

Section 6: Low-Carbon Buildings¹

“Design is the first signal of human intention.” – William McDonough

We used to think of a building’s footprint as the area defined by its foundation. Today, the term means something different: the amount of greenhouse gases each structure emits into the atmosphere. Buildings have a greenhouse gas footprint, and it’s huge.

In the United States, residential and commercial buildings use nearly 40% of our energy and emit 38.5% of our greenhouse gas emissions. That makes our 116 million homes and nearly 5 million commercial buildings the nation’s number one energy consumers and contributors to global warming.² As architect William McDonough might say, the design of today’s buildings signals that we intend to cause climate change and all of its potentially disastrous consequences – surely an outcome we do not want.

Making the sector’s footprint smaller isn’t easy. Once a building is built, its footprint is locked in for decades. The majority of buildings that exist today still will be in use by mid-century. Only about 2-3% of the existing buildings in any given year are newly built. Unless a building undergoes significant remodeling, its enduring footprint affects not only the occupant’s energy bills, but the power grid, fuel supplies, air quality, public health and the climate.

¹ This chapter draws extensively, with permission, from documents of the Alliance to Save Energy, including J. Loper et al., *Reducing Carbon Dioxide Emissions Through Improved Energy Efficiency in Buildings*, October 2007; J. Loper et al., *Building on Success: Policies to Reduce Energy Waste in Buildings*, July 2005, www.ase.org/content/article/detail/2329; and fact sheets issued in 2007, as cited.

² The estimate on the number of buildings in the United States comes from the Energy Information Administration’s (EIA) *Annual Energy Outlook 2007* report, www.eia.doe.gov/oiaf/aeo/index.html. EIA counts 116.34 million residential units, including single family, multifamily and mobile homes. Residents account for 21% of national energy consumption. EIA’s *Commercial Buildings Energy Consumption Survey* from 2003 counted 4.9 million commercial buildings in the United States larger than 1,000 square feet. These buildings account for 18% of national energy use, not including commercial buildings of less than 1,000 square feet.

The good news is that in the United States, buildings and the equipment inside them are becoming more efficient and less polluting. The power demand for commercial lighting has been cut in half in recent years³; a home built in 2001 uses 12% less energy per square foot than one built in 1908⁴; and new refrigerators consume one-fourth the energy of those sold 20 years ago.⁵ Central air conditioners are available today that are 50% more efficient than the current standard,⁶ and modern “low-e” windows are at least 25% more efficient than the double-pane windows that comprise the majority of sales.⁷

But overall energy consumption and greenhouse gas emissions from buildings are rising because the number of buildings, their size and their plug loads all are growing. New homes in 2005 were 26% larger on average than the existing stock⁸; air conditioning has become common; clothes washers and dishwashers are standard appliances in most households; and the use of personal electronics has increased sharply. As a result, residential energy use has increased by one-third since 1980. The U.S. Energy Information Administration (EIA) projects that residential sector electric demand will grow 1.3% every year between 2005 and 2030 due primarily to an increase in the number of households, but also due to larger homes, digital televisions and more electronic devices.⁹

We have the tools to improve, and an array of studies suggest that using them could make rapid and substantial improvements in building efficiency and greenhouse gas reductions:

³ M. Heizer, “Saving Energy in Office Buildings,” *Heating, Piping and Air Conditioning Engineering* (May 2003), cited in Loper et al., *Building on Success*, 68n2.

⁴ Energy Information Administration, *Residential Energy Consumption Survey 2001*, table CE1-6.2u, www.eia.doe.gov/emeu/recs/recs2001/ce_pdf/enduse/ce1-62u_sqft_useind2001.pdf; EIA, *Residential Energy Consumption Survey 2004*, table 1.2.5, cited in Loper et al., *Building on Success*, 68n3.

⁵ “Issues: Oil & Energy; Efficient Appliances Save Energy—and Money,” issue brief, National Resources Defense Council, August 31, 2004, www.nrdc.org/air/energy/fappl.asp.

⁶ EIA, *Annual Energy Outlook 2004*, 72, cited in Loper et al., *Building on Success*, 68n15.

⁷ According to the EIA’s 2004 *Buildings Energy Data Book*, table 7.3.5, a typical single-family home still has single-pane windows. Low-e windows market share data comes from AAMA-WDMA, 2003 Industry Market Studies, 2003 AAMA-WDMA National Statistical Review and Forecast, 5, cited in Loper et al., *Building on Success*, 68n16.

