the green development
IN CHICAGO

By Sadhu Johnston

City Hall green roof.

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We are demonstrating that a major urban area can make protecting the environment a priority and through this we can improve the quality of life in our city and our neighborhoods. ***- Mayor Richard M. Daley***

Over the last 14 years, under the leadership of Richard M. Daley, the city of Chicago has pioneered green urbanism. Much of Chicago's strategy involves utilizing its purchasing power, construction practices, and operations protocol to serve as a catalyst in making Chicago the most environmentally friendly and most desirable city in which to live throughout the world.

From energy to fuel efficiency from green technology centers to parks and buildings, Chicago is leading the way with innovation and changes which will help reshape how cities worldwide approach their built and natural environments. Using lessons from city operations, new policies and programs are developed for adoption throughout the city. This article aims to define green development concepts, outline the strategies used in Chicago and summarize a few accomplishments.

The urban share of the world's population has grown from 30 percent in 1950 to an estimated 47 percent in 2000. By 2015, the urban proportion is projected to rise to 53 percent of total population (Source: United Nations Population Fund's Report on World Population, 2004). As cities continue to expand, so too does their impact on the environment. Increased strain on environmental resources such as air, water, and urban temperature can have dramatic effects on public health, and the economic viability of the city.

Around the world, city leaders are finding that green urbanism can make their cities and citizens healthier, economically prosperous and their streets and neighborhoods more beautiful, while making the city more competitive in the global marketplace. For older industrialized cities, greening can guide redevelopment, making brownfields productive land again, establishing lakefronts and riverfronts as prime recreational land, making wide streets into pedestrian and bike friendly zones and ensuring new construction is healthy, affordable and environmentally friendly.

ENVIRONMENTAL ACTION PLAN

Following the United Nation's Rio Conference on Environment and Development in 1992, a detailed action agenda was created to guide the integration of green development strategies worldwide. The international action plan, known as Agenda 21, recognized local governments as critical to implement-

MAKING CHICAGO AN ENVIRONMENTALLY FRIENDLY CITY

Around the world, city leaders are finding that green urbanism can make their cities and citizens healthier, economically prosperous and their streets and neighborhoods more beautiful, while making the city more competitive in the global marketplace. From energy to fuel efficiency from green technology centers to parks and buildings, Chicago is leading the way with innovation and changes which will help reshape how cities worldwide approach their built and natural environments. Using lessons from city operations, new policies and programs are developed for adoption throughout the city. This article aims to define green development concepts, outline the strategies used in Chicago and summarize a few accomplishments.

ing green or "sustainable" development. The Agenda states that local governments "play a vital role in educating, mobilizing and responding to the public to promote sustainable development and urges cities and local governments to develop their own action plans".

In 2004, Mayor Daley charged 18 members of his cabinet to work together to develop Chicago's first environmental action plan. This plan benchmarks past successes in greening, while setting environmental goals for the city.

The Agenda was an important step on the trajectory that has taken Chicago from the Plan for Chicago (1909), the first land use plan for a modern American city, to Mayor Daley's creation of the Chicago Department of the Environment in 1992, to the mayor's progressive landscaping initiatives, and the numerous green buildings built by the city.

Mayor Daley states that the greening of Chicago is guided by "three equally important goals: to better protect our natural resources, to promote environmentally friendly lifestyles and to lead by example and incorporate our environmental commitment into the everyday work of city government." These three concepts guided the development of Chicago's Environmental Action Agenda.

LEADING BY EXAMPLE

Today, cities compete nationally and internationally for the most talented workers. The goal of making Chicago the greenest city in the nation is driven by an understanding of the importance of resource conservation, quality of life and a conscious strategy designed to increase Chicago's competitive edge as a global city.

"Our commitment to greening and environmentally friendly practices in Chicago helps us save money and improve the quality of life in our neighborhoods. This builds pride in our city and contributes to making it a place where people want to live, work and raise a family," said Mayor Richard M. Daley.

The genesis of many of the city's green initiatives was Mayor Daley's much heralded landscaping efforts. These efforts resulted in more than just beautifying the city. Since the mayor was elected in 1989, the city has planted more than 400,000 trees. Thirty-four miles of the city's historic boulevard system have been renovated and replanted and 70 linear miles of medians have been constructed along many of the arterial streets and planted with urban tolerant plants and over 4,850 trees.

