Smart Growth and Green Location: An Urban Planner's Perspective on Energy Efficiency and Other Impacts of Urban Sprawl

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ABSTRACT

Long range, regional-scale comprehensive land planning, in close coordination with transportation, utility and other infrastructure investment, is an essential component in the promotion and creation of energy efficient regions, cities, and communities. Compact growth patterns, as opposed to the sprawling outward development that dominates much of the post-WWII American landscape, are more efficient in terms of infrastructure cost and provision, and energy consumption. Further, compact and efficient growth provides for wide-ranging benefits, including reduced consumption of sensitive environmental lands, improved air quality, enhanced local and regional mobility, increased housing diversity and affordability, and a reduction in public health and other costs.

Calthorpe Associate's work in Southern California, Austin, Salt Lake City, the Twin Cities, Chicago, and other regions, has been instrumental in demonstrating the consequences of varying growth patterns on such key indicators as infrastructure cost, energy and water consumption, transportation impacts, air quality, land consumption, housing affordability, public health and other essential quality of life factors. This paper strives to engage the energy industry and energy efficiency community in the broad topic of regional and community-level land planning as an essential component in energy policy and implementation.

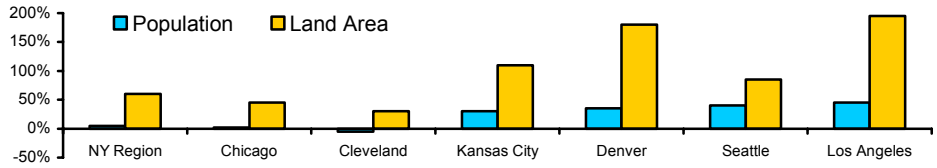
Introduction – The Rise of Regions and the Costs of Sprawl

The latter half of the 20th century saw the rise and growing prominence of metropolitan regions as dominant economic and social units worldwide. Anchored, at least in name, by more traditional cities, places as varied as Shanghai, Mumbai, Berlin, Tokyo, Beijing, and Chicago gathered up their surroundings into ever-expanding regional economies and metro areas. This grand physical and political makeover has been fueled by rampant growth in highway and transport infrastructure that transformed once hinterlands into bedroom communities and industrial complexes, as well as global trade and the growth of multi-national corporations.

Leading a global trend, twenty-first century America, unlike this country at the dawn of the last century, is a country of large well-established metropolitan regions – from the sprawling metropolis of Southern California, to the Chicagoland area, the Dallas Metroplex, the Research Triangle in North Carolina, to Central Texas. With more and more Americans living in metropolitan regions, millions travel through multiple cities every day on their way to work, school, or even to buy groceries. Living and working, and even attending high school, in the same city – once common place due to the reach of local transit and roadway networks – is becoming less and less common every day. With the mobility offered by the private automobile, billions invested in our vast highway systems, and the quest for more affordable housing on the urban fringe, the 30 minute, 1 hour, or even 2 hour commute is barely conversation material anymore.

The consequences of this ever-outward growth pattern are significant. Growth in the land area of our metropolitan regions has far outpaced population growth, with rapidly developing regions like Denver expanding in land area by 180 percent between 1970 and 1990 while its population grew only 35 percent. In the Los Angeles region, population grew by 45 percent over the same period, while urbanized land area grew an astounding 195 percent.

