

US Senate Committee on  
Environment and Public Works  
May 15, 2007

**Green Buildings: Benefits to  
Health, the Environment, and  
the Bottom Line**



The Bank of America Tower at One Bryant Park, view from Bryant Park



# Testimony of Robert F. Fox, Jr. to US Senate Committee on Environment and Public Works

May 15, 2007

Good morning. Thank you very much for the opportunity to be here today.

My name is Bob Fox, and I am a Partner at Cook+Fox Architects in New York City, a firm known for designing beautiful buildings that save energy and resources, while enhancing health and improving the bottom line. This has been the focus of my 40 year career. Beginning in 1995 I was the Architect for Four Times Square, which was the country's first green skyscraper, and which was designed when the industry had no common standard for defining a "green building." In 1999 I led the team that created Residential and Commercial Environmental Guidelines for the Battery Park City Authority, a public-private entity that controls 92 acres of Lower Manhattan. Since then, the Guidelines have been followed by all projects built in Battery Park City, which by 2010 will result in over five million square feet of LEED Gold buildings. Currently, I serve on the Advisory Council for Mayor Michael Bloomberg's Office of Long-Term Planning and Sustainability, which in April released PlaNYC, a comprehensive agenda for sustainable growth over the next 30 years.

Cook+Fox is the Architect for the new Bank of America Tower at One Bryant Park, a 2.2 million square foot, \$1.3 billion commercial headquarters, developed jointly by the Bank of America and the Durst Organization. It is currently under construction on 6th Avenue and 42nd Street in Midtown Manhattan. When completed in 2008, it will be the 2nd tallest building in New York City, standing 945 feet to the top of its roof. Most importantly, it will be the first high-rise office tower in the country to achieve a LEED Platinum rating, the highest possible certification from the US Green Building Council.



Computer simulation of the Bank of America Tower from Rockefeller Center



**<5% of world population**



**25% of world carbon dioxide emissions**

image © Doyle Partners for Cook+Fox Architects

I am here to speak today because buildings are leading consumers of energy and emitters of the greenhouse gases responsible for climate change. Nationwide, the building sector accounts for 43% of carbon dioxide emissions, and buildings consume 71% of all electricity generated.<sup>1</sup> In dense urban areas, buildings can represent the dominant source of emissions. When New York City recently completed its first comprehensive Inventory of Greenhouse Gas Emissions, it was found that 79% of the city's carbon dioxide emissions come from its buildings.<sup>2</sup>

The United States, with only 4.5% of the world's population, is responsible for 25% of worldwide carbon dioxide emissions.<sup>3</sup> Buildings represent a large part of the problem, because as currently designed and operated, they waste enormous amounts of energy as well as clean water and other resources. Green buildings make it possible to create offices, homes, and institutions that perform better than conventional buildings on all levels, saving energy and water, improving health and productivity, and saving money.

The green building industry has grown steadily, and then rapidly accelerated over the last ten years. Both the public and the private sector are witnessing the benefits of green building, and momentum is growing for the transformation of architectural and engineering practices, real estate markets, local building codes, and building services and suppliers. In 2006, the American Institute of Architects challenged practicing professionals to immediately cut fossil fuel consumption by 50% in the buildings they are designing. They further challenged the industry to increase reductions over the next 30 years, resulting in carbon-neutral buildings by 2035. Cities, states, and US Government agencies have been among the first to experiment with and experience the operational cost savings and superior indoor quality of high-performance green buildings.

In large cities like New York, green buildings are being recognized as an essential part of planning for future growth, maintaining the urban infrastructure, and protecting health and quality of life. With urban populations growing rapidly, cities across the US face great challenges, but can also benefit from urban density. Because of the density of apartment buildings and reliance on mass transit, New Yorkers produce 71% less CO<sub>2</sub> per capita than the average American.<sup>4</sup> Cities, therefore, that invest in sustainable growth can be an important part of the solution.

