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Commentary

Integrating Sustainable Development Planning and Climate Change Management: A Challenge to Planners and Land Use Attorneys

John R. Nolon and Patricia E. Salkin

This essay is based on the authors' new book, *Climate Change and Sustainable Development Law in a Nutshell* (West 2011), which describes the close relationship between sustainable development and climate change management. The book reviews the history of both fields and demonstrates how they appeared at the same time as an integrated set of considerations. It contains numerous examples of state and local initiatives that draw on the skills of the planning and legal professions, including energy-efficient buildings, green buildings and sites, renewable energy, green neighborhoods (including transit-oriented development, Leadership in Energy and Environmental Design rating system for Neighborhood Development (LEED-ND), green infrastructure, and district energy systems), and climate change adaptation through sequestration, resiliency, and adjustments to sea level rise.

INTRODUCTION

At the end of the last century, the literature regarding planning and planning law was saturated with discussions of smart growth. By the turn of the century, more emphasis was being placed on incorporating the concepts and principles of sustainable development. As we enter the second decade of 21st century, effective sustainable development planning and law must also include strategies that mitigate and adapt to climate change and the effects of global warming. While the trend in scholarship, if not in practice, is to see the two fields—sustainable development and climate change—as separate

and distinct, this is both historically inaccurate and misleading for practitioners.

Much of the writing and recent policy on climate change law concerns legal mechanisms that cap greenhouse gas (GHG) emissions, tax carbon, establish trading markets, require cleaner energy in fuels, reduce energy consumption, or produce alternative vehicles. The focus has been on international conventions or accords such as those framed in Kyoto, Copenhagen, and Cancun and, in the United States, on federal and state laws that concentrate on GHG reductions, energy policy, alterna-

Comments or questions regarding this month's Commentary? Discussion of "Integrating Sustainable Development Planning and Climate Change Management" can be found at: <http://blogs.planning.org/policy/?p=377>.

tive fuels, and fuel-efficient vehicles. These issues, generally, do not engage the planning profession or include the techniques that are the stock-in-trade of planning law.

Sustainable development law and practice, on the other hand, focus on shaping land and economic development to have a lighter impact on the environment, including climate change mitigation and adaptation. Sustainable development is the currency of planners and their attorneys; it uses less material, avoids consuming wetlands or eroding watersheds, consumes less energy, eliminates or shortens vehicle trips,

emits less carbon dioxide (CO₂), lessens stormwater runoff, reduces ground and surface water pollution, and creates healthier places for living, working, and recreating. This body of law is created mainly by state and local governments, which have the principal legal authority to regulate building construction, land use, and the conservation of natural resources at the local level. More recently, it involves preserving or expanding the GHG-sequestering environment, adapting to sea level rise, and building more resilient developments to withstand the fiercer storms associated with climate change.

The integration of sustainable development and climate change strategies is consistent with the evolution of policy in this field. Our book traces the history of international conventions and agreements and demonstrates that their authors and signatories saw climate change management as an important strategy for achieving development that is sustainable. This was particularly true in Rio, where the Accords included a Declaration and Agenda 21, which constitute a comprehensive plan for global sustainability, and the United Nations (U.N.) Framework Convention on Climate Change, which led to the Kyoto Accord and its emphasis on emissions reductions. Under the Framework Convention, annual Conferences of the Parties are held to stimulate progress on climate change, the most recent of which was held in Cancun, Mexico, in December 2010.

State legislatures during this era planted the seeds of sustainable development law, adopting statutes to control future land development in the interest of resource preservation.

The 16th Conference of the Parties in Cancun resulted in the Cancun Agreements, which reaffirmed the seriousness of climate change and the goal, established in Copenhagen, of limiting any rise in global temperatures to two degrees Celsius. While progress at Cancun was made in measuring and verifying emissions, developing an international system for reducing deforestation, and in defining how a Green Climate Fund will be implemented to help small island states and developing countries, little headway was made in creating an enforceable system of emission reduction. The Cancun Agreements demonstrate interest in broadening the scope of mechanisms capable of managing climate change. Perhaps most relevant to planners and land use lawyers is language contained in items 6 and 7 of the Cancun Agreements. In these sections, the parties recognize “that a low-carbon development strategy is indispensable to sustainable development,” and the need to engage a broad range of stakeholders at global, regional, national and community levels, including state and local governments (United Nations Framework Convention on Climate Change, p. 2).