Figure 1. Population versus Land Area Growth: 1970 – 1990



Source: Smart Growth America 2000

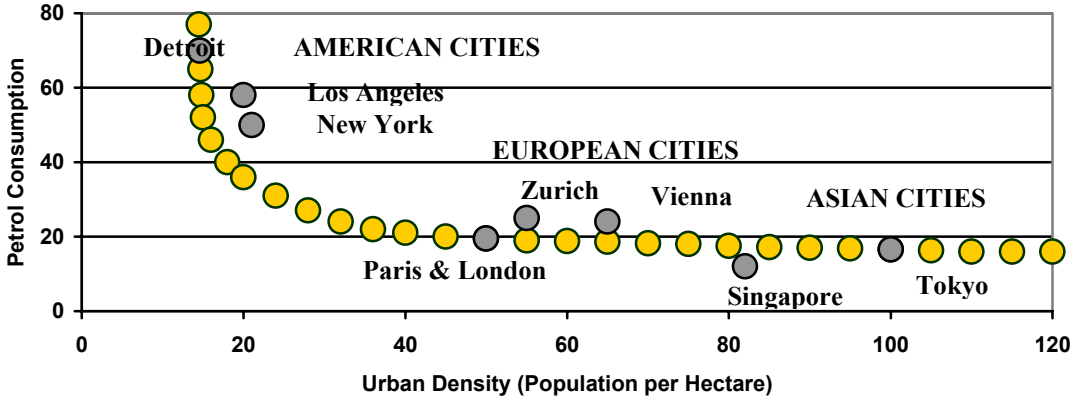
The growth of our metropolitan areas has led to a huge expansion of our roadway system and unprecedented increases in automobile miles traveled, traffic congestion, and pollution. In California, the Department of Transportation estimates that with 90 percent population growth between 1980 and 2020, the number of vehicles will increase by 120 percent, and vehicle miles traveled will nearly double (California Department of Transportation). Regions across the nation are struggling to conform to air quality standards as residents travel more and more miles each year. Indeed, according to the US Environmental Protection Agency, 113 million Americans lived in counties that had unhealthy air quality in 1997 (U.S. Environmental Protection Agency). And studies are demonstrating that $C0_2$ emissions by auto-dependent households in suburban parts of our regions are vastly higher than that of households in the more urban cores, where travel distances are shorter and residents are more likely to use automobile alternatives, such as walking, transit or bicycling for work, school, and everyday trips (The Center for Neighborhood Technology 2006). The increase in suburban emissions is directly related to energy use, specifically the increase in the burning of fossil fuels - the dominant producer of $C0_2$ and other green house gases.

The social implications of all this time behind the wheel are just now being uncovered - including less quality time with family, increased stress, reduced rates of walking and exercise, and skyrocketing urban asthma rates. There is a growing synergy between the planning and public health fields, as the auto-dependent suburban land pattern is considered an important component in the growing obesity epidemic facing the nation and its health care system.

The outward growth of our metropolitan areas consumed more than six million acres of farmland between 1992 and 1997 – an area the size of Maryland (American Farmland Trust 2002). This loss of valuable cropland is coupled with a massive and costly expansion of our nation's roadway and utility infrastructure, reaching further and further out to serve lower density development at the urban fringe. Studies have shown that the cost of serving these far flung areas with services, from schools to roads to utilities, is significantly higher than that of more compact mixed-use development patterns. A Rutgers University study of the economic and fiscal impacts of alternative land use patterns demonstrated a 25 percent reduction in roadway cost and a 15 percent reduction in the cost of utility provision (Burchell, 1996). An Australian study also demonstrated the connection between urban density and petroleum consumption, with

sprawling American metropolitan regions far out-consuming their world counterparts (Kenworthy and Laube, 1999).

Figure 2. Urban Density Versus Petroleum Consumption



Source: UK Commission for Integrated Transport

Comparative studies of regions further demonstrate energy and other savings associated with more compact, efficient land patterns. A recent study of Portland and Atlanta clearly illustrates the benefits of Portland's transit-focused regional land planning over Atlanta's relatively unfettered and highway-based outward expansion. Both metro areas experienced rapid population and job growth in the 1980s and 90s, but commute times in Portland actually declined 9 percent, while in Atlanta commutes lengthened by 1 percent despite an aggressive and costly freeway widening program. The number of "ozone alert" days declined 86 percent in Portland while they rose by 5 percent in Atlanta. Energy consumption per capita in Portland decreased 8 percent, while increasing 11 percent in Atlanta.

Table 1. Comparison Portland and Atlanta (Change from mid 1980s to mid 1990s)		
	Portland	Atlanta
Population Growth	+26%	+32%
Job Growth	+43%	+37%
Energy Consumption per Capita	-8%	+11%
Vehicle Miles Traveled	+2%	+17%
Commute Time	-9%	+1%
Air Quality in Ozone Days	-86%	+5%
Source: Lincoln Institute of Land Policy, 2000		

The mounting fiscal, environmental, and social costs of our nation's sprawling regions has triggered a new era of large-scale regional land and infrastructure planning. This paper discusses the rise of regional planning in the US and presents case studies of planning efforts from around the country that have effectively engaged decision makers and stakeholders in developing regional visions and exploring the consequences of regional growth patterns. Within a larger discussion of the measured impacts of alternative development patterns in Southern California, Central Texas, and the Twin Cities region, the paper highlights the efficiency of more

compact development patterns in energy consumption and the provision of utility and other infrastructure.