⁸ EIA, *Annual Energy Outlook 2004*, 71, cited in Loper et al., *Building on Success* 68n10.

⁹ EIA, *Annual Energy Outlook 2007 with Projections to 2030*, www.eia.doe.gov/oiaf/aeo/demand.html.

- In a study commissioned by PCAP, analysts at the Alliance to Save Energy project that CO₂ emissions from buildings will increase a staggering 86% from today's levels if trends continue. But with aggressive use of energy efficiency measures that are available and cost-effective today, building emissions could be reduced by about 40% – even without major national greenhouse gas-pricing policies.¹⁰
- Recent studies of several states suggest that overall building energy efficiency could be improved by 10% to 30% in the next decade with technologies already known to be feasible and cost-effective.¹¹
- A 2006 report by the McKinsey Global Institute concluded that we could reduce energy use in new and existing buildings by more than 25% by 2020 with measures that pay for themselves in less than 10 years.¹²
- An analysis sponsored by the American Solar Energy Society¹³ predicts that the growth in greenhouse gas emissions from buildings can be held to less than 7% between 2002 and 2025 with the serious application of seven policies and programs: the Federal Energy Management Program, ENERGY STAR, better building codes, up-to-date appliance and equipment efficiency standards, utility-based financial incentives and low-income weatherization assistance.

The Zero-Energy Building

Today, it is possible to build a home that uses no net energy and produces no net greenhouse gas emissions – in other words, a home that generates as much or more energy than it consumes over the course of each year. Zero-energy buildings

¹⁰ Loper et al., *Reducing Carbon Dioxide Emissions*.

¹¹ See S. Nadel et al., *The Technical, Economic and Achievable Potential for Energy Efficiency in the U.S.: A Meta-Analysis of Recent Studies* (Washington, D.C.: ACEEE, 2004), 5-6, cited in Loper et al., *Building on Success*, 68n17. The authors reviewed studies for the United States, California, Massachusetts, New York, Oregon, Southwestern states, Vermont and Washington.

¹² "Improving Building Energy Codes," Alliance to Save Energy fact sheet, May 2007.

¹³ *Tackling Climate Change in the U.S.: Potential Carbon Emissions Reductions from Energy Efficiency and Renewable Energy by 2030* (Boulder, Colo.: ASES, January 2007).

are being demonstrated around the United States. The American Solar Energy Society predicts that net-zero-energy buildings will become cost-competitive alternatives in the marketplace by 2020.¹⁴ A prestigious coalition of associations representing building designers and engineers is advocating that all new and renovated buildings in the United States meet a zero-emissions standard by 2030 (see box).

On the Horizon: Homes as Power Plants

By the time today's children buy their own homes, there will be no utility bills as we know them now. That's the vision of a coalition that includes the American Institute of Architects; the American Society of Heating, Refrigerating and Air-Conditioning Engineers; Architecture 2030; the Illuminating Engineering Society of North America; and the U.S. Green Building Council.

By 2030, they say, new homes and commercial buildings will be selling power to electric utilities rather than buying it. New homes and commercial buildings will be super-efficient and will generate their own energy with solar and other renewable energy systems. The money that tomorrow's families and businesses save in zero-net-energy buildings will be the equivalent of new, tax-free income.

Carbon-neutral buildings will make another vision plausible: zero-emission neighborhoods where smart urban design, clean mass transit, urban forests and other sustainable development practices dramatically reduce the greenhouse gas footprint of the built environment. In June 2007, 40 national leaders meeting to discuss sustainability agreed that technology is not the problem.¹⁵ Good policies and strong leadership are the keys.

The technologies necessary to build and operate carbon-neutral communities largely exist. What's needed are a national leadership commitment; a set of systemic regulatory and market reforms reflecting the true value of energy

¹⁴ Ibid., 59.

