# Building Reuse:
# Finding a Place on American Climate Policy Agendas

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September 2008

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Despite—and perhaps because of—an abdication of leadership at the federal level of government in the United States, public policy at the local level is playing a vital role in combating global climate change. But too few cities focus on greening the existing building stock as part of their climate change initiatives. Even fewer cities support building reuse as part of efforts to reduce greenhouse gas emissions.

The common perception is that historic buildings are energy sieves, and that the environmental costs of demolition and new construction are far outweighed by the energy saved by the operation of more energy efficient buildings. Yet preliminary research reveals that there are major environmental impacts associated with demolition and new construction. Reusing buildings and reinvesting in older and historic neighborhoods offer a means of avoiding these negative impacts.

Furthermore, research suggests that many historic and older buildings are actually more energy efficient than buildings of more recent vintage because of their site sensitivity, quality of construction, and use of passive heating and cooling. Nonetheless, the energy efficiency of many older and historic buildings can and should be improved through retrofits. An increasing number of green historic rehabilitation projects demonstrate that these retrofits can be undertaken with the utmost respect for the unique character of historic buildings.

The research case for the importance of reusing buildings and reinvesting in older communities is the subject of Part I of this paper, as is the rationale for retrofitting the existing building stock. Although the environmental benefits of retrofitting existing buildings can be estimated with some accuracy, research assessing the environmental benefits of reusing buildings is less straightforward.[1] Preliminary evidence suggests that building reuse creates significant carbon and energy savings, but additional research is needed. Research on the value of reinvesting in older, more traditionally planned communities, which offers the benefit of relying on existing infrastructure and promoting other modes besides the automobile, is also examined.

In Part II, this paper provides a brief overview of the federal policy landscape related to buildings and the built environment, then examines local climate change policy in the United States as it relates to preserving and protecting the existing built environment. This paper finds that while building-related climate change policy in most cities and states is directed toward greening new construction, some cities and states are developing innovative policy to address the goals of reuse, reinvestment, and retrofits.

**Background: The National Trust for Historic Preservation Sustainability Initiative**

In the United States, historic preservation—known as heritage conservation in other English-speaking countries—has traditionally focused on the conservation of our irreplaceable cultural resources, including buildings, monuments, and landscapes. Yet heritage stewardship is also inextricably linked to the responsible management of our *natural* resources. After all, our cultural treasures include everything from the majestic landscapes of the American West to buildings and other structures that required a significant investment of natural resources to construct. As the United States mobilizes

[1] A note on terminology: By **reuse** of buildings, I mean the act of keeping an existing building in service rather than demolishing or abandoning the structure. **Retrofitting** buildings, however, refers not just to reusing a building – but improving its energy performance and reducing other negative environmental impacts associated with the building.

to address the climate crisis, it is clear that we must make responsible and sustainable use of *all* of our resources, whether human-made or natural.

Although global warming is the result of the over-consumption of natural resources, the discussion of solutions often turns on activities that lead to further consumption. New green products—whether cars, homes, or office buildings—are presented as the solution to climate change. The National Trust for Historic Preservation launched its Sustainability Initiative in 2007 in order to bring to the conversation towards an understanding of the value of *conserving* our existing resources rather than consuming more.

The National Trust's Sustainability Initiative is guided by four core principles of sustainable stewardship. First, the **reuse** of our existing buildings reduces the amount of demolition and construction waste deposited in landfills, lessens the unnecessary demand for new energy and other natural resources needed to construct a new building, and conserves the energy originally expended to create the structures. **Reinvestment** in older and historic communities also has numerous environmental benefits. Older and historic communities tend to be centrally located, dense, walkable, and are often mass-transit accessible – qualities promoted by Smart Growth advocates. Reinvestment in these communities also preserves the energy expended in creating the existing infrastructure, such as roads, water systems and sewer lines.

**Retrofits** of historic buildings can and should be undertaken to extend building life and better capture the energy savings available through newer technologies. Finally, **respect** for our existing built environment is an important component of the Sustainability Initiative's strategy.

This paper is primarily concerned with three of these four principles – reuse, reinvestment, and retrofits. The more technical aspects of integrating green technology with respect for the integrity of historic buildings, which are not addressed herein, deserve far more attention.

**Part I: Why Existing Buildings Matter**

Although the United States is home to five percent of the world's population, it is responsible for 22 percent of worldwide greenhouse gas (GHG) emissions.[2] In 2006, China surpassed the United States as the single largest emitter of carbon dioxide, the chief contributor to global warming.[3] However, Americans have among the highest per capita emissions in the world. Per capita emissions in the United States amount to double those of other industrialized countries such as the United Kingdom, Japan, and Germany.[4]

The U.S. Energy Information Agency reports that approximately 28 percent of emissions come from the transportation sector, 36 percent are attributed to industry, and 36 percent are attributed to the operations of residential and commercial buildings.[5] Brookings Institution scholar and developer Christopher Lineberger has further analyzed this data and determined that fully 73 percent of carbon emissions are attributed to the built environment. Building operation and construction account for 45 percent of GHG, while the transportation sector (the means through which we move about the built

[2] U.S. Energy Information Agency, "Emissions of Greenhouse Gases Report," http://www.eia.doe.gov/oiaf/1605/ggrpt/ (accessed Sept. 1, 2008).
[3] Brad Knickerbocker, "China Now World's Biggest Greenhouse Gas Emitter," *Christian Science Monitor* June 28, 2007, http://www.csmonitor.com/2007/0628/p12s01-wogi.html (accessed Sept. 1, 2008).
[4] World Resources Institute, "Climate Analysis Indicators Tool," http://cait.wri.org/ (accessed Sept 1, 2008).
[5] U.S. Energy Information Agency, *Emissions of Greenhouse Gases Report*

environment) produces 28 percent of the harmful gases.[6] Annually, buildings also consume 70 percent of electricity in the U.S., and 40 percent of raw materials.[7]

The United States federal government has been slow in responding to the global warming threat in general, and has been particularly sluggish in addressing the challenge of reducing the environmental impacts associated with the nation's building stock. Compared to the federal government, state and local governments have been somewhat more progressive in this arena. Much of the progress made at any level of government has been driven by the work of the non-profit U.S. Green Building Council (USGBC).