This framing of the challenge of climate change within the context of sustainable development and the call to action to state and local governments, in our opinion, is the key to identifying strategies that enable the United States to realize meaningful GHG reductions and to adapt to inevitably worsening climate conditions. It greatly broadens the techniques available to policy makers, legislators, and planners, reaching beyond traditional cap-and-trade mechanisms, and embraces all actions capable of managing climate change and achieving development that is sustainable.

A BRIEF HISTORY OF SUSTAINABLE DEVELOPMENT AND CLIMATE CHANGE POLICY

The Brundtland Commission Report

In 1987, the independent World Commission on the Environment and Development, known as the Brundtland Commission, issued its report, *Our Common Future*. The report asserts that “Human-

ity has the ability to make development sustainable—to ensure that it meets the needs of the present without compromising the ability of the future generations to meet their own needs” (World Commission on Environment & Development, p. 8). The Commission noted the “. . . growing realization . . . that it is impossible to separate economic development issues from environmental issues; many forms of development erode the environmental resources upon which they must be based, and environmental degradation can undermine economic development” (*Id.*, p. 3). The Commission sent a clear signal: Support policies that encourage the proper type of economic development in appropriate locations in order to protect the environment and ensure that development benefits all economic classes. Economic development is to be modulated both to lessen poverty and to improve the environment and to do this with a view toward the needs of future generations.

The Brundtland Commission Report also demonstrated that the serious threat of climate change to sustainable development was well understood more than 25 years ago. The report cites work done by the World Meteorological Organization (WMO) and the U.N. Environment Programme (UNEP), which concluded in October 1985 that “climate change must be considered a ‘plausible and serious probability’” (*Id.*, p. 175). The report noted that CO₂ emissions were accumulating in the atmosphere, causing a greenhouse effect leading to the warming of the planet, sea level rise, the inundation of low-lying coastal cities and river deltas, and grave effects on agricultural production, economic development, and trade systems.

Parallel Efforts

Our Common Future followed a decade and a half of federal environmental law making in the United States: top-down rules and strict enforcement aimed at environmental excesses such as toxic waste and pollution of the air and water by smokestacks and waste pipes. The United States took a giant step over a relatively short span of time to lessen

environmental degradation. The federal environmental laws adopted at this time are credited with significantly improving the quality of surface and ground water and the air.

At the same time that Congress initiated this top-down environmental law movement, a related but disconnected initiative was occurring at the state and local levels. State legislatures during this era planted the seeds of sustainable development law, adopting statutes to control future land development in the interest of resource preservation. The growth management movement began in Oregon in the early 1970s with the creation of state-legislated urban growth boundaries. This gave rise to the notion that human settlements should be shaped so that they do not consume disproportionate amounts of land and resources as they accommodate homes, offices, and other buildings.

Gradually, the growth management movement merged into the smart growth campaign, whose purpose is to shape human settlements to avoid the wasteful consequences of sprawl, which eats up land at a rate greatly in excess of population growth, and to promote the development of affordable housing. Over the last three decades, state and local governments have adopted countless land use laws that exhibit, to greater or lesser degrees, their commitment to shaping settlements to preserve the environment and promote affordable living. They are working to revitalize urban centers, reconfigure older suburbs, create green buildings, and support land use patterns that expand the use of transit systems. In the last few years, there is evidence that these same governments are deliberately using smart growth tools to mitigate and adapt to climate change.

The Road to Rio and the Rio Accords

Reliable measurements of CO₂ were developed in the 1950s when 310 ppm of CO₂ were measured (Gillis). As early as 1971, leading scientists reported a danger of serious global climate change caused by human behavior, primarily due to the use of fossil fuels (*Id.*). By 1979, scientific evidence led the National Academy of Sciences to report that the doubling of

The UNFCCC committed ratifying countries to stabilize GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (human-caused) interference with the climate system.

CO₂ in the atmosphere would cause a significant rise in global temperatures, by between two and 3.5 degrees Celsius (National Academy of Sciences (a), p. 1). In 1985, the International Conference on the Assessment of the Role of Carbon Dioxide and Other Greenhouse Gases in Climate Variation and Associated Impacts was held in Villach, Austria. It was sponsored by the International Council for Science, UNEP, and the WMO. The "Villach 1985" report called for policy makers to advance efforts to mitigate human-induced climate change. Today, the atmosphere contains nearly 390 ppm of CO₂ (<http://co2now.org>). With signs that emissions are accelerating due mainly to human behavior, scientists now predict temperature increases of from 2.5 to 10 degrees Fahrenheit (National Aeronautics and Space Administration).

