Evidence Matters

Transforming Knowledge Into Housing and Community Development Policy

SUMMER 2011

Young adults from the YouthBuild program equip multifamily housing buildings with solar panels while learning to install the new technology. *Everyday Energy*

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Quantifying Energy Efficiency in Multifamily Rental Housing

The sluggish pace of energy-efficiency improvements in the multifamily rental housing sector continues to vex advocates of sustainability. Multifamily housing has a number of characteristics that should make green retrofits an appealing investment, but only a fraction of the potential energy savings in the multifamily sector has been realized. Yet, despite recent advances in building technology and in the financial sector's ability to model energy savings, energy-efficiency retrofits are still far less common in multifamily housing than in single-family housing. Why are multifamily property owners and investors passing up this opportunity to achieve cost savings through greater efficiency?

Unpicked Low-Hanging Fruit?

According to a widely cited 2009 report by the Benningfield Group, an energy consulting and software development firm, multifamily housing stock

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U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

PD&R

Message from the Assistant Secretary

Businesses, government, and individuals both in the United States and abroad have increasingly embraced sustainability. Yet while there are many available examples of sustainable development yielding improved environmental conditions and economic benefits, the overall evidence base for many conventions of sustainability needs to be strengthened. In part, this may be because strong advocacy for sustainability — often responding to entrenched skepticism — can crowd out discussion of the type of research that is needed to back up these claims. But if we want sustainable policies and behaviors to be more widely adopted, advocacy is not enough; the justification for sustainability must be self-evident to everyone, even skeptics. Accomplishing this requires a greater emphasis on measurement.

The Obama administration believes in the promise of sustainability and wants to help build the knowledge base necessary to foster unfettered private investment in technologies that make our homes and communities more sustainable. HUD has made sustainability one of its key strategic goals, and, through various partnerships and investments, is playing an important role in developing the evidence base for sustainability. HUD, along with the Department of Transportation and the Environmental Protection Agency, is part of the federal Partnership for Sustainable Communities, which seeks to facilitate interagency cooperation and collaboration around sustainability. The partnership agencies are undertaking a strategic set of actions — targeted grants and programs, breaking federal barriers, and integrating the partnership's six Livability Principles in each agency's goals and operations — which will help connect existing data and standardize efforts to measure results.

HUD has made several important investments that will help build the evidence base for sustainability, some of which are featured in this magazine. For example, through American Recovery and Reinvestment Act funds and collaboration with the Department of Energy, HUD has increased its investment in weatherization improvements, and HUD's Energy Innovation Fund will help bring multifamily energy-efficiency efforts to scale. The Sustainable Communities Initiative has awarded nearly $140 million to 87 grantees at the local, regional, and state levels to develop local and regional plans that integrate housing, transportation, economic development, and environmental preservation in new and innovative ways. HUD's Office of Policy Development and Research (PD&R) is playing an important role in this effort, partnering with the Office of Sustainable Housing and Communities to run a grant competition to fund research in sustainability. The $2.5 million PD&R has made available for research relating to affordable housing, transportation, healthy community design, and other aspects of sustainability is by far the most sought-after funding source in our history.

PD&R's participation in this grant competition is only the latest in a long history of initiatives that have sought to better understand and advance sustainability. Nearly 20 years ago PD&R played a lead role in the Partnership for Advancing Technology in Housing, which facilitated the introduction of new technologies to promote affordable housing and "green" building practices. More recently, we helped sponsor *Growing Smart*, a handbook for regulatory reform that supports environmentally friendly approaches to development, and *Regional Approaches to Affordable Housing*, a report that identifies and evaluates promising approaches to affordable housing development at the metropolitan level. Efforts such as these will continue.

As the federal government and its partners become more deeply engaged in sustainability, HUD recognizes the ongoing need for a strong and reliable empirical basis for developing sustainability-related policies and understanding their implications. We are leveraging small investments in our partners and grantees to grow our evidence base. For instance, the Sustainable Communities grant winners are serving as laboratories for community- and regional-level sustainability planning, and their funding comes with evidence-gathering requirements that will show how effectively their projects advance sustainability goals. Pilot programs such as PowerSaver and Green Refinance Plus will do the same for building-scale questions.

This issue of *Evidence Matters* highlights some important programs in the field, focusing on the role of data in guiding sustainability policy and practice. The articles demonstrate the ways that good data can spur investment and create consensus around sustainability issues. By highlighting the uses of and demand for evidence, we hope to focus attention on an integral part of the effort to make sustainability a first-order concern for everyone.

— Raphael Bostic, *Assistant Secretary for Policy Development and Research*

Editor's Note

In our third issue of *Evidence Matters*, we delve into the ways sustainability is being defined, measured, and practiced throughout the U.S. One way communities of practice are achieving more sustainable living environments is by reducing home energy consumption, which accounts for 22 percent of U.S. energy consumption. Multifamily rental housing has the greatest untapped potential for such savings, but also has some inherent difficulties. The lead story, "Quantifying Energy Efficiency in Multifamily Rental Housing," looks at steps being taken to resolve these challenges, including efforts by HUD and our partners to increase and standardize the data on the impact of retrofits.

When we "peeled back the onion" on sustainability measurement, we found many different approaches to defining and tracking outcomes. The variety of sustainability indicators, indicator systems, and indices play a pivotal role in developing a common understanding of the concept and its goals, but it is important to understand the elements that make up these measures. "Measuring Sustainability" reviews how sustainability has been defined and measured during its brief history, and how rapid advances in the field are allowing governments, businesses, and individuals to look at it in new and more comprehensive ways.

The way organizations communicate about their vision and goals for a more sustainable future impacts how regional players think and act regionally. "Confronting the Future: Case Studies in Regional Planning and Consensus-Building" describes the techniques employed by regional planning organizations in the Salt Lake City and Sacramento regions that have built strong and broad support for their initiatives. Regional planning can be controversial, but these examples show that an abundance of solid, credible data, combined with the ability to connect that data to people's values, goes a long way toward building the public support necessary to achieve policies that advance regional sustainability.

I hope you enjoy this issue of *Evidence Matters*. Future issues will focus on building economic resilience and recovery in U.S. cities and regions and the role research plays in ending homelessness. As always, we welcome any feedback you have at **www.huduser.org/forums**.

— Erika C. Poethig, *Deputy Assistant Secretary for Policy Development*

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could feasibly become 28.6 percent more energy efficient by 2020.[1] This increased efficiency would translate into a savings of at least 51,000 gigawatt hours of electricity and more than 2,800 million therms of natural gas, which amounts to $9.2 billion at today's residential energy prices.[2,3] Multifamily housing has characteristics that make it especially amenable to energy retrofits. One is that it is inherently more energy efficient than single-family housing due to size per unit, exterior exposure, and other structural differences (see table 1). At the same time, multifamily housing is older on average than single-family housing and has less efficient heating, cooling, plumbing, and lighting systems.[4] An Energy Programs Consortium analysis found that 85 percent of multifamily units were built before 1990, leaving room for substantial savings — anywhere from 30 to 75 percent — from energy-efficiency improvements.[5]

Table 1. U.S. Residential Energy Consumption by Unit Type

	Total energy consumption (quadrillion BTUs)	Percentage of total	Consumption per household (mBTUs)	Consumption per household member (mBTUs)
Single-family dwellings*	8.49	84.4%	106.58	39.36
Multifamily dwellings	1.57	15.6%	64.14	29.37

Note: BTUs = British thermal units; mBTUs = millions of British thermal units.
Source: Energy Information Administration 2005 Residential Energy Consumption Survey, table US 1.
*Excluding mobile homes.

In addition to the potential energy savings, improving the energy efficiency of multifamily housing also improves the stability of vulnerable households. Most multifamily households (88%) are renters, whose average annual income ($31,000) is just over half that of homeowners ($61,000).[6] This means that nationally, the burden of the untapped savings in the older and less energy-efficient multifamily housing stock is being borne by the families with the fewest resources. As a result, renters typically pay a higher percentage of their income for energy. This lowers their discretionary income and makes them much more vulnerable to fluctuations in energy prices, which are increasing at a faster rate than housing

Highlights

- Multifamily housing has high potential for energy savings through retrofits, but the lack of data on best practices and historical cost savings has weakened investment.
- Current efforts by the federal government and its partners are attempting to increase data collection and standardization, but communicating information about efficiency-boosting activities to lenders continues to be a barrier.
- HUD has increased multifamily green retrofits through direct investment by stimulating private investment using the Energy Innovation Fund and Green Refinance Plus program.
- Utilities are an important resource because they have both money for energy-efficiency improvements and comprehensive usage data.

costs; between 2001 and 2009, renters in multifamily units faced an average rent increase of 7.6 percent, while energy costs for these renters rose by 22.7 percent.[7] Thus, efficiency gains from multifamily retrofits have the concurrent benefit of relieving low- and middle-income families of some of their financial strain and uncertainty.

Nevertheless, despite the inducements of cost savings, increased cash flow, and greater tenant stability, multifamily owners have been slow to make energy-efficiency improvements. Many experts believe that their hesitation is due to market failures, flaws in the functioning of the multifamily housing and finance markets that prevent owners, lenders, and tenants from realizing the benefits of retrofits. One of the most significant flaws affecting the market is the lack of sufficient data about multifamily retrofits and their advantages. This article examines these challenges and the current efforts to provide the information necessary to allow multifamily retrofits to reach their potential.

Quantifying Returns From Investments

Lenders are reluctant to dive into the multifamily green retrofit market for several reasons. Ted Toon, deputy assistant secretary of HUD's Office of Affordable Housing Preservation, says that lenders are hesitant to enter a new market with unfamiliar loan structures.[8] Ben Metcalf, senior advisor in HUD's Office of Multifamily Housing, says that compared with single-family retrofits, the multifamily market is more complicated and less liquid, which makes it seem riskier.[9] The biggest issue, however, is the lack of data on the payback period for retrofits, which is the amount of time it will take for savings gained from increased energy efficiency to cover the up-front investment. The data that do exist, says Paula Cino, director of energy and environment policy at the National Multi Housing Council, do not reflect the diversity of the multifamily market and therefore are not broadly applicable.[10] This is partly because there has not been a sufficiently strong market to attract large-scale empirical research; according to Mijo Vodopic of the MacArthur Foundation, "No one has enough data, dollars, or access to good energy-related information to move...on their own."[11]

Recently, however, researchers have begun showing interest in this area, recognizing the potential of relatively inexpensive improvements to capture hitherto untapped energy savings. Living Cities, the MacArthur Foundation, the White House Council on Environmental Quality, and the Urban Land Institute recently agreed to standardize their energy consumption data and plan to develop a common "data taxonomy" by the end of 2011. Meanwhile, a number of organizations have recently developed energy-efficiency metrics, including LEED, Enterprise Green Communities, Stewards of Affordable Housing for the Future, and EarthCraft. The Environmental Protection Agency (EPA) is hoping to develop an ENERGY STAR 1-to-100 energy performance scale for existing multifamily buildings that would allow owners to assess their buildings' performance relative to their peers, with high-performing buildings eligible for ENERGY STAR certification. Fannie Mae is contributing to this effort by collecting energy-usage data on

Everyday Energy

Hector del Real, a former YouthBuild job trainee shown here installing solar panels on a multifamily retrofit, is now a full-time employee with Everyday Energy in one of the new kinds of jobs generated by clean energy initiatives.

thousands of buildings, which EPA will then analyze to determine if there is strong enough evidence to develop a rating scale. Michael Zatz, chief of the Market Sectors Group in EPA's ENERGY STAR Commercial & Industrial Branch, says that collecting whole-building data is the biggest obstacle to developing performance metrics for the multifamily sector.[12]

Lenders, however, need more than just performance data to accurately assess the risk of energy-efficiency investments; they need information about whether specific owners, property managers, and property engineers are able to monitor their buildings and maintain energy performance. Accurate projections for the increased revenue from retrofits are crucial. To make a loan, the increase in revenue from energy savings must be high enough to justify the cost of capital — but if the revenue estimate is higher than the property owner is capable of delivering, the owner may not have enough cash to cover his mortgage and default. Because of this uncertainty, lenders have not yet determined how to appropriately value and incorporate energy savings into the standard underwriting processes, pro forma analyses, or property appraisals for multifamily properties.