Formed in 1993, the USGBC has brought considerable attention to the building-climate connection through advocacy, research and education. Shortly after its founding, the USGBC developed a rating system for sustainable buildings. After pilot studies in the late 1990s, the LEED-NC (New Construction and Major Renovation) standard became available for public use in 2000. Since the beginning of the decade, additional rating systems have been added for neighborhoods (LEED-ND), homes (LEED-H), existing building (LEED-EB) and other building types. The LEED standards are designed to incentivize private developers and building owners to improve energy efficiency of buildings and reduce other environmental impacts associated with building operations and construction. LEED standards have quickly become the gold standard in green building rating systems in the United States.

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[6] Christopher Leinberger, "Sustainable Urban Redevelopment and Climate Change Briefing" July 17, 2008.

[7] U.S. Green Building Council, "Green Building Research," http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1718 (accessed Sept 1, 2008)

Despite widespread public and private support, a number of criticisms of LEED have been raised, including that there is insufficient sensitivity to building location in the current standards. The current version of LEED-NC awards points for dense locations and mass-transit accessibility, but does not *require* that projects be constructed or rehabilitated in smart-locations. In fact, it is possible that a Platinum-certified building (the highest level of LEED certification attainable) could be located on the urban fringe. As has been demonstrated, poorly selected locations have a significant environmental impact. A study by *Environmental Building News* demonstrated that energy efficient gains made with green building technology are easily negated by high vehicle miles traveled (VMT) by employees at offices in sprawl locations.[8]

The allocation of points under the current version of LEED poses significant challenges. In particular, the distribution of credits undervalues the benefits of building reuse. For example, projects can earn one credit for reusing 75 percent of the core and shell of an existing building, or one credit for installing environmentally friendly carpeting.

Fortunately, the USGBC has taken such criticisms seriously. In May 2008, the USGBC released a draft of LEED 2009, which addresses the location and weighting concerns, among other issues. The proposed rating system is more context-sensitive than the previous version and provides many more points for placing or reusing buildings in environmentally responsible locations. This updated version of LEED will adopt a new system where credits are weighted according to Life Cycle Analysis Indicators (explained further below), and will take into consideration the durability of

[8] For further information, see a blog posting by the National Trust for Historic Preservation at http://blogs.nationaltrust.org/preservationnation/?p=625

materials.[9] It will also incorporate what the USGBC calls an "Alternative Compliance Path" which will make it easier for reuse projects to accumulate points.

But even with significant changes to LEED, convincing the American public of the importance of building reuse and retrofits and changing consumer preferences for "the new" will continue to be a challenge. Enormous financial obstacles and market distortions must be addressed before meaningful change can begin to occur. Public policy at every level of government must lead the way.

The remainder of this section examines more closely the environmental benefits associated with reusing buildings, reinvesting in older neighborhoods, and retrofitting the existing building stock.

**A. The Value of Building Reuse**

**Embodied Energy**

We are accustomed to thinking of buildings as mass consumers of energy. But they are also vast *repositories* of energy. It takes energy to extract and manufacture building materials, more energy to transport them to a construction site, and even more energy to assemble them into a building. All of the energy required to provide a finished product is known as embodied energy. Interest in quantifying the embodied energy in building materials first emerged during the 1960s and the 1970s. New York-based architect Richard Stein and researchers at the University of Illinois at Urbana-Champaign led the American field with research published in *Energy Use for Building Construction.*.The report provides the typical embodied-energy values for multiple types of building materials.

[9] Life Cycle Analysis is described in greater in Section I below.

During the oil embargo of the late 1970s, historic preservationists saw the opportunity to link environmental and energy concerns with the reuse of older buildings. Stein's analysis of building materials became the foundation for the preservation-motivated arguments regarding the value of energy embedded in historic buildings. The Advisory Council on Historic Preservation commissioned a study on the subject of energy conservation and historic preservation that is based on Stein's data. This study assessed four issues, including the energy already existing in structures to be rehabilitated, energy needed for construction and rehabilitation, energy needed for demolition and preparation of a construction site, and energy needed to operate a rehabilitated or newly constructed building.

The goal of the study was to produce simple formulas so that energy calculations could be applied to any historic building to better quantify the energy benefits of building conservation and rehabilitation. The final report, *Assessing the Energy Conservation: Benefits of Historic Preservation: Methods and Examples,* concludes that in all of the examined case studies, preservation saves more energy than demolition and reconstruction.

According to the Stein data, for example, constructing a 4600 square meter building requires approximately the same amount of energy needed to drive a car over 22 million kilometers - or more than 600 times around the earth.[10] Recent calculations using Stein's data suggest that when an existing building is demolished it takes between

[10] Advisory Council on Historic Preservation, *Assessing the Energy Conservation Benefits of Historic Preservation: Methods and Examples* (Washington, DC, 1979), 91.

approximately 25 and 60 years to recover the energy used in demolition and new construction.[11]

However, there are qualifications that must be made regarding the Stein data and the calculations produced by the Advisory Council on Historic Preservation. First, because these numbers are based on embodied energy values of materials used in *new* construction in the 1960s, they are not a precise calculation of the energy value of historic buildings. Instead, they offer an estimate of the amount of energy that would be needed to construct a new building in the 1960s. Since material manufacturing has changed over time, some critics argue that embodied energy values based on studies of 1960's new construction no longer accurately represent the amount of energy embodied in a new structure today.

There is also significant variation in the embodied energy numbers produced by Stein and more recent research in the field. Raymond Cole, a researcher at the University of British Columbia, has compared embodied energy data on commercial buildings from several sources and found sizable differences. For example, at an estimate of 18.6 MJ/m2, Richard Stein's embodied energy estimates for commercial structures are approximately double that of Japanese Researcher Oka at approximately 10.9 MJ/m2, and more than four times those produced by Cole's own research, which estimates the energy value at around 4.5 MJ/m2. [12]

The embodied energy research field is plagued with methodological issues. There is no scientifically-agreed upon standard for calculating embodied energy, and uncertainty and controversy surrounds the data collection process. For example,

[11] An embodied energy calculation is available at www.thegreenestbuilding.org.
[12] Raymond Cole, "Life-Cycle Energy use in Office Buildings," *Buildings and Environment* 31, no. 4 (1996), 307-317.

undefined boundary conditions muddle the collection of data. Some data collection relies on cradle-to-gate calculations, which measure the energy involved from raw material extraction up until materials leave the gate of the factory. For example a cradle-to-gate measurement of a building would include energy extracting raw materials (wood, steel, and other natural goods) and converting them in the building materials. Cradle-to-site calculations also include the energy costs associated with the actual buildings construction process on-site, and cradle-to-grave calculations include all energy costs through the disposal of a building. Numerous other methodological issues also await resolution.