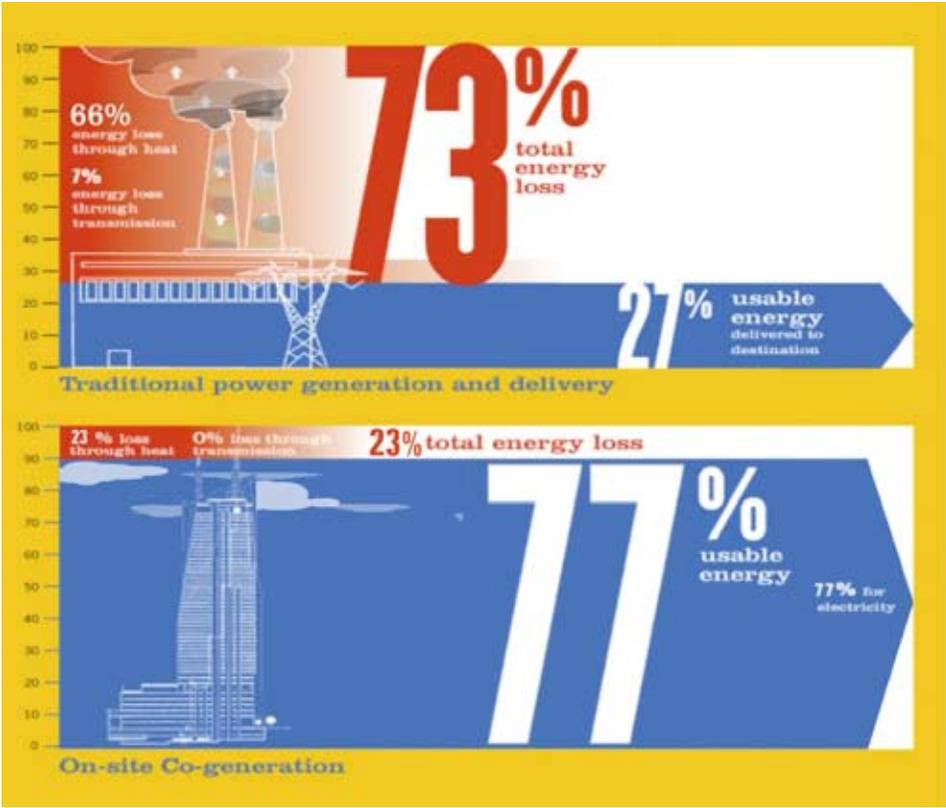


The Bank of America Tower, with 2.2 million square feet of premium office space, will consume about half the energy and water of a typical building of its size, while creating the healthiest, most productive possible work environment for its occupants. It was designed to take advantage of a world-class public transit system: in getting to work, the tenants of the building will generate only 1/20th the energy of the average suburban commute. With 8000 workers arriving each day, the building will have zero parking spaces.

The Bank of America Tower will earn a LEED Platinum certification through an integrated approach to green building practices and technologies. When we began the project, the goal was to create the most high performance building possible: one that would use far less energy, far less water, create a high quality interior environment, use materials with high recycled content and no Volatile Organic Compounds (VOCs), and recycle all construction debris. After we had finished our basic design we turned to LEED, the industry standard and clearly the most advanced measuring tool, to see how well we had done. We were delighted to learn we had the potential to earn a Platinum certification.

Energy efficiency in buildings can be drastically improved with today's strategies and technology. Typically, when power is generated in our country, approximately 2/3 of the energy goes directly up the smokestack in the form of waste heat. After additional transmission losses, what arrives at the typical building is only about 27% of the total energy created. Instead, the Bank of America Tower will have an on-site, 5 megawatt power plant producing clean energy from natural gas at 77% efficiency. Using cogeneration technology, this giant turbine will produce electricity, then use the waste heat to generate even more power. It will be enough to provide approximately 67% of the building's annual energy needs with clean, efficient supply.

Like most large cities, New York has an electric grid that struggles to keep up with demand during peak times. At these times, the power utility is forced to turn on its oldest, dirtiest "peaker" plants. It



**co-generation**

One Bryant Park is an efficient power generator.