These obstacles are especially vexing because the per-unit annual payback on investment (APOI) for multifamily energy-efficiency retrofits is actually better than that for single-family homes, says Louis Schotsky, vice president for investments and sustainability at Equity Residential.[13,14] Multifamily retrofits can take advantage of economies of scale not available in single-family homes; it is easier to coordinate retrofits for multiple units that are contiguous and a single intervention (for example, HVAC replacement) can improve efficiency in every unit in the building. Schotsky says that Equity Residential and other multifamily owners have experienced yields from retrofits that exceed those for single-family homes. For these returns to translate into greater investment, however, building owners would need to communicate firsthand operational knowledge to lenders and show the energy savings that are being achieved across many individual units, in order to allow them to predict energy savings with as much certainty as possible. Moreover, the volatility of the energy market makes predicting energy savings even harder, because returns on energy-efficiency investments depend on both the amount of energy saved and the price of energy. These information asymmetries make multifamily retrofits seem far riskier than they actually are, and solutions are still forthcoming.

Utilities: A Crucial Part of the Efficiency Equation

Utilities have the potential to help lenders and owners better understand performance data. "No single subset of entities has more data than utilities, and without their cooperation it is virtually impossible for owners to actually get real-time, accurate usage data," says Debra Schwartz, director of program related investments at the MacArthur Foundation. "Without this data, modeling and tracking impact information is limited, which in turn constrains the ability to use data as a feedback loop in managing the energy usage in a building." Schwartz emphasizes the importance of standardizing utilities' data and data collection methods to track energy usage efficiently, noting that they constitute "an incredibly fragmented universe with lots of different regulators all over the country."[15]

The robust, measurable results of investments by utilities and utility commissions illustrate their potential to contribute key data on the APOI from energy-efficiency programs. The California Statewide Multifamily Energy Efficiency Rebate Program, for instance, is a collaboration among California's four major investor-owned utilities to encourage energy-efficiency upgrades by providing equipment rebates to owners and tenants of multifamily housing. In the first 3 years of the program (2004 through 2006), the utilities saved $25.4 million in both electricity and gas, resulting in a combined average annual APOI of 16.7 percent (see table 2).

Table 2. California Statewide Multifamily Energy Efficiency Rebate Program, 2004–2006

Provider[1]	Incentives disbursed[2]	Units[2]	Estimated electricity savings[3]	Estimated gas savings[3]	Total estimated energy savings	Average APOI
PG&E	$17,189,132	98,437	$5,728,489	$2,176,193	$7,904,682	15.3%
SCE/SoCalGas	$24,864,513	173,000	$8,969,432	$3,498,633	$12,468,065	16.7%
SDG&E	$8,627,014	59,000	$3,822,406	$1,168,070	$4,990,477	19.3%
Total	$50,680,659	330,437	$18,520,327	$6,842,896	$25,363,224	16.7%

Note: APOI = annual payback on investment; PG&E = Pacific Gas and Electric; SCE = Southern California Edison; SoCalGas = Southern California Gas Company; SDG&E = San Diego Gas and Electric.

[1] PG&E and SDG&E provide customers with both gas and electricity; SCE and SoCalGas provide electricity and gas, respectively, to the same customer base.

[2] Dan York, Marty Kushler, and Patti Witte. 2008. *Compendium of Champions: Chronicling Exemplary Energy Efficiency Programs From Across the U.S.* Washington, DC: American Council for an Energy-Efficient Economy, appendix 15-3.

[3] Kilowatt hours and therms saved: York, Kushler, and Witte; Annual average rates: Correspondence with Donald Lafrenz, Richard Myers, and Doris Lo, California Public Utilities Commission, Energy Division, June 29, July 14, and July 20, 2011.

National Church Residences

Green retrofitting of multifamily housing built prior to 1990 — such as this building that is having insulation added to exterior walls and its windows replaced — can mean substantial savings in energy consumption/costs.

Because utilities have funds set aside for energy efficiency, they have also been able to show how much investment can be leveraged with small amounts of interest-free capital in the multifamily market. In the case of the existing building component of the New York State Energy Research and Development Authority's Multifamily Performance Program, $75 million in grants have seeded an additional $445 million of energy-efficiency investments by property owners; the average annual energy savings for projects that have completed the program and generated a year's worth of energy usage data is 25 percent.[16]

Making Retrofits Make Sense for Property Owners

Utilities' investments can provide multifamily owners with much-needed capital for energy-efficiency retrofits, but an even more basic need is for more data to help owners better understand the opportunities for energy savings. Many owners who rely solely on their energy bills struggle to make informed decisions about greening their properties. Anne Evens, executive director of CNT Energy, has seen significant owner interest in measuring energy efficiency. Owners want to get snapshots of their current usage and learn how much they can save from improvements; at the portfolio level, they want to know what accounts for the bulk of their energy consumption to better target their energy-efficiency investments. Part of the solution to this data problem is more and better energy monitoring, but according to Michael Bodaken, executive director of the National Housing Trust, there are far fewer knowledgeable multifamily energy auditors than their single-family counterparts; as with financing, auditing is much more complicated in the multifamily sector.[17] Technical data is also needed; Paula Cino says that even sophisticated owners who are already able to benchmark and track their energy usage lack information on equipment, maintenance, and other capital costs.

Despite these difficulties, owners are reporting positive results from incorporating energy-efficiency features in multifamily housing and many are responding to these energy savings by adopting efficiency features throughout their portfolio. Dan Levine, senior vice president for construction at the John Stewart Company, a multifamily housing management, development, and consulting organization, says that "over the long term (10 to 15 years), such improvements free up capital for property owners for other maintenance and improvement needs by reducing operating costs. Efficiency improvements have become more

photo courtesy of constructionphotographs.com

Owners report positive results from incorporating energy-efficiency features in multifamily buildings.

Split Incentives

Even if better performance data and ready capital were available for retrofits, they would not completely solve the problem of split incentives, which depress owner demand for retrofits. The biggest cause of split incentives is that in individually metered units, the benefits and savings from retrofits go to tenants, not owners. In addition, owners face several hurdles when trying to use energy savings to justify rent increases. Owners need accurate data on tenant-paid utilities to project the expected savings from their investment and advertise them to potential renters and buyers; this information is often hard to come by. Even if an owner can accurately predict expected utility savings, raising the rent of an occupied unit by the entire expected amount of utility savings may not be possible. These factors make capturing the benefits from energy-efficiency improvements an uncertain proposition, which in turn makes investment in retrofits less attractive.

Creative solutions to the split incentives problem are currently being tested. A recent guide from Enterprise Green Communities describes how public housing authorities can use energy-efficiency utility allowances to incentivize owners to invest in energy-efficiency retrofits in their low-income properties. Utility allowances are used to calculate the rents for HUD-subsidized tenants, ensuring that they are paying only 30 percent of their adjusted monthly income toward gross rent, which includes contract rent and estimated utilities.[1] An energy-efficiency utility allowance gives property owners who make energy-efficiency improvements the opportunity to reduce their tenants' utility allowance, resulting in an increase in contract rent by the same amount.

An innovative strategy for overcoming split incentives in market rentals is to incorporate a cost-sharing agreement for energy-efficiency improvements directly into the lease. In the residential sector this technique, known as "green leasing," is still in its infancy. A green lease specifies the amount that rent has been increased to help cover the owner's investment in energy efficiency as well as the tenant utility savings that will offset that rent increase. For recent investments that have not yet generated sufficient energy usage data, a green lease can stipulate that a rent increase will occur when enough usage data exists to predict energy savings. Cambridge Energy Alliance, a nonprofit sponsored by NSTAR (a natural gas and electricity provider) and the city of Cambridge, Massachusetts, will soon be piloting a model green residential lease in a small number of units. They believe that their model lease will be disseminated widely once the pilot has been completed.

[1] Heschong Mahone Group, Inc. May 2011. "Utility Allowance Options for Investments in Energy Efficiency: Resource Guide," 7.

An infusion of $5 billion from ARRA has allowed the Department of Energy's Weatherization Assistance Program to double the percentage of weatherization grant funds going to multifamily housing.

commonplace in maintaining multifamily housing, including using fluorescent bulbs, ENERGY STAR appliances, [and] environmentally friendly products and incorporating recycling as part of our normal maintenance procedures."[18] Nathan Taft, director of acquisitions at Jonathan Rose Companies, an affordable housing developer and investor, says that these "relatively modest investments can produce energy-efficiency gains of 25 to 30 percent, making units more energy efficient, reducing operating expenses for tenants and owners, and providing owners with better access to low-interest, long-term financing."[19]

Creating a Space for Market Financing Solutions

Efforts are underway across the multifamily housing sector to collect the data necessary to spur private investment in retrofits. Recent multifamily green building and retrofitting programs demonstrate the federal government's commitment to providing concrete examples of multifamily housing's potential for cost and energy savings. In 2009 the Department of Energy's (DOE's) Weatherization Assistance Program (WAP) received $5 billion as part of the American Reinvestment and Recovery Act (ARRA). WAP has been making grants to low-income households for home weatherization measures such as sealing ducts, caulking, and insulating since 1976. DOE used the opportunity afforded by the new infusion of funding to collaborate with HUD to provide weatherization assistance to owners of federally subsidized public and multifamily housing.[20] WAP has already helped weatherize more than 82,000 multifamily units since its inception; Stockton Williams, senior advisor for urban policy at DOE, says that this infusion of funding has doubled the percentage of weatherization funds allocated to multifamily housing, from 8 to 10 percent of WAP funds to up to 20 percent of ARRA weatherization funds.[21,22] DOE expects a 10- to 20-percent improvement in energy efficiency, with an average first-year heating and cooling bill reduction of $437.[23,24]