The early evidence of climate change emerging from the scientific community led the WMO and the UNEP to form the Intergovernmental Panel on Climate Change (IPCC) in 1988. The IPCC is a scientific body that reviews and assesses the most recent scientific, technical, and socioeconomic information produced worldwide that is relevant to the understanding of climate change. More than 150 countries, including the United States, participate in the working groups of the IPCC. These working groups gather scientists, policy analysts, engineers, and resource managers from participating countries to prepare and issue an assessment report approximately every six years. The IPCC began issuing comprehensive assessment reports in 1990. These reports warn that business as usual will result in an unprecedented warming of the planet. The First Assessment Report of the IPCC informed and motivated those who attended a major gathering of the world community in Rio.

The Earth Summit was held in Rio de Janeiro, Brazil, in 1992. It was a historic gathering of representatives of most of the nations of the world called to rethink economic development and to discover ways to develop without polluting the Earth and its air and water or overusing its natural resources. The summit led to the adoption of three

critical agreements: The Rio Declaration on Environment and Development, Agenda 21, and the United Nations Framework Convention on Climate Change (UNFCCC).

In the words of Agenda 21, "[a]n adjustment or even a fundamental reshaping of decision-making . . . may be necessary if environment and development is to be put at the [center] of economic and political decision-making, in effect achieving a full integration of these factors" (United Nations Department of Economic and Social Affairs, paragraph 8.2). The objectives tied to this goal are to allow the full integration of environmental and developmental issues at all levels of decision making, to facilitate the involvement of concerned individuals, groups, and organizations in decision making at all levels, and to establish domestically determined procedures to integrate environment and development issues into decision making.

The UNFCCC, or framework convention, focused on climate change. Rio was preceded by the formation of an International Negotiating Committee for a Framework Convention on Climate Change, which was established by the U.N. General Assembly in 1990. Its task was "to negotiate a framework convention, containing appropriate commitments, and any related legal instruments as might be agreed upon" (Boisson de Chazournes). The Convention was negotiated and opened for signature at the Earth Summit in June 1992 and afterward at the U.N. Headquarters in New York. The UNFCCC entered into force in March 1994; by 2009 the Convention was signed by 192 nations, making it one of the most widely subscribed multilateral environmental agreements in history.

The UNFCCC committed ratifying countries to stabilize GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (human-caused) interference with the climate system. The United States was a participating nation at Rio, and the U.S. Senate ratified this framework convention. The signatory countries made several commitments. First, they agreed

to publish an inventory of anthropogenic GHG emissions by sources, as well as their removal by sinks that store or process GHGs. Second, they agreed to implement measures to mitigate climate change by addressing anthropogenic emissions by sources and sinks. (A "source" is any process or activity that releases a GHG into the atmosphere. "Sinks" are any process, activity, or mechanism that removes or sequesters a GHG from the atmosphere.) Third, they agreed to promote the sustainable management, conservation, and enhancement of sinks of GHG, including forests and other terrestrial ecosystems that absorb and process CO₂, the principal GHG generated by human activity, over the long term. They also agreed to cooperate in adapting to the impacts of climate change such as sea level rise and natural disasters through the development of appropriate plans for coastal zone management and the conservation of ecosystems and the built environment.

The nations that signed the UNFCCC constitute the parties to the convention. They gather annually at a meeting called the Conference of the Parties and negotiate further agreements to implement the matters to which they committed in ratifying the framework convention.

The Kyoto Protocol

The Conference of the Parties held in 1997 resulted in the Kyoto Protocol, which became effective in 2004. Under this agreement, ratifying industrialized nations agreed to respect the GHG reduction targets it established during a five-year period running from 2008 to 2012, when the agreement terminates. The Protocol requires these industrialized countries to reduce their GHG emissions to specified amounts, averaging at least five percent below 1990 levels, during this period. A cap-and-trade system was the method to be used to achieve these targets. Primarily because of the perceived high costs of reaching these emission targets and the Protocol's failure to require rapidly developing countries such as China, India, South Africa, and Brazil to comply, the U.S. Senate declared that it would not ratify the agreement, and Presi-

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dent Bush announced in 2001 that the United States would not become a party to the Protocol.