¹⁵ The meeting was the third in a series of four National Leadership Summits for a Sustainable America, organized by PCAP Executive Director William Becker and hosted by the Johnson Foundation at its Wingspread Conference Center in Racine, WI.

efficiency and renewable energy resources; extensive consumer education and effective community design; and management tools for public and private development practitioners and our elected officials.¹⁶

Presidential Actions

1. Implement the building-related provisions of HR 3221, the energy efficiency legislation introduced in the 110th Congress.¹⁷

The Alliance to Save Energy estimates that full implementation of the building-related provisions of HR 3221 would reduce the projected energy consumption in the buildings sector 20% by 2030 and would cut CO₂ by 18%.¹⁸ By 2050, energy use and greenhouse gas emissions would be reduced 25% below EIA's business-as-usual projections. The provisions include:

- **Efficiency standards for several new appliances and equipment types and updates for several appliances already covered;**
- **An energy efficiency standard calling for a 20% savings in residential building efficiency by 2010 and a 50% savings by 2020;**
- **A stronger building code for manufactured housing;**
- **A renewable energy and energy efficiency portfolio standard requiring electric utilities to meet 15% of their demand with renewable resources, 4% of which can be from energy efficiency programs; and**
- **Extension of tax credits for energy-efficient appliances and energy efficiency improvements to commercial buildings.**

¹⁶ The National Leadership Summit for a Sustainable America: Summit 3, at the Johnson Foundation's Wingspread Conference Center June 4-6, 2007. For more information, see www.summits.ncat.org.

¹⁷ As the PCAP was being written in the fall of 2007, the Senate and House both had passed new energy bills and were preparing to resolve differences in conference. PCAP recommends that if the provisions of HR 3221 are not approved by the 110th Congress and signed by President Bush, the next President and Congress should work to pass and implement them.

¹⁸ These estimates, based on EIA projections, refer to "source energy" – energy consumed directly at the building site as well as the energy consumed by power plants to generate electricity. See the Alliance study referenced in Footnote #4, p. 2.

2. Limit the home-mortgage interest deduction.

Although homes and appliances have become more efficient in recent decades, per capita residential energy use has remained about the same because people have built bigger houses and used more energy-intensive equipment.¹⁹ The average home's floor area more than doubled between 1950 and 2000, as did floor area per capita; both have increased by more than half since the 1980s (see Figure 7.1).

Insofar as the home-mortgage interest deduction encourages people to build bigger homes, it is one of the ways that federal policy encourages greenhouse gas emissions. (See PCAP Chapter 1 for a discussion of subsidy reform.)

One solution has been proposed by Representative John Dingell in the 110th Congress: a reduced deduction for homes of 3,000 square feet and larger starting in 2010, with an exemption for large homes that obtain LEED certification.²⁰ For example, homes of 3,000-3,199 square feet could deduct 85% of mortgage interest, homes of 3,200 to 3,399 square feet could deduct 70% and so on. Homes of more than 4,200 square feet would receive no deduction.²¹

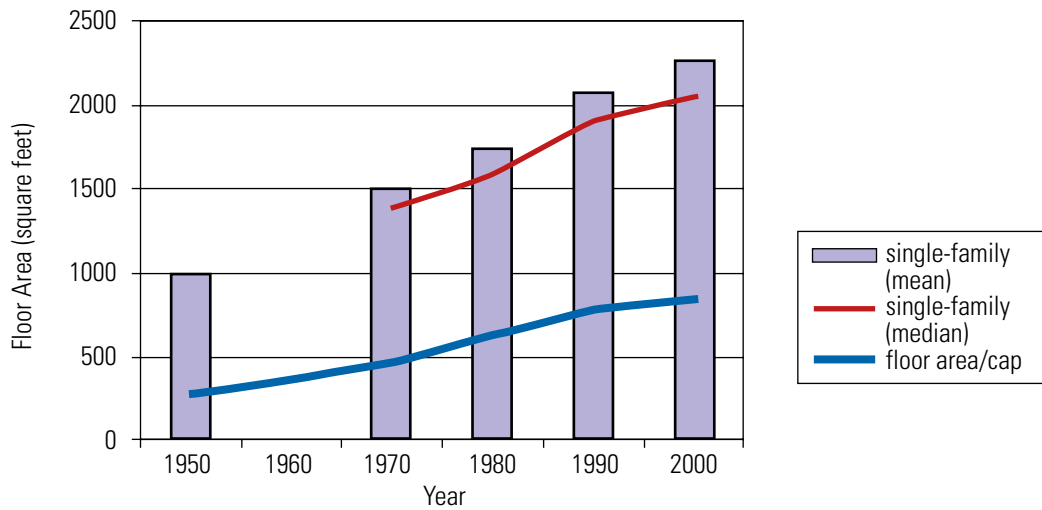
The President should support this change, along with the elimination of mortgage interest deductions for second or vacation homes. While the federal income tax deduction for home mortgage interest is one of the tax code's sacred cows and was originally intended to promote home ownership, it is one of the areas in which the President should ask the people of the United States to help reduce the nation's greenhouse gas emissions. Nationwide, the current deduction amounts to \$64 billion each year. Any additional federal revenue from a reform of the deduction should be returned to homeowners in the form of a tax credit for the cost of LEED certification and an expansion and extension of income-tax deductions for residential energy efficiency improvements, residential renewable energy systems and energy-efficient household equipment.