HUD's Green Retrofit Program is another ARRA-funded program aimed at creating scalable solutions to the multifamily retrofit problem, injecting

Energy upgrades for Section 8 and HUD-subsidized elderly and disabled housing, funded by grants from HUD's Green Retrofit Program, will produce an average annual energy savings of 27 percent per unit.

capital into the areas of the market most in need while preserving affordable housing for the most vulnerable populations. The program has awarded nearly $250 million in retrofit grants for Section 8 and HUD-subsidized elderly and disabled housing to fund energy upgrades for 20,000 affordable units at an average cost of about $12,000 per unit. To accept the funds, building owners must allow thorough audits of energy consumption both before and after the retrofits to create benchmarks for expected energy savings.[25] The Office of Multifamily Housing is currently projecting that this investment will produce an average annual energy savings of 27 percent per unit.[26]

In addition to efforts to directly subsidize multifamily retrofits and data collection, two new HUD programs aim to make energy efficiency attractive to investors. The Energy Innovation Fund was created to overcome barriers to residential energy efficiency by catalyzing private investment, with the eventual goal of creating a flourishing home energy retrofit market in the United States. The fund will award $25 million in highly leveraged funding by the end of 2011 through a competitive grant process that will seed up to $200 million in investment in revolving loan funds, loan guarantees, and energy-efficiency mortgages. The second program, Green Refinance Plus, is an enhancement of the existing Risk-Share program in which the Federal Housing Administration (FHA) assumes half of the risk of loans for refinancing or property acquisition underwritten and issued by Fannie Mae's lending network. In Green Refinance Plus, at least five percent of these loans is dedicated to renovations or green retrofits, and FHA insures this portion of the loan under relaxed but still responsible underwriting standards. This way, FHA can demonstrate the cash-flow benefits of green retrofits, but borrowers will not default even if the improvements do not yield the expected savings, says Chris Tawa, senior advisor in the HUD Office of Multifamily Housing Programs, who helped design the program.[27] Ted Toon hopes that this program will show that "green retrofits can be financed. When FHA insures it and Fannie Mae underwrites it, private borrowers can go to private lenders and let the market work."[28]

The private sector is starting to recognize this potential market. Bank of America recently announced the availability of $55 million in low-interest loans to community development

Before and After: The infrared image on the right highlights the effectiveness of weatherization. The area of blue shows where metal panels have been installed; the "blue" is cold air kept outside the building. The area of reds and yellow, where the plates have not yet been installed, show heat and energy escaping from the building.

financial institutions (CDFIs) for energy-efficiency programs. The financing is intended for CDFIs that have started pilot programs to finance energy savings in multifamily retrofits. Most of these funds will provide long-term financing to 12 CDFIs judged to have the most effective, nationally applicable solutions for funding energy-efficiency improvements.[28] Amy Brusiloff, senior vice president of CDFI lending and investing at Bank of America, explains that CDFIs have "lending expertise and can aggregate resources to mitigate risk and credit enhance loans. They can also use government and philanthropic resources to help defray the costs of marketing to building owners, data collection, and energy-efficiency underwriting training."[30] Bank of America will work with Bright Power to track the energy and water savings post-retrofit in buildings funded through the program.

One area of focus for the Bank of America's program will be finding a scalable model for stand-alone retrofits (that is, retrofits not connected to mortgage initiation or refinancing). These investments are particularly difficult to finance because the risk for the lender is not bundled with other, less risky investments. In addition, because loans for retrofits are relatively small compared with the mortgage for an entire building, underwriting costs will be much larger relative to the expected return, making the loan comparatively more expensive. Moreover, owners of properties with individually metered utilities do not capture the energy savings from retrofits, which limits the revenue that can be applied to debt payments. However, stand-alone retrofits have the benefits of stabilizing tenants through decreased utility costs and increasing owners' solvency because of the net increase in cash flow.

Stand-alone retrofits are particularly difficult to finance because the risk for the lender is not bundled with other, less risky investments.

The Cook County Energy Savers program is providing a model of how the difficulties of stand-alone retrofits can be overcome. Designed and managed by the Center for Neighborhood Technology (CNT), a Chicago-based think tank that works on sustainable development issues, the program targets affordable housing in Chicago not already going through major recapitalization. Using funds from various public and private sources, CNT is a one-stop shop for all of the technical information, capital, and skilled workers necessary for stand-alone retrofits. This centralization substantially lowers the high transaction costs of retrofits for individual owners. In addition, CNT ensures the quality of the retrofit and monitors the results. Community Investment Corporation, a local CDFI, provides the financing (used by about 50 percent of participants) as well as financial advice to participants. Since 2007 Energy Savers has retrofitted 5,000 units in Chicago at an average cost of $2,500 per unit; the program has 2,500 more units in the pipeline and estimates that an additional 4,000 to 5,000 units will be finished by the end of 2011. The retrofits have resulted in a 30-percent reduction in energy consumption; other benefits include a 5,000 metric ton reduction in greenhouse gas emissions and 75 new jobs.[31]

The innovation and collaboration currently underway in the multifamily green retrofit market are encouraging. These developments may soon make capturing the untapped energy savings in the multifamily sector a reality. EM

[1] The Benningfield Group. 2009. "U.S. Multifamily Energy Efficiency Potential by 2020." 8–9.

[2] Ibid.

[3] Energy Information Administration, Office of Electricity, Renewables & Uranium Statistics. *Electric Power Monthly*, July 2011, table 5.3; Energy Information Administration, Office of Electricity, Renewables & Uranium Statistics. *Natural Gas Monthly*, July 2011, table 19. 1 therm = 100 cubic feet of gas.

[4] Joint Center for Housing Studies of Harvard University. 2008. "The State of the Nation's Housing 2008," 33; The Benningfield Group, 7, 15–6.

[5] Matthew Brown and Mark Wolfe. 2007. "Energy Efficiency in Multi-Family Housing: A Profile and Analysis," 3, iv.

[6] The Benningfield Group, 4, 16.

[7] Joint Center for Housing Studies of Harvard University. 2011. "America's Rental Housing: Meeting Challenges, Building on Opportunities," 43.

[8] Interview with Ted Toon, August 2011.

[9] Interview with Ben Metcalf, July 2011.

[10] Interview with Paula Cino, July 2011.

[11] Interview with Mijo Vodopic, June 2011.

[12] Interview with Michael Zatz, August 2011.

[13] Annual Payback on Investment = Total Investment/Payback Period.

[14] Interview with Louis Schotsky, August 2011.

[15] Interview with Debra Schwartz, June 2011.

[16] Correspondence with Lindsay Robbins, project manager, New York State Energy Research and Development Authority, July 28, 2011.

[17] Interview with Michael Bodaken, July 2011.

[18] Interview with Dan Levine, June 2011.

[19] Interview with Nathan Taft, June 2011.

[20] U.S. Department of Housing and Urban Development and U.S. Department of Energy. 2010. "Fact Sheet: HUD-DOE Weatherization Partnership — Streamlining Weatherization Assistance in Affordable Housing."

[21] Ibid.

[22] Interview with Stockton Williams, June 2011.

[23] "Weatherization Assistance Program — The American Recovery and Reinvestment Act of 2009." U.S. Department of Energy, Office of Energy Efficiency and Renewal website. Accessed 1 June 2011.

[24] Joel F. Eisenberg. 2010. "Weatherization Assistance Program Technical Memorandum: Background Data and Statistics," 7.

[25] "Green Retrofit Program for Multifamily Housing." U.S. Department of Housing and Urban Development website. Accessed 10 June 2011.

[26] Savings estimate courtesy of Ted Toon.

[27] Interview with Chris Tawa, August 2011.

[28] Interview with Ted Toon, June 2011.

[29] "Bank of America Announces New Energy Efficiency Finance Program," Bank of America press release, 25 May 2011.

[30] Interview with Amy Brusiloff, May 2011.

[31] American Council for an Energy-Efficient Economy. 2011. "Case Study — Chicago Area Energy Savers Program," 3.

Research Spotlight

Measuring Sustainability

Concerns about sustainability have become increasingly influential in shaping both government policy and the behavior of individuals and businesses. In unveiling PlaNYC, a long-term sustainability plan for New York City, Mayor Michael Bloomberg pronounced, "The science is there. It's time to stop debating it and to start dealing with it....Let's recognize that many of the gains we have made in the quality of our air, water, and land will be lost — if we don't act."[1] However, debate continues about which actions we should take, what our specific goals should be, and how we should measure progress. The 1983 World Commission on Environment and Development is generally thought to have inaugurated the international effort to answer these questions. The report that resulted from the conference — entitled *Our Common Future* but better known as the Brundtland report — originated the now-classic definition of sustainability: "[D]evelopment that meets the needs of the present without compromising the ability of future generations to meet their own needs."[2] This definition is high-level and open to interpretation, which probably has helped popularize sustainability but has also made it difficult for groups with different priorities to agree on a common course of action. The lack of consensus has also complicated attempts to measure the effectiveness of sustainability efforts and make comparisons across programs and geographies. A growing body of work on measurement, however, is providing the means to better document current conditions and demonstrate progress. This article will review the research on metrics — indicators, indicator systems, and indices — that attempts to resolve the challenges of measurement. Sustainability is commonly described as comprising three interdependent pillars or dimensions: social, economic, and environmental. (A fourth, governance or institutions, is often included as well). These dimensions, however, only outline the general scope of a measurement framework. Sustainability is a complex and subjective concept, so in order to measure it, organizations must first define what it means to them and then choose indicators that give the most relevant information about their system and time scale of interest.[1]

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Sustainability Indicators

Sustainability indicators are derived from existing data sources that most closely approximate the qualities people are interested in measuring. Environmental quality, for instance, is typically described in terms of air and water quality, levels of greenhouse gas emissions, and biodiversity. Economic health is usually described using macro-level indicators such as GDP per capita, along with factors such as access to employment, education, and credit, which emphasize the role of individual opportunity. Social equity is measured in literacy rates, infant mortality, health and life expectancy, and crime rates. Indicators that apply to more than one dimension of sustainability can be more holistic; for instance, measuring the quality of a community's wastewater treatment and its land-use patterns can help illustrate how environmental quality varies among different areas, providing information about socioeconomic conditions as well as the environment.

The Partnership for Sustainable Communities (PSC), a collaboration among HUD, the Department of Transportation, and the Environmental Protection Agency (EPA), recently undertook a study with the University of Pennsylvania School of Design to review and evaluate existing indicators, with the goal of developing a core set of indicators for widespread use by U.S. cities and regions. They compiled a list of 336 indicators contained in a collection of 22 indicator systems and then narrowed the list down to the 155 most useful ones. To better understand how this optimized set of indicators might be applied, they categorized them in two ways: by dimension (environmental, economic, or social) and according to the PSC's six livability principles, which the participating agencies are using to guide investments in sustainability. Table 1 illustrates this rubric, including an example of an indicator for each theme.[1]

Highlights

- Measuring sustainability is difficult because there is no universal definition and it encompasses many aspects of our society, economy, and governing institutions in addition to our interaction with the natural environment.
- Indicators can help measure key facets of sustainability to allow organizations to make decisions about how best to become more sustainable.
- Indicators can be bundled into indicator systems for a more comprehensive picture; they can also be aggregated into indices, but this raises concerns about the loss of precision.
- Location efficiency is a thriving area of research on metrics because it ties together the travel and economic impacts of the built environment.