The Copenhagen Accord

The 15th meeting of the Conference of Parties was held in Copenhagen, Denmark, in December 2009. An agreement was reached by the leaders of most of the 193 participating nations, with just five countries failing to note their endorsement of the agreement. The Copenhagen Accord embraces policies and actions to prevent average world temperatures from increasing. It is not legally binding in the technical sense of that phrase, but the nations that sign on are politically bound to pursue its objectives in good faith. The initial goal is to keep the increase to less than two degrees Celsius, or 3.6 degrees Fahrenheit, and to review the results of scientific advances by 2015 and consider adopting a more protective target of 1.5 degrees Celsius at that time. To achieve the two-degree-Celsius goal will require a 40 percent reduction of global emissions below 1990 levels by 2020.

The Accord created a period through calendar year 2010 for developed countries to record their commitments to emission reductions and to record the actions they will take to accomplish them. They agreed to achieve quantified economy-wide emissions targets by the year 2020. Under the Accord, developing countries are to submit mitigation actions that are to be achieved in the context of sustainable development. For the first time, developed countries agreed to provide reports of their GHG inventories every two years for the duration of the Accord.

In late January 2010, the U.S. Special Envoy for Climate Change sent a letter to the Executive Secretary of the UNFCCC informing him of the desire of the United States to be associated with the Copenhagen Accord. The Special Envoy attached the emission reduction target of the United States, which the letter noted was made on the assumption that the other parties to the Accord had submitted mitigation actions as required under the Accord. Most of the major GHG-emitting na-

tions, including the 27 nations of the European Union, China, India, Japan, and Brazil, met that deadline. More than 120 nations have now become signatories to the Accord.

NATIONAL AND LOCAL STRATEGIES

Emission Caps

The essential objective of both the Kyoto Protocol and the Copenhagen Accord is to reduce GHG emissions in each of the signatory countries using some form of cap-and-trade system. In the United States, Congress has been struggling to find consensus on a cap-and-trade system that would be competent to reach responsible emissions targets. Both the House of Representatives and Senate have entertained legislation that would place a national ceiling on emissions, lower that ceiling each year until the established pre-1990 levels are achieved, and sell or give away allowances to polluting power plants, oil refineries, and heavy manufacturing industries, among others. Each allowance might give the regulated industry the right to emit one ton of CO₂; enough allowances would be distributed to allow affected plants to continue emitting without drastic short-term consequences or to sell those allowances to others.

The political limits of a cap-and-trade regime are obvious, however, since it would affect powerful industries with substantial influence in Washington and run the risk of increasing the cost of energy for small businesses and individual households if it is overly aggressive or if it does not smoothly effect a transition to new energy technologies. The failure of Congress to agree on cap-and-trade or a carbon tax and dividend technique, or other emission-reduction strategies, is part of the reason that the international community, as well as domestic policy makers, are looking for other means of mitigating and managing climate change, relying on not just federal efforts but those of state and local governments as well.

Integrating Approaches

The connections between federal, state, and local sustainable development law

and policy are profound, if not well understood. For example, federal transportation initiatives influence where local commercial, industrial, and residential development will be served by roads and transit. Federal housing and community development initiatives help local governments revitalize blighted areas and provide affordable housing. Federal coastal zone management initiatives encourage local, state, and interstate coastal planning that influences land development and conservation along the coasts.

Local efforts to protect wetlands, wildlife habitat, and surface and groundwater align with and can further federal initiatives to conserve and steward these resources. Local law can protect natural resources and open space at the edge of federal parks and preserves. Federal efforts to promote the use of renewable energy—wind turbines, solar panels, combined heat and power facilities, and district energy systems—can be furthered or frustrated by local land use regulations that permit and prohibit facility location.

Local governments are already at work on climate-change initiatives, building programs that can intersect with their historical role in land use planning and regulation. Municipal climate action plans, for example, generally include: (1) a GHG emissions inventory; (2) realistic emissions reduction targets based on this inventory and an analysis of energy savings opportunities; and (3) strategies and policies to meet these emissions reductions goals. For example, Los Angeles's 2007 climate action plan, Green LA, suggests that "the threat of climate change is really an opportunity to transform Los Angeles into the greenest big city in America—a model of sustainability for the 21st century" (City of Los Angeles, p.3). The city's GHG inventory showed that it was responsible for two-tenths of one percent of worldwide GHG emissions—as much as the entire country of Sweden. Green LA calls for emissions to be reduced to 35 percent below 1990 levels by 2030 and to achieve this goal, the plan suggests, among other things: increasing the city's renewable energy