With such dramatic differences in data and such methodological challenges, it is unsurprising that there is little scientific agreement about the importance of embodied energy relative to other energy used in buildings. In the past, embodied energy was believed to be relatively insignificant, amounting to no more than 10-15 percent of a building's total energy usage over a 50 year life span. According to the Athena Institute, a leader in life cycle research in North America, the vast majority of energy usage over a building's lifespan is used in operations. Reoccurring embodied energy, or the energy needed for remodeling and retrofits over a building's life span, accounts for another 10 percent of total energy usage. [13]

Recent research from outside North America looks at more energy efficient buildings and suggests that the Athena Institute findings may significantly underestimate the total ratio of embodied to operating energy. A 2007 study by Klunder Itard finds that

[13] Athena Institute; http://www.athenasmi.org/about/

embodied energy can account for 30 percent of total energy use in homes.[14] Research that assessed green multi-family housing in Sweden found that up to 45 percent of lifecycle energy costs are attributed to embodied energy.[15] One Israeli study found that embodied energy accounted for 60 percent of a building's energy usage over a 50 year life cycle.[16]

With ever-increasing concerns about energy and other resource use, scientists must reach a consensus on an accepted methodology for calculating embodied energy. A renewed effort must then be made to accurately account for the embedded energy in buildings. Even with questions about the reliability of current data, one thing is certain: as buildings become more and more energy efficient, embodied energy will account for a proportionally larger share of a building's total lifetime energy usage.  Proponents of demolition and reconstruction will be increasingly less justified in arguing that buildings can or should be destroyed in the name of environmental conservation.

**Embodied Carbon**

Interest in embodied carbon is a more recent phenomenon, driven by concerns about climate change inducing carbon dioxide emissions. Like embodied energy, embodied carbon calculations estimate the amount of carbon emitted through building construction, including the carbon emitted extracting and manufacturing building materials, carbon emitted in transporting materials, and carbon emitted assembling a

[14] Itard Klunder, "Comparing Environmental Impacts of Renovated Housing Stock with New Construction," *Building Research & Information* 35, no. 3 (2007), 252-267.
[15] Catarina Thormark, "A Low Energy Building in a Life-Cycle –its Embodied Energy, Energy Need for Operation and Recycling Potential," *Building and Environment* 37, no. 4 (2001).
[16] N Huberman and D. Pealman, "A Life-Cycle Energy Analysis of Building Materials in the Negev Desert ," *Energy & Buildings* 40, no. 5 (2008), 837-848.

building. In 2006, a comprehensive assessment of carbon associated with building materials was conducted by researchers Craig Jones and Geoff Hammond from the University of Bath in the United Kingdom. Jones and Hammond's draft of *Inventory of Carbon and Energy* (ICE) drew data from secondary resources, including books, conference papers, and the web. The ICE draft selected what the researchers believed to be the best of this data to create the ICE database.

Jones and Hammond found that the embodied carbon figures are less accurate than those for embodied energy. Only about 20 percent of the researchers that produced embodied energy data used in the Inventory also provided estimates of embodied carbon; thus, Hammond and Craig relied on other sources, such as data for average fuel mix per industry.[17] In addition, embodied carbon numbers are also compromised by other methodological issues that plague researchers. Nonetheless, the *Inventory of Carbon and Energy* is still the most complete study to date that synthesizes research on embodied carbon.

Using ICE data, *New Tricks with Old Bricks*, a March 2008 study from the British Empty Home Agency, compares carbon dioxide emissions in new construction with the refurbishment of existing homes. The study concludes that when embodied CO2 is taken into account, new, energy-efficient homes recover the carbon expended in construction only after 35-50 years of energy efficient operations.[18]

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[17] Geoff Hammond and Craig Jones, *Inventory of Carbon and Energy (Version 1.5 Beta)* (Bath, U.K.: University of Bath,[2006]).pg. 2

[18] Building and Social Housing Foundation and Empty Homes Agency, *New Tricks with Old Bricks* (London, U.K.) Empty Homes Agency, http://www.emptyhomes.com/documents/publications/reports/New%20Tricks%20With%20Old%20Bricks%20-%20final%2012-03-081.pdf. 2008

Architect Stephen Tilly has noted that while new construction may offer carbon savings in the longer term (30-50 years, according to the UK analysis), most climate scientists have argued that carbon emissions must be reduced radically within the next 20-30 years. New construction appears to have a damaging impact on the environment in the short to mid-term, and environmental benefits would be recognized only after up to a half-century of efficient operations.[19] Since the climate crisis requires immediate action to reduce global warming gasses, reuse and retrofits of existing buildings offer a more environmentally responsible way of reducing carbon emissions in the short term than demolition and new construction.

**Life Cycle Analysis**

Estimates of embodied energy or embodied carbon look at only one dimension of the impacts of building construction, and are therefore limited tools. According to Canadian Architect, "the internationally accepted method for evaluating the environmental effects of buildings and their materials is life cycle assessment (LCA)."[20] This process evaluates the direct and indirect environmental impacts associated with a building by quantifying energy, material usage and environmental releases at each stage of the life cycle. The calculation also includes resource extraction, goods manufacturing, construction, use, and disposal.

LCA is considered superior to other forms of environmental assessment because

[19] Personal conversation with Stephen Tilly, AIA. July 28, 2008
[20] Canadian Architect, "Measures of Sustainability," http://www.canadianarchitect.com/asf/perspectives_sustainibility/measures_of_sustainablity/measures_of_sustainablity_intro.htm (accessed June 7, 2007).

it examines impacts during a building's entire life, rather than focusing on environmental impacts at one particular stage. Unlike embodied energy or embodied carbon calculations, LCA provides an assessment of environmental impacts such as air and water pollution, toxic releases in landfills, and natural resource depletion.