Livability Principle and Theme	Example Indicator**	Soc	Econ	Env
1. Provide more transportation choices				
Commute mode/mode share	Percentage of miles traveled (or trips taken) by sustainable modes (walking, biking, public transportation) as a fraction of miles traveled by private auto (6)	✓	✓	✓
Commute time/vehicle miles traveled	Average weekday vehicle miles traveled (3)	✓	✓	✓
Carbon emissions	Greenhouse gas emissions in tons per capita			✓
2. Promote equitable, affordable housing				
Housing affordability	Gap between price of affordability for a typical household and median price of market-rate housing	✓	✓	
Equity in housing (especially as it relates to mobility and location)	Percentage of low-income households within ¼ mile of a transit stop (1)	✓	✓	
Housing energy efficiency	Median energy consumption per household (3)	✓	✓	✓
3. Enhance economic competitiveness				
Educational resources and investment	High school graduation rate	✓	✓	
Agglomeration	Jobs housing ratio (1)		✓	
Access to capital, credit, and markets	Number of internet connections per 100,000 population	✓	✓	
4. Support existing communities				
Compact, transit-oriented development	Linear distance of high capacity public transit per 100,000 population (1)	✓	✓	✓
Efficient land and resource use	Energy consumption per capita (3)		✓	✓
Clean, healthy, and functional natural communities	Percentage of water bodies that are classified as "impaired" by the U.S. Environmental Protection Agency (2,3)	✓	✓	✓
5. Coordinate and leverage federal policies and investment				
Renewable and locally generated energy	Megawatt-hours of renewable energy consumed per capita (3)			✓
State and federal support for local planning efforts	None currently exist			
6. Value communities and neighborhoods				
Public health	Number of air quality nonattainment days in the last year (3)	✓		✓
Public safety	Violent crimes per 100,000 population (4)	✓		
Sense of place	Households within ¼ mile of neighborhood center (4)	✓	✓	

* Partnership for Sustainable Communities.
**Additional principles with which indicators overlap are indicated in parentheses.
Source: Unpublished paper by Lynch et al. 51–8.

One universal difficulty is that the indicators that are available are often only a rough approximation of the physical quality being measured. Although the characteristic feature of an indicator is less-than-ideal accuracy, this imprecision has fed skepticism about the possibilities for measuring sustainability.[5] This concern, however, arises from a misconception about the purpose of indicators. The use of sustainability indicators is patterned after ecologists' use of indicator species to understand and track ecosystem health and gross trends, rather than precisely documenting natural systems. Likewise, the goal of sustainability indicators is to give organizations enough information to set objective, attainable goals for sustainability and then make evidence-based policy decisions that bring them closer to those goals rather than precisely documenting natural or human systems.[6]

Indicator Systems

Sustainability indicators can be more useful for planners and policymakers when they are bundled into indicator systems or aggregated into indices. Much has been done on this front; the Compendium of Sustainable Development Indicator Initiatives, which operates as "a worldwide directory of who is doing what in the field of sustainability indicators," currently lists 894 systems and indices.[7] When selecting a set of indicators to describe a complex system of any scale, one rule of thumb is parsimony: represent the scope and complexity of the system using the smallest possible number of indicators. In addition, several available frameworks can guide index assembly in terms of both process and substance (see "Criteria for Building Measurement Systems," p. 15).

As well as comprehensive, national-level indicator systems such as the Indicators of Sustainable Development published by the United Nations Department of Economic and Social Affairs, some systems have been developed recently that focus on more granular data, making them better suited for measuring urban or regional conditions and the effects of jurisdiction-level policies.[8] The Global Cities Indicator Program, which has attracted significant and growing participation, offers a comprehensive menu of indicators that enables meaningful comparisons among 142 cities worldwide; the ICLEI USA STAR Community Index has similar aspirations but focuses on U.S. cities.[9,10]

Although these systems are designed to maximize usage and comparability, a different strategy is to look at sustainability thematically, creating indicator systems designed for specific disciplines or perspectives. For example, the Smart Mobility Framework from the California Department of Transportation (Caltrans) focuses on sustainability from the perspective of transportation planning, allowing it to concentrate on this sector while emphasizing its crosscutting implications. The framework encourages policymakers to consider six Smart Mobility Principles when making transportation decisions: location efficiency, reliable mobility, health and safety, environmental stewardship, social equity, and robust economy. It cites 17 goals associated with one or more principles and suggests several indicators for measuring each one.[11] The framework was developed with funding from the EPA and has contributed to the agency's just-released "Guide to Sustainable Transportation Performance Measures."[12]

Sustainability indices are a more concise alternative to indicator systems; they combine two or more metrics or indicators to arrive at a single summary indicator.

The Center for Clean Air Policy's recently released report, *Growing Wealthier*, is another example of a thematic indicator system; it summarizes recent empirical research that connects the economic and emissions-reducing benefits of sustainable development with Smart Growth policies and then uses this as a framework for measuring sustainability. The report outlines 37 potential benefits from Smart Growth and categorizes them by type (return on investment, savings on expenditures, or improved quality of life) and primary beneficiary (businesses, households, municipalities/regions, or the entire country).[13] While the Caltrans Smart Mobility Framework starts with a set of normative policy principles and provides a system for measuring their outcomes, *Growing Wealthier* aims to use demonstrable outcomes — the range of economic benefits measured in addition to reduced vehicle miles traveled (VMT) — as an argument for adopting sustainability principles in policymaking.

Sustainability Indices

A more concise alternative to indicator systems are indices, which combine two or more metrics or indicators mathematically to arrive at a single summary indicator. Table 2 summarizes five commonly referenced indices and illustrates the unavoidable tradeoffs of representing sustainability using any one value.[11]

An obvious difficulty is covering all three dimensions of sustainability in one index. Even systems that cover the

Developing a New Approach for Measuring Regional Sustainability

A multidisciplinary team headed by the U.S. Environmental Protection Agency recently published the results of a pilot study undertaken to find an alternative to existing regional sustainability measures that are "data-intensive, difficult to calculate, and difficult for non-researchers to understand."[1] The study's goal was to develop a measurement approach that uses "existing, readily available data sources" and produces information that can easily be applied by decisionmakers.[2] Starting with a working definition of sustainability as "identifying and maintaining a set of conditions that support environmental, social, and economic systems that meet the needs of both current and future generations," the research team enumerated three fundamental aspects of a system that together characterize its sustainability: its inherent order, the energy required to maintain that order, and the human impacts on the system.[3,4] The four metrics selected for the study reflect this focus on the systemic foundations of sustainability:

- *Emergy* is the amount of energy used directly or indirectly in the production of any product or service, expressed in a common unit, solar-equivalent joules. Measuring a system's emergy can therefore reveal the flow of energy into and out of that system. This study used emergy to measure sustainability using two indices: total emergy used by the environmental system (which indicates the level of system health over time) and the fraction of total emergy produced by renewable resources.
- *Ecological footprint* is a widely used method for measuring the demands of a given population relative to the biocapacity of the land available to meet them.
- *Green net regional product* (GNRP) measures aggregate consumption while accounting for depreciation in economic, human, and natural capital, all in common (economic) terms.

San Luis Basin Study Variables

Variable	Metric[1]				Source[2]	Scale[3]	Years
Population	EA	EF	GNRP	FI	BEA	C, S	1980 – 2005
Personal income	EA		GNRP	FI	BEA	C, S	1980 – 2005
Land area	EA	EF		FI	NASS	C	1980 – 2005
Precipitation	EA			FI	PRISM	C	1980 – 2005
Solar and wind	EA			FI	NASS	C	1980 – 2005
Food consumption		EF		FI	USDA-ARS	N	1980 – 2005
Food production	EA			FI	NASS	C	1980 – 2005
Imports	EA				GI	C	1995 – 2005
Exports	EA				GI	C	1995 – 2005
Forest harvest	EA	EF		FI	USDA-FS	C	1980 – 2005
Energy consumption	EA	EF		FI	EIA	S	1980 – 2005
CO_2 emissions			GNRP	FI	EIA	S	1980 – 2005
Water balance	EA		GNRP	FI	CDSS	R	1980 – 2005
Wind erosion	EA		GNRP	FI	Multiple sources	C	1980 – 2005

[1] EA = emergy analysis; EF = ecological footprint; GNRP = green net regional product; FI = Fisher information.
[2] BEA = Bureau of Economic Analysis; PRISM = PRISM (Parameter-elevation Regressions on Independent Slopes Model) Climate Group; NASS = National Agricultural Statistics Service; USDA-ARS = United States Department of Agriculture, Agricultural Research Service; USDA-FS = United States Department of Agriculture, Forest Service; CDSS = Colorado's Decision Support Systems; GI = Global Insight, Inc.; EIA = Energy Information Administration.
[3] C = county; R = region; S = state; N = national.

same dimensions can differ widely in approach. Ecological Footprint (EF) and the Environmental Performance Index (EPI) both focus on the environmental pillar but consider it from different perspectives: EF through the lens of carrying capacity and EPI through that of policy. The Human Development Index (HDI) considers economic and social sustainability but overlooks the environment, whereas the Happy Planet Index (HPI) approximates the environmental costs of human quality of life but ignores the economic costs. The only one of the five that attempts to cover all three pillars of sustainability, the Genuine Progress Indicator (GPI), lacks a standardized methodology and requires a host of assumptions to impute the values of various noneconomic costs. All of these indices vary in scope, from an elegant but narrow accounting of the environmental cost of happiness (HPI) to a system that aspires to capture and monetize all (both internalized and externalized) costs and benefits of development (GPI). One possible way to make the most of the available tools is to use them in combination; for example, the Footprint Network suggests using EF in combination with HDI.[15]