As part of the nation's responsibilities under the U.N. framework convention, the United States must address its historical pattern of land development.

supply to 35 percent of its capacity by 2020; retrofitting all city buildings to improve efficiency; installing 50 cool roofs annually on city buildings and converting public pools to solar heat; distributing nearly three million compact fluorescent light bulbs to city residents; converting most of the city fleet to alternative fuels; expanding the regional rail system; promoting transit-oriented development; encouraging infill; reducing the urban heat island effect by planting one million trees; developing plans to address drought, wildfires, sea level rise, and climate-related health problems; and amending the zoning and building codes to minimize the effects of climate change.

The Connecting Cleveland 2020 Citywide Plan is focused on strategies to improve sustainability. Some of the more specific land use and planning techniques recommended by the city to promote the goals of the Connecting Cleveland plan include: innovative and flexible zoning districts (e.g., live-work overlay districts and pedestrian retail overlay districts), a downtown surface parking lot ban, suitably proportioned urban lot sizes, the incorporation of transit-oriented design into the site review process, a draft city bikeway plan, a program to install bike racks and street benches, green building training for building inspectors, development incentives (especially for infill), a housing trust fund, and housing rehabilitation programs (City of Cleveland).

Land Use Patterns in the United States and Climate Change

These actions at the local level demonstrate the close connection between sustainable land development and climate change management. Today, buildings are responsible for 35 percent of CO₂ emissions in the United States (U.S. Environmental Protection Agency (a), pp. 2–19). Personal vehicles are responsible for 17 percent of total emissions (*Id.*). Current undeveloped landscapes sequester 15 percent of CO₂ emissions (U.S. Environmental Protection Agency (b)). All told, where we build and how we build relates directly to over 66 percent of net CO₂ emissions in the United States.

The U.S. Census Bureau projects that the nation's population will increase by 100 million—over one-third—by 2039 (U.S. Census Bureau). One hundred million people translates into 40 million new households whose members will live, work, and shop in these buildings, traveling from one to the other and beyond, largely by car. Where the buildings that house and employ these additional people are located, how energy conserving they are, and how far these new Americans must travel will greatly affect the emission of CO₂ and how vulnerable new development will be to sea level rise and natural disasters that accompany climate change.

The close connection between land use planning and managing climate change is evident in the United States, where the dominant pattern of human settlement has been the single-family neighborhood, with homes built on individual lots and located apart from shopping, recreation, entertainment, and workplaces. Residents in these neighborhoods own cars and drive to most of their daily destinations. Homes, on average, are large and consume considerable energy for heating, lighting, appliances, and cooling.

As concerns over the consequences of climate change heighten, policymakers are becoming increasingly aware that the single-family settlement pattern contributes significantly to climate change. Single-family homes use more energy than do multifamily dwellings and mixed use developments. The dramatic differences in energy consumption and CO₂ emissions between the single-family and mixed use, higher density land use pattern is due to the size of housing and its proximity to the daily destinations of residents. The development of single-family, single-use neighborhoods increases vehicle miles traveled (VMT) significantly.

As part of the nation's responsibilities under the U.N. framework convention, the United States must address its historical pattern of land development. If it does not, the buildings and cars occupied by these 100 million new Americans will dramatically increase the emission of CO₂, which constitutes

approximately 85 percent of total U.S. GHGs. By shifting from predominately single-family to predominately mixed use, compact settlements, the nation can lower per capita CO₂ emissions significantly. This is because mixed use, compact buildings and neighborhoods are more energy efficient and support transit facilities; they result in fewer emissions for the energy needs of buildings and reduced tailpipe emissions.

The most recent report of the National Academy of Sciences, *America's Climate Choices*, was prepared at the request of Congress. It lists four key opportunities to reduce atmospheric concentrations of CO₂ in the United States (National Academy of Sciences (b)). They include curtailing sprawling development patterns that further our dependence on petroleum; more efficient methods for insulating, heating, cooling, and lighting buildings; expanding the use of renewable energy sources; and managing forests and soils to enhance carbon uptake. All of these strategies can be implemented by reshaping human settlements; clustering more people in livable urban neighborhoods; enacting and enforcing local energy codes for existing and new buildings; fostering wind, solar, and other energy-conserving facilities through construction regulations; and preserving open space by prioritizing lands that sequester the most CO₂, such as open space and forested lands.

CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT LAW AT THE LOCAL LEVEL

Local governments have at their disposal the tools necessary to foster the shift from car-dependent, single-family neighborhoods to transit-oriented urban living, to increase energy efficiency in buildings, and to reduce development pressures on carbon-sequestering open space. And when the impacts of municipalities' regulations, policies, and education programs are aggregated, they collectively represent a significant, if not dominant, impact on domestic GHG reductions.

What follows is a sampling of strategies that local governments are experi-

Unlike local governments that have focused on a single climate change element, Marin County incorporated sustainability provisions throughout [its] plan.

menting with to address sustainability and climate change goals. Not covered here, but discussed in our book, are strategies to promote renewable energy facilities, to achieve more energy-efficient buildings, to ensure more sustainable buildings and sites, preserve the sequestering landscape, and adapt to sea level rise and fiercer storm events. Here we consider the larger planning framework for sustainable development that also reduces emissions and adapts to climate change.

Comprehensive Planning

Some states have enacted either mandatory or optional comprehensive planning provisions relating to energy conservation and sustainable development. However, even without state guidance, local governments are increasingly using their comprehensive plans to respond to climate change threats by incorporating plans to conserve important environmental resources, reduce GHG emissions, and prepare for changing weather patterns. Comprehensive plans, which have been common local government planning documents for nearly a century, present a familiar and convenient format for local governments to incorporate sustainability concerns into their long-term plans.

The comprehensive plan for Blacksburg, Virginia, includes in its environmental element a recognition that “[t]he best way to maintain and enhance Blacksburg’s air quality and to conserve resources is to reduce energy use, thus decreasing fuel combustion and air pollutant emissions” (Town of Blacksburg, p. 11). To promote this goal, the plan suggests that the town can make improvements to its transit system, ensure “a reasonably compact development pattern[,]” and continue to expand the town’s pedestrian and bicycle path network. Additionally, the plan explains that energy use can be reduced through improving building efficiency, and it suggests that “land use patterns that include trees, are properly oriented, maximize infill, cluster, and employ mixed-use development can enhance the usage of natural heating and cooling and reduce

residents’ transportation energy needs” (*Id.*).

The 2007 update of the Marin, California, Countywide Plan was developed using a framework for sustainability that focuses on three central themes: the environment, the economy, and social equity. Unlike local governments that have focused on a single climate change element, Marin County incorporated sustainability provisions throughout the plan. Some of the plan’s strategies relating to climate change include: lowering GHG emissions by encouraging alternative transportation methods and technologies; protecting forests and other natural carbon sinks; using energy-efficient building techniques by emphasizing renewable energy; reducing methane emissions from landfills; encouraging agricultural operations to adopt methane recovery technology; evaluating carbon emissions during the land use approval process; directing development toward existing urban corridors; and studying and preparing for the impacts of climate change. The plan also expresses support for home occupations and other work arrangements that cut down on commuting needs, streetscape and mixed use designs that make neighborhoods more pedestrian friendly, incentives for green building projects, and xeriscaping.

A Revival of Neighborhood Planning

Although planners have long debated how to define “neighborhood” for planning purposes, they are in accord that planning at the neighborhood scale is essential. Neighborhood planning provides a context for individual building and site initiatives and ensures that the community comprises diverse areas that are integrated into the communitywide comprehensive plan to meet the full spectrum of local needs. There are four promising sustainable development mechanisms that operate at the neighborhood level: transit-oriented development (TOD), whose neighborhood is the transit station area; LEED-ND; green infrastructure, which provides ecosystem services to urban places; and district energy systems, which organize energy conservation efforts around a group of buildings.

Transit-Oriented Development. Climate change mitigation requires that we create a less car-dependent society. One of the best ways to do this is to encourage higher density developments around transit stations. TOD reduces vehicle trips and VMT and lowers tailpipe emissions of CO₂. According to the Presidential Climate Action Project, “The greatest potential for reducing greenhouse gas emissions and imported petroleum is to reduce vehicle miles traveled—the miles Americans drive each year” (Presidential Climate Action Project, § 7:6.).