Co-generation provides 67% of the building's total power consumption.

Generating our own energy is 300% more efficient than tapping into the traditional power grid.

image © Doyle Partners for Cook+Fox Architects



image © Doyle Partners for Cook+Fox Architects

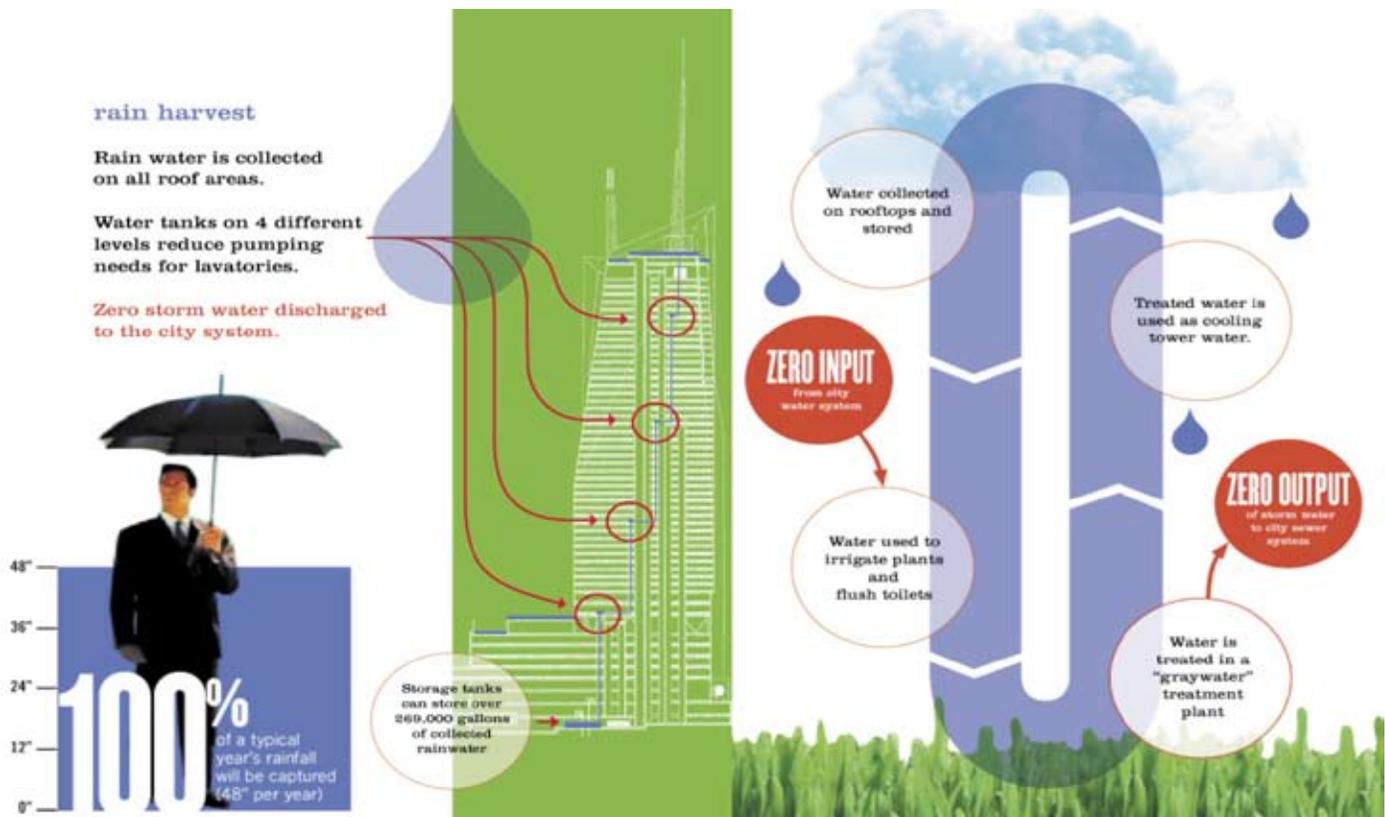


image © Doyle Partners for Cook+Fox Architects

has been estimated that 90% of the air pollution in the city comes from just 50% of its power plants. One of the goals at the Bank of America Tower was to ensure the building did not contribute to this burden on the city's infrastructure. The building will have a thermal storage plant in the cellar, with 44 large tanks making ice at night, when energy demand is low and the cogeneration plant is producing more power than the building needs. During the day, the ice melts to supplement the air conditioning system, reducing the peak demand and creating a much more even level of power consumption. Like most utilities, Con Edison charges its customers a rate based on peak demand, so the building tenants will save money.