¹⁹ EIA, *Annual Energy Outlook 2007*.

²⁰ LEED is a green-building rating system administered by the U.S. Green Building Council.

²¹ See www.house.gov/dingell/summary_detail.shtml for the deduction schedule that would be established in the Dingell bill.

Figure 12: U.S. House Size (floor area) Mean and Median 1950-2000²²



National Association of Home Builders (NAHB), 2003. "Housing Facts: Figures and Trends 2003." Washington, D.C.

Source: NAHB 2003

3. Expand and expedite federal action on appliance efficiency standards.

Minimum energy efficiency standards for appliances and equipment have been a cornerstone of U.S. energy policy for nearly two decades. Today, national standards cover some 25 residential and commercial products that account for more than 50% of all building energy consumption.²³

By 2020, the standards in force today will save the equivalent of the energy used by 27 million American households.²⁴

But the savings would be much larger if the U.S. Department of Energy was complying with the schedules Congress has created for developing and issuing new appliance standards.

²² As appears in J. Harris et al., *Don't Supersize Me! Toward a Policy of Consumption-Based Energy Efficiency* (Washington, D.C.: ACEEE, Environmental Energy Technologies Division, 2006), 7-107.

²³ EIA, *Annual Energy Outlook 2007*, Tables A2, A4 and A5, pp. 138-139 and 142-145.

²⁴ *Leading the Way: Continued Opportunities for New State Appliance and Equipment Efficiency Standards*, Appliance Standards Awareness Project, March 2006, www.standardsasap.org/documents/a062.pdf.

Tax-Free Income

The American Council for an Energy Efficient Economy estimates that if less efficient products were removed from the marketplace, consumers could save an estimated \$186 billion in energy costs or about \$1,750 per household by 2030.

In January 2007, the Government Accountability Office (GAO) reported that DOE had missed all 34 deadlines set by Congress.²⁵ Some standards authorized in 1992 are still awaiting final rulemaking. The GAO estimated that the failure to update efficiency standards had resulted in consumers paying tens of billions of dollars more for energy than they would have, had the deadlines been met.

Bills being considered by the 110th Congress (HR 3221 and HR 6) designate a number of new standards already supported by manufacturers and efficiency advocates, including residential clothes washers, dishwashers and incandescent reflector lamps, walk-in freezers and metal halide lamps, among others. The President should:

- **Direct the U.S. Department of Energy (DOE) to identify the barriers that inhibit timely action on appliance efficiency standards, including staffing and funding needs and unnecessary requirements imposed by Congress – for example, requirements in the Energy Policy Act of 2005 (EPACT 2005) that DOE conduct a lengthy rulemaking process after consensus already had been reached by consumer groups and manufacturers. Champion the necessary appropriations and procedural reforms by Congress.**

²⁵ *Energy Efficiency: Long-standing Problems with DOE's Program for Setting Efficiency Standards Continue to Result in Forgone Energy Savings* (Washington, D.C.: General Accountability Office, January 2007), www.gao.gov/docsearch/abstract.php?rptno=GAO-07-42.

- **Require DOE to review and update each existing standard on a regular timetable.²⁶**
- **Direct DOE to set the maximum cost-effective efficiency level for appliance and equipment standards.**
- **Propose that Congress give DOE the authority to set regional standards for heating and cooling equipment to reflect differences in climate. (Under current law, all standards must be uniform nationwide. Regional standards for space-conditioning equipment would produce greater efficiency gains.)**
- **Propose that standby power (the power that certain appliances use while turned off) be incorporated into federal standards. Standby power represents 5% of residential electricity use in the United States.²⁷**
- **Support legislation to set an efficiency standard for lightbulbs, sufficient to phase out incandescent bulbs by 2012 and to increase the standard in 2020. The American Council for an Energy Efficient Economy (ACEEE) estimates that by 2030, the standards could save more energy than all previous appliance standards combined and could avoid the emission of more than 100 million metric tons (MMT) of CO₂.**