The Athena Institute is one of the leading developers of LCA software in North America. In *Renovating vs. Building New: The Environmental Merits*, Wayne Trusty, President of the Athena Institute, discusses the application of Athena's Environmental Impact Estimator software. The software is able to compare the environmental costs of renovation versus new construction. Trusty explains the importance of looking at a variety of indicators to understand a building's environmental impact.

> "In the case of buildings, the energy required to operate a building over its life greatly overshadows the energy attributed to the products used in its construction. However, for other embodied effects such as toxic releases to water, effects during the resource extraction and manufacturing stages greatly outweigh any release associated with building operations**.** The essence of LCA is to cast a wide net and capture all of the relevant effects associated with a product or process over its full life cycle."[21]

Trusty's analysis suggests the importance of assessing and weighing *all* impacts of new construction – not just the energy used – to understand the full environmental costs and benefits of new construction relative to rehabilitation.

Yet his analysis regarding the energy dimension of the LCA methodology raises important questions. As discussed above, there are significant methodological issues

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[21] Wayne Trusty, *Renovating vs. Building New: The Environmental Merits*, 200?), http://athenasmi.ca/publications/docs/OECD_paper.pdf (accessed October 12, 2007).

that call into question the accuracy of embodied energy estimates, and since these numbers are embedded in LCA models such as those used by Athena, the resulting LCA analysis may be inaccurate.

Nevertheless, a recent study by Dian Ross with the University of Victoria uses the Athena software to perform three separate life cycle analyses for a heritage building and a newly constructed building. The Ross study concludes that the "Hypothetical House [newly constructed house] consumes more energy in its construction, and at a substantially higher environmental cost than the Original house." She notes that operating cost comparisons alone do not fully consider the environmental impact of demolition and new construction. [22]

Both Ross's and Trusty's work demonstrate the need for a comprehensive assessment of the environmental impacts of reuse versus new construction, and underscores the importance of ensuring that embodied energy and embodied carbon data are accurate. This is all the more important now that the influential U.S. Green Building Council has made Athena's LCA model the basis for the distribution of points under LEED.

**B. Reinvestment: Why Neighborhoods Matter**

While building reuse represents an important means of reducing carbon emissions and the use of energy and other natural resources, reinvestment in older neighborhoods offers a means to capitalize not only on the embodied energy and carbon in existing

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[22] Dian Ross, "Life Cycle Assessment in Heritage Buildings" (Work Term Report, Victoria, British Columbia, 2007).

buildings, but also on the infrastructure that serves buildings. As will be examined, older and historic neighborhoods offer other environmental advantages as well.

*Land Use*

In recent years, land has been developed in the United States at a rate of approximately three times that of population growth. In fact, the average American uses five times more land than just 40 years ago. For example, while the city of Baltimore, Maryland lost about 250,000 residents in the last quarter century, its suburbs expanded by 67 percent.[23] In yet another older Northeast city, Philadelphia, metropolitan population growth has grown by 66 percent in the past 50 years, but land development has grown by 401 percent.[24]

Land use has a tremendous impact on carbon emissions. Research has demonstrated that in the United States, people who live in more sprawling locations drive 20-40 percent more than those who live in more compact urban areas.[25] Yet as the authors of the recent *Growing Cooler* report note, "for 60 years, we have built homes ever farther from workplaces, created schools that are inaccessible except by motor vehicle, and isolated other destinations – such as shopping – from work and home."[26] The planning and transportation theory of "smart growth" has emerged as an alternative to such

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[23]Chesapeake Bay Foundation, "Growth Sprawl and the Chesapeake Bay: Facts about Growth and Land use," http://www.cbf.org/site/PageServer?pagename=resources_facts_sprawl (accessed Sept. 1, 2008). http://www.cbf.org/site/PageServer?pagename=resources_facts_sprawl

[24] Brookings Institution Center on Metropolitan Policy, *Back to Prosperity: A Competitive Agenda for Renewing Pennsylvania* (Washington DC: The Brookings Institution,[2003]), http://www.brookings.edu/es/urban/pa/chapter1.pdf.

[25] Reid Ewing, Keith Bartholomew, Steve Winkelman, Jerry Waters and Don Chcen, *Growing Cooler: Evidence on Urban Development and Climate Change Executive Summary* (Washington, D.C.: The Urban Land Institute,2008), http://www.1kfriends.org/documents/Growing_Cooler_Executive_Summary.pdf (accessed Sept. 1, 2008) pg. 4 Cooler pg. 4).

[26] Ibid pg. 2

sprawling development, and promotes high concentration of growth, transit-oriented development, and walkable, mixed-use communities.

The research surveyed in Growing Cooler "shows that much of the [projected] rise in vehicle emissions can be curbed simply by growing in a way that will make it easier of Americans to drive less."[27] Smart growth tactics could "reduce total transportation-related emissions from current trends by 7 to 10 percent as of 2050,"[28] according to some projections. The Brookings Institution notes that carbon savings from smart growth extend well beyond those associated with decreased driving. Compact development often means reduced heating and cooling costs because homes are smaller, or are in multi-family buildings. District energy systems can be used for power generation, which also creates substantial carbon savings. Municipal infrastructure requirements for roads, sewers, communication, power, and water are reduced by high density developments. Brookings points out that the reuse of existing structures provides carbon savings as well. [29]

Sprawl is a relatively recent phenomenon, because pre-World War II communities were built more compactly out of necessity. These neighborhoods tend to be dense, walkable, feature mixed uses, and are very often accessible to public transit. It makes sense that a significant component of a smart growth strategy would be to reinvest and redevelop in older urbanized areas to take advantage of their inherently

[27] Ibid pg.4
[28] Ibid pg. 9
[29]Marilyn A. Brown, Frank Southworth and Andrea Sarzynski, *Shrinking the Carbon Footprint of Metropolitan America* (Washington, D.C.: The Brookings Institution, 2008), pg. 11-12 http://www.brookings.edu/~/media/Files/rc/reports/2008/05_carbon_footprint_sarzynski/carbonfootprint_report.pdf.

sustainable features. Nevertheless, there are numerous obstacles to reinvestment in these older areas.