While providing ample aesthetic benefits and contributing, to some degree, to Chicago's prominence as a tourist and convention destination, this investment in landscaped infrastructure has provided additional benefits. The increase in planted trees has functioned as a "carbon sink" and is estimated to effectively remove the air borne particulate matter of 31,000 vehicles annually. It is estimated that the median trees alone produce 23 tons of oxygen annually while reducing the 'urban heat island effect' (higher urban temperatures resulting from the heat reflective

Economic Impact of Trees for Shopping Districts

Research conducted by the University of Washington has shown people like to shop in districts with mature trees. In large cities, shoppers are willing to pay 12 percent more when shopping in a district with mature, well managed trees. In small towns this number is 9 percent.

"Consumers enjoy landscaped shopping districts, and are willing to spend more time and money in them! Large trees, combined with under story plants are most preferred. Planning and ongoing management of the vegetation is important to create a landscape that pays back on invested costs."

(Source: Nature and Urban Shopping Districts, Kathleen L. Wolf, Ph.D., University of Washington (Seattle, WA, USA)
http://www.cfr.washington.edu/research.envmind/

Chicago Center for Green Technology.

Jobs in the Landscaping Industry

Greencorps Chicago was started in 1994 as part of the city's effort to prepare residents for jobs in the growing and lucrative greening industry. Its green industry job-training program has placed close to 200 residents in landscape jobs upon successful completion of the one-year training program.

Green Pilot Project – Budlong Woods Public Library.

As one of the primary purchasers of construction services in Chicago, the city is using its influence to promote environmentally sustainable building practices in the region's real estate and construction industries through a commitment to building all of its facilities in an environmentally sound manner. On June 10, 2004, Mayor Daley announced the city's adoption of The Chicago Standard, a new set of construction standards guiding the design, construction, and renovation of municipal facilities. The standard commits the city to achieving the Leadership in Energy and Environmental Design (LEED™) certification by the US Green Building Council. Adoption of "the Standard" will result in buildings that save 15 percent to 20 percent in energy costs annually, conserve water and other natural resources, and provide healthier, more productive indoor environments.

The city's most notable green building effort is the award-winning Chicago Center for Green Technology, home of numerous environmentally oriented companies and city services. The lesser-known projects, however, are responsible for incorporating green into the fabric of the working city. The city opened its first "green" library, Budlong Woods, in February 2003 and has opened two others since. The libraries' features include solar panels on the roofs, building materials with recycled content, and HVAC systems designed to perform nearly 20 percent more efficiently than the Chicago Energy Code requires.

The city has built a green police station which it is using to monitor the cost savings associated with high performance buildings, has several green fire stations in development, and is working with the Chicago Public Schools to build and renovate several green elementary and high schools.

qualities of asphalt and cement) and thus decreasing the financial costs and pollution associated with residential and commercial air-conditioning systems. **It is estimated that for every one degree city-wide temperature is lowered, the city saves $150 million.**

In addition, the city's landscaping efforts have been credited with neighborhood revitalization outside of the central business district. The West Loop, currently one of Chicago's hottest real estate markets, was one of the first neighborhoods to receive an investment in arterial, planted medians. This area of once largely abandoned industrial buildings has since become a destination for urban professionals and the restaurants, clubs and retail markets that service them. The financial benefits of greening the area were discussed in a New York Times article titled *In Chicago's West Loop, Real Estate Profits Do Grow on Trees:* "The snickers have turned into a growing chorus of cheers as tree plantings, elaborate landscaping, and streetscape designs have become the catalyst for neighborhood revitalization." (10/3/2004)

Chicago's leadership in green infrastructure doesn't stop with its landscaping programs. The Department of Transportation has implemented a series of other environmental initiatives including the grates around sidewalk trees contain recycled rubber tire, much of the concrete the city pours contains recycled fly ash (a by-product of coal fired power plants), 20-30 percent of all new Chicago street asphalt contains recycled asphalt grindings from the city's repaving projects and the city has replaced most of its incandescent stop lights with low energy LED lights.