4. Extend energy-efficiency and renewable energy tax incentives.

EPACT 2005 established the first comprehensive set of tax incentives for highly efficient commercial buildings, new homes, home improvements, heating and cooling equipment, appliances, fuel cells, and hybrid and advanced diesel vehicles. ACEEE estimates that for a 10-year cost to the U.S. Treasury of about \$2.1 billion, tax incentives can reduce peak electric demand by the equivalent of about twenty 300-megawatt power plants, reduce consumer energy bills by \$27 billion and prevent more than 51 MMT of CO₂ emissions.

However, the tax credits in EPACT 2005 were set to expire at the end of 2007 and 2008, too short a time for most taxpayers to use them. EPACT did not become law until August 2005, and the IRS did not issue several of its guidelines for the

²⁶ For a recommended timetable, see Loper et al., *Reducing Carbon Dioxide Emissions*, 12.

²⁷ P. Bertoldi et al., *Standby Power Use: How Big Is the Problem? What Policies and Technical Solutions Can Address It?* (Berkeley, Calif.: Lawrence Berkeley National Laboratory, 2002).

credits until 2006 or later. PCAP Section 1 recommends that a Presidential Climate Protection Subsidy commission work with industry to determine the ideal duration of federal subsidies. In addition, the President should propose that Congress extend and increase the several energy efficiency tax incentives established by EPACT 2005 to avoid 35 MMT of CO₂ emissions by 2030.²⁸

5. Upgrade the quality and enforcement of building energy codes to reach zero-energy buildings by 2030.

Building energy codes, which set minimum energy efficiency standards for new residential and commercial buildings, are a highly effective policy tool when they are enforced and regularly updated to reflect advances in building technologies and practices. They help ensure that energy efficiency products are installed when each building is constructed – far less expensive than retrofitting buildings later. Cumulatively, consumers have saved an estimated \$8 billion on their energy bills because of building codes since 1991.²⁹

To help states and localities adopt sound building codes, model codes are developed and updated every few years by the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) and the International Code Council (ICC). States are required to adopt the ASHRAE model for commercial buildings, but not the ICC model for residential buildings.

At least 42 states have adopted some type of building energy code, but in many cases the codes follow outdated models (see Figures 1-2).

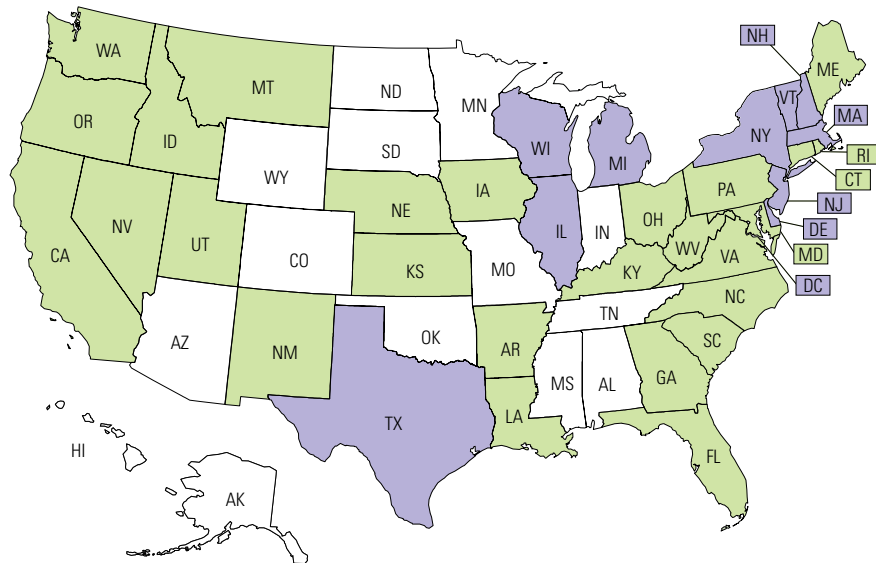
The potential of building codes to reduce the sector's greenhouse gas emissions significantly is constrained by a number of barriers: Authority is scattered among thousands of state and local governments; code agencies often are understaffed;

²⁸ See ACEEE's assessment of potential energy and carbon savings at www.aceee.org/energy/national/SenateBillSavings.pdf. Specific proposals for extensions and increases in EPACT's tax credits can be found in Loper et al., *Reducing Carbon Dioxide Emissions*, 27-28.