*Demographic Shifts and the Abandonment of Sustainable Communities*

Major demographic shifts in the last half-century have resulted in the movement of millions of Americans from older and historic communities in the Northeast and Midwestern United States to points south and southwest.[30] This southward flight has been fueled by the significant restructuring of the American economy, including the loss of manufacturing jobs that were previously concentrated in the Northeast and Midwest. While older industrial cities (now known as rustbelt cities) hollow out, tremendous population growth has occurred in areas such as Atlanta, Phoenix, and Las Vegas, where sprawl is the dominant form of development, and where water resources in particular are scarce. The result is the movement of millions of people from more sustainably designed places to far less sustainably developed areas that face uncertain futures given rapidly escalating gas prices and water scarcity.

There is some good news, however. Reinvestment in many traditionally planned communities in some regions of the U.S. – largely on the coasts - is occurring. With gas hovering between $115-135 a barrel, Americans now have more incentive than ever to reduce VMTs and live and work in transit-accessible areas. Recent analysis suggests that while housing prices have dropped between significantly nationwide, homes in center cities or in transit accessible areas have retained, or even increased in value.[31]

[30]Bruce Katz and Robert Lang, *Redefining Urban and Suburban America: Evidence from Census 2000* (Washington, DC: The Brookings Institution, 2005).
[31] Eric M. Weiss, "Gas Prices Apply Brakes to Suburban Migration," *Washington Post* August 5, 2008, http://www.washingtonpost.com/wp-dyn/content/story/2008/08/04/ST2008080402649.html.

Nonetheless, rustbelt cities lie fallow, and remain significantly underused and potentially undervalued assets. This poses several important questions: Is it environmentally responsible to encourage growth in areas of the country that are environmentally unfit to handle it – while masses of infrastructure and buildings in sustainable designed cities rot? What are the *real* environmental consequences of such decisions? Or is disinvestment in the rustbelt just a simple – if troubling -- economic and political reality with no solution?

The answers are not so clear. But with millions of square feet of abandoned building stock, the questions seem to warrant at least some consideration. This is an area in which additional research and thought is of enormous importance.

### C. The Value of Green Retrofits

In addition to reinvestment in older and historic communities and building reuse, building retrofits offer a significant and essential means of reducing carbon dioxide emissions in the United States. Researchers from McKinsey and Company identified five major clusters of abatement potential, including the building and appliance sectors. Buildings and appliance efficiency is projected to reduce carbon emissions by at least 710 megatons by 2030.[32]

Significant barriers to retrofitting buildings exist, including:

> **Cost:** Many home and business owners expect a short payback period. Many consumers are reluctant or unable to make the capital investment needed to retrofit a home or building.

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[32] Jon Creyts et. al., *Reducing U.S. Greenhouse Gas Emissions: How Much and at what Cost?* McKinsey & Company,[2007]), pg. 33, http://www.mckinsey.com/clientservice/ccsi/pdf/US_ghg_final_report.pdf.

**Visibility:** Energy consumers often do not see the real price of power, or how power usage can be reduced dramatically based on behavioral changes.

**Agency.** Landlords frequently pass on utility costs to tenants. While the market for energy efficient buildings is improving, there are not enough incentives to outweigh the substantial capital outlay required for owners to retrofit their buildings.

**Quality**. Consumers may worry that efficient appliances may not perform as well as conventional ones.

**Availability.** Energy efficient products and/or skilled labor to perform retrofits may not be readily available in certain geographic areas.[33]

These barriers often make it more attractive to demolish and rebuild a new green building rather than reuse and retrofit an existing building.

*Historic Buildings and Energy Efficiency*

There is a widespread perception that buildings constructed prior to World War II are "energy-hogs," and are far less energy efficient than more recently constructed buildings. However, data from the U.S. Energy Information Agency suggests that buildings constructed before 1920 are actually more energy efficient than buildings built

[33] Ibid pg.41

at any time afterwards – except for those built after 2000. Even then, the improved performance of new construction is marginal.[34]

**Average annual energy consumption Btu/sq. ft**

**Commercial Buildings (non malls)**

| | |
|---|---|
| Before 1920 | 80,127 |
| 1920 – 1945 | 90,234 |
| 1946 – 1959 | 80,198 |
| 1960 – 1969 | 90,976 |
| 1970 – 1979 | 94,968 |
| 1980 – 1989 | 100,077 |
| 1990 – 1999 | 88,834 |
| 2000 – 2003 | 79,703[35] |

This data suggests that only in the last ten years have we constructed buildings that are more efficient than those constructed prior to 1920.

Furthermore, in 1999, the federal General Services Administration (GSA) examined its buildings inventory and found that utility costs for historic buildings were 27 percent less than for more modern buildings.[36] The relatively superior performance of historic buildings is due largely to difference in construction methods. Many historic buildings have thick, solid walls with thermal mass that reduces the amount of energy needed for heating and cooling. Buildings designed before the widespread use of electricity often feature transoms, high ceilings, and large windows for natural light and ventilation, as well as shaded porches and other features to reduce solar gain. In the past, architects and builders also paid close attention to siting and landscaping as

[34]U.S. Energy Information Agency. Consumption of Gross Energy Intensity for Sum of Major Fuels for Non Mall Buildings. 2003. Available at: http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set9/2003pdf/c3.pdf
[35] Ibid
[36] U.S. General Services Administration, *Financing Historic Federal Buildings: An Analysis of Current Practice* (Washington, D.C.: Office of Business Performance, Public Building Service, General Services Administration,[1999]).

methods for maximizing sun exposure during the winter months and minimizing it during warmer months.

Despite data suggesting the overall efficiency of pre-1920 buildings, there are many instances in which historic buildings do not use energy efficiently. Older forms of heating and cooling do not often match the precision of today's technology. Elaine Adams from the General Service Administration noted that alterations to many historic buildings over the years have actually made buildings that were once efficient more energy inefficient.[37]

Modern buildings, or those constructed between 1940 an 1970, present a different and more complicated set of challenges. Architect Carl Elefante has noted that modern era buildings perform very differently than buildings constructed before World War II.[38] These buildings were often constructed of experimental materials and systems that failed or never performed as expected. This lack of quality was also driven by a building ethic and philosophy that posited that buildings should only last about 30 years and that each generation should have the opportunity to build anew.