The use of personal automobiles is responsible for approximately 17 percent of domestic CO₂ emissions, and much of the fuel used by buses, vans, and trucks is consumed as vehicles traverse our spread-out landscape. The nation’s human settlement pattern is responsible for most of the annual increase in VMT, as well as the resultant fossil fuel consumed by, and CO₂ emitted from, these vehicles. Only a quarter of the increase in VMTs is due to population growth. The rest is attributable to the increasingly spread-out pattern of development in metropolitan areas. Over the past half century, annual VMT have increased nearly fivefold. Since 1980, the total number of miles driven by Americans has grown three times faster than the population (The Urban Land Institute, p. 2). Unfortunately, these trends outstrip improvements in fuel efficiency and engine technology. Creating higher population densities and transit accessibility is a critical component of climate change mitigation.

TOD land use plans and zoning encourage mixed use, compact development in transit station areas or transit neighborhoods. They locate housing and jobs near transit stops and significantly reduce the number and distance of vehicle trips. Encouraging land use patterns that house and employ more Americans in urban areas will cause a significant reduction in VMT while placing households in smaller, more energy-efficient homes and offices, further reducing fossil fuel consumption and CO₂ emissions.

LEED-ND. LEED-ND advances the United States Green Building Council

Energy-efficient neighborhoods can be planned that encourage green building development, on-site generation, the use of renewable sources of power, efficient distribution systems, and combined heat and power systems shared by multiple buildings.

(USGBC) rating system by focusing on developments and their relationship to their immediate neighborhood. According to the USGBC, the LEED-ND rating system “encourages smart growth and new urbanist best practices, promoting the location and design of neighborhoods that reduce vehicle miles traveled and communities where jobs and services are accessible by foot or public transit.” It also promotes more energy-efficient systems and water use, especially important in urban areas where these services are expensive or where the infrastructure is often over-taxed. Though most applicable on the neighborhood scale, there are no size thresholds for projects seeking ND certification. According to the USGBC, “projects may constitute whole neighborhoods, portions of neighborhoods, or multiple neighborhoods.”

LEED-ND is divided into categories. In each category, there are prerequisites that must be met and a variety of points that may be earned. Developers must meet all prerequisites and earn a specified number of points for basic certification or to achieve certification at higher—silver, gold, or platinum—levels.

LEED-ND points and prerequisites are divided into five categories: Smart Location and Linkage (SLL), Neighborhood Pattern and Design (NPD), Green Infrastructure and Buildings, Innovation and Design Process, and Regional Priority Credits. Within the first three categories, prerequisites are identified that embody the principles of sustainable development.

The SLL prerequisites, for example, encourage development within established communities and near public transit. Developments seeking LEED-ND status as new neighborhoods must protect prime farmland, wetlands, and water bodies from development and avoid floodplains, imperiled species, and ecological communities.

Zoning standards and local laws that foster development in existing neighborhoods or encourage the use of distressed or underutilized older buildings or brownfields will help projects seeking certification to satisfy LEED-ND

smart location requirements. Zoning provisions that permit transfer of development rights from farmlands or other ecologically important areas to existing neighborhoods further LEED-ND principles and manage climate change by preserving the GHG-sequestering environment and by promoting more energy-efficient human settlements.

The NPD prerequisites of LEED-ND promote livability, walkability, and transportation efficiency, as well as communities that are physically well connected with the neighborhood beyond the buildings seeking certification. NPD points can be earned by increasing the density permitted by zoning to accommodate a transit agency’s need for riders. LEED-ND, for example, requires that projects have a minimum floor area ratio of 0.80 for commercial buildings or a minimum of seven dwelling units per acre for residential structures. These standards are at the lower range of density needed to provide sufficient riders to support transit services.

Green Infrastructure. The intensity of higher density, compact development in urban areas that comes with TOD and LEED-ND needs to be mitigated. With greater density comes more impervious coverage causing stormwater runoff, flooding, and increasing surface temperatures. Development that supports transit ridership can reduce open space and urban vegetation as it proceeds. Cities must plan to preserve undeveloped land and add green infrastructure as such development happens.

Green infrastructure is similar to engineered, capital infrastructure projects such as streets, water and sewer systems, lighting, and electrical and gas lines. Both serve and support the development that local comprehensive plans and zoning permit. Without water, to be sure, residential, retail, and office development could not happen. As cities become denser, green infrastructure services also need to be thought of in the same way. Seen comprehensively, a city’s green infrastructure is a coherent and integrated system of amenities (most often natural or vegetated) that absorb, retain, and direct the flow of rain water, that manage intense storm

events, that shade and protect buildings from the heat and cold, and that provide shelter from the elements and rest during a walk or bicycle ride.