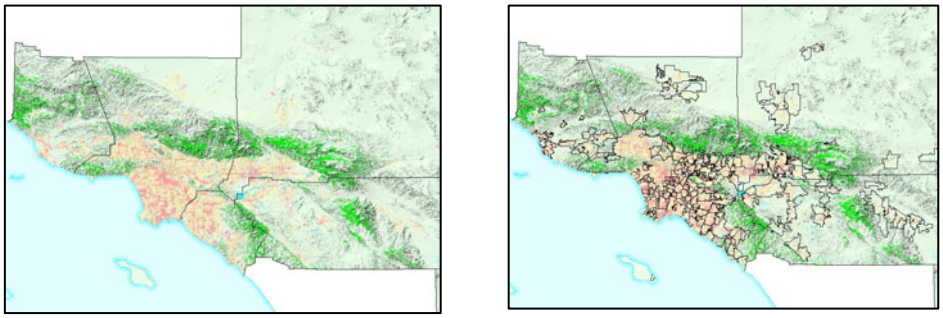
The Rising Role of Regional Planning

In the United States, the past decade has seen the rise and increasing efficacy of long-term regional planning, as our rapidly expanding metropolitan regions stretch the limits of transport networks, energy and utility infrastructure, environmental quality, and social and political systems. There is a growing realization that many of the issues we face as residents of cities, towns, and neighborhoods are indeed regional issues. The air we breathe can move hundreds of miles and is impacted by auto and industrial emissions that span city boundaries; we travel to and from work and school on highways and transit systems that span cities and counties; our water and energy travels hundreds or even thousands of miles to get to us; and mountains, lakes, rivers, and oceans form natural boundaries and support ecological systems for which jurisdictional borders are meaningless.

There is a disconnect, however, between the regional nature of many of our concerns, and the local focus of distinctly non-regional decision making in our metropolitan regions. Inter-jurisdictional competition for tax base, school funding, and infrastructure leads to myopic decisions that fail to consider larger regional concerns. “Leap frog” communities that emerge out of prime farmland on the suburban and exurban fringe, made possible by highway access and utility extensions, stretch infrastructure dollars, use up valuable land resources, put more people on the roads traveling more miles to and from work, and bleed existing cities of their tax base and services.

The governing structures and physical limits of cities and towns that can be so effective at providing police and fire protection, planting street trees, and picking up garbage, are wholly inadequate in dealing with regional issues that require an understanding of the larger impacts of local decisions. Comprehensive large-scale planning, which engages citizens and decision makers in the tradeoffs and consequences associated with how and where growth occurs, places local decisions in this essential regional context.

Figure 3. Southern California – Natural and Urban Forms (Left) and the Fractured Landscape of the Nearly 200 Jurisdictional Boundaries that Make Up the Region (Right)



The near-unfettered growth of metropolitan regions necessitates a broader, more holistic view of the myriad environmental, fiscal, and social impacts of our sprawling land patterns – a need heightened in recent years by the volatility in global energy markets, and the fiscal limits placed on cities and jurisdictions in the wake of deepening federal and state budget deficits and increasing energy costs.

Engaging a Concerned, but Skeptical Public

The impetus for the first full-scale, public input-driven regional planning efforts in this country came from a surprisingly varied cast of characters. Beginning in the mid 1990s in the Salt Lake region, state government, business leaders, environmentalists, and infrastructure providers expressed concern over the impact of rapid population growth on quality of life and long-term economic viability. Concerns ranged from the rapid loss of agricultural lands, to traffic congestion and declining air quality, to expansion into water-poor areas and environmentally sensitive portions of the mountains, to the increasing tax burden on new and existing households.