Since these buildings were constructed during an era in which cheap energy was abundant, there were also few concerns about designing buildings efficiently. Government data provided above illustrates the poor energy performance of these buildings. However, demolishing these buildings and replacing them is not a realistic solution. Elefante notes that "in practical terms, the quantity of the modern-era building stock dictates that we find ways to use these buildings far into the future. Their (lack of)

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[37] This chart was created by Elaine Gallagher Adams, AIA LEED APN, formerly with the GSA's Denver office.
[38] Carl Elefante, "The Greenest Building is...One that's Already Built," *Forum Journal* 21, no. 4 (Summer 2007), pg. 26-38, http://www.preservationnation.org/issues/sustainability/additional-resources/Forum_Journal_Summer2007_Elifante.pdf.

quality requires that we find efficient yet effective ways to transform them, elevating their performance to sustainable levels."[39]

*The Challenge Ahead*

Although building reuse, reinvestment in existing neighborhoods, and retrofits of existing buildings are important strategies for reducing carbon emissions in the United States, these are not yet market-driven outcomes. Because of a range of market realities, consumer preferences, and ill-formed policies, buildings are often demolished to make way for new construction, older communities are abandoned in favor of the new, and green retrofits of existing structures do not occur at nearly the rate needed. Policy changes at every level of government offer a means to addressing some of these challenges.

The following section offers a very brief overview of the federal policy landscape vis-à-vis the built environment, with the goal of establishing the context in which local governments have been left to develop their own approaches to climate change policy, particularly as it relates to the goals of reuse, reinvestment, and retrofits. Recent developments in the cities of New York (NY), San Francisco (CA), Tacoma (WA), and Dubuque (IA) will be assessed.

## II. Policy

### The Federal Policy Landscape

Federal climate-related policy in the United States consists of a patchwork of programs and laws that are estimated to reduce carbon dioxide emissions by a small margin. In

[39] Ibid pg. 29

fact, given projections about population increase in the United States, carbon emissions are expected to rise by 1.5 percent a year between now and 2025, and it is doubtful that existing federal measures will result in net carbon emission reductions in the near term.[40]

Specifically, a small number of federal policies and programs have focused on reducing carbon emissions in privately owned homes and buildings. For example, in 1992, the Department of Energy's Energy Star program was created to provide energy efficiency ratings for homes and appliances. This program enables consumers to make wiser choices about their purchases, and is widely viewed as successful. In addition to the Energy Star program, tax credits for solar panel installation have existed since 2006 and provide homeowners with up to $2000 to cover the cost of installation of solar units. However, these credits are set to expire at the end of 2008.

Although helpful, such programs are a far cry from the over-arching policy framework needed to tackle carbon emissions associated with the buildings.

### *Looking Ahead*

After many years of inaction on climate issues by Congress and the Administration, the mid-term elections of 2006 brought about a Democratic-dominated Congress that was more inclined to consider climate policy. The current session of Congress, which draws to a close in January 2009, produced a large amount of legislation related to climate change that was grand in scope, but less so in substance. Legislative proposals sought to address every aspect and dimension of climate change. Topics included

[40]U.S. Energy Information Agency, "Annual Energy Outlook 2005," U.S. Department of Energy, http://www.preservationnation.org/issues/sustainability/additional-resources/Forum_Journal_Summer2007_Elifante.pdf (accessed Sept 1, 2008).

conservation, energy efficiency, producing renewable sources of energy, and market-based incentives to save energy and reduce the industrial carbon footprint.

The only significant piece of legislation enacted was the Renewable Fuels, Consumer Protection, and Energy Efficiency Act of 2007. This law mandates the improvement of vehicle efficiency to increase the fuel efficiency of automobiles. The law includes an increase in vehicle efficiency from 27.5 miles per gallon to 35 miles per gallon by 2020 and requirements to increase the use of renewable fuels by nearly five times current levels. Other provisions are targeted at improving the energy performance of buildings. The law provides for the creation of an Office of High-Performance Green Buildings, and sets out increased efficiency standards for federal buildings. The law also includes increased efficiency standards for state residential and commercial building codes and authorizes grants to support state implementation of green building codes.

The 111$^{th}$ Congress considered one particularly notable piece of legislation that did not become law: the Lieberman-Warner Climate Security Act. Lieberman-Warner would have established a mandatory cap-and-trade program requiring power plants, petroleum refiners, and other big smokestack industries to either cut their own emissions or buy and sell credits on a new carbon market from carbon-reducing companies. Emissions from about three-quarters of the U.S. economy would be covered under the bill, which seeks to reduce greenhouse gas levels by about 70 percent from 2005 levels by mid-century. The bill suffered from a lack of sufficient political support for passage and was withdrawn in June 2008.

The fate of similar climate change legislation in the 112th Congress will depend on a multitude of factors in the coming year – most notably on who will occupy the

White House in 2009. Climate change proponents are optimistic about passing legislation in the next Congress to cap greenhouse gas emissions and allow polluters to buy and sell emissions allowances. Both presidential nominees, Barrack Obama and John McCain, support their own cap-and-trade plans and will greatly influence climate change sentiments in the White House.

While both Obama and McCain make serious commitments to pass comprehensive energy legislation to address climate change, Obama generally favors more aggressive action. He pledges an 80 percent reduction in emissions by 2050, whereas McCain calls for a 60 percent reduction. In the short and medium term, both candidates' priorities revolve around achieving efficiency goals and the transition to renewable forms energy.

It remains to be seen whether either candidate or the new Congress will create the larger policy framework needed to incite meaningful change in the way we build and use buildings. Far more is needed to both incentivize energy conservation and develop cleaner sources of energy, such as on-site renewables. In the mean time, state and local governments are leading the way.

**Leading the Way: State and Local Policy**

Despite the near absence of federal support or guidance, state and local governments have taken numerous measures to reduce carbon emissions and address other environmental concerns. The commitment of local government to meeting the climate challenge is particularly noteworthy, and demonstrated by the National Conference of Mayors Climate Protection Agreement, which was launched in February 2005. By signing the agreement, mayors pledge to meet or exceed Kyoto targets in their cities through land use policies, building codes, forest restoration projects, education, and other measures. As of August 2008, 850 mayors have signed the pact.