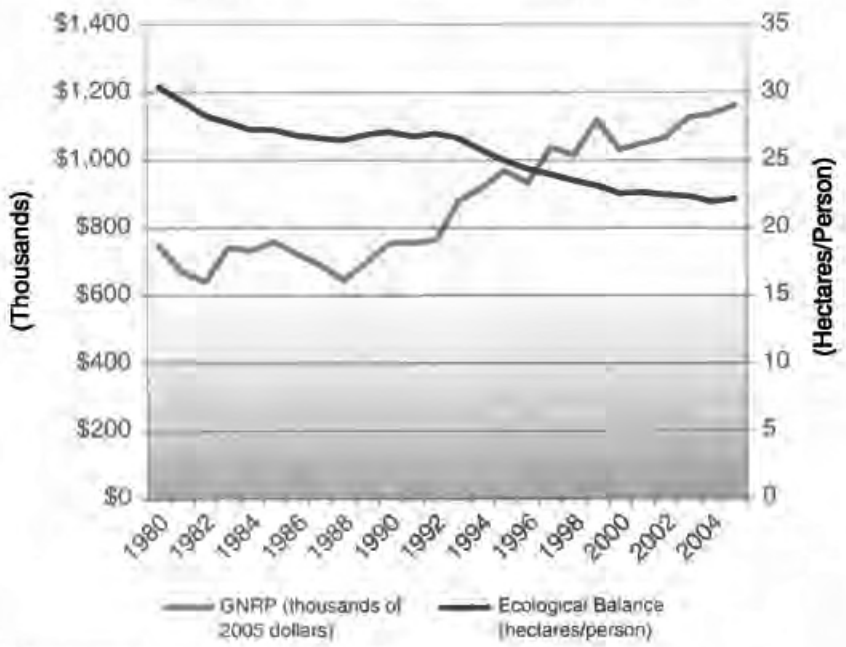
A more fundamental problem is that few if any sustainability indices employ standard mathematical rules of indexing. In 2007 Böhringer and Jochem reviewed 11 sustainability indices (including the 5 described here) for mathematical validity and found several methodological flaws. They note "a high degree of arbitrariness without mentioning or systematically assessing critical assumptions" in the normalization and weighting of component metrics. Even more concerning, the indices largely neglect the mathematical rules that govern the aggregation of metrics into a single index.[16] Even though these flaws cast serious doubt on the indices' ability to inform policy, they are still widely used. Organizations should therefore avoid weighing their rankings in these indices too heavily in their decisionmaking.

- *Fisher information* is a measure of the ongoing stability of a system. The study authors reused 54 variables already included in the 3 other metrics to characterize 6 dimensions of system stability: demographics, energy, food production, food and forest consumption, land use, and environmental health.

The study used the San Luis Basin in south-central Colorado — an agricultural region, most of which is publicly owned — as a test case, collecting data from various county, state, and federal agencies with an obvious preference for more granular data. The table summarizes the metrics, sources, and scales of key variable categories.[5]

Their analysis shows a recent improvement in the fraction of renewably produced emergy despite an overall decline, a gradual decrease in ecological balance, increasing GNRP (indicating that economic growth is not coming at the cost of the environment or human capital), and overall systemic stability. The research team is in the process of doing more in-depth analysis of each metric and will continue to calculate values as more data becomes available. It appears that this study succeeded in its goal of piloting an accessible and useful method for measuring regional sustainability; however, the overarching measure of success will be the extent to which this methodology is adopted.

Green Net Regional Product and Ecological Balance



Source: Correspondence with Matthew Hopton, May 2011

[1] Matthew E. Hopton, Heriberto Cabezas, Daniel Campbell, Tarsha Eason, Ahjond S. Garmestani, Matthew T. Heberling, Arunprakash T. Karunanithi, Joshua J. Templeton, Denis White, and Marie Zanowick. 2010. "Development of a Multidisciplinary Approach To Assess Regional Sustainability." *International Journal of Sustainable Development & World Ecology* 17:1, 48–56.

[2] Ibid.

[3] Heriberto Cabezas, Tarsha Eason, Ahjond S. Garmestani, Matthew T. Heberling, Matthew E. Hopton, Joshua Templeton, Daniel E. Campbell, Denis White, and Marie Zanowick. 2010. "Introduction." In Matthew T. Heberling and Matthew E. Hopton, eds., *San Luis Basin Sustainability Metrics Project: A Methodology for Evaluating Regional Sustainability*. Washington, DC: U.S. Environmental Protection Agency, 1.

[4] Heriberto Cabezas, Tarsha Eason, Ahjond S. Garmestani, Matthew T. Heberling, Matthew E. Hopton, Joshua Templeton, Daniel E. Campbell, and Denis White. 2010. "Sustainability Metrics." In Heberling and Hopton, eds.

[5] Hopton et al. 2010, Table 1.

Index	Brief description	Dimension			Number of indicators ⇒ Number of domains	Maximum resolution
		Env	*Econ*	*Soc*		
Ecological Footprint[1]	Biocapacity of land and sea relative to human demands	yes	no	no	Varies ⇒ 6 types of land use	Regional
Genuine Progress Indicator[2]	Alternative to GDP that includes externalized costs	yes	yes	yes	Varies ⇒ varies	Subnational
Environmental Performance Index[3]	Progress of national environmental policies	yes	no	no	25 ⇒ 10	National
Human Development Index[4]	Health, education, quality of life	no	yes	yes	4 ⇒ 3	National
Happy Planet Index[5]	Longevity and life satisfaction per ecological footprint	yes	no	yes	3 ⇒ 2	National

[1] Brad Ewing, Anders Reed, Alessandro Galli, Justin Kitzes, and Mathis Wackernagel. 2010. "Calculation Methodology for the National Footprint Accounts, 2010 Edition."

[2] This methodology is not standardized, but multiple recent indices have been calculated for U.S. states using similar methodologies. See **www.green.maryland.gov/mdgpi/whatisthegpi.asp** for information on Maryland's GPI and links to those for Vermont, Minnesota, Ohio, and Utah.

[3] Jay Emerson, Daniel C. Esty, Christine Kim, Tanja Srebotnjak, Marc A. Levy, Valentina Mara, Alex de Sherbinin, and Malanding Jaiteh. 2010. 2010 *Environmental Performance Index*.

[4] Jeni Klugman. 2010. *Human Development Report 2010: The Real Wealth of Nations: Pathways to Human Development*. New York: United Nations Development Programme.

[5] Saamah Abdallah, Sam Thompson, Juliet Michaelson, Nic Marks, and Nicola Steuer. 2009. "The (Un)Happy Planet Index 2.0: Why Good Lives Don't Have to Cost the Earth."

Empirical Innovation: Metrics for Location Efficiency

As the field of sustainability measurement evolves, a number of efforts are underway to develop metrics that respond to specific ideas or theories. A prime example is location efficiency — the idea that locating housing near employment, schools, and commercial amenities in transit-rich and pedestrian-friendly environments shifts people's travel behaviors toward less energy-intensive (and more healthful) transportation options such as public transit, walking, or biking. A recent meta-analysis by Reid Ewing and Robert Cervero looked at the findings from more than 200 studies on the effects of various characteristics of the built environment on travel behavior.[17] They found that for a given location, the number and proximity of nearby jobs and the distance to downtown affected VMT nearly twice as much as any of the other factors studied (e.g., density, land-use mix, etc.). Meanwhile, measures of pedestrian connectivity — intersection density, percentage of four-way intersections, and distance to the nearest transit stop — had the greatest effect on transit usage.[18]

Although these findings support the salience of location efficiency, they provide neither a formula for measuring it nor a larger socioeconomic context. The Center for Neighborhood Technology's Housing + Transportation Affordability Index (H+T), developed by compiling transit system or tract-level transportation data from across the United States, complements Ewing and Cervero's work by showing the economic consequences of changes in travel behavior due to residential relocation. Because consumers undervalue transportation costs when choosing a place to live, they tend to move farther from job centers, pursuing lower housing costs at the expense of higher transportation costs. H+T shows that for the 337 metropolitan areas studied, any housing cost savings are negated by increases in transportation costs at commute distances of 10 miles or more.[19]

Although H+T may eventually make it possible to measure the true cost of location decisions nationwide, questions remain about its validity. A recent report commissioned by the National Association of Home Builders raised a number of concerns about H+T's data. The report noted that the index uses some outdated or insufficiently detailed data, fails to incorporate transit service data, and uses housing data that apply to current, but not future, residents.[20] Moreover, despite widespread adoption of the index, the logarithms used to calculate it are proprietary and cannot be reviewed by users. Nevertheless, H+T has enriched the conversation by demonstrating the connection between sustainability and affordability, and HUD is taking an active role in enhancing H+T's applicability, announcing an effort to expand the database beyond the initial study areas and determine how it can be incorporated in HUD programs.[21]

The Walkable Urban Places(WUP) study currently being conducted by the Brookings Institution Metropolitan Policy Program is seeking to quantify location efficiency's broader economic benefits. Using data from 66 regionally significant WUPs in the Washington, DC area, the research team is looking to determine which characteristics of urban places (such as land-use mix, built environment features, and transportation and pedestrian infrastructure) correlate with economic performance. In addition, they plan to integrate their economic performance metrics with social equity metrics and LEED for Neighborhood Development to produce a comprehensive, place-based sustainability metric. The goal is to allow communities to evaluate the contribution of their built environment in terms of the three dimensions of sustainability and use the results to make evidence-based decisions about how to grow and develop.

Next Steps in Metric Development

In September 2010 the Metropolitan Institute at Virginia Tech convened a research roundtable to identify top research priorities for the PSC. Three of the 12 items on the participants' list of recommendations called for more

Criteria for Building Measurement Systems

For an indicator system or index to have credibility, its component indicators must be chosen according to objective criteria. The first attempt to provide this structure for sustainability measurement was in 1996 by an international quorum of experts convened by the International Institute for Sustainable Development. The guidelines they developed, the Bellagio Principles, assert that "assessment of progress toward sustainable development" should:

- Define a clear vision and goals (principle 1);
- Be holistic, value the three dimensions of sustainability, and have adequate scope while addressing concrete issues and metrics (principles 2–5);
- Be open, easy to understand, and involve broad participation (principles 6–8); and
- Provide for ongoing, iterative assessment by a designated institution with adequate capacity (principles 9 and 10).[1]

More recently, Christoph Böhringer and Patrick Jochem reviewed research in this area and enumerated five key requirements for any sustainability index:

- Connection to the definition of sustainability;
- Indicators from holistic fields;
- Reliability and availability of data over long time horizons;
- Process-oriented indicator selection; and
- Applicability to policymaking.[2]

There are also rubrics for selecting specific indicators to include in an index. A particularly concise example is SMART, which was originally developed by the business community and stands for Specific, Measurable, Achievable, Relevant, and Time-bound.[3] Other possible criteria include clarity, feasibility, degree of hierarchy, tentativeness, reliability/validity, comprehensiveness, comparability, and media friendliness.[4]

[1] Peter Hardi and Terrance Zdan. 1997. "The Bellagio Principles for Assessment." In Peter Hardi and Terrance Zdan, eds., *Assessing Sustainable Development: Principles in Practice*. Winnipeg, Manitoba: International Institute for Sustainable Development, 1–4.
[2] Böhringer and Jochem, 1–8.
[3] László Pintér, Darren Swanson, Ibrahim Abdel-Jelil, Kakuko Nagatani-Yoshida, Atiq Rahman, and Marcel Kok. 2008. "Module 5: Integrated Analysis of Environmental Trends and Policies." In László Pintér, Darren Swanson, and Jacquie Chenje, eds., *IEA Training Manual: A Training Manual on Integrated Environmental Assessment and Reporting*. Winnipeg, Manitoba: International Institute for Sustainable Development.
[4] Donella Meadows. 1998. "*Indicators and Information Systems for Sustainable Development.*"

work on sustainability metrics: research into how households and firms make location decisions given preferences and financial constraints, evaluation methods for identifying policies that have successfully fostered affordable housing in location-efficient neighborhoods; and research into the performance and cost-effectiveness of residential green retrofits by building characteristics (see "Quantifying Energy Efficiency in Multifamily Rental Housing," p.1).[22] Because sustainability is contextual and lacks a universal definition, there may never be a single common index or indicator system to measure it. Nevertheless, as sustainability increasingly permeates the public and private sectors, rapidly advancing progress in the field will continue to provide policymakers with better tools for making data-driven decisions about how best to advance sustainability. EM

[1] Michael Bloomberg. "Michael Bloomberg Delivers PlaNYC: A Greater, Greener New York," press release, 22 April 2007.