The elements of green infrastructure include green roofs and building facades, planters, rainwater harvesting/collection, street trees, preserved open space on building sites, natural vegetated corridors and swales, permeable paved areas accented with green features, xeriscaping, private gardens and public parks, stormwater retention features (such as detention basins, bio-retention ponds, and rain gardens), and landscaped medians and edges along streets, paths, and rail lines. Parking lots can be greened by adding trees and using permeable surfaces that allow infiltration and support vegetative growth.

District Energy Systems. Up to 80 percent greater energy efficiency in buildings can be achieved through distributed-generation systems and combined heat and power facilities, which capture waste heat and use it for water and space heating. Such systems should be operated at a scale larger than the individual building, optimally among a large number of buildings in close proximity to one another where maximum efficiency is possible. Energy efficiencies of this sort should be a part of the neighborhood planning process and integrated into local efforts that encourage sustainability through LEED-ND or green infrastructure. Energy-efficient neighborhoods can be planned that encourage green building development, on-site generation, the use of renewable sources of power, efficient distribution systems, and combined heat and power systems shared by multiple buildings.

In higher density, mixed use neighborhoods, there is great potential for energy efficiency through the creation of a District Energy System (DES). A DES produces energy in the form of steam, hot water, or chilled water and sends the energy through an underground closed-loop piping system to buildings connected to the district’s network. These districts can employ mechanical systems that can be used to produce electricity, heat, or both, an approach known as combined heat

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and power, which is capable of much deeper energy conservation and climate change mitigation. A DES can mitigate climate change even further by deriving its energy from renewable fuels such as biomass, municipal waste, and lower carbon alternatives such as natural gas or, in some areas, wind turbines or solar arrays.

To operate most efficiently, districts should contain buildings with different energy needs, such as multifamily buildings, offices, hospitals, nursing homes, mills, factories, and even wastewater treatment plants. When they are located in reasonable proximity, the energy loads of each can complement one another (because their energy needs are varied at different times of day) and the costs of heating and cooling can be reduced. In those buildings, heat exchangers can draw the energy needed to meet their space and water heating needs, returning the water to the plant for recirculation within a closed loop system. This eliminates the need to install individual boilers in each building, which reduces capital costs. In older areas where existing furnaces, chillers, water heaters, and other cooling and water facilities are obsolete, the DES approach can cost-effectively address the need for system modernization.

To increase the use of these systems, the local land use regulatory system will need to adjust to allow, or even to incentivize, them. They must be allowed as permitted uses and practices under local zoning and site plan regulations, as well as local building and energy codes. They may be encouraged through bonus zoning provisions that waive zoning requirements or provide additional development densities for developers who adopt DES technologies. The City of Burlington, Vermont, revised its comprehensive plan to include a commitment to transitioning to renewable sources of energy as well as to cogeneration and district heating, including biomass-fueled district heating technologies. Planners in Washington, D.C., have recognized that the absence of permissive language pertaining to DESs in its local zoning law discourages their use.

They recommend amending the zoning to expressly permit the use of DES in all zoning districts.

CONCLUSION

Neighborhood planning of this sort should become a priority for both state and federal sustainability and climate change planning. Support should be provided to localities interested in learning how to adopt these and other promising techniques. Local planning and regulatory efforts have great potential to achieve sustainable development goals and manage climate change. Helping them to do so should be a fundamental objective of policies at these higher levels of government.

The history and examples above demonstrate that opportunities abound for planners and land use lawyers to lead the way in further integrating the principles of sustainable development and climate change management and to implement effective strategies that will immediately reduce our carbon footprint to ensure a healthy and sustainable future.

The conclusions we reached in preparing our book parallel those contained in several excellent articles contained in the Autumn 2010 issue of the *Journal of the American Planning Association*. We are in agreement with the authors of those articles that:

- The prospects for a silver-bullet emissions reduction initiative emerging from agreements under the U.N. Framework Convention on Climate Change are not bright.
- There is a need for planners to assume strong leadership in crafting state and local mitigation and adaptation strategies.
- Local initiatives should proceed aggressively, regardless of progress at the national level—either as supportive or in lieu of such effort.
- It would be irresponsible not to continue the momentum already achieved by local planners and attorneys as catalogued in our book's review of recent progress in pursuing integrated sustainable development and climate change management policies.

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