²⁹ Based on 2004 correspondence between the Alliance to Save Energy and Karen Mueller, Pacific Northwest National Laboratory.

State Building Codes for Energy Efficiency – Commercial

Information current as of 01/01/07



- Completed 2 – Goes Beyond ECPA (26)**
 AR, CA, CT, FL, GA, ID, IA, KS, KY, LA, ME, MD, MT, NE, NV, NM, NC, OH,
 OR, PA, RI, SC, UT, VA, WA, WV

- Completed 1 – Meets ECPA (11)**
 DE, DC, IL, MA, MI, NH, NJ, NY, TX, VT, WI

Some states have laws that limit their ability to impose building requirements on municipalities. In these “home rule” states, local governments can adopt their own codes. This is the case in AZ, CO, HI, IL (home rule for residential only), MO, NV, OK (home rule for commercial only), TX, SD and WY.

The Energy Conservation and Production Act (ECPA) of 1975 requires states to adopt commercial building codes and to consider adopting residential codes. To meet ECPA, states must either adopt the U.S. DOE-determined “model code” as written, modify it to meet their needs or develop their own equal or better code. DOE has determined that the 2000 Supplement to the IECC and 1999 version of ASHRAE Standard 90.1 improve energy efficiency in residential and commercial buildings, respectively.

The Alliance to Save Energy estimates that aggressive nationwide development and enforcement of building codes could reduce energy use by 12 quads by 2050 – more than half of residential energy consumption in 2007 – and cut CO₂ emissions by 0.7 gigatons (Gt), savings equivalent to removing 125 million passenger cars and light trucks from the road for a year, according to the U.S. Climate Technology Cooperation Gateway.³¹

³¹ See the CTC’s greenhouse gas equivalencies calculator, www.usctcgateway.net/tool/.

DOE should work with ASHRAE and ICC to develop new national model building codes for residential and commercial structures. The model codes would:

- **Require that in 2010 all new buildings and major renovations meet or exceed a 50% reduction in the annual operating energy consumption (fossil fuel consumption per gross square foot) of the regional average for each building type.**
- **Increase the reduction in annual fossil energy consumption for new buildings to 60% by 2013, 70% by 2017, 80% by 2021, 90% by 2025 and 100% (or carbon neutral) by 2030 through a combination of energy efficiency, on-site renewable energy generation and/or certified renewable energy credits.**

The President should propose an increase in funding for states to sponsor training for code officials, builders and designers (see PCAP Section 3's proposal for funding under the State Energy Program)³² and \$200 million annually for DOE's Energy Efficient Commercial Buildings Initiative to achieve net-zero-energy performance for new commercial buildings by 2030.³³

5. Increase the nation's efforts to weatherize the homes of low-income families.

The federal Weatherization Assistance Program (WAP) provides funds to states for basic energy efficiency improvements to the homes of low-income families. The improvements are performed by local crews in each community. Unlike the Low-Income Home Energy Assistance Program administered by the Department of Health and Human Services, WAP prevents rather than responds to the emergencies that develop when low-income families cannot pay their energy bills – a concern that will increase as greenhouse gas pricing raises the cost of

³² These recommendations are based on the "2030 Challenge" of Architecture 2030 and its coalition partners; see http://architecture2030.org/2030_challenge/index.html.

³³ The commercial sector's buildings would achieve zero-net-energy with substantial cuts in energy use through building codes, equipment standards, advanced technologies and practices, on-site renewable energy generation and renewable energy and energy efficiency credits.

fossil fuels. The President should champion congressional reauthorization of WAP and an appropriation of \$1.4 billion annually from 2008-2012, up from \$144 million in the Administration's fiscal year 2008 budget request. Two percent of the budget should be allocated to pilot projects involving materials, equipment and technologies not covered by the current program.