Water and wastewater are also critical issues impacted by the building sector. New York, like Washington, DC, has a combined sewer and stormwater system. During significant rains, sewage treatment facilities routinely become overwhelmed by the volume of wastewater, and discharge partially treated sewage into our waterways. The Bank of America Tower, in contrast, will make zero stormwater contribution to the municipal system. The building will do this by collecting all rainwater that falls on its roofs, about four feet a year, and storing it in four tanks staged throughout the building. Water that condenses from mechanical equipment and drains from lavatory sinks will also be collected, treated, and used to flush toilets and supply the cooling towers. Nearly every office building in the US today uses clean, drinking-quality water for these purposes. The building is also installing waterless urinals, a technology that alone will save three million gallons of water every year. Thanks to these combined strategies, the building will consume less than half the potable water of a typical office building.

To the Bank of America, constructing a building that offered 50% water savings, 50% energy savings, drastically reduced greenhouse gas emissions, and added an iconic element to the New York City skyline was of great interest. But what really caught the Bank's attention was the quality of the indoor environment, and the potential impacts on employee health and productivity. Like other organizations,

### health and productivity

All energy saving features in the building together will save \$3 million a year.

A 1% rise in worker productivity due to improved working environment and health quality would generate \$10 million per year.

A 1% rise in productivity is considered a conservative estimate.



1% = 5 minutes per work day



especially those in a knowledge-based industry, the Bank could expect to spend around 10% of its operating budget on rent and utilities, but more than 80% on salaries and benefits.<sup>5</sup> Even by rough calculations, a 1% increase in productivity – the equivalent of 5 minutes a day – would amount to \$10 million a year. Fewer sick days and overall reduced absenteeism translate into real benefits for any organization. For the Bank, enhancing the ability to hire and retain the best talent was also extremely important.

A high-performance work environment addresses natural light, artificial lighting, thermal and acoustic comfort, air quality, and other design factors. The first priority for the Bank of America Tower was to design a daylit environment that would let tenants work by natural light as much as possible. Enclosed in highly transparent, floor-to-ceiling glass, the workplace also provides a direct connection to the outdoors – a complex set of environmental cues whose impacts on human well-being are just starting to be understood by psychologists and designers, through a field known as *biophilia*.

According to the US Environmental Protection Agency, indoor air is often more polluted than outside air, and many people spend 90% of their time indoors.<sup>6</sup> Whereas the typical code-compliant building in New York is designed to filter out only 35% of particulates from the mechanical ventilation system, the Bank of America Tower will filter 95% of particulates, as well as ozone and VOCs. In effect, the air that is exhausted from the building will be cleaner than the air coming in. In addition, in virtually all US office buildings, air is ducted in through the ceiling and then blown downward, where it mixes with all the air in a room, evenly distributing dust, germs, and allergens. Instead, the Bank of America Tower will have an under-floor air distribution system. Rather than forcing conditioned air down from the ceiling, heat from occupants and computer equipment will draw fresh air upward, at warmer temperatures and lower pressure. Individual air diffusers in the floor will allow workers to adjust the flow of air around their desks, minimizing the circulation of airborne pathogens and resolving the chief complaint among office workers of being too hot or too cold.

16%

Improvement in children's test scores were reported in daylight vs. non-daylit conditions.

25%

of lighting energy is conserved through daylight dimming and selectively shutting off lighting of unused rooms with motion detectors



### daylight access

Floor-to-ceiling windows saturate building in natural light and provide unbelievable views.