Similar concerns were emerging in the Twin Cities region, in Central Texas around rapidly growing Austin, and even in well established regions like Chicago and Southern California. Each of these large metropolitan areas, facing increasing growth from varying combinations of in-migration and natural increase, were struggling with how to break through the jurisdictional focus of every day decisions and engage stakeholders and decision makers in the larger impacts of local decisions. Over the next 30 years, the Salt Lake region and Central Texas were looking at a near doubling of their population; Chicago was considering how to accommodate 1.6 million more people; and the 17 million person Southern California region was struggling over how to accommodate an additional two Chicagos worth of new residents. At stake were the reasons people chose to live in the regions in the first place, the reasons businesses located in them, and the competitive edge of each region in the global economy.

The Public Process

The process that emerged to respond to this challenge sought to combine hands-on charrette-style planning exercises – previously implemented only in smaller more detailed design projects - with robust computer-based scenario development to illustrate the choices regions have in deciding future growth patterns. This publicly-driven process was first implemented in the Salt Lake region with the *Envision Utah* process, where thousands of residents participated in workshops that then served as primary input into the development of alternative regional scenarios. This process was further refined in subsequent regional visioning efforts in Central Texas, Chicago, Southern California, and other locations.

In the Los Angeles region, as part of the Southern California Compass process sponsored by the Southern California Association of Governments (SCAG), workshops challenged citizens to view Southern California as a unified region and work with their neighbors to develop a vision for the region 25 to 30 years into the future. The workshops engaged the public in how and where to accommodate the region's next 6 million people and 3 million jobs – growth mostly attributed to natural increase in the 17 million person region. Working over a base map of the region, the workshops allowed participants to grapple with the trade-offs of low density versus compact growth, redevelopment versus new greenfield development, and the relationship between land use and existing or planned highway and transit infrastructure.

Figure 4. Workshop Participants in Southern California

This challenging exercise emphasizes the inextricable links between land use, transportation, economic, and environmental networks – links that cross conventional political boundaries and thus require planning and decision-making that looks beyond the borders of the nearly 200 cities that make up the Southern California region. The hundreds of workshop maps that emerge out of this public process become the primary input into the development of computer-based scenarios that are then modeled to illustrate the consequences of various growth patterns as they relate to land use, transport networks, environmental and air quality, infrastructure provision and cost, and energy consumption. Metrics vary from region to region based on the priority of unique locational issues, but in all cases the process is meant to provide varied information to spur informed discussion and eventually informed decisions about the preferred direction for the region.

Regional Scenarios and Their Consequences

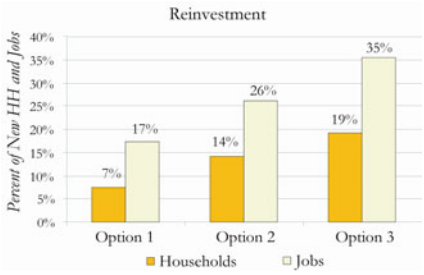
The alternative regional scenarios that emerge from the public workshop process effectively demonstrate that different land use patterns, transportation investment decisions, and open space choices can have significant and varying impacts on the environment, infrastructure, and even the health and well being of residents. Three to four alternative scenarios are created, each accommodating the same expected growth forecasts. The scenarios organize people, jobs, and transportation in different ways, from typical outward-reaching sprawl (often an extrapolation of status-quo or trend growth into the future), to more compact development patterns that are organized around transit networks as opposed to highways. The scenarios do not show the region exactly where it could go, but rather a range of alternatives from which people can explore consequences and pick and choose preferred elements from different scenarios.

In Smart Growth Twin Cites (SGTC), a regional planning process for the Minneapolis-St. Paul region sponsored by the Metropolitan Council regional government, the regional alternatives clearly conveyed the varying impacts of a range of growth patterns. Three alternative development options for the Twin Cities metropolitan area were created with input from public workshops, local comprehensive plans, business and regional stakeholder groups, regional transportation policy, and an inventory of environmentally sensitive lands. These development alternatives, Options 1, 2 and 3, represented three ways to accommodate the region's next 280,000 households and 360,000 jobs. They vary with regard to land consumption, levels of reinvestment, walkable development, density, housing diversity and other development characteristics.