City Hall's Green Roof

Planted in 2000, this extensive garden atop City Hall features native plants, trees, and even beehives. Besides beautifying the space, this roof improves air quality, conserves energy and reduces stormwater runoff, and helps reduce the urban heat island effect. Rooftop comparisons between City Hall and the adjacent Cook County building, which has a traditional black tar roof, indicate that air temperatures above City Hall typically are 10 to 15 degrees lower than those above the County's building. On hot summer days, the difference can be even greater.

The Chicago Standard

Mayor Daley announced the Chicago Standard on June 10, 2004. This new set of construction standards guides the design, construction and renovation of all city buildings to conserve energy and reduce operating cost by achieving LEED certification.

The first several green buildings were constructed with a 6-8 percent premium for green building. As the construction industry and city staff have learned more about green buildings, the additional costs for green buildings have been virtually eliminated.

Construction costs are, however, only 10 percent of the cost of building, operating, and maintaining a building throughout its life. The remaining 90 percent of the costs for operation and maintenance can be significantly reduced when green building design and construction strategies are utilized.

The city of Chicago is also considered a leader in promoting green roofs as a sustainable alternative to the traditional roofing system. Green roofs replace traditional roofs with a growing medium and living plant life. They greatly reduce stormwater runoff and the urban heat island effect, reduce energy costs through better insulation, and extend the life of a roof by protecting it from UV radiation.

In addition to mandating that publicly owned buildings have green roofs, the city is requiring that private developments receiving public assistance and/or being reviewed by the Department of Planning and Development incorporate green roofs into their building design. The city's green roof policies have resulted in over 100 green roof developments. These projects, in various stages of completion, total over 1,600,000 square feet of vegetative cover.

These totals highlight another important benefit of the city's policy – economic development. Creating a market for an industry that did not exist a few years ago has led to the development and expansion of businesses and jobs that support this new economic engine as well as the development of new relationships between the roofing and landscaping industries.

Attracting Renewable Energy Manufacturers to the City

The city utilizes its purchasing power to create Chicago based jobs in the green industry. Through contracts to purchase renewable energy, the city has attracted both Spire Solar Chicago (a solar PV manufacturer) and Solargenix (a solar thermal manufacturer) to Chicago, creating approximately 40 new jobs manufacturing solar equipment. Utilizing this equipment, the city has helped install over 1MW of solar photovoltaic equipment on various facilities, including schools and museums.

2001 ENERGY PLAN AND UTILIZATION OF RENEWABLE ENERGY

In 2001, Mayor Daley laid out a strategy to assure Chicago's energy sources would be clean, affordable, and reliable. The 2001 plan addressed the central role energy plays in the everyday life of Chicagoans and was designed to protect consumers, promote economic growth, and protect the environment.

"Using solar electricity is consistent with our goal as a city to expand the use of renewable energy. Chicago is committed to leading by example and incorporating technology that will not only save money but is good for the environment and the overall quality of life for our residents," stated Mayor Daley.

Since 2001, the city has been working towards achieving goals set out in the energy plan and has made numerous accomplishments, including the following:

Energy efficiency retrofits have been completed for over 15 million square feet of City and Allied agency facilities. The city has installed LED lighting at over 450 intersections in the city, saving over 17,000 MWh annually. Energy assessments at 44 industrial facilities have been completed and five loans for implementation of energy conservation measures.

Green bungalows.

Mayor Daley set a target of 20 percent of the city's energy to come from renewable resources by 2006; by 2003 10 percent was achieved. The city is committed to purchasing between 40,000 and 125,000 MWh annually, beginning in 2006.

The city also leads by example in its commitment to owning and operating an alternatively fueled fleet. Both The City of Chicago Department of Fleet Management and Chicago Transit Authority (CTA) have received "Green Fleet" Awards from the Illinois EPA in recognition of their exceeding Clean Fuel Fleet Program (CFFP) requirements. The city has

deployed 93 Compressed Natural Gas (CNG) vehicles in 12 city departments and 161 Ethanol (E85) light duty vehicles in 17 city departments. The city operates 25 hybrid sedans, a car sharing program for city employees and has a free, natural gas "trolley" fleet that transports tourists and other visitors through the downtown business and shopping districts.

