

PERSPECTIVE

Calculating a City's Carbon Footprint

Catherine R. Ferrari

Today we are living in a “go green” society where citizens recognize that the impact of what they eat, wear, and buy affects the earth. The terms *green*, *sustainable*, and *eco-friendly* have become buzzwords and hot topics in today's popular culture. Different variations of carbon-footprint calculators may be found on the Internet for individuals to use in order to determine how their lifestyle choices impact the earth. Companies hand out promotional canvas bags and reusable metal water bottles to persuade the public to reuse rather than to perpetuate consumption. So let's face it—it's hip to be green. Yet, as increased awareness of the drastic world climate change grows, we begin to realize that we need to not only make better personal decisions, but also alter how we build and plan for the future. The desire to build and live in an environmentally friendly way has planners, developers, architects, and government officials making sustainability standards a top priority when designing cities and neighborhoods for future development.

In 1998, the United States Green Building Council (USGBC) developed a green building rating system called Leadership in Energy and Environmental Design (LEED) that provided a set of standards for sustainable construction. A goal of LEED standards is to transform the building industry by introducing rating systems that reflect scientific knowledge, leading-edge architectural and engineering design approaches, and best practices in construction and development (Yudelson, 2007). Developers and architects around the world now strive to have their buildings become LEED certified and are designing them to reach gold, silver, or platinum status.

While reducing the amount of greenhouse gases a single building creates is beneficial to a community, it has little impact on the overall carbon footprint of a city or neighborhood. Buildings are only one part of a city's infrastructure. When reading a chart for a city's breakdown of carbon emissions, it typically breaks down as percentage from buildings, percentage from industrial, and percentage from transportation. Where do streetscape projects fit in? The transportation category usually relates to the number of automobiles on the road and not the maintenance of streets, whereas the percentage of carbon emissions from the industrial category represents manufacturing plants. Therefore, to make real systemic change in reducing urban emissions, a broader vision is needed. In an urban setting, such a vision must consider the overall plan of the city through its neighborhood development and street infrastructure. Consequently, urban planners are beginning to study and implement sustainable practices on a much larger scale than simply individual buildings.

Efforts to plan environmentally friendly cities and neighborhoods began in 2009 when the USGBC partnered with the Congress for New Urbanism and the Natural Resource Defense Council to create a new strategy for bringing sustainability to the scale of neighborhoods and communities (USGBC, 2008). The LEED for Neighborhood Development Rating System, otherwise known as LEED-ND, integrates the principles of smart growth, urbanism, and green building into the first national system for neighborhood design. The primary goal of LEED-ND is to create communities that have easy access to jobs, housing, public transit, local businesses, goods and services, schools, and recreation so that people spend more time and money in their own neighborhoods and have an overall better quality of life.

Although news and discussions about neighborhood development and LEED-

certified buildings are popular in the press and local government, simply addressing these two issues is not enough. We also need to think about how we maintain the city through the core of its infrastructure—the street. Famous urbanist Jane Jacobs (1992) argued that the public right of way in an urban setting is where the life of a city takes place—people mingle outside storefronts, walk to and from work, are seen at an outdoor café, and advertise for services and goods. Making streets more pedestrian friendly has the potential for helping reducing the carbon footprint of a city.

Currently, Chicago is asking “What is the carbon footprint of a streetscape project?” No other city has tackled this question. Most cities simply address sustainable design ideas in their streetscape manuals and suggest that designers implement sustainable practices into their design. While these manuals explain the benefits of implementing such practices, they do not address this important question: How much carbon emissions would be reduced by using sustainable methods over traditional methods? Chicago is taking an active role incorporating the quantitative data of this question into their guidelines manual.

Answering such a question is not simple. A street plays a key role in stormwater management, the urban heat-island effect, transportation, and quality of life. To address the impact that a street has on a city's carbon footprint, one must consider these different variables. When designing a sustainable streetscape, calculating the amount of carbon emissions that is saved all depends on which design elements a planner decides to implement. For example, stormwater management includes designing a street to handle a large rainfall. Designers have different solutions available to address the problem of runoff. Using permeable pavement instead of asphalt or concrete in the streets, sidewalks, and parking spaces would allow the rain to infiltrate the ground.