Land Consumption and Reinvestment

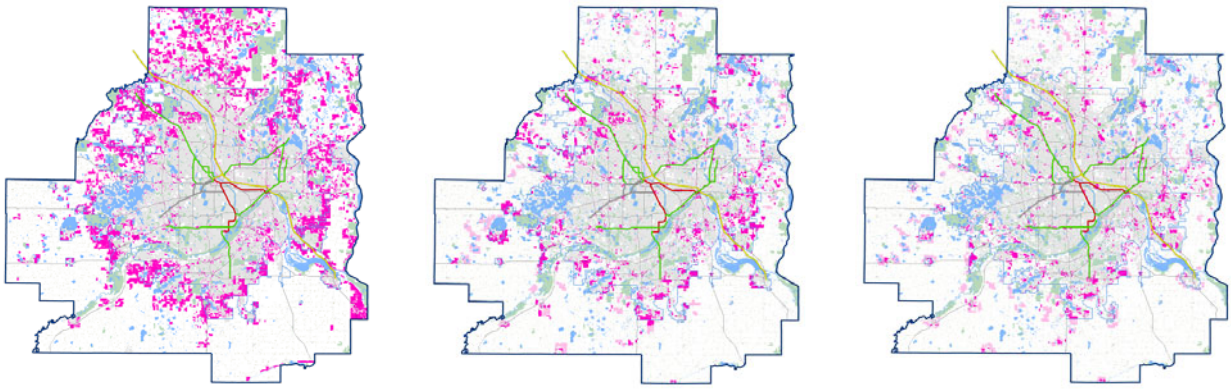
A comparison of land consumption highlights one of the most dramatic differences between the SGTC development options. In accommodating projected growth in population and employment, Option 1, based on a compilation of local plans for each city in the region, consumes 286 square miles of land in the region, significantly greater than the 152 square miles developed in Option 2 and more than double the 136 square miles developed in Option 3. As detailed in Figure 6 at right,

Figure 5. Reinvestment in the SGTC Scenarios



Options 2 and 3 contain higher levels of reinvestment and infill, often with higher-density development, reducing the overall land consumption and development on existing agriculture and undeveloped land.

Figure 6. Twin Cities Scenarios: The Scenarios Vary in Land Consumption, Reinvestment, Density, and other Characteristics. New Land Area Developed Is Shown in Pink.



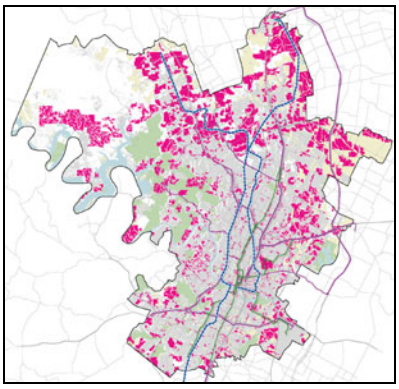
Option 1 *Option 2* *Option 3*

Reinvestment focuses development in older commercial centers, industrial areas and other underutilized lands. These areas are often located along transit corridors. As older downtowns, main streets and central rail yards face divestment or abandonment, they have become ripe for reinvestment. Reinvestment helps to conserve land on the suburban fringe by looking to older industrial areas, aging suburban malls and rural growth centers as prime opportunities to create housing in close proximity to existing jobs. Such development also takes advantage of existing (and often underutilized) utility and energy infrastructure, reducing the need to extend new power lines and sewer and storm water lines out to the urban fringe.