[2] World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press, 43, as cited in International Institute for Sustainable Development, "What is Sustainable Development?" Accessed 19 August 2011.

[3] Simon Bell and Stephen Morse. 2008. *Sustainability Indicators: Measuring the Immeasurable?* London, UK: Earthscan, 12.

[4] Unpublished paper by Amy Lynch, Stuart Andreason, Theodore Eisenman, John Robinson, Kenneth Steif, and Eugenie L. Birch. 2011. "Sustainable Urban Development Indicators: State of the Art and its Potential Congruence with U.S. Department of Housing and Urban Development Sustainability Initiatives," 21–2.

[5] Helen Briassoulis. 2001. "Sustainable Development and its Indicators: Through a (Planner's) Glass Darkly," *Journal of Environmental Planning and Management* 44:3, 409–27.

[6] Bell and Morse, 43.

[7] "Compendium: A Global Directory to Indicator Initiatives." International Institute for Sustainable Development website (**www.iisd.org/measure/compendium**). Accessed 16 May 2011.

[8] United Nations Department of Economic and Social Affairs. 2007. *Indicators of Sustainable Development: Guidelines and Methodologies*. New York: United Nations.

[9] "Participating Cities," Global City Indicator Facility website (**www.cityindicators.org/Participants.aspx**). Accessed 15 June 2011.

[10] ICLEI — Local Governments for Sustainability USA. 2010. "STAR Community Index Sustainability Goals & Guiding Principles."

[11] Ellen Greenberg, Jerry Walters, Richard Lee, and Jeffrey Ang-Olson. 2010. *Smart Mobility 2010: A Call to Action for the New Decade*, Sacramento, CA: California Department of Transportation, 8, 55.

[12] See Environmental Protection Agency. 2011. "Guide to Sustainable Transportation Performance Measures." Environmental Protection Agency website (**www.epa.gov/smartgrowth/pdf/Sustainable_Transpo_Performance.pdf**). Accessed 2 September 2011.

[13] Chuck Kooshian and Steve Winkelman. 2011. *Growing Wealthier: Smart Growth, Climate Change and Prosperity*. Washington, DC: Center for Clean Air Policy.

[14] For a more comprehensive (if slightly less current) listing, see Christoph Böhringer and Patrick E. P. Jochem. 2007. "Measuring the Immeasurable: A Survey of Sustainability Indices," *Ecological Economics* 63:1, 1–8.

[15] "Our Human Development Initiative." Global Footprint Network website (**www.footprintnetwork.org/en/index.php/GFN/page/fighting_poverty_our_human_development_initiative**). Accessed 18 May 2011.

[16] Böhringer and Jochem, 1–8.

[17] Reid Ewing and Robert Cervero. 2010. "Travel and the Built Environment: A Meta-Analysis." *Journal of the American Planning Association* 76:3, 265–94.

[18] Ibid.

[19] María Choca Urban. 2010. "Penny Wise, Pound Fuelish: New Measures of Housing + Transportation Affordability," 10.

[20] Abt Associates Inc. 2010. "A Methodological Review of the Center for Neighborhood Technology's 'Housing + Transportation Affordability Index.'"

[21] HUD Launches Development of a National Housing and Transportation Affordability Index, **http://portal.hud.gov/hudportal/HUD?src=/press/press_releases_media_advisories/2011/HUDNo.11-180**, press release, 30 August 2011.

[22] Casey Dawkins, Joseph Schilling, and Mariela Alfonzo. 2011. "Policy Research Priorities for Sustainable Communities: Insights and Ideas for the U.S. Department of Housing and Urban Development and the Federal Interagency Partnership for Sustainable Communities."

In Practice

Confronting the Future: Case Studies in Regional Planning and Consensus-Building

When it comes to regional coordination around growth issues, the United States has a less developed tradition than many other countries, in part because regional planning efforts often evoke strong reactions from residents concerned about losing local control. As a result, relatively few regional organizations in the United States have been able to build consensus around metropolitan growth management. Two organizations that have been leaders in building this consensus, Envision Utah (EU) and the Sacramento Area Council of Governments (SACOG), have found success by tapping into people's shared values and aspirations while using convincing, unbiased data to demonstrate the need to work regionally.

"In order for communities to thrive, [people] need to understand that the region has to be healthy [in order to compete] in a global market," says Alan Matheson, CEO of Envision Utah. In recent years, he says, it's become clear that "we're going to rise or fall together."[1] The following case studies illustrate how the Salt Lake City and Sacramento regions — both of which are part of the inaugural cohort of HUD Sustainable Communities Regional Planning Grant recipients (see sidebar, p. 22) — have crafted successful regional planning platforms through consensus-building and data-focused planning scenarios.

Salt Lake City and the Wasatch Region

Utah's unique topography and rapid growth have made regional planning critical. Because much of the state's land area is desert, about 80 percent of Utah residents live in a narrow, 120-mile strip known as the Greater Wasatch Area. The Governor's Office of Planning and Budget estimates that the region's population will triple to 5 million by 2050.[2] One consequence of this growth is that by 2040, daily vehicle miles traveled (VMT) in the region are expected to double (relative to 2006 levels); assuming current trends continue, the state's emissions are forecast to grow more than 70 percent by 2030.[3] Due in large part to vehicular emissions, the levels of fine particulate matter and ozone currently exceed the Environmental Protection Agency's (EPA's) air-quality standards in several counties in the region.

Over the past decade, EU, the pioneering Smart Growth coalition founded in 1997, has emerged as a key driver of regional planning. This public-private partnership includes policymakers, business leaders, developers, and leaders of the Church of Jesus Christ of Latter-day Saints. EU has become an influential leader in the state because of its broad buy-in and significant public engagement — for example, 20,000 people participated in developing its Quality Growth Strategy.[4] EU has led

Highlights

- The United States does not have a history of success in regional coordination, but one approach that has worked focuses on connecting hard data on the direction the region is headed with residents' aspirations for their communities.
- Envision Utah has cultivated broad public support by showing residents the challenges presented by significant population growth in a fixed area and then helping them develop sustainable growth management strategies.
- Decades of large-lot home construction have led to debilitating congestion in the Sacramento region; through a consensus-building process, the Sacramento Area Council of Governments has shown people how addressing this problem will also provide appropriate types of housing for the anticipated future population.

PolicyLink

Increase in bike lanes per square mile built has more workers commuting by bicycle in U.S. cities.

cities throughout the region in land-use planning and campaigned successfully for UTA TRAX, Salt Lake County's first light rail, which opened in 1999 and will launch two new lines by 2015.[5]

Envision Utah

The Wasatch Choice for 2040 Vision Map displays the land uses called for in the plan, but also the different regional growth features: growth centers (blue and purple areas), mixed-use corridors (blue and purple lines), and regional greenways and connections to population centers (dark and light green arrows, respectively).

Good data and analysis — rigorous, transparent, and easy to understand — form the foundation of EU's consensus-building strategy. Before getting people together to talk about planning, whether for the region or for one of many demonstration projects, EU does significant background work: baseline analyses and predictive modeling of land use, infrastructure, economic health, and other factors. Armed with a data-driven forecast of how the region will look in 40 or 50 years if current trends continue, EU can query people's level of satisfaction with the region's future. Participants' typical response has been dissatisfaction, which creates the space to have productive conversations that transcend traditional ideological divisions and focus on specific problems and tradeoffs.

Wasatch Choice for 2040

EU's most recent project, a transportation planning initiative called Wasatch Choice for 2040, builds on this success by emphasizing transit-oriented development (TOD) in the Wasatch region's fastest-growing counties. As with all of EU's initiatives, Wasatch Choice for 2040 was conceived with numerous partner organizations and participation from local residents. The initiative's growth scenario ties new residential development to existing transportation and other infrastructure, focusing on growth centers that act like "sponges" for new development. Matheson explains that this planning strategy shows other communities throughout the region how TOD is "sensitive to neighborhood context, creates regional benefits, and succeeds in the marketplace."[6]

The projections for the Wasatch Choice plan are encouraging. By 2040, 11 percent of housing and 20 percent of jobs will be within walking distance of high-capacity transit, a significant increase from the current levels of 2 percent and 12 percent, respectively. This scenario will also conserve 23 square miles of open space, reduce traffic congestion by 18 percent, and increase transit use by 12 percent.[7] Over the next 20 years, the expected savings in infrastructure, housing, and transportation costs will total $4.5 billion.[8]

Although Utah residents are adamant about maintaining local control, they also want their region to be successful. Matheson says that EU has conducted value studies showing that people's shared values outweigh their disagreements; a shared knowledge base, created through strong, unbiased data, enables people to reach a surprising level of consensus. This agreement has resulted in strong grassroots support for the plan — which is imperative, because participation is entirely voluntary — and elected officials from the communities in the planning area have taken notice. Most of the area's 97 communities have already enacted changes

According to the projections for the Wasatch Choice plan, by 2040, 11 percent of housing and 20 percent of jobs in the region will be within walking distance of high-capacity transit, a significant increase from current levels.

to zoning and other regulations in response to the regional vision. The public's support is manifested in different venues. In town meetings, citizens now commonly ask how policies under discussion will align with Wasatch Choice. People have also expressed their support in the voting booth. A referendum to raise tax money for

Envision Utah

The kickoff event for Wasatch Choice for 2040, June 2011.

transit, held in 1997 before EU was founded, was soundly defeated; in 2006, voters passed the same referendum by a margin of 2 to 1.

