high-visible-light transmitting windows. Another: thin-film PV panels, which are sandwiched between window panels on upper-level floors on the southern and eastern side of the building, can provide up to 15 kW of electric power.

Originally, eight 200-kW fuel cells were proposed for the roof, but distribution complexities required scaling back the project. So now there are two fuel cells, both on the fourth floor. The hot water they produce is recycled through the building's heating system. Highly efficient gas-fired absorption chillers and heaters were installed, along with a number of energy efficient components in the ventilating system. The chillers and heaters are free of ozone-depleting CFCs and HCFCs. In addition, DOE-2, a U.S. Department of Energy software that models the energy demand of different lighting and cladding materials and techniques, helped to identify energy efficient strategies and evaluate their cost effectiveness.

A key aspect of the project was the integration of developer and tenant planning. Although developers typically have little interaction with the ultimate occupants, the Durst team took time to educate its tenants about the building's efficient design, and the increased productivity and cost savings it could offer. The team developed guidelines to help tenants design interior spaces to take advantage of the green features of the building – for example, how to tap into natural sunlighting in office layout.

THE RESULTS

The Durst Organization recognized that Four Times Square is a long-term investment. It was willing to accept higher upfront costs, with tenants receiving the benefit of operating costs expected to be 10-15 percent lower than in conventional buildings. The daylighting glass will pay for itself in about 14 months, while payback for the gas-fired chiller and heating system is three years.[1]

The photovoltaic panels and fuel cells supply five percent of the building's daytime energy requirements, and at night the building's needs are met by the fuel cells alone. These alternative power sources generate some 3,500-megawatt (MWh) hours of electricity each year, avoiding 184,500 pounds (92 tons) of CO_2. Also eliminated are New York City-area emissions of over 7,300 pounds of NO_x and 4,900 pounds of SO_2. Efforts currently are underway to estimate energy cost savings for tenants.

And a green building may offer other returns. For example, as the developer has pointed out to prospective tenants, a high-quality air distribution system and well-

designed lighting can improve worker productivity and decrease absenteeism. Indeed, several recent studies support this conclusion.

LESSONS LEARNED

Alternative power generation is one feature that the developers would have liked to incorporate further. Although fuel cells and photovoltaics are commercially available, custom-fitting them into very limited space proved difficult. Windpower for tall buildings is another technology the developers would have liked to explore. If planning for alternative fuel sources could have been accomplished earlier on, additional fuel cell systems might have been installed.

The broader lesson involved communications. Strong coordination among all parties involved in the construction process is seen to be the key to success. In particular, use of standard, reliable forecasting tools like DOE-2 can be important means of conveying the economic benefits of environmentally responsible design.

FUTURE COMMITMENTS

The success of Four Times Square already has inspired a similar project at Three Times Square. The design team is again headed by Fox & Fowle Architects, P.C. In May 2000, New York became the first state to offer a green building tax credit to developers who meet energy goals, use environmentaly friendly materials, or install fuel cells or PV panels. It is funded for five years at $5 million a year.

COMPANY PROFILE

The Durst Organization is a family-owned real estate development company. It has been conducting energy retrofits on its existing buildings since the early 1990's. As planning for Four Times Square was getting underway, Durst chose to expand its environmental initiatives to encompass the design and construction of a new building. The decision was based on both the environmental benefits and life-cycle cost savings for owners and tenants.[2]

CONTACTS

Pamela Lippe
Environmental Consultant
for the Durst Organization
Tel. 212-922-0048

Craig Kneeland
Project Manager
NYSERDA
Tel. 518-862-1090
www.nyserda.org

For more information on New York's green building tax credit, see:
www.dec.state.ny.us/website/dar/ood/grnbldgtxcr.html

[1] The payback period is the time it will take for lower energy bills to defray the additional cost of the high-efficiency measures.

[2] This case study draws on the following sources: Earth Day New York, Lessons Learned – Four Times Square: An Environmental Information and Resource Guide for the Commercial Real Estate Industry, 1997; Nicola Turner, "4 Times Square: Breaking New Ground," World Architecture, February 2000.

CLEAN AIR-COOL PLANET CASE STUDY RATING

This case study reduces CO_2 emissions equivalent to the following:

Avoiding the consumption of 168 barrels of oil per day. (1 barrel = 20 barrels of oil)

OR Taking 13 vehicles off the road per year.

Assumptions: 1,093 lbs of CO_2 per barrel of oil. Vehicles are average passenger cars (approximately 20 lbs CO_2 per gallon of gasoline – 22.5 miles per gallon, averaging 16,000 miles per year)