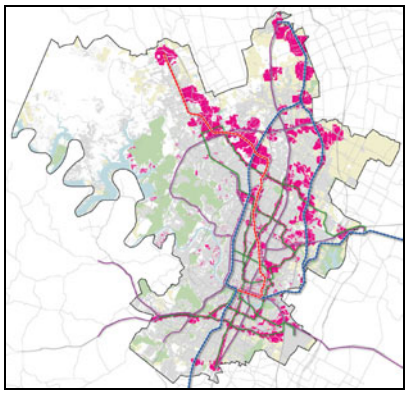
Land consumption and reinvestment impacts are further highlighted in other regional projects. Choices for Central Texas, a recent project for the Capital Metro transit agency in Austin, Texas, examined the role transit infrastructure can play in organizing future growth in Central Texas. The project explored the potential for accommodating a portion of expected population and job growth within convenient access of infrastructure included in the transit agency's newly adopted transit plan, and examined the consequences of such coordination in comparison to development patterns shaped primarily by existing and planned roads. A Base Case, which depicted growth in the study based on current plans, was compared to a Vision scenario, where growth opportunities around transit were maximized. Like in the SGTC process, land consumption and reinvestment measures highlight some of the fundamental differences between the Base Case and Vision scenarios. While the development pattern projected in the Base Case occupies nearly 65,000 acres of currently vacant land, the Vision consumes less than 29,000 acres – a 56 percent reduction. In the Base Case, 16 percent of new households and 29 percent of new jobs are accommodated through reinvestment. The Vision scenario increases these proportions significantly, accommodating 31 percent of households and 41 percent of jobs on underutilized or vacant land. This change is accomplished by seeking out reinvestment opportunities and closely linking future growth to potential transit investments within the region's core. Significantly, this concentration of development around new transit infrastructure

has significant benefits in the reduction of development on sensitive environmental lands including aquifer areas, habitat lands, and agriculture and ranch lands.

Figure 7. In Austin, Scenarios Were Developed to Compare a Transit Oriented Future (Vision Scenario), to a More Auto-Oriented Growth Pattern



Base Case

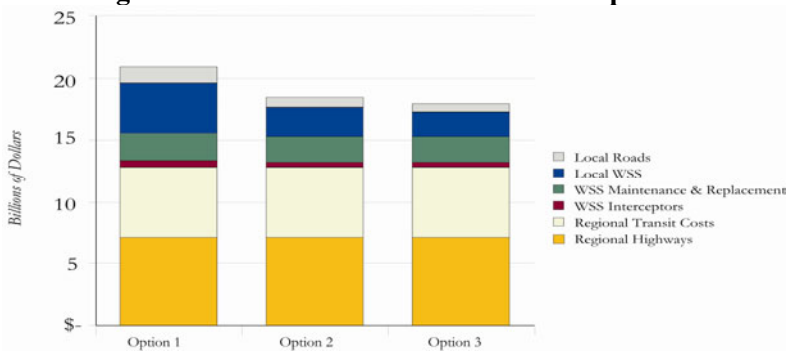


Vision Scenario

Infrastructure Provision and Cost

Work in various regions has demonstrated the infrastructure efficiency benefits of more compact, transit-focused growth patterns that balance reinvestment with green-field development. In the SGTC process, the cost of infrastructure further differentiates the consequences of the three development options. The totals below incorporate the costs of regional sanitary sewer facilities, local water, sewer and storm sewer facilities (WSS), local roads, the regional transit network and regional highways. As Option 1 develops the greatest land area with the greatest number of road-miles, its infrastructure costs are consistently higher, especially the local road and WSS facility expenditures. Option 2 reduces the infrastructure costs by $2.5 billion. Option 3, the most compact pattern reduces infrastructure costs by $3 billion as compared to Option 1. This analysis would benefit from further studies in coordination with energy providers and utilities to demonstrate the benefits of compact growth on specific energy infrastructure provision.

Figure 8. SGTC Infrastructure Cost Comparison



The Choices for Central Texas project further emphasizes the positive impacts of more compact growth in utility cost and provision. The lower density, more expansive form of development projected in the Base Case requires more roads, sewer, and water lines per person

than the more compact pattern projected in the Vision scenario. As a result, the cost associated with serving new development in the Base Case is considerably higher than the cost of serving growth projected in the Vision. A comparison between the infrastructure needs of each scenario indicates that the Vision would require nearly 3,000 fewer lane miles of local roads, 800 fewer miles of water distribution lines, 1,100 fewer miles of wastewater distribution lines, and 1,700 fewer miles of storm water distribution lines. Excluding highway and transit costs, the total study area infrastructure costs projected in the Base Case are $7.1 billion, 97 percent greater than the $3.6 billion total projected by the Vision scenario. This amounts to a $10,900 savings for each current household in Central Texas.