PROMOTING ENVIRONMENTALLY FRIENDLY LIFESTYLES

The city of Chicago is committed to encouraging healthy environmental practices by:

- Providing recycling programs and infrastructure to our citizens and businesses in order to reduce the size of the city's collective waste stream;
- Providing technical assistance, model projects, and incentives to build energy efficient, smart, healthy and green residential buildings;
- Identifying and eliminating barriers to green building practices in the city's building codes;
- Providing incentives to local businesses, developers, and contractors to build or rehabilitate efficient, resource conserving buildings; and
- Providing a range of transportation alternatives to citizens and visitors.

Example of planted median.

GREEN RESIDENTIAL DEVELOPMENT

Chicago's cost of living is on the rise. The vast majority of Chicago's built environment is in the form of residential square footage, yet there is significant demand for this space, especially as it is upgraded. The city seeks to utilize green building strategies to ensure that new and old building stock are built or rehabbed in such a way as to reduce utility bills. The utilization of green residential construction strategies in both publicly funded and market rate housing has been a focus within the city for years.

Chicago has worked to incorporate green building into residential development through demonstration projects, such as the Green Bungalows and Green Homes for Chicago (described below); new programs, such as the green bungalow grants; and policies, such as the citywide Energy Conservation Code and the green residential standards required for residential projects funded by the city.

Green Residential Construction

A green home is one that's designed, constructed, and maintained in such a way as to save energy, improve indoor air quality, and minimize the environmental impact of construction through wise construction and material choices. Utilization of these strategies in both affordable and market rate housing is on the rise across the country. These strategies have the most potential when utilized in urban development as they can make homes significantly more affordable via reduced utility costs and healthier for occupants due to higher indoor air quality. They can also have a reduced impact on the urban environment as a result of reduced storm water runoff and lower urban ambient temperatures.

GREEN BUNGALOWS

Nearly one third of Chicago's single-family homes are bungalows. Over 80,000 of these homes have endured throughout Chicago's development boom. However, as development continues, many of these homes are being renovated or torn down to make way for new development. To demonstrate the ability for reuse, and the applicability of green building to encourage that reuse, the Green Bungalow Initiative was created in 2001.

The city employed a design team of green building experts, historic preservationist, and residents to assess and implement different green building systems within this classic housing type. Each of the four bungalows employed different design techniques and then functioned as a model to be toured by builders and residents before they were sold at affordable rates to neighborhood residents. The bungalows' performance is continually monitored and published by the city's Department of Housing.

The project aimed to test the following green renovation strategies:

- **Geothermal system-** Installation of geothermal wells that utilize the earth's temperature to heat and cool the building. The system was an additional $10,000 over a conventional furnace and resulted in an insignificant annual utility savings.

Green Bungalows: Year One (2002-2003) Energy Savings

	Heating System	Typical	Actual	Savings
6421	Geothermal	$1,913 [1]	$840	$1,073
6423	Combination	$1,149 [2]	$440	$709
6425	Furnace	$1,230 [2]	$381	$849
6448	Boiler	$1,209 [2]	$635	$574

[1] – based on ComEd's all electric rate of $0.0828/kwh for the first 400 kwh and $0.0373 for all kwh over 400
[2] – based on a gas heating cost of $0.60/therm

Green Bungalows: Energy System Payback and Life Cycle Savings

	Annual Savings	Payback	Life Cycle Savings
6421 S. Fairfield	$1,073	12.2 years	1.12
6423 S. Fairfield	$709	7.3 years	2.08
6425 S. Fairfield	$849	5.4 years	2.82
6448 S. Fairfield	$574	5.9 years	2.57

Green Bungalows: 30 Year Mortgage Cash Flow

	Heating System	Monthly Savings	Monthly Cost to Finance 30 yrs	Net Cash Flow
6421	Geothermal	$89	$82.79	+ $6.21
6423	Combination	$59	$32.74	+ $26.26
6425	Furnace	$71	$28.91	+ $42.09
6448	Boiler	$48	$21.42	+ $26.58

- **Combination system-** A combination hot water heater and furnace system was utilized at an additional $2,000 installation cost and created a $700 annual utility savings.
- **Energy efficient furnace system-** Furnaces, 94 percent more efficient than traditional furnaces, were purchased at a $600 premium but created annual utility savings of $849.
- **Efficient boilers-** An 88 percent efficient boiler was installed as well as denim insulation and Low-E storm windows.