Automatic light dimmers reduce energy draw during daylight hours.

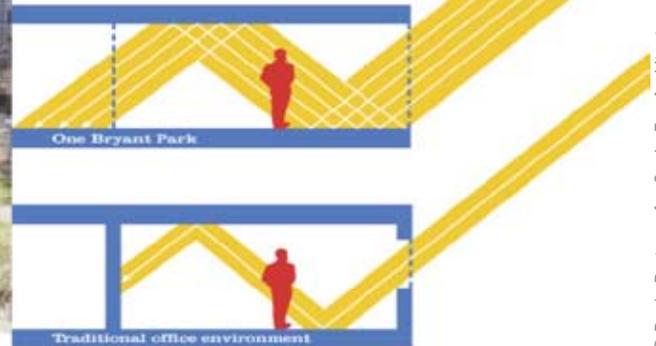


image © Doyle Partners for Cook+Fox Architects

Air inside building is much cleaner than outside air

Fresh air enters building at minimum 100 feet above grade

### fresher air

**One Bryant Park is a 56-story air filter.**

Fresher air means improved health and working environment.

Supply air shaft brings more fresh air than required by code.

100% outside fresh air can be delivered to any four floors at any time

Exhaust air from building is considerably cleaner than ambient air.

95%

of the particulates in fresh air are removed as it enters the building, and then is filtered again on a floor by floor basis

image © Doyle Partners for Cook+Fox Architects

### achoo!

Traditional heating and cooling ventilation violently mixes air.

55° cooling air supply requires more energy to cool, and more energy to distribute under higher pressure.



### displacement air cooling

You are a heat chimney.

Displacement air ventilation delivers air conditioning and heating beneath the floor.

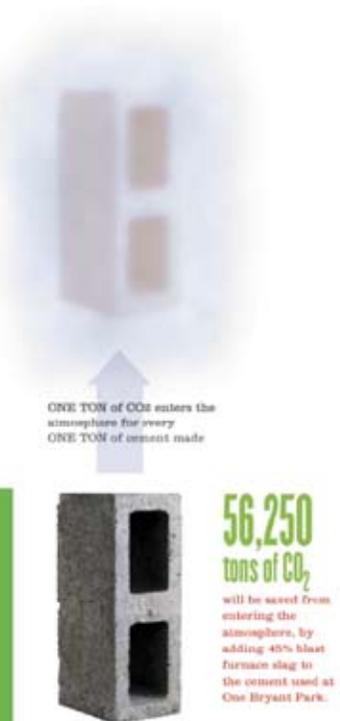
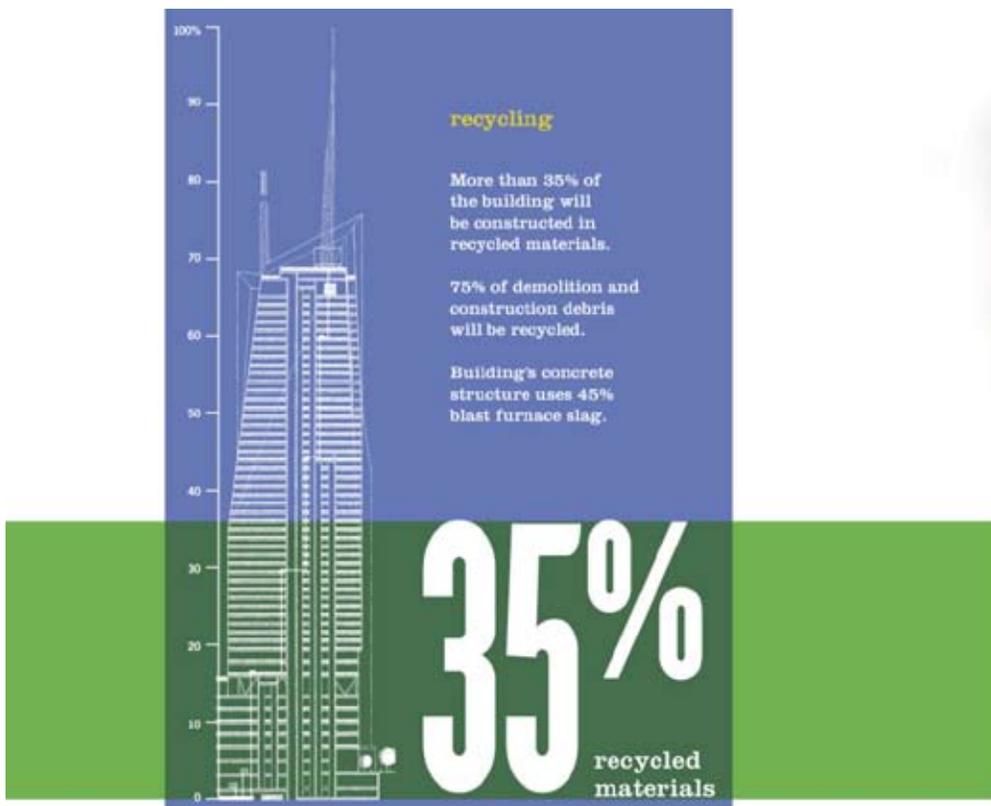
Underfloor cooling air is 65°, which reduces cooling energy costs and allows for two additional months of "free cooling."