Salt Lake City has been successful in its efforts to make the Wasatch regional vision for sustainable development a reality. The city is in the midst of a code revision project and has established an expedited review for projects that meet LEED Silver criteria and/or have an ENERGY STAR rating of 85. In 2008 Mayor Ralph Becker signed a resolution to reduce Salt Lake City's carbon footprint by 20 percent below 2005 levels by 2020 and by 80 percent below 2005 levels by 2050, and the city has secured federal funding to help meet this goal.[9] A U.S. Department of Energy grant has paid for substantial upgrades to the city's cycling infrastructure and has allowed the city to install LED streetlights, reducing its overall annual energy consumption by 4 percent.[10] Using funding from a 2009 EPA grant, the city is engaging in community-based social marketing to promote sustainable transportation options. As of August 2010, these activities had already reduced VMT by 1.3 million miles, and the grant is expected to reduce greenhouse gas emissions by 63,000 metric tons by 2012.[11]

The Sacramento Region

The city of Sacramento, California is home to more than 400,000 people in a region of 1.3 million. After rapid growth in the 1990s and early 2000s, the chief components of its economy — housing construction and government — have suffered due to the recession and California's ongoing fiscal crisis. Nevertheless, the region is expected to recover in the coming decades, adding 1.2 million new residents and 535,000 new jobs by 2035.[12]

In recent years, local leaders have realized that poor land-use planning has taken its toll. In 2002, for instance, SACOG projected that the region's already-heavy congestion would increase by more than 50 percent by

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Pedestrian-friendly neighborhoods with accessible farmers markets, shops, and parks help reduce a community's carbon footprint.

The Costs of Sprawl

Envision Utah and the Sacramento Area Council of Governments have been driven partly by local concern about regional sprawl and its consequences. Although the precise definition of "sprawl" is contested, there is little question that many U.S. metropolitan areas have expanded rapidly in recent decades; between 1982 and 1997, for instance, the urbanized area in the United States grew more than twice as fast as its metropolitan population.[1] This dynamic, repeated in many cities since the end of World War II, was facilitated by public policies that encouraged and enabled low-density growth in the postwar era, such as federal loan appraisal criteria that favored new single-family homes, heavy investment in the interstate highway system, and a move toward single-use zoning.

PolicyLink

Sprawl can have significant environmental and economic costs. Low-density communities lead to greater energy consumption; residents of low-density counties drive more than three times as many miles per year (30,000) than those who live in urban centers (8,000).[2] In addition, the costs of building and sustaining low-density infrastructure are significantly higher than the costs of these same services in denser communities.[3] Overall, a more compact growth pattern would save the United States $126 billion in water, sewer, and road infrastructure costs over the next 25 years, an 11-percent decrease compared with the status quo.[4]

The heavy reliance on driving in sprawling regions also results in a lack of accessible job opportunities for those who cannot afford the costs of owning and maintaining a car. Only 26 to 27 percent of jobs in low- and middle-skill industries are accessible by transit within 90 minutes compared with 34 percent of jobs in high-skill industries.[5]

Sprawl is also linked to various health problems. Exposure to emissions has been shown to exacerbate asthma, raise the risk of lung cancer, and cause heart failure and other critical cardiac conditions — 9,200 premature deaths occur annually from exposure to fine particulate pollution (PM2.5) in California alone.[6,7,8] There is also a significant link between sprawl and body weight; both adult and youth residents of counties with greater sprawl weigh more and have a higher prevalence of hypertension than residents of denser counties.[9]

[1] William Fulton, Rolf Pendall, Mai Nguyen, and Alicia Harrison. 2001. "Who Sprawls Most? How Growth Patterns Differ Across the U.S.,"1–4.
[2] Peter Calthorpe. 2011. *Urbanism in the Age of Climate Change*. Washington, DC: Island Press.
[3] Robert W. Burchell, Anthony Downs, Barbara McCann, and Sahan Mukherji. 2005. *Sprawl Costs: Economic Impacts of Unchecked Development*. Washington, DC: Island Press.
[4] Matthew Kotchen and Stacey Schulte. 2003. "A Meta-Analysis of Cost of Community Service Studies." *International Regional Science Review* 32:3, 63, as cited in **www.activelivingresearch.org/files/Synthesis_Shoup-Ewing_March2010.pdf.**
[5] Adie Tomer, Elizabeth Kneebone, Robert Puentes, and Alan Berube. 2011. "Missed Opportunity: Transit and Jobs in Metropolitan America," 1, 17–8.
[6] David M. Stieb, Mieczyslaw Szyszkowicz, Brian H. Rowe, and Judith A Leech. 2009. "Air Pollution and Emergency Department Visits for Cardiac and Respiratory Conditions: A Multi-City Time-Series Analysis." *Environmental Health* 8:1, 8–25.
[7] Interview with Kalima Rose, June 2011; California Air Resources Board. 2010. "Estimate of Premature Deaths Associated With Fine Particle Pollution (PM2.5) in California Using a U.S. Environmental Protection Agency Methodology."
[8] In addition to diminished quality of life, health conditions caused or exacerbated by pollution pose their own expenses. As Yale University's Nicholas Z. Muller and Robert Mendelsohn have shown, the costs of climate change aside, 94 percent of the costs of air pollution are health related, including visits to the emergency room, decreased productivity, and absences from school.
[9] Reid Ewing, Tom Schmid, Richard Killingsworth, Amy Zlot, and Stephen Raudenbush. 2003. "Relationship Between Urban Sprawl and Physical Activity, Obesity, and Morbidity." *American Journal of Health Promotion* 18:1, 47–57; Reid Ewing, Ross C. Brownson, and David Berrigan. 2006. "Relationship Between Urban Sprawl and Weight of United States Youth." *American Journal of Preventive Medicine* 31:6, 464–74.

The Sacramento Area Council of Governments used hard data to connect people's core values to the details of community and regional planning.

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2025.[13] This growing congestion problem is especially troublesome because the region does not meet federal air quality standards for ozone. Many local leaders are also concerned about suburban sprawl, which threatens to consume open space and farmland in a region that is a major agricultural center.

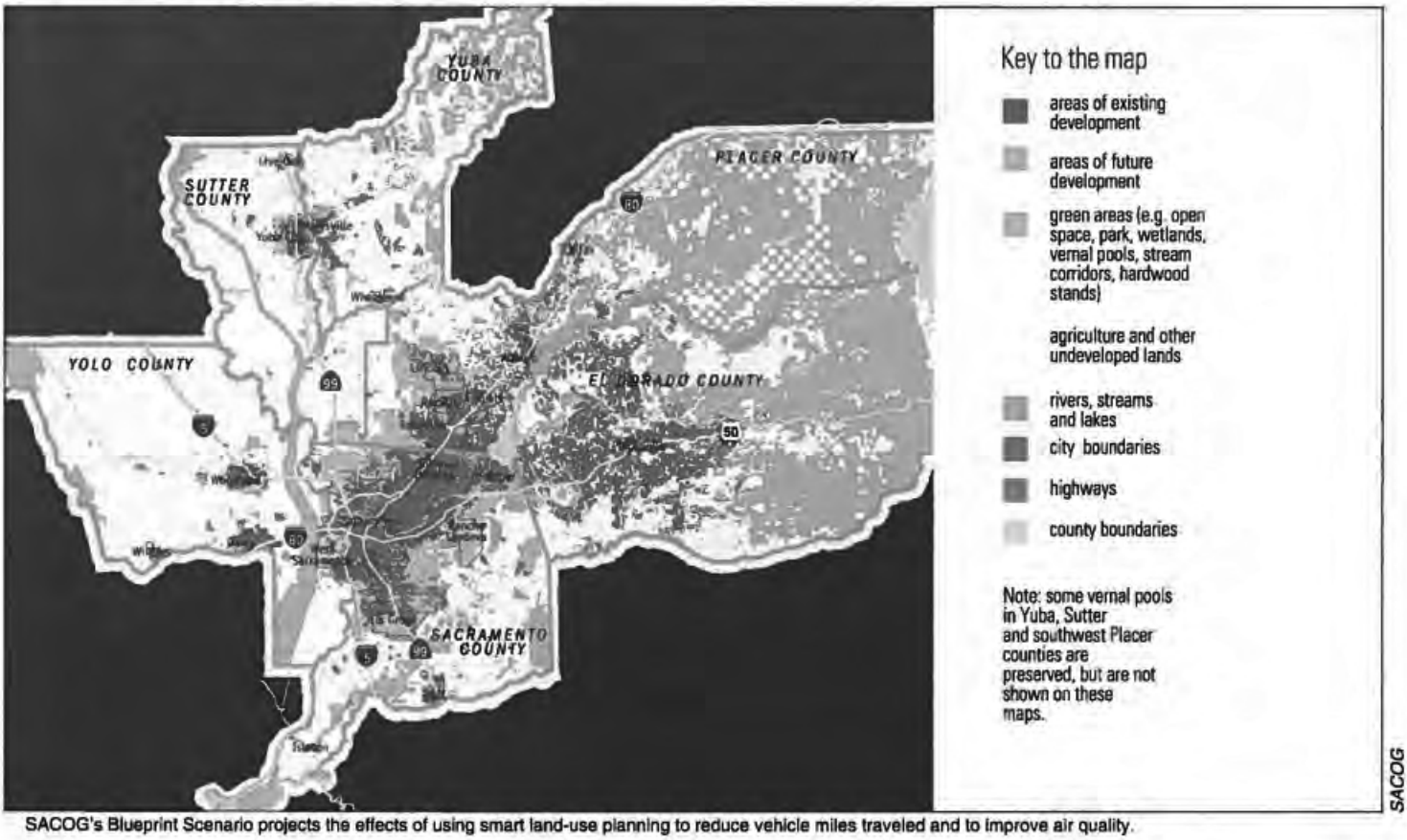
SACOG developed their Sacramento Region Blueprint using computer modeling and input from more than 5,000 residents. In the process, SACOG employed key elements of EU's model; they used hard data to connect people's core values to the details of community and regional planning. Focusing on data allowed SACOG's staff to circumvent planning terms that people might perceive as threatening. For instance, SACOG's research found that the concept of "density" had a negative connotation for many people despite being a crucial element of sustainability planning. SACOG's market and demographic research showed that the region's population would become significantly older over the next several decades and that this older segment would demand housing other than the single-family, large-lot homes currently being built. SACOG decided to "[focus] like a laser on these facts" at the beginning of planning sessions, and "we challenged people to confront the future," says Mike McKeever, CEO of SACOG.[14] The organization then asked people to think about the kinds of housing that each demographic group would need in the coming years. In this way, SACOG cast the discussion in terms of the people's choices rather than those of the planners.

McKeever says that it is encouraging to see how consensus can arise "when you put ordinary people together, give them helpful information, and get out of the way."[15] McKeever credits the combination of an earnest citizen engagement process, which avoided steering participants toward a predetermined conclusion, and the fact that people had the information they needed to determine the best solutions themselves. The integrity of the process has changed people's minds. Before the planning process, 70 percent of people thought that growth would degrade their quality of life; afterward, 70 percent thought that growth would improve their quality of life, provided their leaders followed the principles of the Blueprint.

Sacramento Preferred Blueprint Scenario

In 2004 SACOG adopted its Preferred Blueprint Scenario. The Blueprint illustrates how the area could grow healthier

BLUEPRINT: Projected Development in 2050



SACOG

SACOG's Blueprint Scenario projects the effects of using smart land-use planning to reduce vehicle miles traveled and to improve air quality.