The tables highlight the cost savings through utilities and payback on investment for the various green building techniques. Through the renovation of these four homes, it became evident that green building could be a tool for maintaining these homes as economically viable housing for Chicagoans.

In order to ensure that other bungalow owners could utilize lessons learned from the green bungalow project, the city of Chicago partnered with the Historic Bungalow Association and the Illinois Clean Energy Community Foundation to provide $5 million in grant funds to historic bungalow owners. The grants can be utilized for the installation of solar systems, energy and/or water efficiency improvements or other green building strategies. The renovation techniques utilized in the green bungalows demonstrate how a simple renovation project can be completed and ensure a monthly savings of $71, with a monthly cost to finance the upgrade to energy efficiency of $28 for a 30-year mortgage, thereby creating a $42 net cash flow.

Chicago Department of Housing requires project appropriate green building and energy conservation measures such as:

— Double-glazed, Low-E insulated windows
— Energy efficient gas forced air furnaces and boilers
— R-38 attic insulation and R-19 wall insulation with vapor barrier
— Reflective roof coating on flat roofs
— Downspouts disconnected from the storm sewer system, as approved by the Department of Water Management
— Design of landscape and parking lots to promote on-site water retention
— Low VOC paints
— Fluorescent lighting in common areas
— Low-flow plumbing fixtures
— Energy Star Appliances

GREEN HOMES FOR CHICAGO

In order to demonstrate green building strategies for new residential construction, the city hosted a design competition to build five green residences to be affordable homes. The competition resulted in 73 entries from across the country. Five winning entries were built. Each of the five homes highlighted different green building features, such as green roofs, natural ventilation, non-toxic paints and finishes, and carpets made with recycled materials. The five winning entries, which were sold for approximately $150,000 each, were open to the public for tours prior to being sold.

These models have served to influence the construction currently underway by the Chicago Housing Authority (CHA), and construction funded by the Chicago Department of Housing (DOH). The CHA and DOH are integrating many of the concepts from these demonstration homes into the

construction and rehab of nearly 25,000 housing units as part of the historic Plan for Transformation.

TRANSIT ORIENTED DEVELOPMENT

As a mature urban city, Chicago is built on the back of transit and continues to enjoy high transit ridership. With 12 percent of all work trips using transit, it has the second-highest rate of transit use in the U.S. The city aims to increase these high levels of transit use by creating development near transit to further support its use. This strategy is known as Transit Oriented Development (TOD).

TOD is typically defined as a relatively dense mixed-use development within a half-mile radius of a transit center. Most people will comfortably walk up to one half a mile, or approximately ten minutes, to get to a place of employment, a store, a library, a friend's house or a transit stop. The premise behind TOD is that promoting alternatives to the private automobile, creating pedestrian-friendly neighborhoods, and reducing traffic congestion benefits quality of life. TOD benefits include:

- On average, a household will spend 20 cents for each dollar (after taxes) on transportation, making it the largest expense after housing for most families. Reducing private auto dependency increases the use of alternative modes and saves households money.
- Shops, restaurants, and grocery stores supported by density provide essential needs to neighborhoods. Active retail, restaurants, and cafes that stay open at night activate streets with life and foster safety by providing "eyes on the street."
- People who walk and bike as part of their daily routine experience tremendous health benefits and decreased levels of obesity.
- TOD encourages human-scale architecture and design, and decreases the dominance of automobile-driven design as exemplified by predominant driveways, parking structures, and lots.
- TOD reduces use of the private auto and the corresponding congestion and pollution, and the associated health dangers.