Other issues that have been considered include the impacts of materials over their entire life-cycle, from cradle to grave. The manufacture of cement, for example, results in one ton of CO<sub>2</sub> emitted for every ton of cement produced. This is why worldwide, the cement industry is responsible for more than 5% of CO<sub>2</sub> emissions.<sup>7</sup> To minimize these emissions, 45% of the cement in the Bank of America Tower is being replaced with blast furnace slag, a waste product of the steel industry. By using an industrial waste product, we have calculated that this practice will prevent 56,250 tons of CO<sub>2</sub> from entering the atmosphere. Other materials-related practices include preferred purchasing of recycled and locally-produced materials, and recycling of 83% of construction and demolition debris.

Where green building practices represented an additional cost, the costs and benefits were carefully evaluated by the owner and design team. Some ideas were abandoned, and only strategies that represented a reasonable payback were pursued. In total, the added cost of green technologies and practices, including cogeneration, represents approximately 2% of the project budget. We have found that building at scale was itself an opportunity to reduce the overall cost of high performance green measures.

Building in a fundamentally different way is a challenging task. Before an industry-wide standard was created, practitioners had to determine for themselves what practices were harmful or beneficial. As a standard developed by a coalition representing all sectors of the building industry, the US Green Building Council's LEED system is now a common language for measuring and validating green buildings. Every LEED certified building must comply with certain requirements, from eliminating Environmental Tobacco Smoke to commissioning all mechanical, electrical, and plumbing equipment to ensure it operates at the level at which it was designed to perform. This voluntary standard is designed to evolve over time, and results from a consensus-based process that is inherently robust and inclusive. Some 600,000 volunteer hours have been invested in developing and improving LEED