This following sections profile the progress of four cities in addressing greenhouse gas emissions associated with the built environment. Special emphasis will is placed on evaluating the extent to which these programs promote the goals of reusing existing buildings, reinvesting in traditionally planned communities, and fostering green retrofits of buildings.

**Local Policy**

Typically, the response from municipal governments to global warming has been to develop climate change action plans that involve efforts to reduce greenhouse gas emissions and simultaneously tackle the problems of recycling waste, conserving and recycling water, and creating green jobs. While these plans generally acknowledge the fact that buildings are the largest source of greenhouse gas emissions, they generally offer little in the way of strategies for reducing emissions through reuse of buildings, promoting reinvestment in older areas, and encouraging retrofits of the existing building stock. To varying degrees, the cities of New York (NY), San Francisco (CA), Tacoma (WA), and Dubuque (IA) are exceptional in that they address one or more of these principles of sustainable stewardship to a greater extent than most other communities.

**NYC – Leading the way in addressing the retrofit challenge**

In April 2007, New York City released its PLANYC 2030, which establishes a goal of reducing carbon emissions by 30 percent by 2030. Around 80 percent of New York City's carbon emissions are attributed to the operation of buildings, and in no other American city is the need for policy to address buildings more pronounced.[41] As the PLANYC 2030 authors explain, "Nationwide, energy efficiency efforts are focused on industry and automobiles, but in New York, our challenge is different—it is primarily the buildings." Furthermore, "when buildings are mentioned [in the context of other climate action plans] the context is usually new construction."[42]

PLANYC 2030 addresses the reality that by 2030, at least 85 percent of energy usage is expected to come from buildings that exist today.[43] The city acknowledges that significant efforts must be made to reduce emissions in extant buildings. The plan finds that "under-investment, a series of fragmented programs, and the absence of city-specific programs or planning have prevented us from achieving our efficiency potential."[44] It also notes that participation in existing programs has been disappointing because of the relatively high costs of going green, and because building owners have no incentive to improve energy efficiency, since lower utility costs will only benefit their tenants.

PLANYC 2030 establishes a number of strategies for reducing energy demand in buildings, including improving the energy efficiency of government buildings, enhancing building and energy codes, and creating targeted incentives, mandates and challenges. These incentives, mandates and challenges are specifically directed to the city's largest

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[41] City of New York, *PLANYC* (New York, NY: City of New York,[2007]), pg. 101, http://www.nyc.gov/html/planyc2030/downloads/pdf/full_report.pdf.
[42] Ibid. pg. 106
[43] Ibid pg. 106
[44] Ibid pg. 102

energy users, including institutional buildings, commercial and industrial buildings, and multi-family residential buildings. Targeting these consumers is expected to produce the largest energy savings possible initially, while creating the expertise and best practices needed to tackle energy efficiency improvements in smaller buildings.

The enormity of the challenge is vastly acknowledged. "With 5.2 billion square feet of space parceled into almost a million buildings, reining in the energy consumption of New York's building sector presents a challenge of remarkable complexity and scale."[45] An April 2008 progress report indicated only small steps forward in meeting these goals. While Mayor Michael Bloomberg signed into law a revision to the city's building and energy codes that incorporates many green elements, these will primarily affect new construction and major renovations. Progress in retrofitting major commercial and institutional buildings that are not undergoing major renovation has been slow.[46]

Like most other climate action plans reviewed for this paper, PLANYC 2030 does not identify the reuse of buildings as a priority to help reduce carbon emissions. Historic preservationists have expressed particular frustration that the values of historic buildings have not been called out in the plan.

Perhaps even so more than most other cities, New York is subject to tensions between the value of building reuse and higher levels of density. The increasing value of land located near transit introduces a conflict between the value of reusing existing buildings and increasing density in areas served by mass-transit. Reusing existing buildings, as discussed above, reduces the negative impacts associated with new

[45] Ibid pg. 107
[46] City of New York, *PLANYC Progress Report 2008* (New York, NY: City of New York,[2008]), http://www.nyc.gov/html/planyc2030/html/downloads/download.shtml (accessed Sept 1, 2008).

construction. However, increasing density in areas well served by mass transit reduces VMTs, and the development of environmentally costly new infrastructure.

PLANYC 2030 acknowledges the potential conflict between density and neighborhood preservation, noting “we must ask which neighborhoods would suffer from the additional density and which ones would mature with an infusion of people, jobs, stores and transit. We must weigh the consequences of carbon emissions, air quality, and energy efficiency when we decide the patterns that will shape our city over the coming decades.”[47] But this density-preservation challenge has not always been handled well in recent years.

For example, New York’s Lower East Side was listed by the National Trust for Historic Preservation as one of the 11 Most Endangered Places in 2008. Few places in America can boast such a rich tapestry of history, culture and architecture as New York's Lower East Side. This legendary neighborhood was the first home for waves of immigrants since the 18th century. The area is now undergoing rapid development with new hotels and condominium towers being erected across the area, looming large over the original tenement streetscape.

Neither the density-preservation conflict nor the green retrofits of more than five billion square feet of building stock lend themselves to easy solutions. Acknowledging these challenges and making them explicit in PLANYC 2030 is a significant step in the right direction. Whether the city is able to develop the right combination of policies to tackles these challenges remains to be seen. But New York remains a city to watch, and one that may well serve as an example for others.