Bioswales incorporated into the design would help divert stormwater from flowing into the sewer system. Alternatively, runoff water could be stored in underground cisterns and used to water the surrounding landscape during a drought. These options divert the rainwater from flowing into the sewer system and in turn decrease the amount of emissions produced when pumping and cleaning the stormwater in a waste treatment facility.

In addition, trees help regulate local climate by providing shade and acting as windbreaks. Through evaporation, transpiration, and the uptake and storage of carbon dioxide, trees and other vegetation moderate the climate of the world and provide a breathable atmosphere. These benefits are especially important to the more than 80% of US citizens who live in cities and towns (Sustainable Sites Initiative, 2008). In Chicago, urban trees remove approximately 155,000 tons of carbon a year (*ibid.*, 25). Still, trees do more than simply take carbon out of the air. Planting trees along a street also reduces the urban heat island effect. The amount of energy that is needed to heat and cool a building tends to decrease when a tree is next to it, because the canopy of the tree provides shade on the building (McPherson, 1994). Studies have also shown that businesses with trees outside appear more aesthetically pleasing to consumers (Wolf, 2005). Calculating the amount of carbon that would be saved by implementing trees along a street depends upon the tree's type, age, how far the tree is from the building, and on which side of the building the tree is planted. These factors need to be considered to determine carbon emissions saved from planting a single tree. If a designer decides to have multiple species of trees, the process can become more complicated when calculating the total savings.

Designers need to reconsider the demolition and construction methods used to make the design a reality. If possible, using local materials made within 500 miles of the construction site saves carbon emissions on transporting the materials needed.

A planner might also consider recycling materials such as concrete and scrap metal to recycling centers during the demolition stage. On the other hand, reusing demolition materials and transforming them into new uses in the final project (e.g., street benches) also saves carbon emissions. In either method, virgin materials would be saved from being extracted from the ground.

Nevertheless, streets serve as a passageway for transportation. With the push to "go green" and the rise in gas prices, many people are switching from driving their car to riding public transportation or a bicycle. Naturally, making a street more attractive to alternative transportation (e.g., incorporating a bike lane or widening the sidewalks for pedestrian use) helps to save carbon emissions. These savings, however, depend on the number of people switching from cars to alternative transportation modes, as well as the average length of a trip.

As interest in sustainable design continues to grow, designers are given the opportunity to think creatively and innovatively when making design decisions for the urban environment. Our efforts to preserve and restore healthy ecosystems face a significant challenge—namely, persuading decision makers that the cost of changing conventional methods of landscape design, development, and maintenance is money well spent. Still, to make a wise economic argument for sustainability requires presenting an accurate evaluation of the benefits and cost-effectiveness of sustainable practices for both public and private entities.

We need to stop thinking about just making buildings green or simply planning neighborhoods better. Reducing the carbon footprint of a city takes more than that. We need to consider how we design the street and establish sustainable street standards. Chicago is leading the way and beginning to answer the carbon-emission question through a city sustainable streetscape pilot project. Armed with this information, planners and designers will be one

step closer to convincing government officials that designing cities and streets in a more sustainable way is more environmentally beneficial than using traditional methods. Understanding how much carbon is saved by a traditional streetscape compared to a sustainable one will lead to new standards that other cities might apply in the future and could lead to a LEED rating system for street design. As Kermit the Frog once said, "It's not easy being green," but the situation is improving. Combining and implementing green buildings, sustainable neighborhood development practices, and sustainable streetscape standards into future development will enable planners and public officials to move one step closer to eliminating their city's carbon footprint.

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Address correspondence to: Catherine R. Ferrari, 30 North LaSalle Street, Chicago, IL 60602; (phone) 321-744-5900; (email) cferrari2009@gmail.com.