7. Promote smart growth and smart grids.

According to EPA, urban sprawl continues in the United States despite evidence that smart growth policies can reduce vehicle miles traveled by nearly 60%, the loss of farmland by nearly 30%, the loss of open space by 43% and the loss of environmentally sensitive areas by 80% – at the same time preventing air pollution, fuel waste and lost productivity due to traffic congestions, and saving money on urban services and infrastructure.³⁴

Smart growth – which typically involves denser, transit-oriented urban design – creates new opportunities for energy efficiency and renewable energy. Commercial or industrial buildings in denser development open opportunities for district energy systems, including on-site solar electric arrays or combined heat and power systems. More compact development creates opportunities for electric grids at the neighborhood, city or regional scale that provide backup power for low-emission distributed technologies such as rooftop photovoltaics or urban wind turbines, while reducing strain on traditional transmission and distribution systems.

In recent decades, the concept of whole building design – in which buildings are treated as systems of interrelated parts – has become common in the building industry. Several major U.S. homebuilders participating in DOE's Building America program have found that the whole-building approach saves construction materials, reduces wastes, cuts costs and produces homes that are more comfortable, less expensive to heat and cool and competitively priced.

³⁴ See the EPA's "Basic Information on Smart Growth," www.epa.gov/smartgrowth/basic_info.htm.

Some pioneering organizations now are applying a similar concept in whole community development, seeking to integrate buildings, urban form, infrastructure, transportation patterns and advanced energy technologies. The National Energy Center for Sustainable Communities (NECSC) at San Diego State University is applying this approach to greenfield and brownfield development in Chula Vista, Calif. The U.S. Green Building Council has added a LEED standard (LEED-ND) for neighborhood development to its portfolio of rating systems.

The evolving vision for America's urban and peri-urban areas includes: zero-emission buildings, rooftop gardens, open space, bike lanes and walking paths, public transport and congestion control. They will be powered by a smart, clean, robust, resilient and self-healing electric grid with on-site, regional and central power generation, improved storage, cogeneration and computer-derived identification of critical loads within buildings and cities, which will help them adapt to heat waves, storms and grid interruptions. The result will be fewer vehicle miles traveled, better local air quality, cooler inner-city areas, fewer greenhouse gas emissions and a boost for local and regional economic growth as energy dollars are retained in their economies.

The President should:

- **Direct DOE to provide technical and financial support to these research projects to determine how whole community design, advanced energy technologies and smart grids can be integrated in new urban development.**
- **Direct EPA to develop a methodology for crediting urban smart-growth initiatives in State Implementation Plans under the Clean Air Act.**

8. Use federal loan and loan-guarantee programs to support sustainability.

The President should direct federal agencies to develop these proposals to support low-emission development:

- **Federally insured loan programs. Offer incentives for low-emission housing through the Federal Housing Administration, the Department of Veterans Affairs and other agencies that provide federally insured loans. Incentives might include rate reductions to purchasers of green homes; bonus credits for Fannie Mae and Freddie Mac toward meeting their affordability goals for purchasing energy-efficient mortgages; green**

mortgages that reach beyond energy efficiency and recognize the cost savings of a home that is durable, healthy and in close proximity to mass transit; and bonus funding for rural housing constructed to green building standards.

- **Create Connie Mae:** Former Vice President Al Gore has proposed a Carbon-Neutral Mortgage Association that specializes in mortgage loans for low- and zero-emission buildings.
- **Collaboration between federal and private lending programs:** Explore whether and how federal loan and loan guarantee programs can support private sector initiatives such as the William J. Clinton Foundation's program in which banks are providing billions of dollars in loans to cities and to private landlords to upgrade heating, cooling and lighting systems in older buildings.
- **Green disaster recovery:** Make information on sustainable reconstruction available to disaster victims at the Federal Emergency Management Agency's disaster assistance centers in stricken communities³⁵ and provide information on green building and climate-adaptation practices to disaster victims who apply for the U.S. Small Business Administration's low-interest loans to rebuild homes and commercial buildings. SBA should explore lower interest rates or higher loan eligibility for buildings that incorporate advanced energy efficiency, greenhouse gas-reduction and adaptation features.
- **Brownfield redevelopment:** Provide bonus funding in federal loan programs for brownfield redevelopment projects constructed to green building and LEED-ND standards.
- **Expanded tax incentives:** Broaden the existing commercial and residential energy efficiency tax incentives, including those authorized in the EPACK 2005, to encourage superior performance in other environmental categories: reducing greenhouse gas emissions, conserving and recycling water, using building materials and furnishings with recycled content and adapting buildings to the effects of climate change.

³⁵ Under James Lee Witt during the Clinton Administration, FEMA did this by setting up "sustainability desks" at disaster assistance centers.