[47] City of New York, *PLANYC 2030* pg. 18

**Making Reuse a Priority: San Francisco, California and Tacoma, Washington**

*San Francisco*

San Francisco, California, has developed an even more aggressive goal of reducing carbon emissions by 20 percent below 1990 levels by the year 2012. Like PLANYC 2030, San Francisco's SForward climate action plan places significant emphasis on improving energy efficiency in buildings. Strategies include providing subsidies and loans to businesses, homeowners and multi family housing owners, and assisting with solar roof installation.[48]

Unlike New York, or any other city evaluated for this paper, San Francisco is unique in directly addressing the density-preservation dilemma described above. The City's New Green Building ordinance, which the City touts as the most progressive in the country, requires LEED Gold certification of every private project over 5,000 gross square feet, beginning in 2012. Developers who demolish buildings and rebuild new structures must meet additional, more stringent requirements. For example, if an owner demolishes a building, the project must earn 10 percent more LEED credits than would normally be required. When a new building triples the density of the demolished structure, 8 percent more credits are required under the LEED system. If density is quadrupled, the point penalty is 6 percent of total LEED credits. [49]

The point penalties for demolition are somewhat arbitrary because they are not based on a rigorous assessment of the relative environmental benefits of building reuse

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[48] City of San Francisco, *Building A Bright Future: San Francisco's Environmental Plan 2008* (San Francisco, CA: City of San Francisco,[2008]), http://www.sfgov.org/site/uploadedfiles/mayor/SForwardFinal.pdf (accessed Sept. 1, 2008).
[49] *2008 Green Building Ordinance,* (2008): , http://www.sfenvironment.org/downloads/library/sf_green_building_ordinance_2008.pdf.

versus increasing density. However, San Francisco appears to be the first community to begin to grapple with the value of reuse of relative to density. San Francisco offers a model to other communities that will inevitably face the challenge of balancing increased density with the value of conserving the existing building stock.

*Tacoma*

The City of Tacoma, Washington, is among the more progressive in developing policy that is favorable toward reuse. As with most other cities, Tacoma's climate action plan identifies green building as an important strategy. The plan suggests that energy audits be required before the sale of any building and proposes hiring a "green building advocate" to provide technical assistance to homeowners, builders, architects, and developers. Tacoma also identifies smart growth as an important strategy for reducing carbon emissions. Such policies are largely centered on development that creates dense, walkable neighborhoods with a mixture of uses, and mass-transit accessibility.[50]

The City's recently released a climate action plan also establishes the reuse and recycling of buildings as a strategy for addressing global warming. It is noted that "using older buildings for new purposes should be encouraged by city policy."[51] While more is needed in the way of substantive recommendations to implement this strategy, Tacoma remains a leader among cities in calling out the reuse of buildings as a goal.

This focus on reuse is also reinforced by the development of a stronger demolition ordinance, This ordinance will require review of all permits issued for buildings over 50 years of age and provide an opportunity to determine whether a

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[50] Green Ribbon Climate Action Task Force, *Tacoma's Climate Action Plan* (Tacoma, WA: City fo Tacoma,[2008]), http://www.cityoftacoma.org/Page.aspx?nid=674.
[51] Ibid pg. 18

structure is historically significant and should be listed on the Tacoma register. (Structures listed on the register cannot be demolished.) This proposed policy change is designed to reduce the number of “teardowns” of historic homes and other buildings. Similar to people in other cities in the United States, many homeowners in Tacoma have decided to demolish their older home in order to build new, usually much larger homes.[52]

While teardowns present an enormous challenge for those concerned with retaining community character, they also present environmental concerns. Tacoma’s demolition ordinance is therefore motivated not only by an interest in historic preservation, but also by concerns about landfill waste and reducing the negative environmental impacts associated with new construction.

**Putting it All Together:**

**Promoting Reinvestment in Dubuque, Iowa’s Warehouse District**

Perhaps no single city is doing more than Dubuque, Iowa, to reuse older buildings, reinvest in urbanized areas, and retrofit buildings as part of its sustainable development policy. The Dubuque City Council “is committed to sustainable stewardship of our built environment through the adaptive reuse of existing structures that represent high volumes of embodied energy.” Through the Sustainable Dubuque Program, the city has launched the Dubuque Warehouse District project to revitalize a 17 block neighborhood that used to serve as the city’s mill-working area. The Warehouse district contains

[52] See more about teardowns at http://www.preservationnation.org/issues/teardowns/

approximately 1 million square feet of space that is currently underutilized and energy inefficient. [53]

The Dubuque Warehouse District Project includes the development of an Energy Efficiency Zone (EEZ) pilot program: The EEZ program, similar to an Enterprise Zone[54], would make assistance available to an existing, defined neighborhood to encourage energy efficient redevelopment of the area. Building owners in the EEZ would be eligible for technical assistance on greening their building, as well as grants and low-interest loans. The EEZ will also be home to a Zero Solid Waste pilot project, which will seek to dramatically reduce waste deposited in landfills.

Still, there are significant economic and social dimensions to the Warehouse project. City officials and council members see revitalization of the district as key to attracting high quality jobs and new residents to the area. According to the City, "this pedestrian friendly, urban cultural atmosphere creates a 'Live, Work, and Play' product that will promote the values of economic development, workforce recruitment, and energy efficiency to the growing number of individuals that place value on these components." Social and cultural values are also promoted by the retention of the rich historic fabric of the neighborhood.

## Conclusions

The urgency of climate change requires us to act even before we have all the facts at our disposal. Since each historic building can be seen as a nonrenewable

[53] Cindy Steinhauser and Teri Goodmann, *City of Dubuque, Iowa Power Fund Pre-Application* (Dubuque, Iowa: , 2008).
[54] Enterprise Zones are geographic areas targeted for economic redevelopment. These zones are often eligible for special economic incentives to promote revitalization.

resource, it would be wise -- even without all needed evidence -- to care for our existing built environment and encourage a conservation-based approach to sustainable development that values our existing buildings.

Existing research indicates the environmental value of existing buildings. Specifically, research concludes that it can take between 25 and 60 years to recover the energy lost through demolishing and reconstructing a building, and that it can take between 35-50 years to recover the carbon expended in constructing a new home. Reinvesting in older and historic communities takes advantage of the embodied energy and embodied carbon in existing buildings, and also directs population growth to neighborhoods that are typically sustainably designed. Retrofits of older and historic buildings also offer important means of reducing energy usage. However, more research is needed to quantify the benefits and tradeoffs of building reuse, neighborhood reinvestment, and green retrofits.

There has been a notable absence of federal policy that directs attention and resources to the environmental costs of buildings, leaving local jurisdictions and some states to step alone into the fray; some localities have begun to address their built environment as a chief contributor—and potential ally in combating—climate change. These cities offer practical policy strategies that can serve as examples for other communities, and inspire hope that the value of existing buildings will be integrated into sustainable development policy at all levels of government.

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