Table 2. Choices for Central Texas Infrastructure Cost Per Household (Constant 2004 Dollars)

	Base Case	Vision	Savings in Vision
New Local Roads	$3,747	$1,910	**$1,836**
Water Distribution	$2,252	$1,148	**$1,104**
Wastewater	$4,729	$1,148	**$3,581**
Stormwater	$8,978	$4,578	**$4,400**
Total Cost	**$19,706**	**$8,785**	**$10,921**

Adding the cost of electrical and other energy infrastructure to these metrics would further amplify the difference among the land pattern impacts, as outward growth requires significant energy utility extension as well. Measurements were not made due to a lack of data from utility providers at the time. Moving in this direction, a regional planning program in the Sacramento region is currently upgrading its web-accessible modeling tools to measure full energy demand and generation impacts of varying growth and development patterns. Sacramento's "Blueprint Program" is enhancing regional decision making in California and directly linking energy use and provision into land use decision making (Funders' Network 2004).

Table 3. Choices for Central Texas Infrastructure Costs (Constant 2004 Dollars)

		Base Case	Vision	Savings in Vision
Local Roads	New Lane Miles	5,997	3,058	**2,939**
	Cost (Billions)	$1.4	$0.7	**$0.7**
Water Distribution	New Miles of Dist. Lines	1,649	841	**808**
	Cost (Billions)	$0.8	$0.4	**$0.4**
Wastewater Distribution	New Miles of Dist. Lines	2,249	1,147	**1,102**
	Cost (Billions)	$1.7	$0.8	**$0.9**
Stormwater Distribution	New Miles of Dist. Lines	3,374	1,720	**1,653**
	Cost (Billions)	$3.2	$1.7	**$1.6**
Total Cost (Billions)		**$7.1**	**$3.6**	**$3.6**

Transport System Impacts, Energy Consumption, and Air Quality

One of the most important series of metrics that emerges from the regional modeling process relates to the impacts of varying growth patterns on existing and planned transportation systems, as well as resultant energy costs and consumption. In the Choices for Central Texas

project, a comparison of the automobile and transit use projected in the Base Case and Vision scenarios serves to illustrate the impact of different land use patterns on the region's transportation network. Transportation modeling results indicate that the form of future growth projected in the Vision scenario would result in dramatically higher rates of transit ridership and reduced automobile use, when compared to the development scenario anticipated in the Base Case. The region's entire transit system is expected to accommodate 720,000 boardings in the Vision scenario and 520,000 in the Base Case – a 38 percent difference.

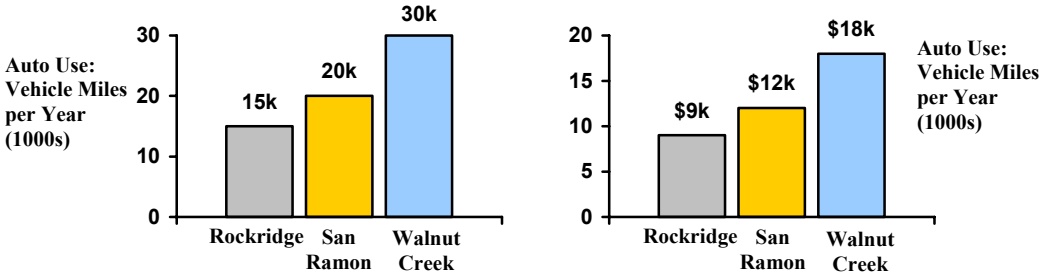
Table 4. Choices for Central Texas Auto Travel, Fuel Consumption, and Pollution Reductions in Vision Scenario (Constant 2004 Dollars)	
Reduction in Annual Vehicle Miles Traveled	700,000,000
Reduction in Annual Fuel Consumption	40,000,000
Reduction in Annual Air Pollution	4,000

Increased transit use facilitated by the growth pattern of the Vision scenario, as well as closer proximity of housing to jobs and daily service needs, leads to a significant reduction in automobile travel and road congestion in the Vision plan. Transportation modeling results indicate 174,000 fewer vehicle hours traveled per day in the Vision scenario than in the Base Case, 21 percent less vehicle hours of delay, an 18 percent decline in the proportion of congested vehicle miles, and 2.5 million fewer vehicle miles traveled per day. As a result of reduced automobile travel and road congestion, the transportation network in the Vision scenario generates 4,000 fewer tons of pollution from mobile sources each year than the Base Case. The transport system in the Vision reduces annual fuel consumption by approximately 40 million gallons per year. Auto travel and congestion reductions in the Vision scenario would provide $1,500 in annual savings from reduced fuel and time costs for each Central Texas household. These modeled results are consistent with national studies on the impacts of land form on energy consumption. A 2001 EPA report indicates that land use factors account for more than 60 percent of the growth in driving and related forms of energy consumption (USEPA 2001).