As part of the city's comprehensive approach to greening, Chicago's Department of Planning and Development (DPD) is focusing on applying TOD related policies. DPD is actively issuing requests for development proposals on sites that the city owns, located near transit services. In addition, the new Chicago Zoning Ordinance, for example, allows for parking reduction within 600 feet of transit. It has also introduced a new "pedestrian" designation for areas frequented by pedestrians, such as certain routes to and from transit as well as streets with active commercial uses frequented by pedestrians. Developments along the "P" streets are now required to have active uses on the ground floor rather than blank walls and prohibit vehicular curb cuts along the sidewalk.

THE CITY THAT BIKES

In addition to transit use, the city promotes travel by bicycle. In 2001, *Bicycling Magazine* selected Chicago as the best "big" city (over 1 million people) for bicycling in North America. This recognition was due in large part to the success of *The Bike 2000 Plan*. Prepared in 1992 by the Mayor's Bicycle Advisory Council, the plan identified 31 strategies to encourage bicycling in Chicago. Almost all of

Energy Conservation. Basement lighting retrofit – Before.

Basement lighting retrofit – After.

these strategies have been addressed to date, including:

- Establishing a network of 100 miles of on-street bike lanes and 47 miles of off-street trails.
- Installing 10,000 bike racks – more than any other city in the United States.
- Permitting bicycles on CTA trains and equipping the fleet of 2,000 buses with bike racks to provide more travel choices.
- Producing award-winning educational publications, including the Chicago Bike Map, Safe Bicycling in Chicago, and Kids on Bikes in Chicago.
- Staging innovative outreach programs, such as Safe Routes to School, the Bicycling Ambassadors, and the annual Bike Chicago festival, which have encouraged 750,000 Chicagoans to bicycle.

A bike commuter station located within Millennium Park is the most recent addition to Chicago's bicycle infrastructure, featuring 300 indoor secure bike parking spaces. The facility provides free parking, bike repair services, bike rentals, and equipment sales, as well as numerous membership benefits such as access to lockers and showers. Partially powered by solar panels and ventilated naturally, the facility is also home to the Chicago Police Bike Patrol. Additionally, a unique partnership with I-Go car sharing has made two hybrid cars available on-site for car sharing.

By providing effective public transportation, and extensive bike infrastructure, Chicagoans are given an alternative to automobile ownership, which frees-up funds and makes Chicago a more affordable place to live. The estimated $6,000 annual cost of car ownership can be utilized for housing, food, or entertainment.

CONSERVING NATURAL RESOURCES

The city of Chicago Environmental Action Agenda states that the city of Chicago will continue to conserve, protect, and restore our region's invaluable natural resources by:

- Identifying opportunities for water conservation, the wise management of stormwater and by sponsoring local and regional legislation to protect our lakes and rivers.
- Developing and maintaining city landscaping, parks, forests and open space.
- Restoring the Chicago River system and increasing access to it as a source of recreation and enjoyment.

The conservation of natural resources, such as the river and lakeshore, implementation of strategies to improve air quality and efforts to improve water quality are important in making Chicago a green city. Perhaps the greatest impact from these conservation efforts has been with water.

Renewable Energy. Art Institute of Chicago PV Installation (51.5 kilowatts).

Recognizing that Chicago has a responsibility to protect our water resources, Mayor Daley introduced Chicago's Water Agenda in Spring 2003. The agenda outlines a comprehensive strategy for ensuring we are good stewards of all our water resources, including Lake Michigan, the Chicago River, Lake Calumet, the Calumet River, and thousands of acres of wetlands, creeks, streams, and lagoons.

Chicago's Water Agenda demonstrates local government leadership and innovation in protecting water resources, outlining a series of action steps related to conservation, water quality protection, stormwater management, and public awareness.

CONCLUSION

Over the next century, cities will play an even larger role in shaping how we live our lives. The innovation underway in Chicago, and other cities, demonstrates that cities can contribute positively to redefining our society's relationship to the natural world while improving quality of life and becoming more economically prosperous.

Cities can capture rainwater and utilize it as a resource instead of paying the financial and environmental costs of sending it from one pipe to another. Cities can be designed and built to encourage citizens to get out of their cars and onto bikes or the sidewalk. Cities can lead by example by incorporating cutting edge environmental strategies into our daily practices. The implications for improving the lives of billions of people around the world rely on taking these efforts to the next step. We invite you to join us in redefining how cities function and in making the lives of city dwellers even more wonderful.