Sustainable Communities Research Grant Program

In early 2011 HUD initiated the Sustainable Communities Research Grant program (SCRGP) under the 2010 Consolidated Appropriations Act. The program, administered by HUD's Office of Policy Development and Research and Office of Sustainable Housing and Communities, offers $2.5 million in grants to help researchers expand existing empirical scholarship on issues relating to sustainability. Funding priorities are for research on:

- expanding housing affordability and choice,
- improving access to community assets through effective transportation systems,
- reducing regulatory barriers to sustainable development by strengthening land use planning and urban design standards,
- advancing economic opportunities that create jobs and promote diverse communities, and
- improving environmental health by reducing carbon emissions and conserving energy.

HUD has just announced the six grant winners, whose grants range from $284,000 to $500,000. HUD believes that the resulting research will help it adopt a broader sustainability agenda beyond current programs and will inform future efforts and initiatives. For information about the grantees and their research, please visit **http://www.huduser.org/portal/rbc/SCRGP_landing.html**.

through 2050 with land-use planning to reduce VMT and improve air quality. By emphasizing TOD, for instance, the Blueprint will locate 41 percent of new jobs and 38 percent of new housing within walking distance of bus or train service, compared with 5 percent of new jobs and 2 percent of new housing at present.[16] The Blueprint has also informed SACOG's development of the Metropolitan Transportation Plan for 2035, which will add light rail and highway lanes for carpools and commuter buses as well as increase bus frequency. As a result, per-household VMT is forecast to decrease 10 percent by 2035.[17]

In concordance with the regional Blueprint plan, the city of Sacramento has enacted numerous transportation-oriented programs of its own to reduce VMT and vehicular emissions. In 2009 the city completed a general plan update that McKeever cites as an excellent model of Blueprint implementation. A key initiative is a change in the traffic level-of-service policy, which has allowed the city to suspend road widening, thus saving money and reducing impediments to walking and biking. The city has also initiated traffic-calming measures and adopted a "complete streets" initiative. These programs are critical, given that on-road transportation accounted for 42.7 percent of the city's total greenhouse gas emissions.[18]

> An inclusive planning process focused on empirical data about the future of regions will help build consensus on the way forward.

Taken together, these initiatives seem to be having a positive effect:

- Between 2008 and 2009, all types of collisions — involving pedestrians, bicycles, parked cars, and other vehicles — declined;
- In 2010 the city had its best air quality in more than 5 years, failing to meet federal and state air-quality standards for 8-hour maximum ozone concentrations on only 4 days (down from 21 the previous year); and
- Weekday VMT per capita decreased from 14.5 miles in 2005 to 14 miles in 2008.

The city's 2030 General Plan projects a 13.2 percent reduction in VMT per capita and an 11.1 percent reduction in car trips per capita.[19] Because of these and other initiatives, the city and the region are well prepared to comply with AB-32 (from 2006) and SB-375 (from 2008), California legislation designed to decrease greenhouse gas emissions and curb sprawl, respectively.

Next Steps for Regional Planning

Both Envision Utah and SACOG want to use their Sustainable Communities Regional Planning grants to make their planning processes more comprehensive. These organizations see these grants as an opportunity to strengthen the connections between the physical plan and socioeconomic factors. "It's pushing us to broaden the engagement tent even more and to really make sure we have a [comprehensive] treatment of the social equity issues in the region," says McKeever. SACOG will be looking at the economic and ethnic distribution across the region and evaluating and managing the effects of rising property values.

The Federal Role in Regional Planning

In June 2009 HUD, the Department of Transportation, and the Environmental Protection Agency formed the Partnership for Sustainable Communities (PSC) to help communities become economically strong and environmentally sustainable. Interagency collaboration has been a key element of the partnership, says Shelley Poticha, director of HUD's Office of Sustainable Housing and Communities. By pushing its member agencies to coordinate federal investments and align their policies, PSC allows them to use their federal funding more efficiently and maximize the benefits from each investment.

www.pedbikeimages.org / Andy Hamilton

The Pioneer Courthouse Square in downtown Portland, Oregon serves as a transit hub and public plaza.

The Sustainable Communities Regional Planning Grant program is a key part of this initiative. These grants support regional, multi-jurisdictional planning efforts that incorporate housing, land use, economic development, transportation, and infrastructure. This multidisciplinary approach reflects PSC's philosophy of "[trying] to help communities solve multiple problems at the same time," says Poticha. In October 2010 the program awarded $98 million to 45 regions nationwide.

Performance measurement is also an important part in the program. Applicants are required to submit benchmarks for indicators of housing affordability, transportation mode share, racial segregation, poverty rates, and access to fresh food, among other factors. Grantees will report on these and other indicators throughout the grant period, with the goal of establishing an empirical basis for demonstrating the effects of regional planning.

SACOG would also like to better incorporate information about nontransportation infrastructure — including water and sewer, surface-water management, and energy — into their planning process. Matheson hopes to enhance people's connections to the process and to each other, whether that means strengthening the bonds between various groups and institutions or expanding EU's engagement model to new sectors and areas of the state. That also means continuing to spread the word, particularly to the private sector, that regional planning is economically smart.

As we learn more from Salt Lake City, Sacramento, and other U.S. regional planning efforts, it will be important to carefully monitor their outcomes in order to help develop and refine best practices for measuring and enacting sustainable development. Until then, one lesson from the successes of EU and SACOG seems clear; regardless of their background or political orientation, people care about the success of their region. An inclusive planning process focused on empirical data about the future of the region will help build consensus on a way forward. EM

[1] Interview with Alan Matheson, June 2011.

[2] Envision Utah. n.d. "The History of Envision Utah," 28. Accessed 31 May 2011.

[3] Governors Office of Planning and Budget, Envision Utah, and Utah Quality Growth Commission. John F. Bennett, ed. 2008. "Utah Baseline Report: Current Conditions, Trends, and Projections," 12.

[4] Interview with Peter Calthorpe, June 2011.

[5] "About Trax." Utah Transit Authority website (**www.rideuta.com/mc/?page=UTA-Home-TRAX-AboutUTATRAX**). Accessed 1 June 2011.

[6] Interview with Matheson.

[7] Envision Utah. n.d. "Wasatch Choices 2040: A Four County Land-Use and Transportation Vision," 22–3. Accessed 2 June 2011.

[8] Wasatch Front Regional Council. n.d. "Wasatch Choice for 2040 Brochure," 3. Accessed 31 May 2011.

[9] "City Carbon Inventory and Reduction Goals." Salt Lake City website (**www.slcgov.com/slcgreen/climate/COreduction.htm**). Accessed 3 June 2011.

[10] Correspondence with Mike Barry, July 2011.

[11] "Sustainable Transportation for a Sustainable Future." U.S. Environmental Protection Agency website (**www.epa.gov/statelocalclimate/local/showcase/sustainable-transportation.html**). Accessed 2 June 2011.

[12] Sacramento Area Council of Governments. 2010. "Special Report: Blueprint's Impact on the Region and Residents' Quality of Life," 13.

[13] Ibid., 2.

[14] Interview with Mike McKeever, July 2011.

[15] Ibid.

[16] Sacramento Area Council of Governments. 2010, 4.

[17] Sacramento Area Council of Governments. 2008. "Final Environmental Impact Report for the Metropolitan Transportation Plan for 2035," 2-17; Sacramento Area Council of Governments. 2007. "Draft Environmental Impact Report for the Metropolitan Transportation Plan for 2035," Table 18-7.

[18] "City of Sacramento Climate Action Plan." 2010. City of Sacramento General Plan Update website (**www.sacgp.org/documents/CAP-Fact-Sheet_4-26-10.pdf**). Accessed 30 May 2011.

[19] City of Sacramento. 2009. "2010 Annual Report: Sacramento 2030 General Plan," 16–35.

Additional Resources

- *Suburban Nation: The Rise of Sprawl and the Decline of the American Dream* (2000), by Andres Duany, Elizabeth Plater-Zyberk and Jeff Speck, lays out the case against sprawl and for mixed-use, pedestrian-friendly neighborhoods. **http://us.macmillan.com**.

- *Beyond Growth: The Economics of Sustainable Development* (1997), by Herman Daly, argues that the economy should be understood as part of the ecosystem and that, as such, sustainable development can only be achieved by abandoning the goal of endless economic growth. **www.beacon.org**.

- *The Post Carbon Reader: Managing the 21st Century's Sustainability Crises* (2010), edited by Richard Heinberg and Daniel Lerch, features articles by some of the world's most provocative thinkers on the key drivers shaping this new century, from renewable energy and urban agriculture to social justice and systems resilience. **www.postcarbon.org**.

- "Year in review — EROI or energy return on (energy) invested" (2010), by David J. Murphy and Charles A. S. Hall, reviews the concept of Energy Return on Investment and five biggest areas of empirical research in the subject at present. *Annals of the New York Academy of Sciences*, 1185:1, 102–18. **www.nyas.org**.

- "Location Efficiency and Housing Type: Boiling it Down to BTUs" (2011), prepared by Jonathan Rose Companies, provides analysis of the roles housing type and location and energy-use features of homes and vehicles have in achieving greater energy efficiency. **www.epa.gov**.

- "Penny Wise, Pound Fuelish: New Measures of Housing + Transportation Affordability" (2010), from the Center for Neighborhood Technology, uses the H+T Index to show the negative financial implications of sprawling growth patterns for families and regions. **www.htaindex.cnt.org**.

- "Central Corridor Tracker 2011 Baseline Indicators: Progress Beyond the Rail" (2011) is an example of a concise, visually appealing and accessible report on a set of indicators. **www.funderscollaborative.org/**.

- *Performance-Based Transit-Oriented Development Typology Guidebook* (2010), by Mason Austin et al., is a toolkit designed to help users analyze the conditions and performance of their existing transit systems. **www.ctod.org**.

- *Growing Smart Legislative Guidebook: Model Statutes for Planning and Management of Change* (2002), edited by Stuart Meck, is an update to, and rethinking of, the Standard City Planning and Zoning Enabling Acts drafted by an advisory committee of the U.S. Department of Commerce in the 1920s and the American Law Institute's A Model Land Development Code, as well as other model statutes. **www.planning.org** or **www.huduser.org**.

- "Sustainable Design and Green Building Toolkit for Local Governments" (2010), from the U.S. Environmental Protection Agency, is designed to help local governments identify and remove barriers to sustainable design and green building within their permitting process. **www.epa.gov**.

- *Value Beyond Cost Savings: How to Underwrite Sustainable Properties* (2010), by Scott R. Muldavin of the Green Building Finance Consortium, discusses enabling private investors to incorporate sustainability into the decisions they make, especially relating to potential revenue and risk. **www.greenbuildingfc.com**.

For additional resources archive, go to **www.huduser.org/portal/periodicals/em/additional_resources_2011.html.**

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