Table 5. Choices for Central Texas Annual Regional and Household Savings in Vision Scenario (Constant 2004 Dollars)		
	Regional Savings (millions)	Household Savings
Time Costs	$463	$1,300
Fuel Costs	$71	$200
Reduction in Annual Air Pollution	$534	$1,500
Costs Source: Texas Transportation Institute 2003 Mobility Study		

Studies of communities in the San Francisco Bay Area reinforce the regional and household-level benefit of transit-supportive land use patterns. A California Department of Transportation study of three Bay Area communities demonstrated significant differences in driving behavior and household costs among auto versus transit-oriented development. The figures below illustrate these differences, with the rail transit-oriented Rockridge district in Oakland showing lower vehicle miles and much lower per household transport costs than auto-oriented counterparts in Walnut Creek and San Ramon, mostly due to reduced fuel consumption and vehicle wear and tear.

Figure 9. Household Average Auto Use and Auto-Related Costs in Bay Area Communities



A recent Funders' Network study concluded that "energy used for the transportation of people is closely linked to growth patterns." It goes on to note that "the single most important relationship between urban form and transport energy requirements is the physical separation of activities." Naomi Friedman, the study's author, points out that significant reductions in energy use could be accomplished through smarter land use policies. She highlights that highway vehicles (mainly passenger cars and light trucks) account for more than 70 percent of transportation energy use and carbon emissions.

Measured Consequences Leading to Visions for the Future

A preferred vision for a region often emerges out of a greater understanding of the choices a region has in how it accommodates projected growth and the consequences of those choices. In the Salt Lake region, the scenarios and the *Envision Utah* process became a topic of everyday conversation among decision-makers and members of the general public. After the two year planning process, which has served as a model for subsequent efforts across the country, the state legislature passed the Quality Growth Strategy in 1999, further funding regional planning activities and leading to the construction and planning of major transit improvements throughout the region. In Central Texas, the demonstrated benefits of a more compact growth pattern led to the adoption of a comprehensive transit infrastructure plan and contributed to voter approval of a new rail transit line in 2005. And in Southern California, where huge growth projections pose significant challenges, especially to local and regional infrastructure and service providers, the Southern California Compass led to the development of a preferred strategy called The Two-Percent Solution.

The Two-Percent Solution, which emerged from public input and close study of the coordination of land use decisions and transportation infrastructure provision, demonstrates how a large proportion of the region's expected growth can be accommodated on only 2 percent of the land, maintaining stable neighborhoods, protecting valuable environmental resources, and improving air quality. SCAG, the project sponsor, is the agency responsible for the planning and programming of regional transportation infrastructure, as well as air quality conformance. Air quality conformance determines essential federal transportation funding to the region. The Compass project demonstrated that close coordination of development with carefully planned transit investments was the most effective means of reducing impacts on an overburdened roadway system and was the only way for the region to conform to federal air quality requirements.

The Compass project, like other projects across the county, demonstrates the essential role of land use in efforts to cope with regional issues. These projects highlight the critical role of infrastructure provision in shaping land development. Even more importantly, they emphasize

the need to coordinate land use decisions with infrastructure investment – from highway extensions, to new transit lines, to new water and energy infrastructure, to new power plants.

New fiscal realties, from growing federal and state budget deficits, to increasing volatility in global energy markets, highlight the need for efficient infrastructure investments that are closely coordinated with development decisions. The regional planning projects discussed in this paper recognize the power of infrastructure provision in guiding land use decisions and the shape of regions. They measure the impact of coordinated land use and infrastructure planning, from new growth and redevelopment that increases the efficiency of new transit investments; to land use and transport decisions that reduce fuel consumption and the need for extra utility extensions and new power plants; to decisions about where to extend sewer infrastructure. These elements are all seen as essential components of effective regional strategies.

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