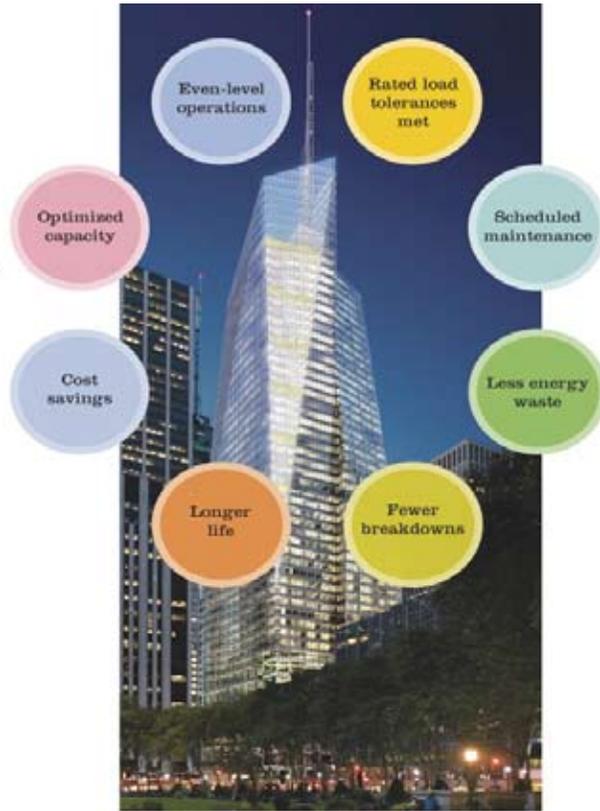
### commissioning

**One Bryant Park is a finely-tuned instrument.**

Commissioning is the term for fine tuning all equipment, interface, and controls so that all perform at optimum and most efficient operating conditions.

One Bryant Park will be fully commissioned, dramatically improving its efficiency and longevity.

This process commences early in the base building construction period.



over the past 10 years (had this time been billed at \$200/hr, it would add up to \$120,000,000). This level of collaboration by architects, engineers, builders, and manufacturers is unmatched in any industry, and has helped accelerate the current transformation of building markets. The opportunities of high performance green buildings are not limited to new buildings. Existing buildings are an extremely important part of the energy equation – in New York City, it is estimated that by 2030, 85% of the city’s energy usage will come from buildings that exist today. Existing buildings can be upgraded through retrofits to lighting and heating and cooling systems; the resulting energy savings typically amount to a three to seven year payback. Retro-commissioning to optimize mechanical equipment functioning typically pays for itself within two to three years.<sup>8</sup>

Buildings such as the Bank of America Tower prove that it is possible to create high-performance green buildings on a very large scale. At 2.2 million square feet, large building budgets can afford to make creative innovations – but what about the rest of us?

In fact, buildings at all scales can make a difference in the health and well-being of their occupants, and in the quality of environment we pass on to future generations. In early 2006, Cook+Fox had outgrown its previous office and needed to find new space. Using the same standards for beautiful design and high performance, and with the help of creative engineers, we worked hard to create a LEED Platinum interior space of 12,000 square feet, with a 3600 square foot green roof. We moved in June 2006, and are already enjoying terrific employee and client satisfaction.

The United States has always been a high-performance country and an incubator for innovation. No landlord or developer wants to own a building destined for obsolescence because it locked itself into the thinking of the 20th century. As costs decline and benefits accumulate, high-performance building will become the only way to design the places we live and work. The question now is how to act intelligently and effectively to set a new high standard.



photo © Cook+Fox Architects

Green Roof at the office of Cook+Fox Architects



photo © Bilyana Dimitrova for Cook+Fox Architects

Interior of the office of Cook+Fox Architects

(Endnotes)

- 1 Oak Ridge National Laboratory. *Towards a Climate-Friendly Built Environment*. Arlington: Pew Center on Global Climate Change, 2005.
- 2 New York City. *PlaNYC: A Greener, Greater New York*. April, 2007. (<http://www.nyc.gov/html/planyc2030/html/plan/plan.shtml>)
- 3 World Resources Institute. 2007. *EarthTrends: Environmental Information*. (<http://earthtrends.wri.org>). Washington DC: World Resources Institute.
- 4 New York City. *PlaNYC: A Greener, Greater New York*. April, 2007. (<http://www.nyc.gov/html/planyc2030/html/plan/plan.shtml>)
- 5 Wilson, Alex. "Productivity and Green Buildings." *Environmental Building News* 13.10, October 2004.
- 6 US EPA and US Consumer Product Safety Commission. "The Inside Story: A Guide to Indoor Air Quality." April 1995.
- 7 Lawrence Berkeley National Laboratory. "Carbon Dioxide Emissions from the Global Cement Industry." *Annual Review of Energy and Environment* vol.26, 2001.
- 8 New York City. *PlaNYC: A Greener, Greater New York*. April, 2007. (<http://www.nyc.gov/html/planyc2030/html/plan/plan.shtml>)